

Savitribai Phule Pune University [SPPU]

B.Sc. (Chemistry)

(Three Years Integrated Degree Program)

Choice Based Credit System [CBCS]

From Academic Year

2019-2020

First Year (F.Y. B. Sc.)

Board of Studies (Chemistry)

Savitribai Phule Pune University [SPPU]

Pune-41107

Structure of F. Y. B. Sc. Chemistry

Semester	Course	Discipline Specific Core Course (DSCC)*
I	Theory	CH-101 : Physical Chemistry (2 credit , 36 L)
	Theory	CH-102 : Organic Chemistry (2 credit, 36 L)
	Practical	CH-103 : Chemistry Practical –I (1.5 Credit, 46.8 L)
II	Theory	CH-201 :Inorganic Chemistry (2 credit , 36 L)
	Theory	CH-202 : Analytical Chemistry (2 credit, 36 L)
	Practical	CH-203 : Chemistry Practical –II (1.5 Credit, 46.8 L)

***N.B.:**

- i. Each lecture (L) will be of 50 minutes.**
- ii. Each practical of 3h 15 min and 12 practicals per semester**
- iii. 12 weeks for teaching 03 weeks for Contentious assessments**
- iv. For details refer UG rules and regulations (CBCS for Science program under science & Technology) given in Appendix**

Savitribai Phule Pune University, Pune

F.Y.B.Sc. Chemistry Syllabus

(CBCS Semester Pattern)

From Academic Year 2019-2020

Equivalence with Previous Syllabus

New Course (2019 Semester Pattern) (50 min /L)	Old Course (2013 Annual Pattern) (48 min /L)
CH-101 : Physical Chemistry (2 credit , 36 L) 50 Marks	Paper I : Physical and Inorganic Chemistry (72 L) 100 Marks
CH-201 :Inorganic Chemistry (2 credit , 36 L) 50 Mark	
CH-102 : Organic Chemistry (2 credit, 36 L) 50 Marks	Paper II : Organic and Inorganic Chemistry (72 L) 100 Marks
CH-202 : Analytical Chemistry (2 credit, 36 L) 50 Marks	
CH-103 : Chemistry Practical-I (1.5 Credit, 46.8 L) 50 Marks	Paper III : Chemistry Practical 100 Marks
CH-203 : Chemistry Practical-II (1.5 Credit, 46.8L) 50 Marks	

Preamble:

The syllabus of Chemistry for First year has been redesigned for Choice based Credit System (CBCS) to be implemented from 2019-2020.

In CBCS pattern semester system has been adopted for FY, SY and TY which includes Discipline Specific Core Course (DSCC) at F Y level, Ability Enhancement Compulsory Course (AECC), Discipline Specific Elective Course (DSEC) and Skill Enhancement Course (SEC). DSCC courses has been introduced at FY level and AECC courses at SY level along with DSEC. At TY level DSEC and SEC courses has been introduced.

Syllabus for Specific Core Courses of Chemistry (2 Theory and 1 Practical) subject for F. Y. B. Sc. is to be implemented from the year 2019-20. Syllabus for S. Y. and T. Y. B. Sc. will be implemented from the year 2020-21 and 2021-22 respectively as per structure approved.

Learning Objectives:

1. To understand basic concept of physical, organic and Inorganic chemistry.
2. To impart practical skills and learn basics behind experiments.
3. To prepare background for advanced and applied studies in chemistry.

SEMESTER-I

CH- 101: Physical Chemistry (2 Credits, 36 Lectures of 50 min.)

1. Chemical Energetics

Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances, problems [11]

2. Chemical Equilibrium:

Introduction: Free Energy and equilibrium - Concept, Definition and significance
The reaction Gibbs Energy, Exergonic and endergonic reaction. The perfect gas equilibrium, the general case of equilibrium, the relation between equilibrium constants, Molecular interpretation of equilibrium constant. The response of equilibria to conditions- response to pressure, response to temperature, Van't Haff equation, Value of K at different temperature, Problems [11]

3. Ionic Equilibria

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts– applications of solubility product principle. [14]

Learning Outcome

1. Chemical Energetics

1. Students will be able to apply thermodynamic principles to physical and chemical process
2. Calculations of enthalpy, Bond energy, Bond dissociation energy, resonance energy
3. Variation of enthalpy with temperature –Kirchoff's equation
4. Third law of thermodynamic and its applications

2. Chemical Equilibrium

Knowledge of Chemical equilibrium will make students to understand

1. Relation between Free energy and equilibrium and factors affecting on equilibrium constant.
2. Exergonic and endergonic reaction
3. Gas equilibrium, equilibrium constant and molecular interpretation of equilibrium constant
4. Van't Haff equation and its application

3. Ionic equilibria

Ionic equilibria chapter will lead students to understand

1. Concept to ionization process occurred in acids, bases and pH scale
2. Related concepts such as Common ion effect hydrolysis constant, ionic product, solubility product
3. Degree of hydrolysis and pH for different salts, buffer solutions

CH- 102: Organic Chemistry (2 Credits, 36 Lectures of 50 min.)

Fundamentals of Organic Chemistry

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule. [09]

Stereochemistry

Introduction, classification, Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Conformations with respect to ethane, butane and cyclohexane. Configuration: Geometrical - *cis* – *trans*, and E / Z Nomenclature (for upto two C=C systems). Optical isomerism Enantiomerism, Diastereomerism and Meso compounds). Concept of chirality (upto two carbon atoms). Threo and erythro; D and L; nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) [14]

Aliphatic Hydrocarbons

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Alkanes: (Up to 5 Carbons) *Preparation:* Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. *Reactions:* Free radical Substitution: Halogenation.

Alkenes: (Up to 5 Carbons) *Preparation:* Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); *cis* alkenes (Partial catalytic hydrogenation) and *trans* alkenes (Birch reduction). *Reactions:* *cis*-addition (alk. KMnO_4) and *trans*-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymercuration-demercuration, Hydroboration-oxidation.

Alkynes: (Up to 5 Carbons) *Preparation:* Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalide *Reactions:* formation of metal acetylides, addition of bromine and alkaline KMnO_4 , ozonolysis and oxidation with hot alk. KMnO_4 . [13]

Learning Outcome

1. The students are expected to understand the fundamentals, principles, and recent developments in the subject area.
2. It is expected to inspire and boost interest of the students towards chemistry as the main subject.
3. To familiarize with current and recent developments in Chemistry.
4. To create foundation for research and development in Chemistry.

Reference Books

1. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
 2. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
 3. Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
 4. Eliel, E.L. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.
 5. Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
 6. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
 7. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.
 8. Samuel Glasstone, *Thermodynamics for Chemists*, Affiliated East West Private Limited.
 9. B S Bahl, G D Tuli, Arun Bahl, *Essentials of Physical Chemistry*
 10. Peter Atkins and Julio de Paula, *Elements of Physical Chemistry*, Sixth edition (2013), Oxford press
 11. Ball D. W., *Physical Chemistry*, Thomson Press , India (2007)
 12. Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa (2004).
 13. Atkins' *Physical Chemistry –Thermodynamics and Kinetics*, 11th Edition, Oxford Press
 14. Thomas Engel, Philip Reid; *Physical Chemistry*, Pearson Education (2006)
 15. J. N. Gurtu, A. Gurtu; *Advanced Physical Chemistry*, Pragati Edition
 16. Mortimer R. G., *Physical Chemistry*, 3rd Edition, Elsevier, Noida (UP)
 17. Samuel H. Maron and Carl F. Prutton, *Principles of physical Chemistry*, 4th Edition, Collier Macmillan Ltd.
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CH- 103: Chemistry Practical Course I

(1.5 Credits, 46.8 Lectures of 50 min.)

Section A: Chemical and Lab Safety (Compulsory)

1. Toxicity of the compounds used in chemistry laboratory.
2. Safety symbol on labels of pack of chemicals and its meaning
3. What is MSDS sheets? Find out MSDS sheets of at least hazardous chemicals ($K_2Cr_2O_7$, Benzene, cadmium nitrate, sodium metal, etc.)
4. Precautions in handling of hazardous substances like Conc. acids, ammonia, organic solvents, etc.

Section B: Physical Chemistry

a. Thermochemistry (Any three)

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO_3 , NH_4Cl).
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of ΔH .

b. Ionic equilibria (Two experiments)

1. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.

OR

1. Measurement of the pH of buffer solutions and comparison of the values with theoretical values.
2. Preparation of buffer solutions (Any One)
 - (i) Sodium acetate-acetic acid and determine its buffer capacity
 - (ii) Ammonium chloride-ammonium hydroxide and determine its buffer capacity

Section C: Organic Chemistry (Five experiments)

1. To determine type and detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing up to two extra elements) (Three)
2. Separation of constituents of mixtures by Chromatography: Measure the R_f value in each case (Two)
 - (a) Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acids) / pigments from plant extract/ 2 organic compounds by paper chromatography
 - (b) Identify and separate the sugars present in the given mixture by paper chromatography.

Note: Combination of two compounds/plant extract to be given

Reference Books:

1. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
2. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Text book of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
4. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.
5. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R.Chand & Co.: New Delhi (2011).
6. Prof. Robert H. Hill Jr., David C. Finster *Laboratory Safety for Chemistry Students*, 2nd Edition Wiley ISBN: 978-1-119-02766-9 May 2016
7. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*, Updated Version, ISBN 978-0-309-13864-2 | DOI 10.17226/12654, THE NATIONAL ACADEMIES PRESS Washington, D.C.

Learning Outcome

1. Importance of chemical safety and Lab safety while performing experiments in laboratory
 2. Determination of thermochemical parameters and related concepts
 3. Techniques of pH measurements
 4. Preparation of buffer solutions
 5. Elemental analysis of organic compounds (non instrumental)
 6. Chromatographic Techniques for separation of constituents of mixtures
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SEMESTER-II

CH-201: Inorganic Chemistry (2 Credits, 36 Lectures of 50 min.)

1. Atomic Structure

Origin of Quantum Mechanics: Why study quantum mechanics? Quantum mechanics arose out of interplay of experiments and Theory Energy quantization- i) Black body radiation ii) The photoelectric effect iii) Wave particle duality-a) The particle character of electromagnetic radiation b) the wave character of particle, iv) diffraction by double slit v) atomic spectra, Review of-Bohr's theory and its limitations, Heisenberg Uncertainty principle.

Quantum mechanics: Time independent Schrodinger equation and meaning of various terms in it, Significance of ψ and ψ^2 , Schrödinger equation for hydrogen atom. Radial and angular parts of the hydrogenic wavefunctions (atomic orbitals) and their variations for $1s$, $2s$, $2p$, $3s$, $3p$ and $3d$ orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to $1s$ and $2s$ atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers ml and ms . Shapes of s , p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (ms). [14]

2. Periodic table and Periodicity of Elements

Periodic table: periodic table after 150 years, review on the eve of international year of periodic table[IYPT].

Periodicity of elements: Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations

Long form of periodic table-s, p, d and f block elements,

Detailed discussion of following properties of elements with reference to s and p block

- Effective nuclear charge, shielding or screening effect
- Atomic and ionic radii
- Crystal radii
- Covalent radii
- Ionization energies
- Electronegativity, Pauling's / electronegativity scale
- Oxidation states of elements

[10]

3. Chemical Bonding

Attainment of stable electronic configurations, Types of Chemical bonds: Ionic, covalent, coordinate and metallic bonds

Ionic Bond: General characteristics of ionic bonding, Types of ions, Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy,

Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bond: Valence Bond Approach, Hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. VSEPR theory, Assumptions, need of theory, application of theory to explain geometries of molecules such as i) ClF_3 ii) Cl_2O iii) BrF_5 iv) XeO_3 v) XeOF_4 [12]

Learning Outcome

1. Atomic Structure

1. Various theories and principles applied to reveal atomic structure
2. Origin of quantum mechanics and its need to understand structure of hydrogen atom
3. Schrodinger equation for hydrogen atom
4. Radial and angular part of hydrogenic wave functions
5. Significance of quantum numbers
6. Shapes of orbitals

2. Periodicity of Elements

1. Explain rules for filling electrons in various orbitals- Aufbau's principle, Pauli exclusion principle, Hund's rule of maximum multiplicity
2. Discuss electronic configuration of an atom and anomalous electronic configurations.
3. Describe stability of half-filled and completely filled orbitals.
4. Discuss concept of exchange energy and relative energies of atomic orbitals
5. Design Skeleton of long form of periodic table.
6. Describe Block, group, modern periodic law and periodicity.
7. Classification of elements as main group, transition and inner transition elements
8. Write name, symbol, electronic configuration, trends and properties.
9. Explain periodicity in the following properties in details:
 - a. Effective nuclear charge, shielding or screening effect; some numerical problems.
 - b. Atomic and ionic size.
 - c. Crystal and covalent radii
 - d. Ionization energies
 - e. Electronegativity- definition, trend, Pauling electronegativity scale.
 - f. Oxidation state of elements

3. Chemical Bonding

1. Attainment of stable electronic configurations.
2. Define various types of chemical bonds- Ionic, covalent, coordinate and metallic bond
3. Explain characteristics of ionic bond, types of ions, energy consideration in ionic bonding, lattice and solvation energy and their importance in the context of stability and solubility of ionic compounds
4. Summarize Born-Landé equation and Born-Haber cycle,
5. Define Fajan's rule, bond moment, dipole moment and percent ionic character.

6. Describe VB approach, Hybridization with example of linear, trigonal, square planer, tetrahedral, TBP, and octahedral.
7. Discuss assumption and need of VSEPR theory.
8. Interpret concept of different types of valence shell electron pairs and their contribution in bonding.
9. Application of non-bonded lone pairs in shape of molecule
10. Basic understanding of geometry and effect of lone pairs with examples such as ClF_3 , Cl_2O , BrF_5 , XeO_3 and XeOF_4 .

CH- 202: Analytical Chemistry (2 Credits, 36 Lectures of 50 min.)

1. Introduction to Analytical Chemistry

What is analytical Chemistry, the analytical perspectives, Common analytical problems. [03]

2. Calculations used in Analytical Chemistry

Some important units of measurements-SI units, distinction between mass and weight, mole, millimole and Calculations, significant figures

Solution and their concentrations- Molar concentrations, Molar analytical Concentrations, Molar equilibrium concentration, percent Concentration, part per million, part per billion, part per thousand, Solution –dilutant volume ration, functions , density and specific gravity of solutions, problems

Chemical Stoichiometry – Empirical and Molecular Formulas, Stoichiometric Calculations, Problems. [10]

3. Qualitative Analysis of Organic Compounds

Types of organic compounds, characteristic tests and classifications, reactions of different functional groups, analysis of binary mixtures.

Analysis – Detection of nitrogen, sulfur, halogen and phosphorous by Lassaigne's test.

Purification of organic compounds- Introduction, recrystallization, distillation, sublimation [05]

4. Chromatographic Techniques –Paper and Thin Layer Chromatography

Introduction- Introduction to chromatography, IUPAC definition of chromatography.

History of Chromatography- paper chromatography, Thin Layer Chromatography, Ion exchange Chromatography, Gas permeation Chromatography, affinity chromatography, Gas chromatography, Supercritical fluid chromatography, High Performance Liquid Chromatography, Capillary electrophoresis, Classification of chromatographic methods – according to separation methods, according to development procedures.

Thin Layer Chromatography: Theory and principles, outline of the method, surface adsorption and spot shape, Comparison of TLC with other forms of chromatography, adsorbents, preparation of plates, application of samples, development.

Paper Chromatography- Origin, overview of technique, sample preparation, types of paper, solvents, equilibrium, development, sample application and detection, Identification, Quantitative methods, applications of paper chromatography [14]

5. pH meter

Introduction, pH meter, Glass pH electrode, combination of pH electrode-Complete Cell, Standard Buffer –reference for pH measurement, Accuracy of pH measurement, Using pH meter –How does it work? Applications of pH meter. [04]

Learning Outcomes**1. Introduction to Analytical Chemistry**

- i. Analytical Chemistry –branch of chemistry
- ii. Perspectives of analytical Chemistry
- iii. analytical problems

2. Calculations used in Analytical Chemistry

- i. Calculations of mole, molar concentrations and various units of concentrations which will be helpful for preparation of solution
- ii. Relation between molecular formula and empirical formula
- iii. Stoichiometric calculation
- iv. Define term mole, millimole, molar concentration, molar equilibrium concentration and Percent Concentration.
- v. SI units, distinction between mass and weight
- vi. Units such as parts per million, parts per billion, parts per thousand, solution-dilutant volume ratio, function density and specific gravity of solutions.

3 Qualitative Analysis of Organic Compounds

Basics of type determination, characteristic tests and classifications, reactions of different functional groups.

- i. Separation of binary mixtures and analysis
- ii. Elemental analysis -Detection of nitrogen, sulfur, halogen and phosphorous by Lassaigne's test.
- iii. Purification techniques for organic compounds.

4. Chromatographic Techniques – Paper and Thin layer Chromatography

- i. Basics of chromatography and types of chromatography
- ii. Theoretical background for Paper and Thin Layer Chromatography

5. pH metry

- i. pH meter and electrodes for pH measurement
- ii. Measurement of pH
- iii. Working of pH meter
- iv. Applications of pH meter

Reference Books:

1. Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
4. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.

5. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
 6. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
 7. Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
 8. Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
 9. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
 10. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.
 11. A Braithwait and F. J. Smith, *Chromatographic method*, 5th edition, Kluwer Academic publishers
 12. G D Christian -Analytical Chemistry
 13. Qualitative Organic Analysis 4th Edn by A I Vogel (ELBS)
 14. Vogel's Quantitative Analysis
 15. Douglas A Skoog, Donald M West, F James Holler ,Stainly R Crouch , *Fundamentals of Analytical Chemistry*, 9th edition
 16. David Harvey, *Modern Analytical Chemistry*, McGraw Hill Higher education
 17. Gurudeep R Chatwal, Sham K Anand, *Instrumental Methods of Chemical Analysis*, Himalaya Publishing House.
 18. Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).
 19. Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry* Cengage Learning India Pvt. Ltd., New Delhi (2009).
 20. Mahan, B.H. *University Chemistry* 3rd Ed. Narosa (1998).
 21. Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985).
 22. *Atkins' Physical Chemistry*, 10th edition (2014), Oxford University Press
 23. Thomas Engel, Philip Reid; *Physical Chemistry* , Pearson Education (2006)
 24. J. N. Gurtu, A. Gurtu, *Advanced Physical Chemistry*, Pragati Edition
 25. McQuarrie, D. A., & Simon, J. D., *Physical Chemistry: A molecular approach*. Sausalito, CA: University Science Books (1997)
 26. Atkins, P., & de Paula, J., *Physical Chemistry for the Life Sciences*. New York: W. H. Freeman and Company (2006)
 27. McMahon, D. (2005). *Quantum Mechanics Demystified*. New York: McGraw-Hill Professional
 28. Ladd, M. *Introduction to Physical Chemistry* (3rd ed). Cambridge, UK: Cambridge University Press (1998)
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CH- 203: Chemistry Practical –II (1.5 Credits, 46.8 Lectures of 50 min.)

Section A: Inorganic Chemistry

Wherever required standardization of volumetric reagent must be performed.

I] Synthesis of commercially important inorganic compounds (any two)

- 1) Synthesis of potash alum from aluminium metal (scrap Aluminium metal)
- 2) Synthesis of Mohr's Salt $[(\text{FeSO}_4)(\text{NH}_4)_2\text{SO}_4]\cdot 6\text{H}_2\text{O}$
- 3) Preparation of Dark red inorganic pigment: Cu_2O
- 4) Synthesis of $\text{FeSO}_4\cdot 7\text{H}_2\text{O}$

Note:

- i. In synthesized compound student must confirm the particular cation and anion by performing qualitative tests.
- ii. Costing of product for 100 g pack can be calculated on the basis of cost of raw materials used and percent yield of the product.
- iii. Synthesized compounds should be collected from all students and stored properly. They should be used in other experiments such as Mohr's salt for determination of water of crystallization. Potash alum and FeSO_4 can be given in IQA experiments or for estimations at SY and TY level.

II] Volumetric Analysis (Any Two)

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Determination of basicity of boric acid or oxalic acid or citric acid hence determination of their equivalent weight.
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4 .

III] Analysis of Commercial products containing inorganic substances (any two)

- 1) Estimation of Ca from calcium supplementary tablet by complexometric titration.
- 2) Estimation of acid neutralizing capacity of antacids like Gelusil tablet/ Gellusil syrup etc.
- 3) Estimation of selectively Cu(II) from brass alloy by iodometrically (Use KIO_3 as primary standard for standardization of $\text{Na}_2\text{S}_2\text{O}_3$ and **not** $\text{K}_2\text{Cr}_2\text{O}_7$).

IV] To draw polar plots of s and p orbitals.

Section B: Organic Chemistry

I] Organic Purification Techniques

1. Purification of organic compounds by i) crystallization (from water and alcohol) ii) distillation (Two Compounds), iii) Sublimation (micro technique).

II] Organic preparations: Derivatives

2. Preparations: Mechanism of various reactions involved to be discussed. Recrystallization, determination of melting point and calculation of quantitative yields to be done. (Any Two)
 - a) Bromination of Cinnamic acid using sodium bromide and Sodium bromate. (Green Chemistry Approach)

OR

- a) Bromination of acetanilide using KBr and Ceric ammonium nitrate in aqueous medium. (Green Chemistry Approach)
- 3) Semicarbazone derivatives of aldehydes and ketones
- 4) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone

Note: Presence of extra element in the synthesized compound must be tested (Br and N in respective compound)

N. B.:

1. Use molar concentrations for volumetric /estimations/synthesis experiments.
2. Use optimum concentrations and volumes
3. Two burette method should be used for volumetric analysis (Homogeneous mixtures)
4. Use of microscale technique is recommended wherever possible

Reference Books:

1. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
2. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
4. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.
5. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

Learning Outcome

1. Inorganic Estimations using volumetric analysis
2. Synthesis of Inorganic compounds
3. Analysis of commercial products
4. Purification of organic compounds
5. Preparations and mechanism of reactions involved

Course Outcome

CH- 101: Physical Chemistry

After completing the course work learner will be acquired with knowledge of chemical energetics, Chemical equilibrium and ionic equilibria.

CH- 102: Organic Chemistry

Students will learn Fundamentals of organic chemistry, stereochemistry (Conformations, configurations and nomenclatures) and functional group approach for aliphatic hydrocarbons.

CH- 201: Inorganic Chemistry

Students will learn quantum mechanical approach to atomic structure, Periodicity of elements, various theories for chemical bonding.

CH-202: Analytical Chemistry

Students will know about basics of analytical chemistry, some techniques of analysis and able to do calculations essential for analysis.

Lab Course CH 103 and CH-203

1. The practical course is in relevance to the theory courses to improve the Understanding of the concepts.
 2. It would help in development of practical skills of the students.
 3. Use of microscale techniques wherever required
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Savitribai Phule Pune University [SPPU]

B.Sc. (Chemistry)

(Three Years Integrated Degree Program)

Choice Based Credit System [CBCS]

2019 Pattern

Second Year Bachelors of Science

(S. Y. B. Sc.)

From Academic Year

2020-21

Board of Studies in Chemistry

Savitribai Phule Pune University [SPPU]

Pune-411007

Structure of S. Y. B. Sc. Chemistry

(According to CBCS – 2019 Pattern of SPPU)

Semester	Course	Discipline Specific Core (DSCC)*
III	Theory	CH-301 : Physical and Analytical Chemistry (2 credit, 36 L)
	Theory	CH-302 : Inorganic and Organic Chemistry (2 credit, 36 L)
	Practical	CH-303 : Chemistry Practical - III (2 credit, 72 L)
IV	Theory	CH-401 : Physical and Analytical Chemistry (2 credit, 36 L)
	Theory	CH-402 : Inorganic and Organic Chemistry (2 credit, 36 L)
	Practical	CH-403 : Chemistry Practical - IV (2 credit, 72 L)

***Important Notice:**

- i. Each lecture (L) will be of 50 minutes.
- ii. Each practical of 4 hours and 12 practical sessions per semester
- iii. 12 weeks for teaching 03 weeks for evaluation of students (theory as well as practical).
- iv. For details refer UG rules and regulations (CBCS for Science program under Science & Technology) published on SPPU website.

Evaluation Pattern (As per CBCS rules, SPPU 2019 Pattern)

1. Each theory and practical course carry 50 marks equivalent to 2 credits.
2. Each course will be evaluated with Continuous Assessment (CA) and University Assessment (UA) mechanism.
3. Continuous assessment shall be of 15 marks (30%) while university Evaluation shall be of 35 marks (70%).
4. To pass each course, a student has to secure 40% mark in continuous assessment as well as university assessment i.e. 6 marks in continuous assessment and 14 marks in university assessment for the respective course.
5. For Continuous Assessment (internal assessment) minimum two tests per paper must be organized, of which one must be written test of 10 marks.
6. Method of assessment for internal exams: Viva-Voce, Project, survey, field visits, tutorials, assignments, group discussion, etc. (on approval of the head of centre).

Theory - University Assessment Question Paper Pattern**(According to CBCS - 2019 Pattern of SPPU)**

Note that in theory question paper weightage will be given to each topics equivalent to number of lectures assigned in the syllabus.

Total Marks: 35		Duration: 2 Hours	
Note: i) Question -1 will be compulsory (5 marks). ii) Solve any three questions from question 2- 5. iii) Questions 2 to 5 carry equal marks (10 each).			
Q-1		Solve any five of the following (a) (b) (c) (d) (e) (f)	a) four tricky questions and b) two question on problem type (if applicable). 5 marks
Q-2	(A)	Describe type of question(s) i) ii)	6 mark
	(B)	Short question, but tricky	4 mark
Q-3	(A)	Explain type of question(s) i) ii)	6 mark
	(B)	Problem based question if applicable. Justification type of question	4 mark
Q-4	(A)	Discuss type of question(s) i) ii)	6 mark
	(B)	Problem based question if applicable. Justification type of question	4 mark
Q-5		Attempt any two of the following (A) Questions A, B, C, - will be Explain, Derivation, Discuss, Notes, (B) etc. type of long questions (C)	10 mark

S. Y. B. Sc. Chemistry Syllabus

(CBCS - 2019 Semester Pattern)

From Academic Year 2020-21

Equivalence with Previous Syllabus (2013 Pattern)

New Course (2019 Pattern)	Old Course (2013 Pattern)
CH-301 : Physical and Analytical Chemistry	CH-211 : Physical and Analytical Chemistry
CH-302 : Inorganic and Organic Chemistry	CH-212 : Organic and Inorganic Chemistry
CH-303 : Chemistry Practical - III	CH-223 : Chemistry Practical
CH-401 : Physical and Analytical Chemistry	CH-221 : Physical and Analytical Chemistry
CH-402 : Inorganic and Organic Chemistry	CH-222 : Organic and Inorganic Chemistry
CH-403 : Chemistry Practical - IV	CH-223 : Chemistry Practical

Preamble:

The syllabus of Chemistry for second year has been redesigned for Choice based Credit System (CBCS: 2019 pattern) to be implemented from 2020-21.

In CBCS pattern semester system has been adopted for FY, SY and TY which includes Discipline Specific Core Course (DSCC) at F Y level, Ability Enhancement Compulsory Course (AECC), Discipline Specific Elective Course (DSEC) and Skill Enhancement Course (SEC). A DSCC course has been introduced at FY level and AECC courses at SY level along with DSEC. At TY level DSEC and SEC courses has been introduced.

Syllabus for Specific Core Courses of Chemistry (2 Theory and 1 Practical) subject for F. Y. B. Sc. is to be implemented from the year 2019-20. Syllabus for S. Y. and T. Y. B. Sc. will be implemented from the year 2020-21 and 2021-22 respectively as per structure approved.

Learning Outcome:

1. To understand basic concept/principles of Physical, Analytical, Organic and Inorganic chemistry.
2. To impart practical skills and learn basics behind experiments.
3. To prepare background for advanced and applied studies in chemistry.

Overall Syllabus

SEMESTER-III			
Sr. No.	Course Code	Course Name	Credits and No of Lect.
1	CH-301	Physical and Analytical Chemistry	Credit -2, 36 L
2	CH-302	Inorganic and organic Chemistry	Credit -2, 36 L
3	CH-303	Practical Chemistry-III	Credit -2, 72 L
SEMESTER-IV			
4	CH-401	Physical and Analytical Chemistry	Credit -2, 36 L
5	CH-402	Inorganic and organic Chemistry	Credit -2, 36 L
6	CH-403	Practical Chemistry-IV	Credit -2, 72 L

The detailed Semester and Course wise of Syllabus is as follows:

SEMESTER-III

CH-301: Physical and Analytical Chemistry [Credit -2, 36 L]

Chapter No.	Chapter	No of Lectures
1	Chemical Kinetics	12
2	Surface Chemistry	06
3	Errors in Quantitative Analysis	05
4	Volumetric analysis	13

1. Chemical Kinetics:

[12 L]

Introduction to kinetics, the rates of chemical reactions – definition of rates, rate laws and rate constants, reaction order and molecularity, determination of rate law, factors affecting reaction rates, integrated rate laws – zeroth-order reactions, first-order reactions, second-order reactions (with equal and unequal initial concentration of reactants), half-life period, methods for determination order of a reactions, Arrhenius equation- temperature dependence of reaction rates, interpretation of Arrhenius parameters, reaction dynamics - collision theory and transition-state theory of bimolecular reactions, comparison of the two theories, Problems.

(*Ref. No: 1- 725-728, 731-733, 741-742, 780-784, 792-794, Ref. No: 2- 1033- 1067*)

Learning Outcome:

After studying the Chemical Kinetics student will able to-

1. Define / Explain concept of kinetics, terms used, rate laws, molecularity, order.
2. Explain factors affecting rate of reaction.
3. Explain / discuss / derive integrated rate laws, characteristics, expression for half-life and examples of zero order, first order, and second order reactions.
4. Determination of order of reaction by integrated rate equation method, graphical method, half-life method and differential method.
5. Explain / discuss the term energy of activation with the help of energy diagram.
6. Explanation for temperature coefficient and effect of temperature on rate constant k.
7. Derivation of Arrhenius equation and evaluation of energy of activation graphically.
8. Derivations of collision theory and transition state theory of bimolecular reaction and comparison.
9. Solve / discuss the problem based applying theory and equations.

2. Surface Chemistry**[6L]**

Introduction to surface chemistry - some basic terms related to surface chemistry adsorption, adsorption materials, factors affecting adsorption, characteristics of adsorption, types of adsorption, classification of adsorption isotherms, Langmuir adsorption isotherm, Freundlich's adsorption isotherm, BET theory (only introduction), application of adsorption, problems. (*Ref. No:1- 824-826, 832-837, Ref. No: 2- 1251-1264; Ref. No: 3- 932-938*)

Learning Outcomes

- Define / explain adsorption, classification of given processes into physical and chemical adsorption.
- Discuss factors influencing adsorption, its characteristics, differentiates types as physisorption and Chemisorption
- Classification of Adsorption Isotherms, to derive isotherms.
- Explanation of adsorption results in the light of Langmuir adsorption isotherm, Freundlich's adsorption Isotherm and BET theory.
- Apply adsorption process to real life problem.
- Solve / discuss problems using theory.

Reference Books (Physical Chemistry)

1. Atkins' Physical Chemistry by Peter Atkins, Julio de Paula, James Keeler -11th edition
2. Principles of physical chemistry by B.R. Puri, L.R. Sharma, M.S. Pathania
3. Essentials of Physical chemistry by BahlTuli-Revised Multicolour Edition 2009, S. Chand and Company Ltd.
4. Physical-Chemistry-4th Edition - Gilbert W. CastellanNarosa (2004).
5. Principles of ChemicalKinetics-2rdEdition- James E. House
6. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
7. Principles of Physical Chemistry, Fourth Edition by S.H. Marron and C. F. Pruton
8. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry, Cengage Learning India Pvt. Ltd.: New Delhi (2009).
9. Mahan, B.H. University Chemistry, 3rd Ed. Narosa (1998).
10. Petrucci, R.H. General Chemistry, 5th Ed., Macmillan Publishing Co. New York, 1985).
11. Physical Chemistry by Thomas Engel, Philip Reid, Warren Hehre.

3. Errors in Quantitative Analysis**[5 L]**

Introduction to errors, limitations of analytical methods, classifications of errors, accuracy, precision, minimization of errors, significant figures and computation, methods of

expressing accuracy and precision: mean and standard deviations, reliability of results and numerical. (*Ref-1: 127-138, supplementary references- Ref-2: 62-75, Ref-3: 82-121*)

Learning Outcomes

- Define, explain and compare meaning of accuracy and precision.
- Apply the methods of expressing the errors in analysis from results.
- Explain / discuss different terms related to errors in quantitative analysis.
- Apply statistical methods to express his / her analytical results in laboratory.
- Solve problems applying equations.

4. Volumetric Analysis

[13 L]

Introduction to volumetric analysis, classification of reactions in volumetric analysis, standard solutions, equivalents, normalities, and oxidation numbers, preparation of standard solutions, primary and secondary standards. **Types of Volumetric Analysis methods:**
1. Neutralization titrations: Theory of indicators, neutralization curves for strong acid strong base, weak acid strong base, weak base strong acid. Preparation of approximate 0.1 M HCl and standardization against anhydrous sodium carbonate, determination of Na_2CO_3 content in washing soda. **2. Complexometric Titrations:** Definition of complexing agent and complexometric titration, EDTA-as complexing agent (structure of EDTA and metal ion-EDTA complex), Types of EDTA titration (direct and back titration), pH adjustment and amount of indicator in EDTA titration, metal ion indicators (general properties, solochrome black – T, Patton and Reeder's indicator only), standard EDTA solution, determination of Ca(II) and Mg(II), total hardness of water. **3. Redox Titrations:** Definition of oxidizing agent, reducing agent, redox titration, $\text{K}_2\text{Cr}_2\text{O}_7$ and KMnO_4 as oxidizing agents, 1,10-phenanthroline as indicator in reduction titration, diphenyl amine as oxidation indicator, KMnO_4 as self-indicator, Standard KMnO_4 solution and standardization with sodium oxalate, Determination of H_2O_2 . **4. Precipitation titrations:** precipitation reactions, determination of end point (formation of coloured ppt, formation of soluble coloured compound, adsorption indicator), standard AgNO_3 soln., standardization of AgNO_3 soln. – potassium chromate indicator- Mohr's titration, determination of chloride and bromide, determination of iodide. Problems based on analysis.

(*Ref-1: Pages-257-275, 286, 295, 309 -322, 328-332, 340-351, 364-372.; supplementary reference Ref-2: 382-302, 322-334, 366-374, 437-452*)

Learning Outcome:

After studying the Volumetric Analysis student will able to-

1. Explain / define different terms in volumetric analysis such as units of concentration, indicator, equivalence point, end point, standard solutions, primary and secondary standards, complexing agent, precipitating agent, oxidizing agent, reducing agent, redox indicators, acid base indicators, metallochrome indicators, etc.
2. Perform calculations involved in volumetric analysis.
3. Explain why indicator show colour change and pH range of colour change.
4. To prepare standard solution and **b.** perform standardization of solutions.
5. To construct acid – base titration curves and performs choice of indicator for particular titration.
6. Explain / discuss acid-base titrations, complexometric titration / precipitation titration / redox titration.
7. Apply volumetric methods of analysis to real problem in analytical chemistry / industry.

Reference Books: (Analytical Chemistry)

1. Vogel's Textbook of quantitative Chemical Analysis, 5th Ed. G. H. Jeffry, J. Basset, J. Mendham, R. C. Denney, Longman Scientific and Technical, 1989.
 2. Analytical Chemistry, G. D. Christian, P. K. Dasgupta, K. A. Schug, 7th Ed, Wily, 2004.
 3. Fundamentals of Analytical Chemistry- Skoog, west, Holler, Crouch, 9th Ed. Brooks / Cole, 2014/2004.
 4. Basic Concept of Analytical Chemistry- S. M. Khopkar
 5. Instrumental methods of chemical analysis- Chatwal Anand
 6. Analytical Chemistry, G.R. Chatwal, Sham Anand.
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CH-302: Inorganic and Organic Chemistry [2Credit, 36 L]

Chapter No.	Chapter	No of Lectures
1	Molecular Orbital Theory of Covalent Bonding	13
2	Introduction to Coordination chemistry	05
3	Aromatic hydrocarbons	05
4	Alkyl and Aryl Halides	07
5	Alcohols, Phenols and Ethers	06

1. Molecular Orbital Theory of Covalent Bonding**[13 L]**

Introduction to Molecular Orbital Method (MOT) and postulates of MO theory, LCAO approximation, s-s combination of orbitals, s-p combination of orbitals, p-p combination of orbitals, p-d combination of orbitals, d-d combination of orbitals, non-bonding combination of orbitals, Rules for linear combination of atomic orbitals, example of molecular orbital treatment for homonuclear diatomic molecules: Explain following molecules with respect to MO energy level diagram, bond order and magnetism: H_2^+ molecule ion, H_2 molecule, He_2^+ molecule ion, He_2 molecule, Li_2 molecule, Be_2 molecule, B_2 molecule, C_2 molecule, N_2 molecule, O_2 molecule, O_2^- and O_2^{2-} ion, F_2 molecule, Heteronuclear diatomic molecules: NO , CO , HF .

(Ref-1:89-112, Ref-4: 278-292, Ref-5: 33-38)

Learning Outcome:

After studying the Molecular Orbital Theory student will able to-

1. Define terms related to molecular orbital theory (AO, MO, sigma bond, pi bond, bond order, magnetic property of molecules, etc).
2. Explain and apply LCAO principle for the formation of MO's from AO's.
3. Explain formation of different types of MO's from AO's.
4. Distinguish between atomic and molecular orbitals, bonding, anti-bonding and non-bonding molecular orbitals.
5. Draw and explain MO energy level diagrams for homo and hetero diatomic molecules. Explain bond order and magnetic property of molecule.
6. Explain formation and stability of molecule on the basis of bond order.
7. Apply MOT to explain bonding in diatomic molecules other than explained in syllabus.

2. Introduction to Coordination Compounds**[5 L]**

Double salt and coordination compound, basic definitions: *coordinate bond, ligand, types of ligands, chelate, central metal ion, charge on complex ion, calculation of oxidation state of central metal ion, metal ligand ratio*; Werner's work and theory, Effective atomic number, equilibrium constant (**Ref-6: 138-140**), *chelate effect, IUPAC nomenclature*. (**Ref-1: 194-200, 222-224; Ref-4: 483-492**)

Learning Outcome:

After studying the Introduction to Coordination Compounds student will able to-

1. Define different terms related to the coordination chemistry (double salt, coordination compounds, coordinate bond, ligand, central metal ion, complex ion, coordination number, magnetic moment, crystal field stabilization energy, types of ligand, chelate effect, etc.)
2. Explain Werner's theory of coordination compounds. Differentiate between primary and secondary valency. Correlate coordination number and structure of complex ion.
3. Apply IUPAC nomenclature to coordination compound.

Reference Books: (Inorganic Chemistry)

1. Concise Inorganic Chemistry, J. D. Lee, 5th Ed (1996) Blackwell Science
2. Inorganic Chemistry, James E. House, Academic Press (Elsevier), 2008
3. Inorganic Chemistry by Miessler and Tarr, Third Ed. (2010), Pearson.
4. Principles of Inorganic Chemistry, Brian W. Pfennig, Wiley (2015)
5. Inorganic Chemistry, Catherine Housecroft, Alan G. Sharpe, Pearson Prentis Hall, 2008.
6. Basics Inorganic Chemistry, Cotton and Wilkinson

3. Aromatic Hydrocarbons:**[5 L]**

Introduction and IUPAC nomenclature, preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. *Reactions* (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (up to 4 carbons on benzene). Side chain oxidation of alkyl benzenes (up to 4 carbons on benzene).

(**Ref-1: 493-513**)

Learning Outcome:

After studying the aromatic hydrocarbons student will able to-

1. Identify and draw the structures aromatic hydrocarbons from their names or from structure name can be assigned.

2. Explain / discuss synthesis of aromatic hydrocarbons.
3. Give the mechanism of reactions involved.
4. Explain /Discuss important reactions of aromatic hydrocarbon.
5. To correlate reagent and reactions.

4. Alkyl and Aryl Halides:**[7 L]**

Alkyl Halides (up to 5 Carbons): Introduction and IUPAC nomenclature, Types of Nucleophilic Substitution (SN^1 , SN^2 and SNi) reactions. *Preparation:* from alkenes and alcohols. *Reactions:* hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs. substitution.

Aryl Halides: Introduction and IUPAC nomenclature, *Preparation:* (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer and Gattermann reactions. *Reactions (Chlorobenzene):* Aromatic nucleophilic substitution (replacement by $-OH$ group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

(*Ref.-1: 165-211 and 943-967*)

Learning Outcome:

After studying the Alkyl and Aryl Halides student will able to-

1. Identify and draw the structures alkyl / aryl halides from their names or from structure name can be assigned.
2. Explain / discuss synthesis of alkyl / aryl halides.
3. Write / discuss the mechanism of Nucleophilic Substitution (SN^1 , SN^2 and SNi) reactions.
4. Explain /Discuss important reactions of alkyl / aryl halides.
5. To correlate reagent and reactions.
6. Give synthesis of expected alkyl / aryl halides.

5. Alcohols, Phenols and Ethers (Up to 5 Carbons):**[6 L]**

Alcohols: Introduction and IUPAC nomenclature, *Preparation:* Preparation of 1o, 2o and 3o alcohols: using Grignard reagent, ester hydrolysis, reduction of aldehydes, ketones, carboxylic acid and esters. *Reactions:* with sodium, HX (Lucas test), esterification, oxidation (with PCC, alc. $KMnO_4$, acidic dichromate, conc. HNO_3). Oppeneauer oxidation *Diols:* (Up to 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

Phenols (Phenol case): Introduction and IUPAC nomenclature, *Preparation:* Cumene hydroperoxide method, from diazonium salts. *Reactions:* Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann Reaction, Houben–Hoesch Condensation, Schotten–Baumann Reaction. **Ethers (aliphatic and aromatic):** Cleavage of ethers with HI.

(Ref-1: 213-244 and 889-912)

Learning Outcome:

After studying the Alcohols and Phenols student will able to-

1. Identify and draw the structures alcohols / phenols from their names or from structure name can be assigned.
2. Able to differentiate between alcohols and phenols
3. Explain / discuss synthesis of alcohols / phenols.
4. Write / discuss the mechanism of various reactions involved.
5. Explain /Discuss important reactions of alcohols / phenols.
6. To correlate reagent and reactions of alcohols / phenols
7. Give synthesis of expected alcohols / phenols.

References: (Organic Chemistry)

1. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Prentice Hall of India, Sixth Edition, 2002, 283-308.

Other Reference Books for All Chapters:

2. Jonathan Clayden, Nick Greeves, Stuart Warren, Peter Wothers *Organic Chemistry* - Oxford University Press, USA, 2nd Ed.
 3. Bahl, A. and Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.
 4. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley and Sons (2014).
 5. Mc Murry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
 6. Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
 7. Finar, I. L. *Organic Chemistry* (Vol. I and II), E.L.B.S.
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CH-303: Practical Chemistry-III [2 credit, 72* L]

* 72 L distributed as 58 L for performing practicals and 14 L for internal evaluation.

For practicals, see the manual prepared by BOS of Chemistry. The examination will be held according to this manual.

Instructions

1. Use molar concentrations for volumetric /estimations/synthesis experiments.
2. Use optimum concentrations and volumes
3. Two burette method should be used for volumetric analysis (Homogeneous mixtures)
4. Use of Microscale technique is recommended wherever possible

A. Chemical Kinetics: (Any Three)

1. To Study the Acid catalysed hydrolysis of an ester (methyl Acetate) and determine the rate constant (k). (first order reaction)
2. To study the kinetics of saponification reaction between sodium hydroxide and ethyl acetate.
3. To compare the relative strength of HCl and H₂SO₄ or HNO₃ by studying the kinetics of hydrolysis of methyl acetate.
4. Energy of activation of the reaction between K₂S₂O₈ and KI with unequal initial concentration.

OR

4. To determine the order of the reaction with respect to K₂S₂O₈ by fractional life method following the kinetics of per sulphate-iodide reaction.

References:

- i) Systematic experimental physical chemistry, S. W. Rajbhoj, T. K. Chondekar, Anjali publication.
- ii) Practical Physical Chemistry, Vishwanathan and Raghwan , Viva book.
- iii) Practical Chemistry, O. P. Pandey, D. N. Bajpai Dr. S. Giri, S Chand Publication
- iv) Experiments in Chemistry, D. V. Jahagirdar, Himalaya Publication.

B. Inorganic quantitative / qualitative analysis (Any two)

1. Estimation of Fe(III) from given solution by converting it to Fe(II) using Zn metal and then by titrating with standard solution of K₂Cr₂O₇-A Green Approach (Ref.-1,3).

- Determination of BaCO_3 content in a given sample by precise determination of volume of CO_2 (Ref-2).
- Separation and Identification of metal ions by Paper Chromatography (Ref.,4,5)

References:

- Iron Analysis by Redox Titration A General Chemistry Experiment, *Journal of Chemical Education*, Volume 65, Number 2, February 1988.183.
- A Precise Method for Determining the CO_2 Content of Carbonate Materials, *Journal of Chemical Education*, Vol. 75, No. 12, December 1998.
- Vogel's Textbook Quantitative Chemical Analysis, 3rd and 6th Ed.
- Advanced Practical Chemistry, Jagdamba Sing et al, Pragati Prakashan, Merrut.
- Practical Chemistry, Panday, Bajpai, Giri, S.Chand and Co.

C. Organic Qualitative Analysis (Two mixtures: solid-solid type)

- Separation of Two Components** from given binary mixture of organic compounds containing mono-functional group (Ex. - carboxylic acid, phenols, amines, amide, nitro, etc.) and systematic identification of each component qualitatively.

D. Organic Preparations (Any two)

- Preparation of benzoic acid from ethyl benzoate (Identification and confirmatory Test of $-\text{COOH}$ group, M.P and purity by TLC)
- Acetylation of primary amine (Green approach)
- Base catalyzed Aldol condensation (Green approach)
- Preparation of Quinone from hydroquinone (Confirm the conversion by absence of phenolic $-\text{OH}$ group in product, M.P and purity by TLC)

E. pH Metry (Compulsory)

- To determine equivalence point of neutralisation of acetic acid by pH-metric titration with NaOH and to find best indicator for the titration.

F. Volumetric Analysis (Any two)

- Estimation of Aspirin from a given tablet and find errors in quantitative analysis. (*Standardization of acid must be performed with standard Na_2CO_3 solution, prepared from dried anhydrous AR grade Na_2CO_3*)
- Determination of acetic acid in commercial vinegar by titrating with standard NaOH. Express your results as average \pm standard deviation. (*Standardization of base must be performed with standard KHP*)

3. Determination of Hardness of water from given sample by complexometric titration (Using E.D.T.A.) method and total dissolve solids by conductometry. Express your results as average \pm standard deviation. (*Standardization of Na₂EDTA must be performed with standard Zn(II) solution*)

Reference:

1. Vogel's Textbook Quantitative Chemical Analysis, 3rd and 5th Ed.
2. Experiments in chemistry, D. V. Jahagirdar, Himalaya Publication.

Examination Pattern: At the time of examination student will have to perform one experiment. In case of organic qualitative analysis, after separation of binary mixture any one component has to be analysed according to OQA scheme. Distribution of 35 marks: 30 marks for experimental performance and 5 mark for oral.

To cope up with NACC criterion and to motivate and inculcate research culture among the students, interested students can be assigned mini-scale project. Project should be based either on applications of chemistry in day to day life or application or novel / applied synthesis / demonstrating principles of chemistry. The project work is equivalent to three experiments. *Student performing project can be exempted from 3 experiments from two semester. (*from three different sections of two semester) and project will be evaluated by external examiner. Project being choice based activity; student will not get any exemption in external examination.* Systematic project report (Name page, certificate, introduction/theory, importance of project, learning outcome, requirements, safety precautions, procedure, observations, calculations, results and conclusions) be submitted separately in binding form duly certified by mentor teacher and HOD.

Illustrative list of some projects is given below for your perusal.

1. Synthesis of soap from different types of oils with respect to i) percent yield ii cost of obtaining 50 g soap (students will learn saponification or alkaline hydrolysis of oils – a chemical reaction for the synthesis of day to day life product, which oil is better for soap making).
2. Synthesis of biodegradable plastic (Principles demonstrated: Chemical reactions for mores safe products and to mitigate environmental pollution).
3. Synthesis of azo dyes and effect substituents of benzene ring on colour of azo dye (Principle demonstrated -Inductive effect a visible demonstration, strategy to charge the colour of dye, chemical reactions for industries).

4. Quality of Consumer products: identification reactions and Purity of NaHCO_3 (eating soda) of different brands by thermal decomposition. (Application of analytical chemistry and simple decomposition reaction for the determination of purity of consumer product)
5. Determination pH, surface tension, CMC and washing action of detergent of different brands for comparing their quality. (Application of chemistry principles in determination of quality of consumer product)
6. Removal of dyes / nitrophenols / by Fenton's process or by adsorption on activated charcoal. (Applications of principles of chemistry in mitigation of environmental pollution, an industrial application of chemistry).
7. Study of deionization water using cation and anion exchange resins / zeolites. Amount of zeolites / resin required for the softening of water. (Day to day life application of chemistry, student can apply their knowledge and can construct their own deionizer).
8. Preparation shampoo. Ingredients required, their proportion, mixing and testing.
9. Eudiometer: Determination of oxidation state, equivalent wt. and determine stoichiometry of the reaction between i) iron metal and HCl. Fe can have oxidation state +2 or +3. ii) Zn and HCl iii) Al and HCl. What happens with HNO_3 ? Why similar method cannot used to investigate reaction between HNO_3 and these metals?
10. Study stoichiometry of simple chemical reactions thereby determination of equivalent wt. of one of the reactant: i) $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ and KMnO_4 (determine equivalent wt. of KMnO_4) ii) Mn(II) and KMnO_4 (determine equivalent wt. of KMnO_4). Explain the concept of variable oxidation state and variable equivalent wt. for same substance i.e. mol. wt. is constant. (Known Fe^{2+} oxidizes to Fe^{3+} only).
11. Synthesis /isolation of essences, purity by TLC/ B.P. (at least two).
12. Synthesis and estimation of purity of aspirin (medicinal compound) by green chemistry route.
13. Compare the paracetamol content in tablet of different brands (at least three different brands).
14. Compare the vitamin-c content in tablet of different brands. (at least three different brands).
15. Determination of Avagadro Number (N) by various technics such as Brownian Moment, Electrodeposition, number of molecules in monolayer etc.
16. Hess Law verification
- 17 Determination of Faraday constant and Avagadro number
- 18 To determine thermodynamic values of various compounds

- 19 To determine density of various substances
- 20 Preparation of Nylon and study its properties
- 21 Microscale techniques in Chemistry

References:

1. A laboratory manual for general, organic and biological chemistry, 3rd Ed. Pearson.
2. Safety-Scale Laboratory Experiments for Chemistry for Today: General, Organic and Biochemistry Seventh Edition, Spencer L. Seager, Michael R. Slabaugh, Cengage Learning, 2010
3. Laboratory Manual for Principles of General Chemistry, Bearen, 8th Ed. Wiley.
4. Green Chemistry Laboratory Manual for General Chemistry, Sally A. Henrie, CRC Press Taylor & Francis Group, and Informa Business. 2015
5. Experiments in General Chemistry, G. S. Weiss T. G. Greco L. H. Rickard, Ninth Edition, Pearson Education Limited, 2014.
6. Mini-scale and micro-scale organic chemistry laboratory experiments 7th Ed. Schoffstall, Gaddis, Mc-Graw-Hill Higher Education, 2004.
7. Journal of Chemical Education, ACS, (search relevant topics).

II. Students short activity (for both semesters)

These are the extra-time activities for the students which can be performed with the permission of mentor. Mentor can arrange a demonstration on these activities to explain basic principles of chemistry. **Teacher can design many such activities to explain theory that you taught in the class.** Systematic report of activity performed be written in journal. Sample list of small activities is given below. These short activities can be considered for internal evaluation. Some activities are given below.

1. Amphoteric nature of $\text{Al}(\text{OH})_3$ (Principle demonstrated-demonstration of amphoteric nature substance and why $\text{Al}(\text{OH})_3$ is used in antacid preparations)
2. Enzyme deactivation by Hg^{2+} (Principle demonstrated-catalyst deactivation and toxicity effect of Hg^{2+})
3. Adsorption of dyes on activated charcoal (Principle demonstrated and application- surface adsorption for removal of dyes from effluents)
4. Detection of adulteration in milk / chilli powder / turmeric powder / food colours
5. Use of EXCEL in drawing of graphs and calculations.
6. Catalysis by $\text{Mn}(\text{II})$ in KMnO_4 -Oxalic acid titration. (Principle, demonstrated - Homogeneous catalysis)

7. Identification of type of salt (strong acid – strong base, strong acid – weak base, weak acid – strong base) by hydrolysis reactions and indicators. (Principle demonstrated – hydrolysis reaction of salts, it really takes place)
8. Identification of inorganic ions in soft drinks / tooth paste, form of iodide in table salt / waste water / bore well water.
9. Spectrochemical series using CuSO_4 solution and i) NaCl, ii) KBr, iii) Ammonia, iv) ethylene diamine, v) salicylic acid [correlate colour with wavelength and predict ligand strength]
10. Green Chemistry principles in Organic Chemistry.

References: Journal of Chemical Education, ACS, (search relevant topics).

Learning Outcome- Practical Chemistry-III

1. Verify theoretical principles experimentally.
2. Interpret the experimental data on the basis of theoretical principles.
3. Correlate theory to experiments. Understand/verify theoretical principles by experiment observations; explain practical output / data with the help of theory.
4. Understand systematic methods of identification of substance by chemical methods.
5. Write balanced equation for the chemical reactions performed in the laboratory.
6. Perform organic and inorganic synthesis and is able to follow the progress of the chemical reaction by suitable method (colour change, ppt. formation, TLC).
7. Set up the apparatus / prepare the solutions - properly for the designed experiments.
8. Perform the quantitative chemical analysis of substances explain principles behind it.
9. Systematic working skill in laboratory will be imparted in student.

Important Notes:

- i) Wherever feasible develop and practice micro or semi-micro methods from known / recommended procedures and the reference books. This is to i) minimize the cost of experiment, ii) reduce wastage of chemicals iii) reduce environmental pollution.
- ii) Mentor should promote students to ***complete the Journal on the same day before leaving of the lab***. Ensure that the original data is retained and used by the candidate. Students may adjust the data from their lab work to reach close to theoretical values. If journal is completed before leaving the lab it will not encourage students to “adjust” the facts from their lab work. (Ref-Journal of Chemical Education, Min J. Yang and George F. Atkinson, Designing New Undergraduate Experiments, Vol. 75, No. 7, July 1998).

Internal Evaluation Strategy for practical (Both semester):

During start of the practical course methodology of internal evaluation should be discussed with students. Internal evaluation is a continuous assessment (CA). Hence during each practical, internal evaluation must be done with different tools. **Guidelines for internal evaluation:** To each practical 15 marks can be assigned which can be distributed as follows:

Overall performance and timely arrival	Interaction	Accuracy of results	Journal /Lab report	Post laboratory quiz / assignment / oral
4	2	2	5	2

At the end of semester, average of 12 experiments can be assigned as internal marks out of 15. Systematic record of internal evaluation must be maintained which is duly sign by mentor and student. If student is absent with prior-intimation her/his absentee will be considered but student will have to complete the experiment in the same week or in with the permission of mentor. Mentor or practical in-charge should arrange the practical for such students. Students performing projects (one mini project equivalent to three practical session) / student activities (4 to 6 activities equivalent to three practical session) can be assigned up to 3 marks out of 15.

SEMSER-IV**CH-401: Physical and Analytical Chemistry [Credit: 2, 36 L]**

Chapter No	Chapter	No of Lectures
1	Phase Equilibrium	09
2	Ideal and Real Solutions	09
3	Conductometry	06
4	Colorimetry	06
5	Column Chromatography	06

1. Phase equilibrium**[9L]**

Introduction; definitions of phase, components and degrees of freedom of a system; stability of phases, criteria of phase equilibrium. Gibbs phase rule and its thermodynamic derivation, phase diagrams of one- component systems- water, carbon dioxide and sulphur systems, problems. (*Ref. No: 1, Page No- 119 - 126, Ref. No: 2, Page No – 661-675, Ref. No:4, Page No 344- 354*).

Learning Outcomes

- Define the terms in phase equilibria such as- system, phase in system, components in system, degree of freedom, one / two component system, phase rule, etc.
- Explain meaning and Types of equilibrium such as true or static, metastable and unstable equilibrium.
- Discuss meaning of phase, component and degree of freedom.
- Derive of phase rule.
- Explain of one component system with respect to: Description of the curve, Phase rule relationship and typical features for i) Water system ii) Carbon dioxide system iii) Sulphur system

Reference Books (Physical Chemistry)

1. Atkins' Physical Chemistry by Peter Atkins, Julio de Paula, James Keeler -11th edition
2. Principles of Physical chemistry by B.R. Puri, L.R. Sharma, M.S. Pathania
3. Essentials of Physical chemistry by Bahl Tuli-Revised Multicolour Edition 2009, S. Chand and Company Ltd.
4. Principles of Physical Chemistry, Fourth Edition by S.H. Marron and C. F. Pruton
5. Physical-Chemistry-4th Edition - Gilbert W. Castellan Narosa (2004).
6. Principles of Chemical Kinetics- 2nd Edition- James E. House.

7. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
8. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry, Cengage Learning India Pvt. Ltd.: New Delhi (2009).
9. Mahan, B.H. University Chemistry, 3rd Ed. Narosa (1998).
10. Petrucci, R.H. General Chemistry, 5th Ed., Macmillan Publishing Co.: New York (1985).
11. Physical Chemistry by Thomas Engel, Philip Reid, Warren Hehre.

2. Ideal and real solutions

[9L]

Introduction, chemical potential of liquids - ideal solutions, ideal dilute solutions - Raoult's and Henry's Law, liquid mixtures, phase diagram of binary systems : liquids - vapour pressure diagrams, temperature composition diagrams, liquid-liquid phase diagrams, solubility of partially miscible liquids-critical solution temperature, effect of impurity on partially miscible liquids, Problems. (*Ref. No: 1, Page Nos- 150-153, 155-157, 166 – 175, Ref. No: 2, Page No. - 750-775, 696-705**Ref. No:4, Page No. 261-292, 298- 302*).

Learning Outcomes

- Define various terms, laws, differentiate ideal and non-ideal solutions.
- Discuss / explain thermodynamic aspects of Ideal solutions-Gibbs free energy change, Volume change, Enthalpy change and entropy change of mixing of Ideal solution.
- Differentiate between ideal and non-ideal solutions and can apply Raoult's law.
- Interpretation of i) vapour pressure–composition diagram ii) temperature- composition diagram.
- Explain distillation of liquid solutions from temperature – composition diagram.
- Explain / discuss azeotropes, Lever rule, Henry's law and its application.
- Discuss / explain solubility of partially miscible liquids- systems with upper critical. Solution temperature, lower critical solution temperature and having both UCST and LCST.
- Explain / discuss concept of distribution of solute amongst pair of immiscible solvents.
- Derive distribution law and its thermodynamic proof.
- Apply solvent extraction to separate the components of from mixture interest.
- Solve problem by applying theory.

3. Conductometry

[6 L]

Introduction, Electrolytic Conductance, Resistance, conductance, Ohm's law, cell constant, specific and equivalent conductance, molar conductance, variation of equivalent and specific conductance with concentrations, Kohlrausch's law and its applications, conductivity cell, conductivity meter, Wheatstone Bridge, determination of cell constant,

conductometric titrations (strong acid-strong base, strong acid-weak base, weak acid strong base) and Numericals. **Ref-1:** 398-402, 414-423, 433-434, **Ref-2:** 519-527, **SupplementaryRef-3:** 746-756, **Ref-4:** 528-532.

Learning Outcomes

- Explain / define different terms in conductometry such as electrolytic conductance, resistance, conductance, Ohm's law, cell constant, specific and equivalent conductance, molar conductance, Kohlrausch's law, etc.
- Discuss / explain Kohlrausch's law and its Applications, Conductivity Cell, Conductivity Meter, Whetstone Bridge.
- Explain / discuss conductometric titrations.
- Apply conductometric methods of analysis to real problem in analytical laboratory.
- Solve problems based on theory / equations.
- Correlate different terms with each other and derive equations for their correlations.

4. Colorimetry:

[6 L]

Introduction, interaction of electromagnetic radiation with matter, essential terms: radiant power, transmittance, absorbance, molar, Lambert's Law, Beer's Law, Lambert-Beer's Law, molar absorptivity, deviations from Beer's Law, Colorimeter: *Principle, Construction and components, Working*. Applications—unknown conc. By calibration curve method, Determination of unknown concentration of Fe(III) by thiocyanate method, Numericals. (**Ref-2:** 645-651, 658-661, 690, **Ref-3:** 97, 100, 159-172, **Ref-4:** 144-153, 157-160, **Ref-6-Relevant pages**).

Learning Outcomes

- Explain / define different terms in Colorimetry such as radiant power, transmittance, absorbance, molar, Lambert's Law, Beer's Law, molar absorptivity
- Discuss / explain / derive Beer's law of absorptivity.
- Explain construction and working of colorimeter.
- Apply colorimetric methods of analysis to real problem in analytical laboratory.
- Solve problems based on theory / equations.
- Correlate different terms with each other and derive equations for their correlations.

5. Column Chromatography

[6 L]

Introduction, Principle of Column Chromatography, **Ion Exchange Chromatography:** Ion exchange resins, action of ion exchange resin (Ion exchange equilibria, Ion exchange capacity), Experimental technique, Application: i) Separation of

Metal ions / non-metal ions on Ion Exchange Chromatography (*Zn(II)* and *Mg(II)*, *Cl⁻* and *Br⁻*), ii) Purification of water, (**Ref-2:** 186-192, 205-209) **Adsorption Chromatography – Liquid solid chromatography:** Introduction, the technique of conventional chromatography, column packing materials, Selection of solvent for adsorption chromatography, Adsorption column preparation and loading, Application – Purification of anthracene (**Ref-5:** 209-215, 221), Size Exclusion Chromatography(*Supplementary - Ref-4: pages 111-153, 212-215, Ref-6-Relevant pages*)

Learning Outcomes

- Explain / define different terms in column chromatography such as stationary phase, mobile phase, elution, adsorption, ion exchange resin, adsorbate, etc.
- Explain properties of adsorbents, ion exchange resins, etc.
- Discuss / explain separation of ionic substances using resins.
- Discuss / explain separation of substances using silica gel / alumina.
- Apply column chromatographic process for real analysis in analytical laboratory.

References (Analytical Chemistry)

1. Principles of Physical Chemistry, S.H. Marron and C. F. Pruton^{4th} ed., Oxford and IBH publishing company / CBS, new Delhi.
 2. Vogel's Textbook of quantitative Chemical Analysis, 5th Ed. G. H. Jeffry, J. Basset, J. Mendham, R. C. Denney, Longman Scientific and Technical, 1989.
 4. Basic Concept of Analytical Chemistry- S. M. Khopkar
 5. Vogel's Text Book of Practical Organic Chemistry, Furniss, Hannaford, Smith, Tatchel, 5th Ed., Longman Scientific and Technical, 2004.
 6. Analytical Chemistry, G.R. Chatwal, Sham Anand.
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CH-402: Inorganic and Organic Chemistry [2 credit, 36L]

Chapter No.	Chapter	No of Lectures
1	Isomerism in coordination complexes	02
2	Valance Bond Theory of Coordination Compounds	04
3	Crystal field Theory	12
4	Aldehydes and ketones	05
5	Carboxylic acids and their derivatives	05
6	Amines and Diazonium Salts	04
7	Stereochemistry of Cyclohexane	04

1. Isomerism in coordination complexes [2 L]

Introduction, polymerization isomerism, ionization isomerism, hydrates isomerism, linkage isomerism, coordination isomerism, coordination position isomerism, geometric isomerism, optical isomerism.

(Ref-1: 232-236)

Learning Outcome:

After studying the aromatic hydrocarbons student will able to-

1. Isomerism in coordination complexes
2. Explain different types of isomerism in coordination complexes.

2. Valance Bond Theory of Coordination Compounds [4 L]

Aspects and assumptions of VBT, applications of VBT on the basis of hybridization to explain the structure and bonding in $[\text{Ag}(\text{NH}_3)_2]^+$, $[\text{Ni}(\text{Cl}_4)]^{2-}$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Cr}(\text{H}_2\text{O}_6)]^{3+}$, $[\text{Fe}(\text{CN})_6]^{3-}$ (Inner orbital complex) and $[\text{FeF}_6]^{3-}$ (outer orbital complex). Use of observed magnetic moment in deciding the geometry in complexes with C.N.4, limitations of VBT.

(Ref-2: 592-597, Ref-3:350-351).

Learning Outcome:

After studying the aromatic hydrocarbons student will able to-

1. Apply principles of VBT to explain bonding in coordination compound of different geometries.
2. Correlate no of unpaired electrons and orbitals used for bonding.
2. Identify / explain / discuss inner and outer orbital complexes.
4. Explain / discuss limitation of VBT.

3. Crystal Field Theory**[12 L]**

Shapes of d-orbitals, Crystal field Theory (CFT): Assumptions, Application of CFT to
i) Octahedral complexes (*splitting of 'd' orbitals in Oh ligand field, effect of weak and strong ligand fields, colour absorbed and spectrochemical series, crystal splitting energy, Crystal field stabilization energy and factors affecting it, tetragonal distortion in Cu(II) complexes*)
ii) Square planar complexes and iii) Tetrahedral complexes; spin only magnetic moment of Oh and Td complexes.

(Ref-1:194-225).

Learning Outcome:

After studying the aromatic hydrocarbons student will able to-

1. Explain principle of CFT.
2. Apply crystal field theory to different type of complexes (Td, Oh, Sq. Pl complexes)
3. Explain: i) strong field and weak field ligand approach in Oh complexes ii) Magnetic properties of coordination compounds on the basis of weak and strong ligand field ligand concept. iii) Origin of colour of coordination complex.
4. Calculate field stabilization energy and magnetic moment for various complexes.
5. To identify Td and Sq. Pl complexes on the basis of magnetic properties / unpaired electrons.
6. Explain spectrochemical series, tetragonal distortion / Jahn-Teller effect in Cu(II) Oh complexes only.

Reference Books: (Inorganic Chemistry)

1. Concise inorganic chemistry, J. D. Lee, 5th Ed (1996), Blackwell Science
2. Inorganic Chemistry, James E. House, Academic Press (Elsevier), 2008
3. Inorganic Chemistry by Miessler and Tarr, Third Ed. (2010), Pearson.

4. Aldehydes and Ketones (aliphatic and aromatic)**[5 L]**

(Formaldehyde, acetaldehyde, acetone and benzaldehyde)

Introduction and IUPAC nomenclature, *Preparation*: from acid chlorides and from nitriles. *Reactions* – Reaction with HCN, ROH, NaHSO₃, NH₂-G derivatives. Iodoform test, Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation, Clemenson reduction and Wolff Kishner reduction. Meerwein-Ponndorf Verley reduction.
(Ref-1: 657-700 and 797-816)

Learning Outcome:

After studying the aldehydes and ketones student will able to-

1. Identify and draw the structures aldehydes and ketones from their names or from structure name can be assigned.
2. Explain / discuss synthesis of aldehydes and ketones.
3. Write / discuss the mechanism reactions aldehydes and ketones.
4. Explain /Discuss important reactions of aldehydes and ketones.
5. To correlate reagent and reactions of aldehydes and ketones
6. Give synthesis of expected aldehydes and ketones.
7. Perform inter conversion of functional groups.

5. Carboxylic acids and their derivatives

[5 L]

Carboxylic acids (aliphatic and aromatic): Introduction and IUPAC nomenclature, *Preparation:* Acidic and Alkaline hydrolysis of esters. *Reactions:* Hell–Vohlard - Zelinsky Reaction.

Carboxylic acid derivatives (aliphatic): (up to 5 carbons) *Preparation:* Acid chlorides, Anhydrides, Esters and Amides from acids and their inter conversion. Reaction: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation. (*Ref-1:* 713-745 and 753-785).

Learning Outcome:

After studying the carboxylic acids and their derivatives student will able to-

1. Identify and draw the structures carboxylic acids and their derivatives from their names or from structure name can be assigned.
2. Explain / discuss synthesis of carboxylic acids and their derivatives.
3. Write / discuss the mechanism reactions carboxylic acids and their derivatives.
4. Explain /Discuss important reactions of carboxylic acids and their derivatives.
5. Correlate reagent and reactions of carboxylic acids and their derivatives
6. Give synthesis of expected carboxylic acids and their derivatives.
7. Perform inter conversion of functional groups.

6. Amines and Diazonium Salts:

[4 L]

Amines (Aliphatic and Aromatic): Introduction and IUPAC nomenclature, *Preparation* from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction. *Reactions:* Hofmann vs. Saytzeff elimination, Electrophilic substitution (Case Aniline): nitration, bromination, sulphonation.

Diazonium salts: Preparation from aromatic amines. (*Ref-1:* 821-877)

Learning Outcome:

After studying the amines and diazonium Salts student will able to-

1. Identify and draw the structures amines from their names or from structure name can be assigned.
2. Explain / discuss synthesis of carboxylic amines.
3. Write / discuss the mechanism reactions carboxylic amines.
4. Explain /Discuss important reactions of carboxylic amines.
5. To correlate reagent and reactions of carboxylic amines.
6. Give synthesis diazonium salt from amines and reactions of diazonium salt.
7. Perform inter conversion of functional groups.

7. Stereochemistry of Cyclohexane: [4 L]

Bayer's strain theory, heat of combustion of cycloalkanes, structure of cyclohexane, axial and equatorial H atoms, conformations of cycloalkane, stability of conformations of cyclohexane, methyl and t-butyl monosubstituted cyclohexane, 1,1 and 1,2 dimethyl cyclohexane and their stability.

(*Ref-1*: 283-308).

Learning Outcome:

After studying the aromatic hydrocarbons student will able to-

1. Draw the structures of different conformations of cyclohexane.
2. Define terms such as axial hydrogen, equatorial hydrogen, confirmation, substituted cyclohexane, etc.
3. Convert one conformation of cyclohexane to another conformation and should able to identify governing structural changes.
4. Explain / discuss stability with respect to potential energy of different conformations of cyclohexane.
5. Draw structures of different conformations of methyl / t-butyl monosubstituted cyclohexane (axial, equatorial) and 1, 2 dimethyl cyclohexane.
6. Identify cis- and trans-isomers of 1, 2 dimethyl substituted cyclohexane and able to compare their stability.

Reference Books: (Organic Chemistry)

1. Morrison, R.T. and Boyd, R.N. *Organic Chemistry*, Prentice Hall of India, Sixth Edition, 2002, 283-308.

Other Reference Books for all chapters:

2. Jonathan Clayden, Nick Greeves, Stuart Warren, Peter Wothers, *Organic Chemistry*-Oxford University Press, USA, 2nd Ed.
 3. Bahl, A. and Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.
 4. Graham Solomon, T. W., Fryhle, C. B. and Snyder, S. A. *Organic Chemistry*, John Wiley and Sons (2014).
 5. Mc Murry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
 6. Sykes, P. A *Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
 7. Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
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CH-403: Practical Chemistry-IV [2 credit, 72* L]

* 72 L will be distributed as 58 L performing practical and 14 L for internal evaluation.

Instructions:

1. Use molar concentrations for volumetric /estimations/synthesis experiments.
2. Use optimum concentrations and volumes
3. Two burette method should be used for volumetric analysis (Homogeneous Mixtures)
4. Use of Microscale technique is recommended wherever possible.

A. Conductometry (Compulsory)

- a) To determine the cell constant of the given cell using 0.01 M KCl solution and determine dissociation constant of a given monobasic weak acid.
- b) To investigate the conductometric titration of any one of the following a) Strong acid against strong base b) Strong base against weak acid. (*standardization of base must be performed with KHP*)

B. Chromatography (compulsory)

1. Separation of binary mixture of cations by Column Chromatography by ion exchange resins / cellulose (any one mixture) (Co + Al, Cu + Mg, Zn+Mg). Separation of cations must be confirmed by qualitative test

References:

- i. Vogel's Textbook Quantitative Chemical Analysis, 3rd, 6th Ed.
- ii) Experiments in chemistry, D. V. Jahagirdar, Himalaya publication.

C. Ideal and Real solutions (Any two)

1. To study the variation of mutual solubility temperature with % concentration for the phenol - water system
2. To study the effect of added electrolyte on the critical solution temperature of phenol-water system and to determine the concentration of the given solution of electrolyte.
3. To obtain the temperature-composition phase diagram for a two component liquid system with maximum (or minimum) boiling point and to determine the maximum (or minimum) boiling point and composition.

D. Adsorption (Compulsory)

1. To verify the Freundlich and Langmuir adsorption isotherm for adsorption of acetic acid on activated charcoal.

References:

- i) Systematic experimental physical chemistry, S. W. Rajbhoj, T. K. Chondekar, Anjali publication.
- ii) Practical Physical Chemistry, Vishwanathan and Raghwan , Viva book.
- iii) Practical Chemistry, O. P. Pandey, D. N. Bajpai Dr. S. Giri, S Chand Publication

E. Synthesis of Coordination compounds (any two)

1. Synthesis of sodium cobaltinitrite (a laboratory chemical) from Co(II) salt and NaNO_2 salts. Comment on colour and magnetic properties of the complex. (Ref.-1, 2)
2. Synthesis of potassium Tris(oxalate)aluminium(III) using Al metal powder(Scrap aluminium). Comment on colour and magnetic properties of the complex. (Ref-2, 3, 4)
3. Synthesis of Tris(acetylacetonate)iron(III) by green chemistry method by reaction between $\text{Fe}(\text{OH})_3$ and acac. Comment on colour and magnetic properties of the complex. (Ref.- 5,6).
4. Synthesis of Tris(ethylenediamine)nickel(II) from Ni(II) salt, ethylenediamine and sodium thiosulfate. Comment on colour and magnetic properties of the complex. (Ref.-7)

F. Inorganic colorimetric investigations (Any two)

1. Prepare standard solutions of KMnO_4 / CuSO_4 , record their absorbance and Verify Beer's Law and determine unknown concentration. **(Compulsory)**
2. Prepare solution of Fe(III) and SCN^- in different molar proportion, record their absorbance and calculate equilibrium constant of $[\text{Fe}(\text{SCN})]^{2+}$ complex (Ref.-9,10)
3. Prepare solution of Fe(III)/Cu(II) and salicylic acid in different molar proportion and determine metal ligand ratio in Fe(III) or Cu(II)–Salicylic acid complex. (Ref.-11, 12, 13)

References

1. Handbook of Preparative Inorganic Chemistry, Volume 2, Second Edition, Edited By Georg Brauer, Academic Press, New York, London, 1965. (Page-1541)
2. Practical Chemistry, Pandey, Bajpai, Giri, S.Chand and Co.
3. McNeese, T.J.; Wierda, D.A. Synthesis of Potassium Tris(oxalato)aluminate(III) Trihydrate. *Journal of Chemical Education*, 1983, 60(11), 1001.
4. Inorganic Syntheses Vol -1 by H S Booth. First Ed, 1939. (page-36).
5. Novel Synthesis of Tris(acetylacetonato)-iron(III), *Journal of Chem. Soc. Dalton Trans.* 1983
6. Metal Acetylacetonate Synthesis Experiments: Which Is Greener?, *Journal of Chemical Education*, 2011, 88, 947–953, dx.doi.org/10.1021/ed100174f

7. Experimental Inorganic/Physical Chemistry: An Investigative, Integrated Approach to Practical Project Work, Mounir A. Malati, Woodhead Publishing Limited, 1999.
8. Vogel's Textbook Quantitative Chemical Analysis, 6th Ed.
9. Colorimetric Determination of the Iron(III)-Thiocyanate Reaction Equilibrium Constant with Calibration and Equilibrium Solutions Prepared in a Cuvette by Sequential Additions of One Reagent to the Other, *Journal of Chemical Education*, Vol.88 No.3 March 2011.
10. Experiments in chemistry, D. V. Jahagirdar, Himalaya publication.
11. A spectrophotometric study of complex formation between Fe(III) and salicylic acid, Kinya Ogawa, Nobuko Tobe, Bulletin of chemical society of Japan, 39, 227-232, 1966.
12. Salicylate determination by complexation with Fe(III) and optical absorbance spectroscopy
13. Determination of Equilibrium Constants of Metal Complexes from Spectrophotometric Measurements: An Undergraduate Laboratory Experiment, *Journal of Chemical Education*, Vol. 76, No. 9, September 1999.

G. Organic Estimations (any two)

1. **Determination of molecular weight:** Determination of molecular weight of organic acid by titration against standardized NaOH - a) monobasic acid or b) dibasic acid
2. **Estimation of amides:** Determine the amount of acetamide in given solution by volumetric method. (Standardization of acid must be performed)
3. **Estimation of Ethyl benzoate:** To determine the amount of ethyl benzoate in given solution volumetrically. (Standardization of acid must be performed).

References:

- i) Vogel's textbook of practical organic chemistry
- ii) Comprehensive Practical Organic Chemistry by V.K. Ahluwalia and Renu Aggarwal

Examination Pattern: At the time of examination student has to perform one experiment either from inorganic sections or organic section. 50% students must be assigned inorganic chemistry and 50% organic chemistry experiment. In case of organic qualitative analysis, after separation of binary mixture any one compound has to be analysed. Distribution of or 35 marks: 30 marks for experimental performance and 5 mark for oral.

Section - C: Industrial Visit

Visit any Chemical / Pharmaceutical / Polymer / Research Institutes / Sugar Factories / waste water treatment plant, etc. and submit report.

Learning Outcomes

1. Verify theoretical principles experimentally

2. Interpret the experimental data on the basis of theoretical principles.
 3. Correlate the theory to the experiments. Understand / verify theoretical principles by experiment or explain practical output with the help of theory.
 4. Understand systematic methods of identification of substance by chemical methods.
 5. Write balanced equation for all the chemical reactions performed in the laboratory.
 6. Perform organic and inorganic synthesis and able to follow the progress of the chemical reaction.
 7. Set up the apparatus properly for the designed experiments.
 8. Perform the quantitative chemical analysis of substances and able to explain principles behind it.
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Faculty of Science and Technology

Choice Based Credit System (CBCS)

B. Sc. (Physics)

From Academic Year 2019-2020

Structure of Syllabus

SAVITRIBAI PHULE PUNE UNIVERSITY

GANESHKHIND, PUNE-411007

Proposed Structure of B.Sc. (Physics) Syllabus(C.B.C.S.)

1) Title of the Course: B.Sc. Physics

2) Preamble:

The curriculum for the B. Sc. (Physics) programme is designed to cater to the requirement of Choice Based Credit System following the University Grants Commission (UGC) guidelines. In the proposed structure, due consideration is given to Core and Elective Courses (Discipline specific - Physics), along with Ability Enhancement (Compulsory and Skill based) Courses. Furthermore, continuous assessment is an integral part of the CBCS, which will facilitate systematic and thorough learning towards better understanding of the subject. The systematic and planned curricula from first year to the third year (comprised of six semesters) shall motivate the student for pursuing higher studies in Physics and inculcate enough skills for becoming an entrepreneur.

Objectives:

- To foster scientific attitude, provide in-depth knowledge of scientific and technological concepts of Physics.
- To enrich knowledge through problem solving, minor/major projects, seminars, tutorials, review of research articles/papers, participation in scientific events, study visits, etc.
- To familiarize with recent scientific and technological developments.
- To create foundation for research and development in Physics.
- To help students to learn various experimental and computational tools thereby developing analytical abilities to address real world problems.
- To train students in skills related to research, education, industry, and market.
- To help students to build-up a progressive and successful career in Physics.

3) Introduction: Semester Credit System

4) Eligibility:

1. **First Year B.Sc.:** Higher Secondary School Certificate (10+2) Science stream or it's equivalent examination, as per the eligibility norms of SavitribaiPhule Pune University (SPPU).
2. **Second Year B.Sc.:** Keeping terms of the First Year of B. Sc. with Physics as one of the subjects. Other students, fulfilling the conditions approved by the equivalence committee of Faculty of Science and Technology, SavitribaiPhule Pune University, are also eligible.
3. **Third Year B. Sc.:** Students, who have earned all credits of Physics courses at the First Year B. Sc. (i.e. successfully passed the internal and external examinations) and satisfactorily keeping terms of Second Year of B. Sc. with Physics as one of the subjects.

** If the student intends to pursue M. Sc. (Physics) at Department of Physics, SPPU, Pune, he/she must take Mathematics as one of the subjects at F. Y. B. Sc.*

Note: Admissions will be given as per the selection procedure/policies adopted by the respective college/institute, for university department in accordance with conditions laid down by the SPPU, Pune. Reservation and relaxation will be applicable as per the Government rules and regulations.

5) Examination: As per the BOOKLET prepared by SPPU, Pune

- A) Pattern of Examination:
- B) Standard of Passing
- C) ATKT Rules
- D) Award of Class
- E) External Students
- F) Setting of Question paper / Pattern of Question paper
- G) Verification / Revaluation

6) Structure of the Course:

**Structure of B.Sc. Physics (Choice Based Credit System)
Programme to be implemented from Academic Year 2019-20**

Subject Name	Year	Semester	Course Type	Course Code	Course Name	Credit
Physics	1	I	Compulsory Course	PHY-111	Mechanics and Properties of Matter	2
				PHY-112	Physics Principles and Applications	2
				PHY-113	Physics Laboratory-IA	1.5
		II	Compulsory Course	PHY-121	Heat and Thermodynamics	2
				PHY-122	Electricity and Magnetism	2
				PHY-123	Physics Laboratory-IB	1.5
	2	III	Compulsory Course	PHY-231	Mathematical Methods in Physics I	2
				PHY-232	Electronics I /Instrumentation	2
				PHY-233	Physics Laboratory-2A	2
			Ability Enhancement Compulsory Course	PHY-2310	Environment -I	2
				PHY-2310	Language-I	2
				IV	Compulsory Course	PH-241
		PH-242	Optics			2
		PH-243	Physics Laboratory-2B			2
		Ability Enhancement Compulsory Course	PHY-2410		Environment –II	2
			PHY-2411	Language-II	2	
	3		V	Discipline Specific Elective Course	PH- 351	Mathematical Methods in Physics II
		PH- 352			Electrodynamics	2
		PH- 353			Classical Mechanics	2
		PH- 354			Atomic and Molecular Physics	2
		PH- 355			Computational Physics	2
		PH- 356			Elective I (Select any One)	2
		PH- 357			Physics Laboratory-3A	2
PH- 358		Physics Laboratory-3B			2	
PH- 359		Physics Laboratory-3C			2	
Skill Enhancement Course		PH-3510			Maintenance and Repairing of Laboratory equipment – I	2
		PH- 3511	Household Electrification,	2		

					Maintenance and repairing - I	
		VI	Discipline Specific Elective Course	PH- 361	Solid State Physics	2
				PH- 362	Quantum Mechanics	2
				PH- 363	Thermodynamics and Statistical Physics	2
				PH- 364	Nuclear Physics	2
				PH- 365	Electronics II /Advanced Electronics	2
				PH- 366	Elective II (Select any One)	2
				PH- 367	Physics Laboratory-4A	2
				PH- 368	Project	2
				PH- 369	Project	2
			Skill Enhancement Course	PH-3610	Maintenance and Repairing of Laboratory Equipment – II	2
		PH- 3611		Household Electrification, Maintenance and Repairing- II	2	

Syllabi of B.Sc. Physics (Choice Based Credit System)
Programme to be implemented from Academic Year 2019-20

First Year B. Sc. (F. Y. B. Sc.)

Course code and title: PHY-111 Mechanics and Properties of Matter

Lectures: 36

(Credits-02)

1. Motion: (9 Lectures)

Introduction to motion, Types of motion, Displacement, Velocity, Acceleration, Inertia, Newton's laws of motion with their explanations, Various types of forces in nature, Frames of reference (Inertial and Non inertial), Laws of motion and its real life applications, Problems.

2. Work and Energy: (7 Lectures)

Kinetic energy, Work Energy Theorem, Work done with constant force, Work done with varying force (spring force), Conservative and Non conservative forces, Potential energy, Law of energy conservation, Gravitational potential energy, Problems.

3. Fluid Mechanics: (8 Lectures)

Concept of viscous force and viscosity, Coefficient of viscosity, Steady and Turbulent flow, Reynolds number, Equation of continuity, Bernoulli's Principle, Applications of Bernoulli's Principle (Ventury Meter, PitotTube), Applications of viscous fluids, Problems.

4. Properties of Matter: (12 Lectures)

Surface tension, Angle of contact, Factors affecting surface tension, Jaeger's method for determination of surface tension, Applications of surface tension.

Stress and Strain, Hook's law and Coefficient of elasticity, Young's modulus, Bulk modulus, Modulus of rigidity, Work done during longitudinal strain, Volume strain, Shearing strain, Poisson's ratio, Relation between three elastic moduli, (Y , η , K), Applications of elasticity, Problems.

Reference Books

1. Physics: Resnick, Halliday & Walker 9/e, Wiley.
2. University Physics : Sears and Zeemansky, XIth/XIIth Edition, Pearson Education.
3. Mechanics: D. S. Mathur, S. Chand and Company, New Delhi.
4. Elements of Properties of Matter : D. S. Mathur, S. Chand, New Delhi.
5. Concepts of Physics: H. C. Verma, Bharati Bhavan Publisher.
6. Problems in Physics: P. K. Srivastava, Wiley Eastern Ltd.
7. Applied Fluid Mechanics: Mott Robert, Pearson Benjamin Cummir VI Edition. Pearson Education/Prentice Hall International, New Delhi.
8. Fundamentals of Mechanics: J C Upadhyaya, Himalaya Publishing House.
9. Mechanics: D. S. Mathur, Revised by P. S. Hemne, S. Chand and Company, New Delhi.

Course code and title: PHY-112Physics Principles and Applications

Lectures: 36

(Credits-02)

Learning Outcomes:

On successful completion of this course students will be able to do the following:

1. To understand the general structure of atom, spectrum of hydrogen atom.
2. To understand the atomic excitation and LASER principles.
3. To understand the bonding mechanism and its different types.
4. To demonstrate an understanding of electromagnetic waves and its spectrum.
5. Understand the types and sources of electromagnetic waves and applications.
6. To demonstrate quantitative problem solving skills in all the topics covered.

1. Physics of Atoms

(08-Lectures)

1.1 Introduction to Atom

1.2 Atomic Models:

1.2.1 Thomson's Atomic Model

1.2.2 Rutherford's Atomic Model

1.2.3 Bohr's Atomic Model

1.3 Atomic Spectra:

1.3.1 Emission line Spectrum

1.3.2 Absorption line spectrum

1.3.3 Uses of Atomic Spectra

1.4 Classical planetary model of Hydrogen Atom

1.5 The Bohr Theory of the Hydrogen Atom

1.6 The Hydrogen Spectrum

1.7 Frank-Hertz experiment

Problems

2. LASERS and Its Applications

(07-Lectures)

2.1 Introduction to LASERS

2.2 Basic Principle of Lasers: Three Processes

2.3 Characteristics of Lasers: brief explanation

2.4 Boltzmann Distribution Law

2.5 Population Inversion and Pumping

2.6 Types of Lasers:

2.5.1 He-Ne Laser

2.5.2 Ruby Laser

2.7 Applications of Lasers

Problems

3. Physics of Molecules

(08-Lectures)

3.1 Introduction to Bonding Mechanisms

3.2 Forces between Atoms

3.3 Types of Bonding:

3.3.1 Ionic Bonds

3.3.2 Covalent Bonds

3.3.3 van der Waal's Bonds

3.3.4 Hydrogen Bond

3.3.5 Metallic Bond

3.4 Rotation energy levels of a diatomic molecule

3.5 Vibration energy levels of a diatomic molecule

Problems

4. Sources of Electromagnetic Waves

(06-Lectures)

4.1 Introduction to Electromagnetic Waves: Historical Perspective

- 4.2 General properties of Electromagnetic radiations
- 4.3 Electromagnetic spectrums and its sources
- 4.4 Production of electromagnetic waves: Hertz experiment
- 4.5 Plank's hypothesis of Photons
- 4.6 Applications of various waves in electromagnetic spectrum

5. Applications of Electromagnetic Waves

(07-Lectures)

- 5.1 Microwave oven
 - 5.2 RADAR
 - 5.3 Pyroelectric thermometer
 - 5.4 X-ray radiography
 - 5.5 CT Scan
 - 5.6 Solar cell and its types
- Problems

Books/References

1. Concepts of Modern Physics: A Beiser (6th ed., McGraw Hill, 2003
2. Modern Physics: Raymond A. Serway, Clement J. Moses, Curt A. Moyer
3. Sears and Zemansky's University Physics: H.D. Young R. A. Freedman, Sandin (11th Ed. Pearson Education)
4. LASERS: M. N. Avdhanulu, S. Chand Publications.

Course code and title: PHY-113Physics Laboratory 1A

Practical: 08 (Credits-1.5)

Section I- Mechanics and Properties of Matter

Sr. No	Title of the experiment
1	Study and use of various measuring Instruments. 1. Vernier caliper 2. Micrometer Screw Gauge 3. Travelling Microscope
2	Study of Modulus of Rigidity of wire using Torsional Oscillations
3	Determination of coefficient of Viscosity by Poiseuille's method
4	Determination of “Y” and “ η ” by flat spiral spring
5	Determination of “Y” by bending method.
6	Study of surface tension by Jaeger’s method
7	Study of Poisson’s ratio of rubber using rubber tube /rubber chord
8	Study of surface tension of liquid using Fergusson Method

Section II-Physics Principles and Applications

Sr. No	Title of the experiment
1	Study of Spectrometer and determination of angle of prism
2	Study of Spectrometer calibration and determination of refractive indices of different colors
3	Study of divergence of LASER beam
4	Study of total internal reflection using LASER
5	Determination of Plank’s constant
6	Determination of wavelength of LASER light by plane diffraction grating
7	Study of I-V characteristics of solar cell

Note : Any four experiments from each section be conducted during the semester

Course code and title: PHY-121 Heat and Thermodynamics

Lectures: 36

(Credits-02)

1. Fundamentals of Thermodynamics

(10 Lectures)

Concept of thermodynamic state, Equation of state, Van der Waal's equation of state, Thermal equilibrium, Zeroth law of thermodynamics, Thermodynamic processes: Adiabatic, Isothermal, Isobaric and Isochoric changes, Indicator diagram, Work done during isothermal change, Adiabatic relations, Work done during adiabatic change, Internal energy, Internal energy as state function, First law of thermodynamics, Reversible and Irreversible changes, Problems.

2. Applied Thermodynamics:

(9 Lectures)

Conversion of heat into work and its converse, Second law of thermodynamics, Concept of entropy, Temperature - entropy diagram, T-dS equations, Clausius - Clapeyron latent heat equations, Problems.

3. Heat Transfer Mechanisms

(9 Lectures)

Carnot's cycle and Carnot's heat engine and its efficiency, Heat Engines: Otto cycle & its efficiency, Diesel cycle & its efficiency, Refrigerators: General principle and coefficient of performance of refrigerator, Simple structure of Vapour compression refrigerator, Air Conditioning: Principle and its applications, Problems.

4. Thermometry:

(8 Lectures)

Concept of heat & temperature, Principle of thermometry, Temperature scales & inter-conversions, Principle, Construction and Working: (Liquid thermometers, Liquid filled thermometers, Gas filled thermometers, Bimetallic thermometers, Platinum resistance thermometer, Thermocouple), Problems.

Reference Books:

1. Concept of Physics: H. C. Verma, BharatiBhavan Publisher.
2. Heat and Thermodynamics: Brijlal, N. Subrahmanyam, S. Chand and Company Ltd.
3. Heat and Thermodynamics: Mark W. Zemansky, Richard H. Dittman, 7th Edition, Mc-Graw Hill International Edition.
4. Thermodynamics and Statistical Physics: J. K. Sharma, K. K. Sarkar, Himalaya Publishing House.
5. Thermal Physics (Heat and Thermodynamics): A. B. Gupta, H. P. Roy books and Allied (P) Ltd. Calcutta.
6. Instrumentation: Devices & Systems, Rangan, Mani, and Sarma.

Course code and title: PHY-121 Electricity and Magnetism

Lectures: 36

(Credits-02)

Learning Outcomes:

On successful completion of this course students will be able to do the following:

- 1) To understand the concept of the electric force, electric field and electric potential for stationary charges.
- 2) Able to calculate electrostatic field and potential of charge distributions using Coulomb's law and Gauss's law.
- 3) To understand the dielectric phenomenon and effect of electric field on dielectric.
- 4) To Study magnetic field for steady currents using Biot-Savart and Ampere's Circuital laws.
- 5) To study magnetic materials and its properties.
- 6) Demonstrate quantitative problem solving skills in all the topics covered.

1. Electrostatics

(08-Lectures)

- 1.1 Revision of Coulomb's law:
 - 1.1.1 Statement
 - 1.1.2 Variation of forces with distances
 - 1.2 Superposition principle:
 - 1.2.1 Statement
 - 1.2.2 Explanation with illustration
 - 1.3 Energy of system of charges
 - 1.4 Concept of electric field
 - 1.4.1 Due to point charge
 - 1.4.2 Due to group charges
 - 1.5 Concept of electric flux
 - 1.6 Gauss's law in electrostatics
- Problems

2. Dielectrics

(08-Lectures)

- 2.1 Introduction to dielectric materials
 - 2.2 Electric Dipole
 - 2.2.1 Electric dipole
 - 2.2.2 Dipole moment
 - 2.3 Electric potential and intensity at any point due to dipole
 - 2.4 Torque on a dipole placed in an electric field
 - 2.5 Polar and non-polar molecules
 - 2.6 Electric polarization of dielectric material
 - 2.7 Gauss' law in dielectric
 - 2.8 Electric vectors and its relation
- Problems

3. Magnetization

(07-Lectures)

- 3.1 Introduction to Magnetization
 - 3.2 Magnetic materials
 - 3.3 Types of Magnetic Materials
 - 3.3.1 Diamagnetic materials
 - 3.3.2 Paramagnetic materials
 - 3.3.3 Ferromagnetic materials
 - 3.3.4 Antiferromagnetic materials
 - 3.4 Bohr magneton
- Problems

4. Magnetostatics

(07-Lectures)

- 4.1 Introduction to magnetization,
 - 4.2 Magnetic Induction and Intensity of magnetization
 - 4.3 Biot-Savart's law:
 - 4.3.1 Statement
 - 4.3.2 Long straight conductor
 - 4.3.3 Circular Coil
 - 4.4 Ampere's circuital law:
 - 4.4.1 Statement
 - 4.4.2 Field of Solenoid
 - 4.4.3 Field of Toroid
 - 4.5 Gauss law for magnetism
- Problems

5. Magnetic Properties of Materials

(06-Lectures)

- 5.1 Definition
 - 5.1.1 Magnetization (M),
 - 5.1.2 Magnetic Intensity (H),
 - 5.1.3 Magnetic Induction (B),
 - 5.1.4 Magnetic Susceptibility
 - 5.1.5 Magnetic Permeability
 - 5.2 Relation between B, M and H
 - 5.3 Hysteresis and Hysteresis Curve
 - 5.4 Ferrite materials and its Applications
- Problems

References:

1. Fundamentals of Physics: HallidayResnik and Walkar, 8th Edition.
2. Electromagnetics: B. B. Laud.
3. Foundations of Electromagnetic theory: Reitz,Milford, Christey.
4. Electricity and Electronics: D.C.Tayal, Himalaya Publishing House, Mumbai.
5. Introduction to Electrodynamics: D.G. Griffith.
6. Electricity and Magnetism: BrijLal, Subramanyan, RatanPrakashan (Revised edition, 1997).
7. Electricity and Magnetism: Khare, Shrivastav (Revised edition, 1997).

Practical: 08 (Credits-1.5)

Section I- Heat and Thermodynamics

Sr No	Title of the experiment
1	Interpretation of Isothermal and Adiabatic curve on P-V diagram and theoretical study of Carnot's cycle by drawing graphs of Isothermal and Adiabatic curves
2	Study of temperature coefficient of Thermistor.
3	Study of Thermocouple and determination of inversion temperature
4	Study of thermal conductivity by Lee's method
5	Study of specific heat of Graphite
6	Study of Solar constant
7	Determination of calorific values of different fuels

Section II- Electricity and Magnetism

Sr No	Title of the experiment
1	Study of charging and discharging of capacitor
2	Study of LR circuit
3	Study of LCR circuit
4	Study of Kirchhoff's Laws
5	Study of Diode characteristics
6	Study of Voltmeter, Ammeter and Multimeter (AC, DC, ranges and least count)
7	Determination of frequency of AC mains
8	Comparison of capacitor using DeSauty's method

Note: Any four experiments from each section be conducted during the semester

Course code and title: PHY-213Physics Laboratory 1B

Practical: 08 (Credits-1.5)



Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B. Sc. Degree Program in Physics

(Faculty of Science & Technology)

S. Y. B. Sc. (Physics)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2020-2021

SEMESTER-III**Course code and title: PHY-231: Mathematical Methods in Physics-I****Total Lectures: 36****(Credits-02)****Learning Outcomes:** After the completion of this course students will be able to

- Understand the complex algebra useful in physics courses.
- Understand the concept of partial differentiation.
- Understand the role of partial differential equations in physics.
- Understand vector algebra useful in mathematics and physics.
- Understand the concept of singular points of differential equations.

1. Complex Numbers**(9L)**

- 1.1 Introduction to complex numbers
- 1.2 Rectangular, polar and exponential forms of complex numbers
- 1.3 Argand diagram
- 1.4 Algebra of complex numbers using Argand diagram
- 1.5 De-Moivre's Theorem (Statement only)
- 1.6 Power, root and log of complex numbers
- 1.7 Trigonometric, hyperbolic and exponential functions
- 1.8 Applications of complex numbers to determine velocity and acceleration in curved motion.
- 1.9 Problems.

2. Partial Differentiation**(9L)**

- 2.1 Definition of partial differentiation
- 2.2 Successive differentiation
- 2.3 Total differentiation
- 2.4 Exact differential
- 2.5 Chain rule
- 2.6 Theorems of differentiation
- 2.7 Change of variables from Cartesian to polar co-ordinates
- 2.8 Conditions for maxima and minima (without proof)
- 2.9 Problems.

3. Vector Algebra and Analysis**(12L)**

- 3.1 Introduction to scalars and vectors, dot product and cross product of two vectors and their physical significance. (Revision)

3.2 Scalar triple product and its geometrical interpretation

3.3 Vector triple product and its proof

3.4 Scalar and vector fields

3.5 Differentiation of vectors with respect to scalar

3.6 Vector differential operator and Laplacian operator

3.7 Gradient of scalar field and its physical significance

3.8 Divergence of scalar field and its physical significance

3.9 Curl of vector field and its physical significance.

3.10 Vector Identities.

a. $\nabla \times (\nabla \Phi) = 0$

b. $\nabla \cdot (\nabla \times \mathbf{V}) = 0$

c. $\nabla \cdot (\nabla \Phi) = \nabla^2 \Phi$

d. $\nabla \cdot (\Phi \mathbf{A}) = \nabla \Phi \cdot \mathbf{A} + \Phi (\nabla \cdot \mathbf{A})$

e. $\nabla \times (\Phi \mathbf{A}) = \Phi (\nabla \times \mathbf{A}) + (\nabla \Phi) \times \mathbf{A}$

f. $\nabla \cdot (\mathbf{A} \times \mathbf{B}) = \mathbf{B} \cdot (\nabla \times \mathbf{A}) - \mathbf{A} \cdot (\nabla \times \mathbf{B})$

3.11 Problems.

1.1 **4. Differential Equation** **(6L)**

4.1 Degree, order, linearity and homogeneity of differential equation.

4.2 Concept of Singular points. Example of singular points ($x = 0$, $x = x_0$ and $x = \infty$) of differential equation.

4.3 Problems.

1.2 **Reference Books:**

1. Methods of Mathematical Physics by Laud, Takwale and Gambhir.
2. Mathematical Physics by B.D.Gupta.
3. Mathematical Physics by Rajput and Gupta.
4. Mathematical Methods in Physical Science by Mary and Boas.
5. Vector analysis by Spiegel and Murrey.
6. Mathematical Methods for Physicists by Arfken and Weber. (5th Edition)
7. Fundamentals of Mathematical Physics by A.B.Gupta.
8. Vector Analysis by Seymour Lipschutz and Dennis Spellman.

Course code and title: PHY-232: Electronics**Total Lectures: 36****(Credits-02)**

N.B: This course is for students **who have not taken Electronic Science as one of the subjects at F. Y. B. Sc.**

Learning outcomes:

On successful completion of this course the students will be able to

- Apply different theorems and laws to electrical circuits.
- Understand the relations in electricity.
- Understand the parameters, characteristics and working of transistors.
- Understand the functions of operational amplifiers.
- Design circuits using transistors and applications of operational amplifiers.
- Understand the Boolean algebra and logic circuits.

1. Network Theorem**(6L)****1.1** Krichhoff's Law**1.2** Voltage and current Divider Circuit**1.3** Thevenin's Theorem**1.4** Norton's Theorem**1.5** Superposition Theorem**1.6** Maximum Power transfer theorem (With proof)**1.7** Problems**2. Study of Transistor****(12L)****2.1** Bi-junction Transistor

1. Revision of bipolar Junction Transistor, Types, Symbol and basic action.
2. Configuration (Common Base, Common Emitter and Common Collector)
3. Current Gain Factors (α and β) and their relations
4. Input, Output and transfer Characteristic of CE Configuration
5. Biasing method and Voltage Divider
6. DC Load line (CE), Operating Point (Q- point)
7. Transistor as a switch
8. Problems

2.2 Uni-Junction Transistor

1. Symbol, Types, Construction, Working Principle, I-V characteristics, Specifications and Parameters of Uni-Junction Transistor (UJT)
2. UJT as a relaxation Oscillator.

3. Operational Amplifiers and Application**(12 L)****3.1 Operational Amplifiers**

1. Introduction
2. Ideal and practical Characteristics
3. Operational Amplifier: IC741- Block Diagram and Pin diagram
4. Concept of Virtual Ground
5. Inverting and Non-inverting operational amplifiers with concept of gain
6. Operational amplifier as an adder and subtractor
7. Problems

3.2 Oscillators

1. Concept of Positive and negative feed back
2. Barkhausein Criteria for an oscillator
3. Construction, working and application of phase shift oscillator using IC741
4. Problems

4. Number System and Logic Gates**(6 L)**

1. Number System: Binary, Binary coded Decimal (BCD), Octal, Hexadecimal
2. Addition and Subtraction of binary numbers and binary fractions using one's and two's complement
3. Basic Logic gates (OR, AND, NOT)
4. Derived gates: NOR, NAND, EXOR, EXNOR, with symbols and truth table
5. Boolean Algebra
6. De Morgan's theorem and its verification
7. Problems

Reference Books-

1. **Electronic Principles**, Malvino, 7th Edition Tata Mc-Graw Hills publication.
2. **Principles of Electronics**, V.K. Mehta, S. Chand publication.
3. **Op-amp and Linear Integrated Circuit**, Ramakant Gaikwad, Prentice Hall of India publication.
4. **Integrated Circuit**, Botkar, Khanna Publication, New Delhi.
5. **Digital Principles and Application**, Malvino and Leech, Tata Mc-Graw Hills publication.

Course code and title: PHY-232: Instrumentation**Total Lectures: 36****(Credits-02)**

N.B: This course is for students **who have taken Electronic Science as one of the subjects at F. Y. B. Sc.**

Learning outcomes:

After successful completion of this course, the student will be able to

- Understand the concept of measurement.
- Understand the performance of measuring instruments.
- Design experiments using sensors.

1. Fundamental of measurement**(8L)****1.1** Aims of measurement**1.2** Functional elements of typical measurement system (Block diagram and its explanation).**1.3** Standards of measurement and its classification. (International, primary or national, secondary and working standards).**1.4** Static characteristics: Accuracy, Precision, Sensitivity, Linearity, Resolution, Drift and Hysteresis.**1.5** Dynamic characteristics concepts: First and Second order instruments, Examples of first order: Resistance thermometer and thermal element, Example of 2nd order: U-tube Manometer.**1.6** Errors in measurement and its classifications.**1.7** Problems**2. Transducers****(12L)****2.1** Classification of Transducers and its characteristics**2.2 Displacement Transducer****a)** Resistive Type: Linear and Angular (Rotary) Potentiometer, Strain Gauge: Bonded and Unbonded**b)** Inductive Type: Self inductive: Variable number of turns, Variable Reluctance Mutual Inductive: LVDT**c)** Piezoelectric Type: Quartz Crystal**2.3 Force Transducer:** Cantilever beam, Column type devices**2.4 Temperature Measurement**

Scales for temperature: Celsius, Kelvin and Fahrenheit

Temperature Measurement Techniques

a. Non-electrical: Liquid filled thermometer and bimetallic thermometer**b.** Electrical Methods:

- i. Platinum Resistance Thermometer
- ii. Thermistor: PTC and NTC with characteristics
- iii. Thermocouple: Seebeck effect and Peltier effect,
Types of Thermocouple

3. Measurement of Pressure (8L)

- 3.1 Unit of pressure, Concept of vacuum, Absolute gauge and differential pressure,
- 3.2 Elastic Transducer- Diaphragm, Corrugated Diaphragm, Bellows, Bourdon Tube
- 3.3 Electric Type- LVDT, Strain gauge
- 3.4 Pressure Transducer- Calibration by dead weight tester Method
- 3.5 Problems

4. Signal Conditioning and Processing (8L)

- 4.1 Current to voltage, Voltage to current convertors, buffer amplifier, S/H Amplifier and Characteristics, Acquisition time, Aperture time, Drop rate
- 4.2 Filters: First order LPF and HPF with design,
- 4.3 Instrumentation Amplifier (Using 3 op-amp)

Reference Books:

1. **Instrumentation Device and System**, Rangan, Mani and Sarma, Tata Mc Graw Hill
2. **Instrumentation Measurement and Analysis**, Nakra, Choudhari, Tata Mc Graw Hill India publication.
3. **Sensors and Transducers**, D. Patranabis, PHI publications.
4. **Op-Amps and Linear Integrated Circuits**, by Ramakant A. Gayakwad, Pearson India publications.
5. **Process control Instrumentation Technology**, C.D. Johnson, PHI publications.

Course code and title: PHY-233: Practical Course (Laboratory 2A)**Learning Outcome:****(Credits-02)**

After completing this practical course students will be able to

- Use various instruments and equipment.
- Design experiments to test a hypothesis and/or determine the value of an unknown quantity.
- Investigate the theoretical background of an experiment.
- Setup experimental equipment to implement an experimental approach.
- Analyze the data, plot appropriate graphs and reach conclusions from data analysis.
- Work in a group to plan, implement and report on a project/experiment.
- Keep a well-maintained and instructive laboratory logbook.

Total Experiments to be performed by a student: (A) 10 OR (B) 8 + Two Activities

(A): At least **6** experiments from **Section I** and **2** experiments from **Section II**

(B): At least **4** experiments from **Section I** and **2** experiments from **Section II** + **Any Two Activities**

Section I: Electronics/Instrumentation

1. Circuit Theorems (Thevenin's, Norton's and Maximum Power Transfer Theorems)
2. Transistor Characteristics (Input and Output characteristics of CE Configuration)
3. Single Stage Transistor Amplifier
4. Study of Rectifiers (Half, Full Wave and Bridge) with different filters
5. I-V Characteristics of UJT/ UJT as Relaxation Oscillator
6. Zener as a Regulator (Line and Load Regulation)
7. Op-amp as inverting and non-inverting amplifier
8. Study of Wein Bridge / Phase Shift Oscillator using 741
9. Op-amp as an adder and subtractor
10. Study of logic gates and verification of de Morgan's theorems
11. To measure displacement using potentiometer/variable inductor/ variable capacitor
12. Use of CRO (AC/DC Voltage measurement, Frequency measurement)
13. To measure force using load cell
14. To measure pressure using elastic diaphragm (In Variable Capacitor / Bourdon Tube)

15. To measure magnetic field using Hall Probe for a system of ring magnets

Section II: Use of Computer

1. Plotting of various trigonometric functions using spread sheet/any graphic software viz. Microsoft Excel, Origin: $\sin x$, $\cos x$, $\tan x$, e^x , e^{-x} , $\log x$, $\ln x$, x^n
2. Plotting of conic sections using spreadsheet /any graphic software viz. Microsoft Excel, Origin: circle, ellipse, parabola, hyperbola
3. Inverse, determinant of matrix, solution of linear equations using Microsoft Excel or Origin software

Additional Activities (Any two)

1. Plotting of any **two** graphs using spreadsheets (of data obtained from various experiments performed by the student)
2. Any **two** computer aided demonstrations (Using computer simulations or animations)
3. Demonstrations-Any **two** demonstrations
4. Study tour with report
5. Mini project

SEMISTER-IV**Course code and title: PHY-241: Oscillations, Waves, and Sound****Total Lectures: 36****(Credits-02)****Learning Outcomes:**

On completion of this course, the learner will be able:

- To study underlying principles of oscillations and its scope in development.
- To understand and solve the equations / graphical representations of motion for simple harmonic, damped, forced oscillators and waves.
- To explain oscillations in terms of energy exchange with various practical applications.
- To solve numerical problems related to undamped, damped, forced oscillations and superposition of oscillations.
- To study characteristics of sound, decibel scales and applications.

1. Undamped Free Oscillations (7L)

- 1.1 Different types of equilibria (static, dynamic, stable, unstable, and metastable equilibrium) – definitions only with examples.
- 1.2 Definitions of linear Simple Harmonic Motion (S.H.M) and angular S.H.M.
- 1.3 Differential equation for linear S.H.M. and its solution.
- 1.4 Composition of two perpendicular linear S.H.Ms. for frequency ratio 1:1 and 2:1 (analytical method).
- 1.5 Lissajous figures, their demonstration (optical and electrical method) and applications.
- 1.6 Problems.

2. Damped Oscillations (8L)

- 2.1 Introduction
- 2.2 Differential equation for damped harmonic oscillator and its solution, discussion of different cases.
- 2.3 Logarithmic decrement.
- 2.4 Average energy of damped harmonic oscillator.
- 2.5 Quality factor.
- 2.6 Application: LCR series circuit.
- 2.7 Problems.

3. Forced Oscillations (8L)

- 3.1 Introduction.
- 3.2 Differential equation for forced oscillations and its solution .
- 3.3 Resonance : mechanical, acoustic and electrical.
- 3.4 Velocity and Amplitude resonance.
- 3.5 Sharpness of resonance and half width.

- 3.6 Average energy of forced oscillator.
- 3.7 Quality factor of forced oscillator.
- 3.8 Relation between quality factor and bandwidth.
- 3.9 Application of forced oscillations- LCR series circuit.
- 3.10 Problems.

4. Wave Motion

(6L)

- 4.1 Introduction.
- 4.2 Equation for longitudinal waves and it's solution (one dimension only).
- 4.3 Equation for transverse waves and it's solution (one dimension only).
- 4.4 Energy density and intensity of a wave.
- 4.5 Qualitative discussion of seismic waves and gravitational waves.
- 4.6 Problems.

5. Sound and Doppler Effect

(8L)

- 5.1 Definition of sound Intensity, Loudness, Pitch, Quality and timbre.
- 5.2 Reverberation time and reverberation of hall.
- 5.3 Sabine's formula (without derivation).
- 5.4 Doppler effect in sound, Expression for apparent frequency in different cases.
- 5.5 Asymmetric nature of Doppler effect in sound.
- 5.6 Doppler effect in light, Symmetric nature of Doppler effect in light.
- 5.7 Applications: Radar, Speed of distant star, Rotational speed of binary star, Red Shift and Width of spectral line.
- 5.8 Problems.

Reference Books:

1. **Waves and Oscillations** by Stephenson.
2. **The Physics of Waves and Oscillations** by N. K. Bajaj, Tata McGraw- Hill, publication.
3. **Fundamentals of Vibrations and Waves** by S. P. Puri, Tata McGraw-Hill publication.
4. **A Text Book of Sound** by Subramanyam and Brijlal, Vikas Prakashan.
5. **Sound** by Mee, Heinmann Edition, London.
6. **Waves and Oscillations** - R.N. Chaudhari, New Age International (p) ltd.
7. **A Textbook on Oscillations, Waves and Acoustics** by M. Ghosh, and D. Bhattacharya, S. Chand and Company Ltd.

Course code and title: PHY-242: Optics**Total Lectures: 36****(Credits-02)****Learning Outcomes:**

On successful completion of this course the students will be able to

- Acquire the basic concept of wave optics.
- Describe how light can constructively and destructively interfere.
- Explain why a light beam spread out after passing through an aperture
- Summarize the polarization characteristics of electromagnetic wave
- Understand the operation of many modern optical devices that utilize wave optics
- Understand optical phenomenon such polarization, diffraction and interference in terms of the wave model
- Analyze simple example of interference and diffraction.

1. Geometrical optics (8L)

- 1.1 Introduction to lenses and sign conventions.
- 1.2 Thin lenses: lens equation for convex lens
- 1.3 Lens maker equation
- 1.4 Concept of magnification, deviation and power of thin lens
- 1.5 Equivalent focal length of two thin lenses
- 1.6 Concept of cardinal points
- 1.7 Problems.

2. Lens Aberrations (8 L)

- 2.1 Introduction
- 2.2 Types of aberration: Monochromatic and chromatic
- 2.3 Types of monochromatic aberrations and their reductions
- 2.4 Types of chromatic aberrations
- 2.5 Achromatism: lenses in contact and separated by finite distance
- 2.6 Problems.

3. Optical Instruments (6L)

- 3.1 Introduction
- 3.2 Simple Microscope
- 3.3 Compound Microscope
- 3.4 Ramsden's eye piece
- 3.5 Huygens eye piece
- 3.6 Problems.

4. Interference and Diffraction (8L)

- 4.1 Introduction

4.2 Phase change on reflection. (Stokes treatment)

4.3 Interference due to wedge shaped thin film

4.4 Newton's ring

3.5 Diffraction types: Fresnel's diffraction and Fraunhofer's diffraction

4.6 Fraunhofer's diffraction at single slit

4.7 Plane diffraction grating, Rayleigh criterion for resolution

4.8 Problems

5. Polarization

(6L)

5.1 Introduction

5.2 Brewster's law

5.3 Law of Malus

5.4 Polarization by double refraction.

5.5 Nicol Prism

5.6 Problem

Reference Books:

1. **Optics** by A. R. Ganesan, IVth edition, Pearson Education, E. Hetch.

2. **A Textbook of Optics** by N Subhramanyam, Brijlal, M. N. Avadhanulu, S. Chand Publication

3. **Physical Optics** by A.K. Ghatak, McMillan, New Delhi

4. **Fundamental of Optics** by F. A.Jenkins, H. E.White Mc Graw-Hill International edition

5. **Principles of Optics**, by D. S. Mathur, Gopal Press, Kanpur.

Course code and title: PHY-243: Practical Course (Laboratory 2B)**Learning Outcome:****(Credits-02)**

After completing this practical course students will be able to

- Use various instruments and equipment.
- Design experiments to test a hypothesis and/or determine the value of an unknown quantity.
- Investigate the theoretical background of an experiment.
- Setup experimental equipment to implement an experimental approach.
- Analyze the data, plot appropriate graphs and reach conclusions from data analysis.
- Work in a group to plan, implement and report on a project/experiment.
- Keep a well-maintained and instructive laboratory logbook.

Total Experiments: (A) 10 OR (B) 8 + Two Activities

(A): 5 experiments from Section I and 5 experiments from Section II

(B): 4 experiments from Section I and 4 experiments from Section II + Any Two Activities

Section I: Oscillations, Waves and Sound

1. Logarithmic decrement (in air and water).
2. Study of coupled oscillators comprising two simple pendulum (Mechanical) and determination of coupling coefficient.
3. 'g' by bar pendulum.
4. Study of musical scales using a signal generator and musical instruments.
5. Measurement of coefficient of absorption of sound for different materials (cork, thermocol, mica, paper etc.).
6. Study of Lissajous figures and determination of unknown frequency.
7. Determination of speed of sound by Quincke's method interferometer.
8. Directional characteristics of Microphone.
9. Velocity of sound by Phase shift method.
10. To determine the frequency of an electrically maintained tuning fork by stroboscopic method.
11. To Determine the velocity of sound in air at room temperature with Kundt's Tube.

Section II: Optics

1. Newton's Ring: Determination of wavelength of monochromatic light source (λ).
2. Dispersive power of glass prism.
3. Total internal reflection using LASER beam and glass prism.
4. Diffraction at the edge of a razor blade.
5. Optical activity of sugar solution using polarimeter.
6. Goniometer to determine cardinal points and focal length.
7. To determine temperature of sodium flame.
8. Double refracting prism.
9. Determination of Cauchy's constant.

1.3 Additional Activities (Any two)

1. Plotting of any **two** graphs using spreadsheets (of data obtained from various experiments performed by the student).
2. Any **two** computer aided demonstrations (Using computer simulations or animations).
3. Demonstrations –Any **two** demonstrations.
4. Study tour with report.
5. Mini project.



Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Statistics

(Faculty of Science & Technology)

F.Y.B.Sc. Statistics

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the program: F.Y.B.Sc. Statistics/ Statistical Techniques**Preamble of the syllabus:**

The word *Statistics* is used in different ways in different contexts. To a cricket fan, Statistics is the information about runs scored or wickets taken by a player. To the manager of a manufacturing unit, Statistics may be the information about the process control. To a medical researcher investigating the effects of a new drug, Statistics are evidence of research efforts. To a college student, Statistics are the grades or marks scored in a course. Thus, in all these illustrations Statistics word refers to quantitative data in the area under study. Statistics as a subject is an important branch of knowledge and is devoted to various techniques of collection, presentation, analysis and interpretation of data. It is a science of learning from data.

Statistics provides tools for making decisions when conditions of uncertainty prevail. Hence these tools and techniques are used in almost all fields. Statistics is indispensable for people working in fields like agriculture, business, management, economics, finance, insurance, education, biotechnology and medical science etc. Since last two decade, with the help of computers large amount of data can be handled and more sophisticated statistical techniques can be used in an effective manner. Knowledge of different aspects of Statistics has become crucial. There is a continuous demand for statisticians in every field – education, industry, software, insurance, clinical trials data and research. The syllabus of the three Year B. Sc. degree course in Statistics is framed in such a way that the students at the end of the course can apply judiciously the statistical tools to a variety of data sets to arrive at some conclusions.

Statistics can be divided into two broad categories, (1) exploratory statistics or descriptive statistics, which is concerned with summarizing data and describing these data, and (2) confirmatory statistics or inferential statistics, which is concerned with making decisions about the population based on the sample.

Up to higher secondary school, students are mostly exposed to descriptive statistics. These techniques are briefly reviewed but the emphasis in degree course is on inferential statistics. At the end of the degree course a student is expected to apply the statistical tools to real life data and analyze it.

Introduction: Choice based credit (semester) system:

B. Sc. in Statistics program is of three years duration, with semester pattern for all the three years. A student of three-year B.Sc. degree program will not be allowed to offer Statistics and Statistical Techniques simultaneously in any of the three years of the course. Students offering **Statistics** at the First year of the three-year B.Sc. course may be allowed to offer **Statistical Techniques** as one of their subjects in the second year of the three-year B.Sc. in place of Statistics. Students offering Statistical Techniques at the first year of the three-year B.Sc. course may be allowed to offer Statistics as one of their subjects in the second year of the three-year B.Sc. course in place of Statistical Techniques provided they satisfy other requirements regarding subject combinations, if any.

At **first year of under-graduation**, students will be given the basic information that includes – methods of data representation and summarization. Correlation and regression are the forecasting tools that are frequently used in statistical analysis. These topics are studied in one of the papers in each semester. Further they are introduced to probability and different discrete probability distributions along with applications in the other paper. Relevant experiments on these topics will be included in practical course. Further the students are expected start using some statistical software and verify the computations during practicals. It is a skill oriented part of the course.

At **second year of under-graduation**, students are expected to study various probability distributions and its applications to real life situations. It is a foundation for further theory. An important branch of Statistics, viz. testing of hypotheses related to mean, variance, proportion, correlation etc. will be introduced. Some topics related to applications of Statistics will be also introduced. Further the students are expected start using some statistical software and verify the computations during practicals. It is a skill oriented part of the course.

At **third year of under-graduation**, six theory papers deal with theoretical as well as applied aspect of statistics. Some papers such as distribution theory and parametric inference are core and mathematical in nature. Some papers such as sampling methods and Design of Experiments are core and applied but less mathematical. In Design of Experiments paper, various designs used in agriculture and industry are studied agriculture, clinical trials. Papers of applied nature, like medical statistics, actuarial statistics, time series, and optimization techniques (operations research), statistical quality control. There are some skill oriented courses C programming and R software. There are three practical courses based on core courses. In one of the practical courses, project component will be introduced to get hands on training or experiential learning.

Structure of the Course

Structure of the course for three years and the pattern of examination and question papers are as specified below

Structure of F. Y. B. Sc. Statistics/ Statistical Techniques

Semester	Paper code	Paper	Paper title	credits	Marks		
					CIA	ESE	Total
1	ST 111	I	Descriptive Statistics I	2	15	35	50
	ST 112	II	Discrete Probability	2	15	35	50
	ST113	III	Statistics Practical PaperI	1.5	15	35	50
2	ST121	I	Descriptive Statistics II	2	15	35	50
	ST122	II	Discrete Probability Distributions	2	15	35	50
	ST123	III	Statistics Practical Paper II	1.5	15	35	50

Structure of S. Y. B. Sc. Statistics

Semester	Paper code	Paper	Paper title	credits	Marks		
					CIA	ESE	Total
3	ST 231	I	Statistics theory paper 1	2	15	35	50
	ST 232	II	Statistics theory paper 2	2	15	35	50
	ST233	III	Statistics Practical Paper	2	15	35	50
4	ST241	I	Statistics theory paper 1	2	15	35	50
	ST242	II	Statistics theory paper 2	2	15	35	50
	ST243	III	Statistics Practical Paper	2	15	35	50

Structure of T. Y. B. Sc. Statistics

Semester	Paper code	Paper	Paper title	credits	Marks		
					CIA	ESE	Total
5	ST 351	I	Statistics theory paper 1	2	15	35	50
	ST 352	II	Statistics theory paper 2	2	15	35	50
	ST 353	III	Statistics theory paper 3	2	15	35	50
	ST 354	IV	Statistics theory paper 4	2	15	35	50
	ST 355	V	Statistics theory paper 5	2	15	35	50
	ST 356	VI	Statistics theory paper 6	2	15	35	50
	ST 357	VII	Statistics Practical Paper 1	2	15	35	50
	ST 358	VIII	Statistics Practical Paper 2	2	15	35	50
	ST 358	IX	Statistics Practical Paper 3	2	15	35	50
	ST 359	X	Skill enhancement course 1	2	15	35	50
	ST 3510	XI	Skill enhancement course 2	2	15	35	50

6	ST 361	I	Statistics theory paper 1	2	15	35	50
	ST 362	II	Statistics theory paper 2	2	15	35	50
	ST 363	III	Statistics theory paper 3	2	15	35	50
	ST 364	IV	Statistics theory paper 4	2	15	35	50
	ST 365	V	Statistics theory paper 5	2	15	35	50
	ST 366	VI	Statistics theory paper 6	2	15	35	50
	ST 367	VII	Statistics Practical Paper 1	2	15	35	50
	ST 368	VIII	Statistics Practical Paper 2	2	15	35	50
	ST 369	IX	Statistics Practical Paper 3	2	15	35	50
	ST 3610	X	Skill enhancement course 1	2	15	35	50
	ST 3511	XI	Skill enhancement course 2	2	15	35	50

SEMESTER – I**PAPER – I****ST – 111: Descriptive Statistics I**

Objectives: The main objective of this course is to acquaint students with some basic concepts in Statistics. They will be introduced to some elementary statistical methods of analysis of data. At the end of this course students are expected to be able,

- (i) to compute various measures of central tendency, dispersion, skewness and kurtosis.
- (ii) to analyze data pertaining to attributes and to interpret the results.

Unit 1. Introduction to Statistics(2L)2H

1.1 Meaning of Statistics as a Science.

1.2 Importance of Statistics.

1.3 Scope of Statistics: In the field of Industry, Biological sciences, Medical sciences, Economics, Social Sciences, Management sciences, Agriculture, Insurance, Information technology, Education and Psychology.

1.4 Statistical organizations in India and their functions: CSO, ISI, NSSO, IIPS (Devnar, Mumbai), Bureau of Economics and Statistics.

1.5 Statistical Heritage (Indian Perspective: i) Dr. V. S. Huzurbazar, Dr. P.C. Mahalanobis, Dr. P. V. Sukhatme, Dr. C. R. Rao).

Unit 2. Population and Sample (4L)3H

2.1 Types of characteristics:

Attributes: Nominal scale, ordinal scale,

Variables: Interval scale, ratio scale, discrete and continuous variables, difference between linear scale and circular scale

2.2 Types of data:

(a) Primary data, Secondary data

(b) Cross-sectional data, time series data, directional data.

2.3 Notion of a statistical population:

Finite population, infinite population, homogeneous population and heterogeneous population. Notion of a sample and a random sample. Methods of sampling (Description only): Simple random sampling with and without replacement (SRSWR and SRSWOR) stratified random sampling, systematic sampling, cluster sampling and two-stage sampling.

Unit 3. Summary Statistics: (14 L) 12H

3.1 Review/Revision of Presentation of Data.

Interpretation of Data from table and graph.

data validation

3.2 Frequency Classification: Raw data and its classification, ungrouped frequency distribution, Sturges' rule, grouped frequency distribution, cumulative frequency distribution, inclusive and exclusive methods of classification, Open end classes, and relative frequency distribution.

3.3 Measures of Central Tendency:

Concept of central tendency of statistical data, Statistical averages, characteristics of a

good statistical average.

Arithmetic Mean (A.M.): Definition, effect of change of origin and scale, combined mean of a number of groups, merits and demerits, trimmed arithmetic mean.

Mode and Median: Definition, formulae (for ungrouped and grouped data), merits and demerits. Empirical relation between mean, median and mode.

Partition Values: Quartiles, Deciles and Percentiles (for ungrouped and grouped data), Box Plot.

Geometric Mean (G.M.): Definition, formula, merits and demerits.

Harmonic Mean (H.M.): Definition. Formula, merits and demerits.

Order relation between arithmetic mean, geometric mean, harmonic mean

Weighted Mean: weighted A.M., G.M. and H.M.

Situations where one kind of average is preferable to others.

3.4 Measures of Dispersion:

Concept of dispersion, characteristics of good measure of dispersion.

Range, Semi-interquartile range (Quartile deviation): Definition, merits and demerits,

Mean deviation: Definition, merits and demerits, minimality property (without proof),

Variance and standard deviation: Definition, merits and demerits, effect of change of origin and scale, combined variance for n groups (derivation for two groups).

Mean squared deviation: Definition, minimality property of mean squared deviation (with proof), Measures of dispersion for comparison: coefficient of range, coefficient of quartile deviation and coefficient of mean deviation, coefficient of variation (C.V.)

2. Moments, Skewness and Kurtosis: (8 L) 7H

4.1 Raw moments (m'_r) for ungrouped and grouped data.

Central moments (m_r) for ungrouped and grouped data, Effect of change of origin

and scale. Relations between central moments and raw moments, upto 4-th order (without proof).

4.2 Concept of skewness of frequency distribution, positive skewness, negative skewness, symmetric frequency distribution.

Bowley's coefficient of skewness: Bowley's coefficient of skewness lies between -1 to 1 (with proof), interpretation using Box plot.

Karl Pearson's coefficient of skewness.

Measures of skewness based on moments ($\hat{\beta}_1, \hat{\gamma}_1$).

4.3 Concepts of kurtosis, leptokurtic, mesokurtic and platykurtic frequency distributions.

Measures of kurtosis based on moments ($\hat{\beta}_2, \hat{\gamma}_2$).

5 Theory of Attributes: (8 L) 6H

5.1 Attributes: Concept of a Likert scale, classification, notion of manifold classification, dichotomy, class-frequency, order of a class, positive class-frequency, negative class frequency, ultimate class frequency, relationship among different class frequencies (up to three attributes), and dot operator to find the relation between frequencies, fundamental set of class frequencies.

5.2 Consistency of data up to 2 attributes.

5.3 Concepts of independence and association of two attributes.

Yule's coefficient of association (Q), $-1 \leq Q \leq 1$, interpretation.

Recommended Books:

1. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, NewDelhi.
2. Ghosh, J. K. and Mitra, S. K., Parthsarathi, K. R. (1993). Glimpses of India's Statistics Heritage, Wiley publishing Co.
3. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta.
4. Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, NewDelhi.
5. Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, NewDelhi.
6. Neil A. Weiss, (2016). Introductory Statistics, Tenth Edition, Pearson.
7. Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, NewDelhi.
8. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentce Hall of India, NewDelhi.
9. Snedecor G. W. and Cochran W. G. (1989). Statistical Methods, Eighth Ed. East-West Press.

SEMESTER – I**PAPER – II****ST – 112: Discrete Probability and Probability DistributionsI****Objectives**

The main objective of this course is to introduce to the students the basic concepts of probability, axiomatic theory of probability, concept of random variable, probability distribution (univariate and bivariate) discrete random variables, expectation and moments of probability distribution. By the end of the course students are expected to be able

- (i) to distinguish between random and non-random experiments.
- (ii) to find the probabilities of events.
- (iii) to obtain a probability distribution of random variable (one or two dimensional) in the given situation.

1. Basics of Probability:(6L)4H

1.1 Experiments/Models, Ideas of deterministic and non-deterministic models. Random Experiment, concept of statistical regularity.

1.2 Definitions of - (i) Sample space, (ii) Discrete sample space: finite and countably infinite, (iii) Event, (iv) Elementary event, (v) Complement of an event. (vi) Certain event (vii) Impossible event

Concept of occurrence of an event.

Algebra of events and its representation in set theory notation. Occurrence of following events.

- (i) at least one of the given events,
- (ii) none of the given events,
- (iii) all of the given events,
- (iv) mutually exclusive events,
- (v) mutually exhaustive events,
- (vi) exactly one event out of the given events.

1.3 Classical definition of probability and its limitations.

Probability model, probability of an event, equiprobable and non-equiprobable sample space,

1.4 Axiomatic definition of probability. Theorems and results on probability with proofs based on axiomatic definition such as $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. Generalization $P(A \cup B \cup C), 0 \leq P(A) \leq 1, P(A) + P(A^c) = 1, P(\Phi) = 0, P(A) \leq P(B)$ when $A \subset B$

Boole's inequality.

2. Conditional Probability and Bayes' Theorem:(5L)4H

2.1 Definition of conditional probability of an event. Results on conditional probability.

Definition of independence of two events $P(A \cap B) = P(A) \cdot P(B)$

Pairwise independence and mutual independence for three events

Multiplication theorem

$P(A \cap B) = P(A) \cdot P(B|A)$. Generalization to

$P(A \cap B \cap C)$.

2.2 Partition of the sample space, prior and posterior probabilities. Proof of Bayes' theorem. Applications of Bayes' theorem in real life. True positive, false positive and sensitivity of test as application of Bayes' theorem.

3. Univariate Probability Distributions (Defined on Discrete Sample Space): (3L) 2H

Concept and definition of a discrete random variable.
 Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.), $F(\cdot)$ of discrete random variable, properties of c.d.f..
 Mode and median of a univariate discrete probability distribution.

4. Mathematical Expectation (Univariate Random Variable):(8L)7H

4.1 Definition of expectation (Mean) of a random variable, expectation of a function of a random variable, m.g.f. and c.g.f. Properties of m.g.f. and c.g.f.

4.2 Definitions of variance, standard deviation (s.d.) and Coefficient of variation (c.v.) of univariate probability distribution, effect of change of origin and scale on mean, variance and s.d.

4.3 Definition of raw, central and factorial raw moments of univariate probability Distributions and their interrelations (without proof).

4.4 Coefficients of skewness and kurtosis based on moments.

5 Some Standard Discrete Probability Distributions: (15L) 13H

5.1 Degenerate distribution (one point distribution):

$P(X=c) = 1$, mean and variance.

5.2 Uniform discrete distribution on integers 1 to n:

p.m.f., c.d.f., mean, variance, real life situations, comments on mode and median.

5.3 Bernoulli Distribution: p.m.f., mean, variance.

5.4 Binomial Distribution : p.m.f.

$$P(x) = \binom{n}{x} p^x q^{n-x}, x = 0, 1, 2, \dots, n; 0 < p < 1, q = 1 - p \\ = 0, \text{ otherwise}$$

Notation: $X \sim B(n, p)$.

Recurrence relation for successive probabilities, computation of probabilities of different events, mode of the distribution, mean, variance, m.g.f. and c.g.f. moments, skewness (comments when $p = 0.5$, $p > 0.5$, $p < 0.5$). Situations where this distribution is applicable. Additive property for binomial distribution.

Conditional distribution of X given $(X+Y)$ for binomial distribution.

5.5 Hypergeometric Distribution: Necessity and importance of Hypergeometric distribution, capture-recapture method.

p.m.f. of the distribution,

$$p(x) = \frac{\binom{M}{x} \binom{N-M}{n-x}}{\binom{N}{n}}, \quad x = 0, 1, \dots, \min(M, n) \\ = 0, \quad \text{otherwise}$$

Notation : $X \sim H(N, M, n)$.

Computation of probability, situations where this distribution is applicable, binomial approximation to hypergeometric probabilities, statement of mean and variance of the distribution (Derivation is not expected).

Recommended Books:

1. Agarwal B. L. (2003). Programmed Statistics, second edition, New Age International Publishers, NewDelhi.
2. Gupta, S.C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, NewDelhi.
3. Hoel P. G. (1971). Introduction to Mathematical Statistics, John Wiley and Sons, New York.
4. Hogg, R. V. and Craig R. G. (1989). Introduction to Mathematical Statistics, Ed. MacMillan Publishing Co., New York.
5. Mayer, P. (1972). Introductory Probability and Statistical Applications, Addison Wesley Publishing Co., London.
6. Mood, A. M. and Graybill, F. A. and Boes D. C. (1974). Introduction to the Theory of Statistics, Ed. 3, McGraw Hill Book Company.
7. Rao, VLS Prakash (2008). First Course in Probability and Statistics, New Age International Publishers, NewDelhi.
8. Ross S. (2002). A First Course in Probability, Sixth Edition, Pearson Education, Inc. & Dorling Kindersley Publishing, Inc.

SEMESTER I**Statistics Practical Paper III****ST – 113 : PRACTICALS**

Pre-requisites: Knowledge of the topics in theory papers I and II.

Objectives: At the end of this course students are expected to be able

- (i) to use various graphical and diagrammatic techniques and interpretation.
- (ii) to analyse data pertaining to discrete and continuous variables and to interpret the results,
- (iii) to compute various measures of central tendency, dispersion, skewness and kurtosis.
- (iv) to interpret summary statistics of computer output.
- (v) to summarize and analyze the data using computer.

S. No.	Title of the experiment	No. of Practicals
1	Diagrammatic representation of statistical data: simple and subdivided bar diagrams, multiple bar diagram, percentage bar diagram, pie diagram. Also using Ms-Excel/Any statistical software	2
2	Graphical representation of statistical data: Histogram, frequency curve and ogive curves. Determination of mode and median graphically. Also using Ms-Excel/Any statistical software	2
3	Tabulation	1
4	Data Interpretation form various graphs and diagrammes.	1
5	Use of random number tables to draw SRSWOR, SRSWR, stratified sample and systematic sample. Also using Ms-Excel/ Any statistical software	2
6	Computation of measures of central tendency and dispersion (ungrouped data). Use of an appropriate measure and interpretation of results and computation of partition values.	1
7	Computation of measures of central tendency and dispersion (grouped data). Use of an appropriate measure and interpretation of results and computation of partition values.	1
8	Measures of skewness and kurtosis, Box plot.	1
9	Computation of summary statistics using Ms-Excel/ Any statistical software	1
10	Project	3

SEMESTER – II**PAPER – I**

Objectives: The main objective of this course is to acquaint students with bivariate data. They will be introduced to some methods of analysis of bivariate data. At the end of this course students are expected to be able,

- (i) to compute the correlation coefficient for bivariate data and interpret it.
- (ii) to fit linear, quadratic and exponential curves to the bivariate data to investigate relation between two variables.
- (iii) to compute and interpret various index numbers.

ST - 121: Descriptive Statistics II**1 Correlation: (10L) 9H**

1.1 Bivariate data, Scatter diagram and interpretation.

Concept of correlation between two variables, positive correlation, negative correlation, no correlation.

Covariance between two variables (m_{11}): Definition, computation, effect of change of origin and scale.

1.2 Karl Pearson's coefficient of correlation (r): Definition, computation for ungrouped data and interpretation. Properties: (i) $-1 \leq r \leq 1$ (with proof), (ii) Effect of change of origin and scale (with proof).

1.3 Spearman's rank correlation coefficient: Definition, derivation of formula, computation and interpretation (without ties). In case of ties, compute Karl Pearson's correlation coefficient between ranks. (Spearman's rank correlation coefficient formula with correction for ties not expected.)

2 Fitting of Line (Regression Line): (8L) 6H

2.1 Concept of dependent and independent variables.

2.2 Identification of response and predictor variables and relation between them.

2.3 Meaning of regression, difference between correlation and regression, Connection between correlation and regression. Fitting of line $Y = a + bX$. a and b are estimated using least square method. Regression coefficient. Explained and unexplained variation, coefficient of determination, standard error of an estimate of line of regression. Interchanging the role of X and Y we can study some more properties.

3. Curve Fitting: (10L) 9H

3.1 Necessity and importance of drawing second degree curve.

3.2 Fitting of second degree curve ($Y = a + bX + cX^2$),

3.3 Fitting of exponential curves of the type $Y = a b^X$ and $Y = aX^b$.

In all these curves constants a , b , c are found out by the method of least squares.

(Justification via determinant of matrix of second derivative/second derivative test).

4. Index Numbers: (8L) 6H

4.1 Introduction and scope of Index Numbers. Various types of Index Numbers like Human Development Index, Happiness Index BSE sensitivity Index.

4.2 Definition and Meaning.

- 4.3 Problems/considerations in the construction of index numbers.
- 4.4 Simple and weighted price index numbers based on price relatives.
- 4.5 Simple and weighted price index numbers based on aggregates.
- 4.6 Laspeyre's, Paasche's and Fisher's Index numbers.
- 4.7 Consumer price index number: Considerations in its construction. Methods of construction of consumer price index number - (i) family budget method
(ii) aggregate expenditure method
- 4.8 Shifting of base, splicing, deflating, purchasing power.

Recommended Books:

1. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
2. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta.
3. Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
4. Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, New Delhi.
5. Montgomery, D. C.; Peck, E. A.; Vining, G. G. (2006). Introduction to Linear Regression Analysis, John Wiley and Sons
6. Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, New Delhi.
7. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi.
8. Snedecor G. W. and Cochran W. G. (1989). Statistical Methods, Eighth Ed. East- West Press.

SEMESTER – II**PAPER – II****ST – 112: Discrete Probability and Probability Distributions II**

Objectives: The main objective of this course is to introduce to the students some discrete Distributions and its application in real life.

(i) to apply standard discrete probability distribution to different situations.

(ii) to study properties of these distributions as well as interrelation between them.

1. Some Standard Discrete Probability Distributions: (16L) 13H**1.1 Poisson distribution:**

p.m.f. of the distribution

$$p(x) = \frac{e^{-m} m^x}{x!}, \quad x = 0, 1, 2, \dots, \quad m > 0$$

= 0, otherwise

Notation: $X \sim P(m)$.

m.g.f. and c.g.f. Moments, mean, variance, skewness and kurtosis.

Situations where this distribution is applicable.

Additive property for Poisson distribution.

Conditional distribution of X given (X+Y) for Poisson distribution.

1.2 Geometric distribution:

Notation: $X \sim G(p)$,

Geometric distribution on support (0, 1, 2, ...) with p.m.f. $p(x) = pq^x$.

Geometric distribution on support (1, 2, ...) with p.m.f. $p(x) = pq^{x-1}$. $0 < p < 1, q = 1 - p$.

Mean, variance, m.g.f. and c.g.f.

Situations where this distribution is applicable.

Lack of memory property.

2. Bivariate Discrete Probability Distribution: (6L) 5H

2.1 Definition of two-dimensional discrete random variable, its joint p.m.f. and its distribution function and their properties.

2.2 Concept of identically distributed r.v.s.

2.3 Computation of probabilities of events in bivariate probability distribution.

2.4 Concepts of marginal and conditional probability distributions.

2.5 Independence of two discrete random variables based on joint and marginal p.m.f.s

3 Mathematical Expectation (Bivariate Random Variable) (14L) 12H

- 3.2 Definition of raw and central moments, m.g.f, c.g.f.
- 3.3 Theorems on expectations of sum and product of two jointly distributed random variables.
- 3.4 Conditional expectation.
- 3.5 Definitions of conditional mean and conditional variance.
- 3.6 Definition of covariance, coefficient of correlation, independence and uncorrelatedness of two variables.
- 3.7 Variance of linear combination of variables $\text{Var}(aX + bY)$.

Recommended Books:

1. Agarwal B. L. (2003). Programmed Statistics, second edition, New Age International Publishers, New Delhi.
2. Gupta, S.C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
3. Hoel P. G. (1971). Introduction to Mathematical Statistics, John Wiley and Sons, New York.
4. Hogg, R. V. and Craig R. G. (1989). Introduction to Mathematical Statistics, Ed. MacMillan Publishing Co., New York.
5. Mayer, P. (1972). Introductory Probability and Statistical Applications, Addison Wesley Publishing Co., London.
6. Mood, A. M. and Graybill, F. A. and Boes D.C. (1974). Introduction to the Theory of Statistics, Ed. 3, McGraw Hill Book Company.
7. Ross S. (2002). A First Course in Probability, Sixth Edition, Pearson Education, Inc. & Dorling Kindersley Publishing, Inc.

Reference Websites for Paper I and Paper II:

1. www.stats.unipune.ac.in (100 Data sets for Statistics Education by Dr. Anil P. Gore, Dr. Mrs. S. A. Paranjpe and Madhav B. Kulkarni available in ISPS folder).
2. www.freestatistics.tk (National Statistical Agencies)
3. www.psychstat.smsu.edu/sbk00.htm (Online book)
4. www.bmj.bmjournals.com/collections/statsbk/index.shtml
5. www.statweb.calpoly.edu/bchance/stat-stuff.html
6. www.amstat.org/publications/jse/jse-data-archive.html (International journal on teaching and learning of statistics)
7. www.amstat.org/publications/chance (Chance magazine)
8. www.statsci.org/datasets.html (Datasets)
9. www.math.uah.edu/stat (Virtual laboratories in Statistics)
10. www.amstat.org/publications/stats (STATS : the magazine for students of Statistics)
11. www.stat.ucla.edu/cases (Case studies in Statistics).
12. www.statsoft.com
13. www.statistics.com
14. www.indiastat.com
15. www.unstat.un.org
16. www.stat.stanford.edu
17. www.statpages.net
18. www.wto.org
19. www.censusindia.gov.in
20. www.mospi.nic.in
21. www.statisticsofindia.in

SEMESTER II**Paper III****ST – 123 : PRACTICALS**

Pre-requisites: Knowledge of the topics in theory papers I and II.

Objectives: At the end of this course students are expected to be able

- (i) to compute correlation coefficient, regression coefficients,
- (ii) to compute probabilities of bivariate distributions,
- (iii) to fit binomial and Poisson distributions
- (iv) to compute probabilities of bivariate distributions.
- (v) to draw random samples from Poisson and binomial distributions.

S. No.	Title of the experiment	No. of Practicals
1	Scatter diagram, correlation coefficient (ungrouped data). Fitting of line of regression.	2
2	Fitting of second degree curve, exponential curve of type $Y = ab^x$, $Y = ax^b$	2
3	Fitting of Binomial distribution and computation of expected frequencies.	1
4	Fitting of Poisson distribution and computation of expected frequencies.	1
5	Applications of Binomial & hypergeometric distributions.	1
6	Applications of Poisson & geometric distributions.	1
7	Model sampling from Poisson and Binomial distributions.	1
8	Index numbers.	1
9	Scatter diagram, correlation coefficient, fitting of a line of regression, fitting of second degree curve using Ms-excel/ Any statistical software & interpretation.	2
10	Project	3

Notes:

1. For project, a group of maximum 8 students be made.
2. All the students in a group be given equal marks for project.
3. Different data sets from newspapers, internet, magazines may be collected and students will be asked to use Statistical techniques/tools which they have learnt.
4. Students must complete all the practicals to the satisfaction of the teacher concerned.
5. Students must produce at the time of practical examination, the laboratory journal along with the completion certificate signed by the Head of the Department.

Savitribai Phule Pune University**(Formerly University of Pune)****REVISED SYLLABUS****OF****S. Y. B. Sc. STATISTICS****(at subsidiary level)****Choice Based Credit System Syllabus (pattern 2019-20)****With Effect from June 2020****STATISTICS****Notes :**

1. A student of the three year *B.Sc.* degree course will not be allowed to offer Statistics and Statistical Techniques simultaneously in any of the three years of the course.
2. Students offering Statistics at the first year of the three year *B.Sc.* course may be allowed to offer Statistical Techniques as one of their subjects in the second year of the three year *B.Sc.* course in the place of Statistics.
3. Students offering Statistical Techniques at the first of the three year *B.Sc.* course may be allowed to offer Statistics as one of their subjects in the second year of the three year *B.Sc.* course in place of Statistical Techniques provided they satisfy other requirements regarding subject combinations, if any.
4. Students must complete all the practicals to the satisfaction of the teacher concerned.
5. At the time of practical examination, a student must produce the laboratory journal along with the completion certificate signed by the Head of the Department.
6. **Study Tour:** In order to acquaint the students with applications of Statistical methods in various fields such as industries, agricultural sectors , Government Institutes etc. study tour may be arranged and the report be attached in practical journal.
7. Structure of evaluation of practical paper at *S. Y. B. Sc.*

A) Continuous Internal Assessment (CIA)

Section	Marks
i) Journal	05
ii) Viva-voce	05
iii) Project	05
Total of A	15

B) End of Semester Examination (ESE)

Section	Nature	Marks	Time
I	<p>On line examination: Note : Question No.1 is compulsory. Q. 1: Execute the commands and write the same in answer book along with answers using (A) <i>Ms – EXCEL</i> (For Sem-III) (B) <i>R – Software</i> (For Sem-IV)</p>	<p>07 07</p>	Maximum 30 minutes
II	<p>Using Calculator / Computer Note : Attempt any two of the four questions : Q2 : Q3 : Q4 : Q5 :</p>	<p>24 (12 marks for each question)</p>	<p>2 hours - for calculator user 1 hour 30 minutes- for computer user</p>
III	Viva-voce	04	10 minutes
	Total of B	35	<p>2 Hours 40 minutes- for calculator user 2 hour 10 minutes- for computer user</p>
	Total of A and B	50	

Preparation by Internal Examiner for Section I (Online examination) :

1. Keep at least 15 **computers** with latest configuration ready with battery backup and necessary software, printers, scientific calculators, necessary statistical tables, normal probability paper at the examination laboratory.
2. Appropriate data sets for time series: linear, quadratic, exponential trend fitting, exponential smoothing be entered in spreadsheet.
3. Any other type of data required as per slip also be entered in computer spreadsheet.

Instructions to Examiners:

1. Students are not expected to fill data items at the time of examination. They are expected to use *Ms – EXCEL* and *R –commands* (whichever is applicable) to operate on the data set which are already fed.
2. The questions on section I (On line examination Using *Ms – EXCEL / R–commands* (whichever is applicable)) are compulsory and there is no internal option.
3. The slips made available for Section I shall be allotted to the candiadtes at random so that the total marks of all asked commands will be exactly 07.

Objectives:

1. To fit various discrete and continuous probability distributions and to study various real life situations.
2. To identify the appropriate probability model that can be used.
3. To use forecasting and data analysis techniques in case of univariate and multivariate data sets.
4. To use statistical software packages.
5. To test various hypotheses of significance like means, proportions, independence of attributes, variance etc. included in theory (using calculators, software).
6. To compute probabilities of discrete and continuous probability distributions using MS-Excel and/or R software (whichever is applicable).
7. To study applications of statistics in the field of demography etc.

Instruction for Examination

1. The theory question paper for each paper shall cover all the topics in the pertaining syllabus with proportional weightage to the number of hours of instruction prescribed.
2. The practicals are to be conducted in batches as per the University norms for the faculty of science.
3. Medium of Instruction: English
4. Examination:
 - A) Pattern of examination: Semester wise
 - B) Standard of passing : As per norms of University

S.Y.B.Sc. STATISTICS Syllabus

For Choice Based Credit System (pattern 2019-20)

To be implemented from the Academic year 2020-2021

Structure of the course:

	Semester- III		Credits	Semester-IV		Credits	Lecture/ Week	Marks	
								Internal	External
Paper-I	ST-231	Discrete Probability Distributions And Time Series	02	ST-241	Tests of Significance And Statistical Methods	02	03 (each lecture of 50 minutes)	15	35
Paper-II	ST-232	Continuous Probability Distributions	02	ST-242	Sampling Distributions And Exact tests	02	03 (each lecture of 50 minutes)	15	35
Paper-III	ST-233	Statistics Practical	02	ST-243	Statistics Practical	02	Each practical is of duration 04 hours.& 20 minutes.	15	35

Equivalence for courses (2014-15 pattern) with new Course (2019-20 pattern):

Semester- III		Semester-IV	
Old Course (2014-15 pattern)	New Course (2019-20 pattern)	Old Course (2014-15 pattern)	New Course (2019-20 pattern)
ST-211: Discrete Probability Distributions, Time Series & R Software	ST-231: Discrete Probability Distributions And Time Series	ST-221: Statistical Methods and Use of R Software	ST-241: Tests of Significance And Statistical Methods
ST-212: Continuous Probability Distributions	ST-232: Continuous Probability Distributions	ST-222: Sampling Distributions and Inference	ST-242: Sampling Distributions And exact tests
ST-223: Statistics Practical(Annual Examination)	No equivalence	-----	-----

SEMESTER – III

PAPER - I

ST – 231: DISCRETE PROBABILITY DISTRIBUTIONS AND TIME SERIES

1. Negative Binomial Distribution: (07 L)

Probability mass function (p.m.f.)

$$P(X = x) = \binom{x+k-1}{x} p^k q^x \quad ; \quad x = 0,1,2, \dots \quad ; \quad 0 < p < 1 ; q = 1 - p ; k > 0$$

$$= 0 \quad ; \quad otherwise.$$

Notation: $X \sim NB(k, p)$.

Graphical nature of p.m.f., negative binomial distribution as a waiting time distribution, moment generating function(MGF), cumulant generating function(CGF), mean, variance, skewness, kurtosis(recurrence relation between moments is not expected), additive property of NB(k,p). Relation between geometric distribution and negative binomial distribution. Poisson approximation to negative binomial distribution. Real life situations.

2. Multinomial Distribution: Probability mass function (p.m.f.) (10 L)

$$P(X_1 = x_1, X_2 = x_2, \dots, X_k = x_k) = \frac{n! p_1^{x_1} p_2^{x_2} \dots p_k^{x_k}}{x_1! x_2! \dots x_k!} ; \quad x_i = 0, 1, 2, \dots, n - \sum_1^{i-1} x_r,$$

$$i = 1, 2, \dots, k$$

$$x_1 + x_2 + \dots + x_k = n;$$

$$0 < p_i < 1; i = 1, 2, \dots, k;$$

$$p_1 + p_2 + \dots + p_k = 1;$$

$$= 0 \quad ; \text{ otherwise.}$$

Notation: $(X_1, X_2, \dots, X_k) \sim MD(n, p_1, p_2, \dots, p_k), \underline{X} \sim MD(n, \underline{p}),$

where $\underline{X} = (X_1, X_2, \dots, X_k), \quad \underline{p} = (p_1, p_2, \dots, p_k).$

Joint MGF of (X_1, X_2, \dots, X_k) , use of MGF to obtain means, variances, covariances, total correlation coefficients, variance – covariance matrix, rank of variance – covariance matrix and its interpretation, additive property of multinomial distribution, univariate marginal distribution, distribution of $X_i + X_j$, conditional distribution of X_i given $X_j = r$, conditional distribution of X_i given $X_i + X_j = r$, real life situations and applications.

3. Truncated Distributions: (05L)

Concept of truncated distribution, truncation to the right, left and on both sides. Binomial distribution left truncated at $X = 0$ (value zero is discarded), its p.m.f., mean and variance. Poisson distribution left truncated at $X = 0$ (value zero is discarded), its p.m.f., mean and variance. Real life situations and applications.

4 Time Series: (14L)

- 4.1 Meaning and utility of time series, components of time series: trend, seasonal variations, cyclical variations, irregular (error) fluctuations or noise.
- 4.2 Exploratory data analysis: Time series plot to (i) check any trend and seasonality in the time series (ii) identify the nature of trend .
- 4.3 Methods of trend estimation and smoothing: (i) moving average, (ii) linear, parabolic, exponential, Parato curve fitting by least squares principle (iii) exponential smoothing.
- 4.4 Choosing parameters for smoothing and forecasting.
- 4.5 Forecasting based on exponential smoothing.
- 4.6 Measurement of seasonal variations: i) simple average method, ii) ratio to moving average method, iii) ratio to trend where linear trend is calculated by method of least squares.(Numerical examples with heavy computations are to be asked preferably in practicals).
- 4.7 Fitting of autoregressive model $AR(p)$, where $p = 1, 2$.
- 4.8 Case studies of real life Time Series: Price index series, share price index series, economic time series: temperature and rainfall time series, wind speed time series, pollution levels.

SEMESTER – III

PAPER – II

ST 232 : CONTINUOUS PROBABILITY DISTRIBUTIONS

1. Continuous Univariate Distributions: (10L)

1.1 Continuous sample space: Definition, illustrations.

Continuous random variable: Definition, probability density function (p.d.f.), cumulative distribution function (c.d.f.), properties of c.d.f. (without proof), probabilities of events related to random variable.

1.2 Expectation of continuous r.v., expectation of function of r.v. $E[g(X)]$, mean, variance, geometric mean, harmonic mean, raw and central moments, skewness, kurtosis, mean deviation about mean.

1.3 Moment generating function (MGF): Definition, properties. Cumulant generating function (CGF): Definition.

1.4 Mode, partition values : quartiles(Q_1, Q_2, Q_3), deciles, percentiles.

1.5 Probability distribution of function of r. v. : $Y = g(X)$ using i) Jacobian of transformation for $g(\cdot)$ monotonic function and one-to-one, on to functions, ii) Distribution function for $Y = X^2, Y = |X|$ etc., iii) M.G.F. of $g(X)$.

2. Continuous Bivariate Distributions: (09 L)

2.1 Continuous bivariate random vector or variable (X, Y) : Joint p. d. f., joint c. d. f., properties (without proof), probabilities of events related to random variables (events in terms of regions bounded by regular curves, circles, straight lines). Marginal and conditional distributions.

2.2 Expectation of r.v. (X, Y) , expectation of function of r.v. $E[g(X, Y)]$, joint moments, $Cov(X, Y)$, $Corr(X, Y)$, conditional mean, conditional variance, $E[E(X|Y = y)] = E(X)$ & $E[E(Y|X = x)] = E(Y)$, regression as a conditional expectation.

Theorems on expectation:

i) $E(X + Y) = E(X) + E(Y)$, (ii) $E(XY) = E(X)E(Y)$, if X and Y are independent, generalization to k variables. $E(aX + bY + c)$, $Var(aX + bY + c)$ (statement only proof not expected).

2.3 Independence of random variables X and Y and also its extension to k random variables.

2.4 Moment generating function (MGF): $M_{X,Y}(t_1, t_2)$, properties, MGF of marginal distribution of random variables(r.v.s.), properties

i) $M_{X,Y}(t_1, t_2) = M_X(t_1, 0)M_Y(0, t_2)$ if X and Y are independent r.v.s.,

ii) $M_{X+Y}(t) = M_{X,Y}(t, t)$

iii) $M_{X+Y} = M_X(t) M_Y(t)$ if X and Y are independent r.v.s.

2.5 Probability distribution of transformation of bivariate r. v. $U = \phi_1(X, Y), V = \phi_2(X, Y)$.

3. Standard Univariate Continuous Distributions:

3.1 Uniform or Rectangular Distribution: (03 L)

Probability density function (p.d.f.)

$$f(x) = \begin{cases} \frac{1}{b-a}, & a \leq x \leq b \\ 0, & \text{otherwise} \end{cases}$$

Notation : $X \sim U[a, b]$. p. d. f., sketch of p. d. f., c. d. f., mean, variance, symmetry, MGF.

Distributions of i) $\frac{x-a}{b-a}$, ii) $\frac{b-x}{b-a}$, iii) $Y = F(X)$, where $F(X)$ is the c. d. f. of continuous r.

v. X . Application of the result to model sampling. (Distributions of $X + Y, X - Y, XY$ and X/Y are not expected.)

3.2 Normal Distribution: (10 L)

Probability density function (p. d. f.)

$$f(x) = \begin{cases} \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2} ; & -\infty < X < \infty, -\infty < \mu < \infty, \sigma > 0 \\ 0 & ; \text{ otherwise} \end{cases}$$

Notation: $X \sim N(\mu, \sigma^2)$.

p. d. f. curve, identification of scale and location parameters, nature of probability curve, mean, variance, MGF, CGF, central moments, cumulants, skewness, kurtosis, mode, quartiles(Q_1, Q_2, Q_3), points of inflexion of probability curve, mean deviation, additive property, probability distribution of : i) $\frac{X-\mu}{\sigma}$, standard normal variable (S.N.V.), ii) $aX + b$, iii) $aX + bY + c$, where X and Y are independent normal variates. Probability distribution of \bar{X} , the mean of n i. i. d. $N(\mu, \sigma^2)$ r. v s., computations of normal probabilities using normal probability integral tables. Central limit theorem (CLT) for i. i. d. r.v.s. with finite positive variance(statement only), its illustration for Poisson and Binomial distributions.(Box-Muller transformation and normal probability plot to be covered in practicals)

3.3 Exponential Distribution: Probability density function (p. d. f.) (04 L)

$$f(x) = \begin{cases} \alpha e^{-\alpha x} ; & x \geq 0, \alpha > 0 \\ 0 & ; \text{ otherwise} \end{cases}$$

Notation : $X \sim Exp(\alpha)$.

Nature of density curve, interpretation of α as a interarrival rate of customers joining the queue and $\frac{1}{\alpha}$ as mean, mean, variance, MGF, CGF, skewness, kurtosis, c.d.f., graph of c.d.f., lack of memory property, quartiles(Q_1, Q_2, Q_3), mean deviation about mean, distribution of sum of two i.i.d exponential random variables. Distribution of $min(X, Y)$ and $max(X, Y)$ with X, Y i. i. d. exponential random variables.

SEMESTER – III

PAPER - III

ST-233: PRACTICALS

Pre-requisites: Knowledge of the topics in theory.

Objectives:

1. To fit various discrete and continuous probability distributions and to study various real life situations.(Using calculators and *Ms – EXCEL*)
2. To identify the appropriate probability model that can be used.
3. To use forecasting and data analysis techniques in case of univariate data sets.

Preparation by Internal Examiner for Section I (Online examination):

1. Keep at least 15 **computers** with latest configuration ready with battery backup and necessary software, printers, scientific calculators, necessary statistical tables, normal probability paper at the examination laboratory.
2. Appropriate data set for time series, linear, quadratic, exponential trend fitting, exponential smoothing be entered in spreadsheet.
3. Any other type of data required as per practical slip also be entered in computer spreadsheet

Instructions to Examiners:

1. Students are not expected to fill data items at the time of examination. They are expected to use *Ms – EXCEL* to operate on the data set which is already fed.
2. The question on section I are compulsory and there is no internal option.
3. The slips made available for Section I shall be allotted to the candiadtes at random so that the total marks of all asked commands will be exactly 07.

Sr. No.	Title of the Practical	No. of Practicals
1	Fitting of negative binomial distribution and computation of expected frequencies.	1
2	Fitting of normal distribution and computation of expected frequencies. Use of normal probability paper to check normality of raw data.	1
3	Applications of negative binomial and multinomial distributions.	1
4	Applications of normal distributions.	1
5	Model sampling from exponential distribution using distribution function, Model sampling from normal distribution using (i) distribution function, , (ii) Box-Muller transformation.	1
6	Time series : Estimation and forecasting of trend by exponential smoothing, moving averages, plotting of residuals. Fitting of AR (1) model	1
7	Estimation of seasonal indices by (i)ratio to trend (ii)ratio to moving range	1
	Practicals based on MS- EXCEL	
8	Finding negative binomial probabilities. Fitting of negative binomial distribution and bar diagram of p.m.f. using <i>Ms – EXCEL</i> .	1
9	Finding normal probabilities .Fitting of normal distribution and tracing of normal probability curve using <i>Ms – EXCEL</i> .	1
10	Fitting of linear, quadratic , exponential trends to time series data. Finding the best fit using R^2 . Moving averages . Exponential smoothing using <i>Ms – EXCEL</i> .	2
11	Project: Project based on analysis of data collected by students in groups of maximum 6 students. (Project is equivalent to three practical's)	3
	Study tour report (if any)	-

SEMESTER – IV

PAPER – I

ST – 241: TESTS OF SIGNIFICANCE AND STATISTICAL METHODS.

1. Tests of Significance: (14L)

1.1 Random sample from a distribution as *i. i. d.* r.v.s. $X_1, X_2, X_3, \dots, X_n$.

1.2 **Statistic and Parameter.** Sampling distribution of a statistic, standard error of a statistic with illustrations. **Statistical Inference:** Introduction to problem of Estimation and testing of hypothesis. Estimator and estimate. Unbiased estimator (definition and simple illustrations only). Point and interval estimation. Statistical hypothesis, null and alternative hypothesis, simple and composite hypothesis, one sided and two sided alternative hypothesis, critical region, *type – I* and *type – II* error, level of significance, *p – value*. Two sided confidence interval. Tests of hypotheses using i) critical region approach, ii) *p – value* approach and iii) confidence interval approach.

1.3 Tests for population means (large sample / approximate tests):

i) $H_0: \mu = \mu_0$ against $H_1: \mu \neq \mu_0, H_1: \mu > \mu_0, H_1: \mu < \mu_0$. (variance known)

ii) $H_0: \mu_1 = \mu_2$ against $H_1: \mu_1 \neq \mu_2, H_1: \mu_1 > \mu_2, H_1: \mu_1 < \mu_2$. (variances known)

iii) Construction of two sided confidence interval for μ and $\mu_1 - \mu_2$

1.4 Tests for population proportions:

i) $H_0: P = P_0$ against $H_1: P \neq P_0, H_1: P > P_0, H_1: P < P_0$.

ii) $H_0: P_1 = P_2$ against $H_1: P_1 \neq P_2, H_1: P_1 > P_2, H_1: P_1 < P_2$.

iii) Construction of two sided confidence interval for P and $P_1 - P_2$.

2. Multiple Linear Regression Model: (08L)

2.1 Definition of multiple correlation coefficient $R_{Y.X_1X_2}$ Derivation of the expression for multiple correlation coefficient. Properties of multiple correlation coefficient.

i) $0 \leq R_{Y.X_1X_2} \leq 1$ ii) $R_{Y.X_1X_2} \geq \min\{r_{yx_1}, r_{yx_2}\}$.

2.2 Interpretation of coefficient of multiple determination $R^2_{Y.X_1X_2}$ as i) proportion of variation explained by the linear regression ii) $R^2_{Y.X_1X_2} = 1$ and iii) $R^2_{Y.X_1X_2} = 0$.

2.3 Partial correlation coefficient: Definition and derivation of partial correlation coefficient $r_{yx_1.x_2}$ and $r_{yx_2.x_1}$ Property of partial correlation coefficient ($-1 \leq r_{yx_1.x_2}, r_{yx_2.x_1} \leq 1$). (Statement only)

2.4 Notion of multiple linear regression. Yule's notation (trivariate case) (statement only).

Fitting of regression plane of Y on X_1 and X_2 , $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$ by the method

of least squares; obtaining normal equations, solution of normal equations. Definition and interpretation of partial regression coefficients β_1 and β_2 . (relations between partial regression coefficients and multiple correlations are not expected).

Residual: Definition, order, derivation of variance, properties. Finding multiple and partial correlation coefficients if $(X_1, X_2, X_3) \sim MD(n, P_1, P_2, P_3)$

3. Demography: (08L)

3.1 Vital events, vital statistics, methods of obtaining vital statistics, rates of vital events, sex ratios, dependency ratio.

3.2 Death/Mortality rates: Crude death rate, specific (age, sex etc.) death rate, standardized death rate (direct and indirect), infant mortality rate.

3.3 Fertility/Birth rate: Crude birth rate, general fertility rate, specific (age, sex etc.) fertility rates, total fertility rate.

3.4 Growth/Reproduction rates : Gross reproduction rate, net reproduction rate.

.(Numerical examples with heavy computations are to be asked preferably in practicals).

3.5 Interpretations of different rates, uses and applications.

3.6 Trends in vital rates as revealed in the latest census.

4. Queuing Model: (06L)

Introduction to queuing model. as an application of exponential distribution, Poisson distribution and geometric distribution. Kendall's notation $M/M/1: FIFO/\infty/\infty$

Inter arrival rate (λ), service rate (μ), traffic intensity ($= \frac{\lambda}{\mu} < 1$), queue disciplines.

Probability distribution of number of customers in queue, average queue length, average waiting time in: i) queue, ii) system.(without derivations) statement of Little's formula / relations.

SEMESTER-IV

PAPER-II

ST-242: SAMPLING DISTRIBUTIONS AND EXACT TESTS.

1. **Gamma Distribution:** (04 L)

$$f(x) = \begin{cases} \frac{\alpha^\lambda}{\Gamma(\lambda)} x^{\lambda-1} e^{-\alpha x} & ; x > 0, \alpha, \lambda > 0 \\ 0 & ; \text{otherwise} \end{cases}$$

$= 0$, otherwise.

Notation: $X \sim G(\alpha, \lambda)$,

Nature of probability curve, special cases: i) $\alpha = 1$, ii) $\lambda = 1$, MGF, CGF, moments, cumulants, skewness, kurtosis, mode, additive property. Distribution of sum of n i.i.d. exponential variables. Relation between distribution function of Poisson and Gamma variates.

2. **Chi-square Distribution:** (11 L)

Definition of chisquare r.v. as a sum of squares of i.i.d. standard normal variables. Derivation of the p.d.f. of Chi-square variable with n degrees of freedom (d.f.) using MGF.

Notation: $X \sim \chi_n^2$

Mean, variance, MGF, CGF, central moments skewness, kurtosis, mode, additive property. Use of chi-square tables for calculations of probabilities. Normal approximation: $\frac{\chi_n^2 - n}{\sqrt{2n}}$ (statement only) Distribution of \bar{X} and $\frac{nS^2}{\sigma^2} = \frac{1}{\sigma^2} \sum_{i=1}^n (X_i - \bar{X})^2$ for a random sample from a normal distribution using orthogonal transformation, independence of \bar{X} and S^2 .

3. **Student's t –distribution:** (05 L)

Definition of t r.v. with n d.f. in the form of $t = \frac{U}{\sqrt{\frac{V}{n}}}$, where $U \sim N(0, 1)$ and V is chi-square

with n d.f., where U & V are independent random variables.

Notation: $t \sim t_n$

Derivation of the p.d.f of t distribution, nature of probability curve, mean, variance, moments, mode. Use of t -tables for calculations of probabilities, statement of normal approximation.

4. **Snedecore's F –distribution:** (06 L)

Definition of F r.v. with n_1 and n_2 d.f. as $F_{n_1, n_2} = \frac{X_1/n_1}{X_2/n_2}$ where X_1 & X_2 are independent chi-square variables with n_1 and n_2 d.f.

Notation: $F \sim F_{n_1, n_2}$

Derivation of the p.d.f, nature of probability curve, mean, variance, moments, mode.

Distribution of $\frac{1}{F_{n_1, n_2}}$, use of F –tables for calculation of probabilities.

Interrelationship between Chi-square, t and F distributions.

5. Test of Hypothesis: (10 L)

5.1 Tests based on chi-square distribution:

- a) Test for independence of two attributes arranged in 2×2 contingency table (with Yate's correction) (to be covered in practical only)
- b) Test for independence of two attributes arranged in $r \times s$ contingency table, Mc Nemar's test (to be covered in practical only)
- c) Test for goodness of fit. (to be covered in practical only)
- d) Test for variance ($H_0: \sigma^2 = \sigma_0^2$) against one-sided and two-sided alternatives i) for known mean , ii) for unknown mean.

5.2 Tests based on t –distribution:

- a) Tests for population means:
 - (i) Single sample with unknown variance and two sample for unknown equal variances tests for one-sided and two-sided alternatives.
 - (ii) $100(1 - \alpha)\%$ two sided confidence interval for population mean and difference of means of two independent normal populations.
- b) Paired t-test for one-sided and two-sided alternatives.

5.3 Test based on F –distribution:

Test for $H_0: \sigma_1^2 = \sigma_2^2$ against one-sided and two-sided alternatives when i) means are known and ii) means are unknown. Take $F = \frac{S_1^2}{S_2^2}$.

SEMESTER IV
PAPER III
ST-243: PRACTICALS

Pre-requisites : Knowledge of the topics in theory.

Objectives:

1. To conduct various tests of significance like averages, population proportions, independence of attributes, variance etc. included in theory (using calculators, *R* software).
2. To compute probabilities of discrete and continuous probability distributions using *R* software.
3. To use *R* software for finding basic summary statistics.

Preparation by Internal Examiner for Section I (Online examination):

1. Keep at least 15 **computers** with latest configuration ready with battery backup and necessary software, printers, scientific calculators, necessary statistical tables at the examination laboratory.

Instructions to Examiners:

1. The question on section I are compulsory and there is no internal option.
2. The commands of the nature attached in specimen are to be asked, so that the total marks of all asked commands will be exactly 7.

Sr. No.	Title of the Practical	No. of Practicals
1	Computations of GRR and NRR	1
2	Test for proportions and construction of confidence interval for $H_0: P = P_0$ and $H_0: P_1 = P_2$	1
3	Test for means and construction of confidence interval i) $H_0: \mu = \mu_0, \sigma^2$ known and σ^2 unknown ii) (ii) $H_0: \mu_1 = \mu_2, \sigma_1^2$ and σ_2^2 both known iii) $H_0: \mu_1 = \mu_2, \sigma_1^2 = \sigma_2^2 = \sigma^2$ unknown (iv) $H_0: \mu_1 = \mu_2$ (paired t test)	1
4	Tests based on χ^2 distribution (i) Goodness of fit i) Independence of attributes ($2 \times 2, r \times s$ contingency table) ii) Mc Nemar's test iii) $H_0: \sigma^2 = \sigma_0^2, \mu$ unknown, confidence interval for σ^2	2
5	Tests based on F distribution $H_0: \sigma_1^2 = \sigma_2^2$ for i) means known ii) means unknown	1
Practicals based on R software		
6	Use of basic R software commands c(), scan(), rep(), seq(), min, max, sort, extract, data.frame, matrix, accessing resident data sets etc.	1
7	Finding summary statistics using summary () and fivenum(). Calculate arithmetic mean (AM), geometric mean (GM), harmonic mean (HM), median, mode, quantiles, range, quartile deviation (QD), variance, coefficient of variation (CV) using R software.	1
8	Computation of probabilities of negative binomial, multinomial, normal, exponential, gamma, t, χ^2, F using R software	1
9	Tests for proportions, means, χ^2 distribution, F distribution using R software. Fitting of trivariate regression plane using R software	1
10	Project: Project based on analysis of data collected by students in groups of maximum 6 students. (Project is equivalent to three practical's)	3
	Study tour report (if any)	-

Books Recommended:

1. Brockwell P.J. and Davis R.A. (2003), Introduction to Time Series and Forecasting (Second Edition), Springer Texts in Statistics.
2. Chatfield C. (2001), The Analysis of Time Series An Introduction, Chapman and Hall / CRC, Texts in Statistical Science .
3. Goon A. M., Gupta, M. K. and Dasgupta, B. (1986), Fundamentals of Statistics, Vol. 2, World Press, Kolkata.
4. Gupta, S. C. and Kapoor, V. K. (2002), Fundamentals of Mathematical Statistics, (Eleventh Edition), Sultan Chand and Sons, 23, Daryaganj, New Delhi , 110002 .
5. Gupta, S. C. and Kapoor V. K. (2007), Fundamentals of Applied Statistics (Fourth Edition), Sultan Chand and Sons, New Delhi.
6. Gupta, S. P. (2002), Statistical Methods (Thirty First Edition), Sultan Chand and Sons, 23, Daryaganj, New Delhi 110002.
7. Hogg, R. V. and Craig, A. T. , Mckean J. W. (2012), Introduction to Mathematical Statistics (Tenth Impression), Pearson Prentice Hall.
8. Kulkarni, M. B., Ghatpande, S. B. and Gore, S. D. (1999), Common Statistical Tests, Satyajeet Prakashan, Pune 411029
9. Medhi, J., Statistical Methods, Wiley Eastern Ltd., 4835/24, Ansari Road, Daryaganj, New Delhi – 110002.
10. Meyer, P. L., Introductory Probability and Statistical Applications, Oxford and IBH Publishing Co. New Delhi.
11. Mood, A. M., Graybill F. A. and Bose, F. A. (1974), Introduction to Theory of Statistics (Third Edition, Chapters II, IV, V, VI), McGraw - Hill Series G A 276
12. Mukhopadhyaya Parimal (1999), Applied Statistics, New Central Book Agency, Pvt. Ltd. Kolkata
13. Purohit S. G., Gore S. D. and Deshmukh S. R. (2008), Statistics using R, Narosa Publishing House, New Delhi.
14. Ross, S. (2003), A first course in probability (Sixth Edition), Pearson Education publishers , Delhi, India.
15. Walpole R. E., Myers R. H. and Myers S. L. (1985), Probability and Statistics for Engineers and Scientists (Third Edition, Chapters 4, 5, 6, 8, 10), Macmillan Publishing Co. Inc. 866, Third Avenue, New York 10022.
16. Weiss N., Introductory Statistics, Pearson education publishers.



Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Zoology

(Faculty of Science & Technology)

F.Y.B.Sc. Zoology

Choice Based Credit System Syllabus

to be implemented from

Academic Year 2019-2020

Preamble:

Zoology is one of the major subjects of Basic Sciences and deals with all aspects of animal biology. It includes an interesting range of highly diverse topics. A zoology student needs to gain understanding of many areas of the subject to keep pace with advancements in Life Sciences.

This under-graduate degree program has been designed by the Board of Studies in Zoology of Savitribai Phule Pune University with a substantial component of what is needed from zoologists as a skilled career and what zoologists need to pursue for post-graduation and further academic studies. It follows the guidelines laid down by the University Grants Commission, New Delhi. This newly designed curriculum is a perfect blend of the classical aspects in Zoology and the advanced and more specialized areas.

This degree offers Discipline Specific Core Courses [CC] in Animal Systematics, Animal Ecology, Animal Cell biology, Applied Zoology, Pest Management, Histology, Biological Chemistry, Genetics, Developmental Biology, Parasitology, Medical & Forensic Zoology, Animal Physiology, Molecular Biology, Entomology, Techniques in Biology and Evolutionary Biology.

In addition to the Core Courses, Ability Enhancement Compulsory Courses [AECC] have been added in the second year i.e. Semester III and Semester IV of the undergraduate course. In the third year i.e. Semester V and Semester VI, Discipline specific Elective Courses [DSEC] and Skill Enhancement Courses [SEC] have been offered. The students, therefore, have an opportunity to take courses in Environment Awareness, Language communication: English/Marathi, Aquarium Management, Poultry Management and Environmental Impact Assessment. In Semester VI the students also have a course dedicated to Project work.

The syllabus has been framed in such a way that the student gains each year, a broader perspective of the subject as he progresses towards completion of the degree program. Field trips, Educational visits and the Project work have been included for the student to experience the applications of the theory learnt in the classroom.

After completion of the program, it is expected that students will understand and appreciate: animal diversity, few applications of Zoology, the structure, functions and life processes at cellular, tissue, organ and system level, significance of evolution, and basic concepts of human health. The students would also gain an insight into laboratory and field work through the practical course, field work and the project.

While presenting this new syllabus to the teachers and students of F.Y.B.Sc. Zoology, I am extremely happy to state that efforts have been made to seek inputs of all the stake holders to make it more relevant.

The new course that will be effective from the academic year 2019- 2020 and will follow the Choice Based Credit System in a Semester mode. It has been primed keeping in view the distinctive requirements of B.Sc. Zoology students. The contents have been drawn-up to accommodate the widening prospects of the discipline of Life Sciences. They reflect the changing prerequisites of the students. This program has been introduced with 132 credits for the subject group while 08 credits to earn from any of the 08 groups offering a range of curricular, cocurricular and extracurricular activities. This pattern has been specially aimed towards the overall development of the students'. The calculation of credits and CGPA will

be as per the guidelines of the University. The B.Sc. Zoology program provides an appropriate blend of classical and applied aspects of the subject. This newly designed curriculum will allow students to acquire the skill in handling scientific instruments planning and performing in the laboratory and exercising critical judgement, independent thinking and problem solving skills. The Syllabus has been revised with the following aims

- To foster curiosity in the students for Zoology
- To create awareness amongst students for the basic and applied areas of Zoology
- To orient students about the importance of abiotic and biotic factors of environment and their conservation.
- To provide an insight to the aspects of animal diversity.
- To inculcate good laboratory practices in students and to train them about proper handling of lab instruments.

1. Course Structure:**Course Structure with Credit Distribution of the Undergraduate Science Program in Zoology**

Course	Course Code and Name of the Course		Credits
F.Y.B.Sc.	SEMESTER I	SEMESTER II	
CC	ZO-111 Animal Diversity I	ZO-121 Animal Diversity II	2+2
CC	ZO-112 Animal Ecology	ZO-122 Cell Biology	2+2
CC	ZO-113 Zoology Practical Paper	ZO-123 Zoology Practical Paper	1.5 +1.5
S.Y.B.Sc.	SEMESTER III	SEMESTER IV	
CC	ZO-231 Animal Diversity III	ZO-241 Animal Diversity IV	2+2
CC	ZO-232 Applied Zoology I	ZO-242 Applied Zoology II	2+2
CC	ZO-233 Zoology Practical Paper	ZO-243 Zoology Practical Paper	2+2
AECC	EVS 231-Environment Awareness	EVA 241-Environment Awareness	2+2
AECC	LA 231-English/Marathi	LA 241- English /Marathi	2+2
T.Y.B.Sc.	SEMESTER V	SEMESTER VI	
DSEC	ZO-351 Pest Management	ZO-361 Medical & Forensic Zoology	2+2
DSEC	ZO-352 Histology	ZO-362 Animal Physiology	2+2
DSEC	ZO-353 Biological Chemistry	ZO-363 Molecular Biology	2+2
DSEC	ZO-354 Genetics	ZO-364 Entomology	2+2
DSEC	ZO-355 Developmental Biology	ZO-365 Techniques in Biology	2+2
DSEC	ZO-356 Parasitology	ZO-366 Evolutionary Biology	2+2
DSEC	ZO-357 Zoology Practical Paper 1	ZO-367 Zoology Practical Paper 1	2+2
DSEC	ZO-358 Zoology Practical Paper 2	ZO-368 Zoology Practical Paper 2	2+2
DSEC	ZO-359 Zoology Practical Paper 3	ZO-369 Zoology Practical Paper 3	2+2
SEC	ZO-3510 Aquarium Management	ZO-3610 Environmental Impact Assessment	2+2
SEC	ZO- 3511 Poultry Management	ZO-3611 Project	2+2

Detailed Syllabus of F.Y.B.Sc.

Paper	Semester I Course Code & Course	Credits	No of Lectures	Marks (Internal + University)	SemesterII Course Code & Course	Credits	No of Lectures	Marks (Internal + University)
I	ZO-111 Animal Diversity I	02	30	15+ 35= 50	ZO-121 Animal Diversity II	02	30	15+ 35 = 50
II	ZO-112 Animal Ecology	02	30	15+ 35 = 50	ZO-122 Cell Biology	02	30	15+ 35 = 50
III	ZO-113 Zoology Practical Paper	01	15 practical	15+ 35 = 50	ZO-123 Zoology Practical Paper	01	15 Practical	15+ 35 = 50

Course No.	Course Title	Total Number of lectures/practical per Term	Standard of passing		
			Internal marks	University marks	Total marks
ZO-111 (First term)	Animal Diversity-I	Three lectures/Week (Total 30 lectures per term)	15	35	50
ZO-121 (Second term)	Animal Diversity-II	Three lectures/Week (Total 30 lectures per term)	15	35	50
ZO-112 (First term)	Animal Ecology	Three lectures/Week (Total 30 lectures per term)	15	35	50
ZO-122 (Second Term)	Cell Biology	Three lectures/Week (Total 30 lectures per term)	15	35	50
ZO-113 (First term)	Zoology Practical Paper	Practical session of 3 hours. 15 Practicals	15	35	50
ZO-123 (Second Term)	Zoology Practical Paper	Practical session of 3 hours. 15 Practicals	15	35	50

Animal Diversity I & II**Objectives:**

1. To understand the Animal diversity around us.
2. To understand the underlying principles of classification of animals.
3. To understand the terminology needed in classification.
4. To understand the differences and similarities in the various aspects of classification.
5. To classify invertebrates and to be able to understand the possible group of the invertebrate observed in nature. to understand our role as a caretaker and promoter of life.

Learning outcomes for the course:

1. The student will be able to understand classify and identify the diversity of animals.
2. The student understands the importance of classification of animals and classifies them effectively using the six levels of classification.
3. The student knows his role in nature as a protector, preserver and promoter of life which he has achieved by learning, observing and understanding life.

Course Title: Animal Diversity –I**Course Code-ZO-111****Semester I****(2 credits-30 lectures)**

No.	Title & Contents	Number of lectures
1.	Principles of Classification: Taxonomy & Systematics 1.1 Taxonomy: Basic terminology and Introduction <ul style="list-style-type: none"> • Alpha, Beta and Gamma levels of taxonomy, Micro-taxonomy • Macro taxonomy: Phenetics (numerical taxonomy, Cladistics (Phylogenetic systematics), Evolutionary taxonomy (evolutionary systematics) • Classical taxonomy and experimental or neo taxonomy (biochemical taxonomy and Cytotaxonomy) • Significance of Taxonomy 1.2 Systematics: definition introduction	(05)

- 1.3 Linnaean system of classification (Six level classification: Phylum, class, order, family, genus, species)
- 1.4 Concept of Species: Biological & Evolutionary
- 1.5 Introduction to Binomial Nomenclature.
- 1.6 Introduction to Five kingdom system.
2. **General Features of kingdom Animalia** (02)
- 2.1 General characters of Kingdom Animalia, Grades of organization
- 2.2 Symmetry.
3. **Kingdom Protista (Phylum: Protozoa)** (07)
- 3.1 Introduction to Phylum Protozoa
- 3.2 Salient features of Phylum Protozoa
- 3.3 Classification of Phylum Protozoa up to classes with two examples of each class (names only).
- Class Rhizopoda (e.g :*Entamoeba histolytica*, *Arcella*),
- Class Mastigophora (e.g: *Euglena viridis*, *Trypanosoma gambiense*),
- Class Ciliata (e.g *Paramecium caudatum*, *Opalina ranarum*),
- Class Sporozoa (e.g *Plasmodium vivax*, *Toxoplasma gondii*)
- 3.4 Locomotion in Protozoa: Amoeboid, Ciliary and Flagellar with suitable examples
- 3.5 Type Study: ***Paramecium caudatum***: Classification, Habit and Habitat, External morphology, Feeding and digestion, Excretion, Reproduction (binary fission and conjugation)
- 3.6. Economic importance of Protozoa (three harmful and one useful protozoan)
- 3.6.1-**Harmful Protozoa:**
- Plasmodium vivax* (malarial parasite),
- Entamoeba histolytica* (Amoebic dysentery),
- Trypanosoma gambiense* (Gambian sleeping sickness).
- 3.6.2- **Useful Protozoa:**
- Trichonympha*

4. **Origin of Metazoa** (01)
4.1 Introduction Origin and importance of Metazoa
5. **Phylum Porifera** (06)
5.1. Introduction to Phylum Porifera
5.2 Classification of Phylum Porifera up to classes with two examples of each class (names only, no description of specimens).
Class Calcarea (e.g.: *Leucosolenia*, *Sycon* (*Scypha*))
Class Hexactinellida (e.g: *Euplectella* (venus flower basket), *Hyalonema* (glass sponge))
Class Demospongiae (e.g: *Chalina* (Mermaid's gloves, *Spongilla* (fresh water sponge))
5.3 Canal system in sponges: Ascon, Leucon and Rhagon type.
5.4 Skeleton in sponges: Spicules, its types:
Microscleres & Megascleres,
Monoaxon – monactinal, diactinal, Amphidiscs, Triaxon, Polyaxon,
Spongin fibres.
5.5 Regeneration in sponges.
5.6 Economic importance of Phylum Porifera.
6. **Phylum: Cnidaria** (05)
6.1 Introduction to Phylum Cnidaria
6.2 Salient features of Phylum Cnidaria
6.3 Classification of Phylum Cnidaria up to class level with given examples each class (names of examples only)
Class Hydrozoa e.g.: *Hydra*, *Physalia* (Portuguese man of war)
Class Scyphozoa e.g: *Aurelia* (Jelly fish), *Leucernaria* (trumpet shaped Jellyfish)
Class Anthozoa: e.g; *Metridium* (Common sea anemone)
6.4 Polymorphism in Hydrozoa: Polyps & Medusa (polyp types: gastrozooids, dactylozooids, gonozooids) and functions
6.5 Economic importance of Cnidarians with reference to Corals and Coral reefs.

7. Phylum Platyhelminthes (04)

7.1 Introduction to Phylum Platyhelminthes

7.2 Salient features of Phylum Platyhelminthes

7.3 Classification of Phylum Platyhelminthes up to classes with two examples each class (names of examples only).

Class: Turbellaria (e.g: *Dugesia*, *Bipallium*)

Class: Trematoda (e.g: *Fasciola hepatica*, *Schistosoma haematobium*)

Class Cestoda: (*Taenia solium* (pork tape worm), *Echinococcus granulosus* (dog tapeworm))

7.4 Parasitic adaptations in Platyhelminthes: structural and physiological.

7.5 Economic importance of Platyhelminthes

Course Title: Animal Ecology

Course Code: ZO 112

Semester I

(2 Credits-30 Lectures)

Learning outcomes for the course:

- The learners will be able to identify and critically evaluate their own beliefs, values and actions in relation to professional and societal standards of ethics and its impact on ecosystem and biosphere due to the dynamics in population.
- To understand anticipate, analyse and evaluate natural resource issues and act on a lifestyle that conserves nature.
- The Learner understands and appreciates the diversity of ecosystems and applies beyond the syllabi to understand the local lifestyle and problems of the community.
- The learner will be able to link the intricacies of food chains, food webs and link it with human life for its betterment and for non-exploitation of the biotic and abiotic components.
- The working in nature to save environment will help development of leadership skills to promote betterment of environment.

ZO 112: Animal Ecology**(2 Credits-30 Lectures)**

No.	Topic & Content	Number of lectures
1.	Introduction to Ecology 1.1 Concepts of Ecology, Environment, Population, Community, Ecosystem, Biosphere, Autecology and synecology.	(02)
2.	Ecosystem 2.1 Types of ecosystems: Aquatic (Freshwater, estuarine, Marine and terrestrial (Forest, Grassland and Desert) 2.2 Structure and Composition of Ecosystem (Abiotic components and biotic components. 2.3 Food chain: Detritus and grazing food chains, Food web, Energy flow through the ecosystem, Ecological pyramids: Number, Biomass, and Energy. 2.4 concept of Eutrophication in lakes and rivers.	(08)
3	Population 3.1Characteristic of population: Density, Natality, Mortality, Fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion. 3.2Exponential and logistic growth, 3.3 Population regulation – density-dependent and independent factors. Population interactions, Gause's Principle with laboratory and field interactions, 3.4 Quadrate, line and belt transect methods.	(08)
4.	Community 4.1Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Eco tone and edge effect; Ecological succession with one example.	(07)
5.	Animal interactions 5.1Introduction to Animal interactions 5.2 Types of Animal interactions with at least to suitable examples of each 5.2.1-Competition: Interspecific and intraspecific	(05)

5.2.2- Beneficial Associations:

Commensalism (remora fish on shark, Cattle egrets on livestock),

Mutualism (Termite and *Trichonympha*, bees and flowers, cleaning symbiosis in fish by prawns).

5.3 Antagonistic associations: Parasitism (*Ascaris* and man, lice and humans), Prey predation (Lion and deer).

Course Title: Zoology Practical Paper

Course Code: ZO113

Semester I

(1.5 Credits-45 Hours)

Animal Diversity –I

1. Museum Study of phylum Protozoa: *Euglena*, *Paramecium*, *Amoeba*, *Plasmodium* sp.
2. Museum study of Phylum Porifera: *Sycon*, *Euplectella*, *Chalina*, *Spongilla*.
3. Museum study of phylum Cnidaria: *Hydra*, *Physalia*, *Aurelia*, *Metridium*.
4. Museum Study of phylum Platyhelminthes: *Planeria*, *Faciola hepatica*, *Taenia solium*
5. Study of *Paramecium*: Culture, External morphology, Conjugation and Binary fission.
6. Study of permanent slides: Spicules and Gemmules in Sponges, T.S. of *Sycon*, T.S. of *Hydra*, *Taeniasolium*: Scolex, Gravid proglottid.
7. Identification of any three museum specimen with help of taxonomic identification key.
8. Visit to Zoological survey of India/ Museum/National Park.

Animal Ecology:

1. Estimation of Dissolved oxygen from given water sample.
2. Estimation of Water Alkalinity from given water sample.
3. Study of animal community structure by quadrat method (Field or Simulation).
4. Determination of density, frequency and abundance of species by quadrat method.
5. Study of microscopic fauna of freshwater ecosystem (from pond).
6. Estimation of water holding capacity of given soil sample.
7. Estimation of dissolved and free carbon dioxide from water sample.
8. Study of Eutrophication in lake/river.

Course Title: Animal Diversity –II**Course Code: ZO-121:****Semester II****(2 credits-30 lectures)**

No.	Title & Contents	Number of lectures
1.	Phylum Aschelminthes 1.1 Introduction to phylum Aschelminthes 1.2 Salient features of Phylum Aschelminthes 1.3 Classification of Phylum Aschelminthes (Class Nematoda only with two examples – <i>Ascaris lumbricoides</i> (common round worm), <i>Wuchereria bancrofti</i> (Elephantiasis)). 1.4 Economic importance of class Nematoda.	(04)
2.	Phylum Annelida 2.1 Introduction to Phylum Annelida 2.2 Salient features of Phylum Annelida. 2.3 Classification of Phylum Annelida up to classes with examples of following classes (names of examples only). Class Polychaeta (e.g: <i>Nereis pelagica</i> (<i>neries</i> / sand worm, <i>Aphrodita aculeata</i> (=Aphrodite/ seamouse) Class Oligochaeta (e.g.: <i>Pheritima posthuma</i> (earthworm), Class Hirudinea (e.g: <i>Hirudinaria granulosa</i> common cattle leech) 2.4 Economic importance of Annelida with reference to earthworms as friends of farmers and in their role in vermicomposting.	(06)
3.	Phylum Arthropoda 3.1 Introduction to Phylum Arthropoda 3.2 Salient features of Phylum Arthropoda 3.3 Classification of Phylum Arthropoda with specific classes and mentioned examples (names only) Class:Crustacea: <i>Palaemon palaemon</i> (Prawn) <i>Brachyura</i> spp. crabs) Class: Chilopoda: <i>Scolopendra</i> sp. (centipede) Class: Diplopoda: <i>Julus</i> sp. (millipede)	(06)

Class Insecta: *Periplaneta americana* (American Cockroach),
Anopheles stephensii (mosquito).

Class: Arachnida- Spiders, *Buthus sp* (scorpion)

3.4 mouth parts in insects: Mandibulate (cockroach), Piercing and sucking (female *Anopheles* mosquito), chewing and lapping type (honey bee)

3.5 Economic importance of Arthropoda

Useful Insects: Honey bee, Lac insect, Silkworm.

Harmful insects: Female *Anopheles* mosquito, Red cotton bug, Rice weevil

4. **Phylum Mollusca** (06)

4.1 Introduction to Phylum Mollusca

4.2 Salient features of Phylum Mollusca

4.3 Classification of Phylum Mollusca with specific classes and mentioned examples (names only)

Class Gastropoda e.g *Pila globosa* (apple snail)

Class Pelecypoda e.g *Lamellidens marginalis* (Bivalve)

Class Polyplacophora e.g *Chiton*

Class: Cephalopoda e.g: *Octopus vulgaris* (common octopus), *Sepia officinalis* (common Cuttle fish)

4.4 Economic importance of Mollusca.

5. **Study of Phylum Echinodermata** (08)

5.1 Introduction to Phylum Echinodermata

5.2 Salient features of Phylum Echinodermata.

5.3 Classification of Phylum Echinodermata with specific classes and mentioned examples (names only)

Class Asteroidea (*Asterias rubens* sea stars or starfish)

Class: Holothuroidea. *Holothuria sp.* sea cucumbers)

Class: Echinoidea (*Echinus esculentis* common sea urchins)

Class: Crinoidea (sea lilies or feather stars)

5.4 **Type study: *Asterias rubens* (Sea Star):** Classification, Habit
Habitat, External Morphology, Digestive system, Water vascular
System and autotomy and regeneration

5.5 Pedicellaria in Echinodermata: straight, crossed, valvate,
tridactylous, globigerous.

5.6 Economic importance of Echinodermata.

Course Title: Cell biology

Course Code: ZO122:

Semester II

(2 credits-30 lectures)

Learning outcomes for Cell Biology

- The learner will understand the importance of cell as a structural and functional unit of life.
- The learner understands and compares between the prokaryotic and eukaryotic system and extrapolates the life to the aspect of development.
- The dynamism of bio membranes indicates the dynamism of life. Its working mechanism and precision are responsible for our performance in life.
- The cellular mechanisms and its functioning depends on endo-membranes and structures. They are best studied with microscopy.

ZO122: Cell biology

(2 credits-30 lectures)

No.	Title & Contents	Number of lectures
1.	Introduction:	(04)
	1.1 Introduction cell biology,	
	1.2 Cell as basic unit of life.	
	1.3 Importance of Cell Biology and its applications in industry.	
	Overview of Cells	
	1.3 Introduction to Prokaryotic and Eukaryotic cells.	
	1.4 Structure and function of Prokaryotic (<i>E. coli</i>)	
	1.5 Structure and function of Eukaryotic cells (Animal and Plant Cell)	

- 2 **Techniques in Cell Biology:** (04)
- 3.1 Introduction
- 3.2 Microscopy: Basic Principle, Simple, Compound and applications of Electron Microscope.
- 3.3 Stains and dyes:
Types of Stain: Acidic, basic and neutral.
Dye (Preparation and chemistry of dyes not expected)
- 3.4 Micrometry.
- 3 **Plasma Membrane:** (06)
- 4.1 Introduction
- 4.2 Structure of plasma membrane: Fluid mosaic model.
- 4.3 Transport across membranes: Active and Passive transport, Facilitated transport, exocytosis, endocytosis, phagocytosis – vesicles and their importance in transport.
- 4.4 Other functions of Cell membrane in brief Protection, cell recognition, shape, storage, cell signalling.
- 4.5 Cell Junctions: Tight junctions, gap junctions, Desmosomes.
- 4 **Nucleus: Structure and function** (04)
- 5.1 Introduction to Nucleus
- 5.2 Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleoplasm, Nucleolus
- 5.3 Chromatin: Eu-chromatin and Hetro-chromatin, nature and differences.
- 5.4 Functions of nucleus
5. **Endomembrane System** (04)
- 6.1 Introduction
- 6.2 Structure, location and Functions: Endoplasmic Reticulum, Golgi apparatus, Lysosomes and vacuoles.
7. **Mitochondria and Peroxisomes** (03)
- 7.1 Introduction
- 7.2 Mitochondria: ultrastructure and function of mitochondrion.

7.3 Peroxisomes

Cell Division

(05)

7.1 Introduction

7.2 Cell cycle (G₁, S, G₂, M phases),

7.3 Mitosis.

7.4 Meiosis.

Course Title: Zoology Practical Paper

Course Code: ZO123

Semester II

(1.5 Credits-45 Hours)

Animal Diversity –II

1. Museum study of Phylum Aschelminthes: *Ascaris lumbricoides*,
2. Museum study of phylum Annelida: *Neries*, Earthworm, Leech.
3. Museum study of phylum Arthropoda: Prawn, Cockroach, Centipede, Millipede, Crab
4. Museum study of phylum Mollusca: *Pila*, *Chiton*, Bivalve, Octopus.
5. Museum study of phylum Echinodermata: Sea Star, Sea urchin, Brittle Star, sea cucumber.
6. Study of permanent slides: Mouthparts of Insects -Mandibulate, Piercing and sucking, Chewing and Lapping.
7. Types of Shells in Mollusca. *Pila*, Bivalve, *Chiton*, *Sepia*.
8. Economic importance of honey bees, Lac insects silk worms, red cotton bug, *Anopheles* mosquito
9. Earthworm: vermicomposting bin preparation and maintenance.
10. Visit to a vermicomposting unit/ field for insect pest collection and its identification

Cell Biology

1. Study of Microscope: Simple and Compound
2. Micrometry: Measurement of microscopic objects
3. Study of cell: Preparation of temporary mount of human buccal epithelial cells.
4. Preparation of blood smears to observe the blood cells
5. Temporary preparation of mitotic cell from onion roots
6. Study of Cell organelles (any three) by using microphotographs

Recommended Reference Books

Animal Diversity – I and II

1. Anderson, D.T (Ed) 1988: Invertebrate Zoology, Oxford University Press.
2. Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.
3. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
4. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
5. Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students. Asia Publishing Home.
6. Brusca, R.C and Brusca, G. J (2003): Invertebrate (2nd ed.) Sinauer Associates Inc., Publishers Sunderland.
7. Hadzi, J (1963): The Evolution of Metazoa, Macmillan Newyork.
8. Hyman, L. H (1940): Invertebrates Vol I, Protozoa through ctenophore.
9. Hyman. L. H (1955): The Invertebrates Vol: IV, Echinodermata, the coelomate bilateria, Mcgraw Hill, Newyork.
10. Modern Text-Book of zoology, Vertebrates. By Kotpal, RL., Rastogi and Co., Meerut.
11. Nigam H.C., Zoology of Chordates, Vishal Publication, Jalandhar-144008.
12. Phylum Protozoa to Echinodermata (series) by Kotpal, RL. Rastogi and Co., Meerut
13. Parker T.J and W.A Haswell (1972): A text book of Zoology, Vol –I (7th edition by Marshall and Williams) Mcmillan Press ltd.
14. Jordan, E.L. and P.s.Verma Invertebrate Zoology, S. Chand and Co., Ltd. Ram Nagar, New Delhi.
15. Russel Hunter: - A Biology of higher invertebrates, MacMillon Co. Ltd. London

Animal Ecology

1. Colinvaux, P. A. (1993). Introduction to Ecology. II Edition. Wiley, John and Sons, Inc.
2. Krebs, C. J. (2001). Ecology: The Experimental Analysis of Distribution and Abundance, 6th Edition, ©2009, Pearson
3. Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
4. Robert Leo Smith Ecology and field biology Harper and Row publisher
5. Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Press
6. Sharma P.D. (2002) Ecology and Environment, Himalaya Publication

Cell Biology

1. Karp, G. (2010). *Cell and Molecular Biology: Concepts and Experiments*. VI Edition John Wiley and Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. (2009). *The Cell: A Molecular Approach*. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). *The World of the Cell*. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
5. Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). *Molecular Biology of the Cell*, V Edition, Garland publishing Inc., New York and London
6. Inside the Cell (2005); US Department of Health Sciences, National Institute of Health, Natinal institute of General Medicine Sciences.
7. Lodish, H., D. Baltimore, A. Berk, L. Zipursky, M. Matsudaira and J. Darnell. (2010).
8. Molecular Cell Biology, Eds. 3, Scientific American & W. H. Freeman. New York.
9. Powar C B.: Cell Biology, Himalaya Publication, Meerut

Note: Latest editions of the recommended books may be referred.

SavitribaiPhule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Zoology

(Faculty of Science & Technology)

S.Y.B.Sc. Zoology

(w.e.f. June 2020)

As per

Choice Based Credit System

Syllabusimplemented from

Academic Year 2020-2021

Preamble:

Zoology is one of the major subjects of Basic Sciences and deals with all aspects of animal biology. It includes an interesting range of highly diverse topics. A zoology student needs to gain understanding of many areas of the subject to keep pace with advancements in Life Sciences.

This under-graduate degree program has been designed by the Board of Studies in Zoology of SavitribaiPhule Pune University with a substantial component of what is needed from zoologists as a skilled career and what zoologists need to pursue for post-graduation and further academic studies. It follows the guidelines laid down by the University Grants Commission, New Delhi. This newly designed curriculum is a perfect blend of the classical aspects in Zoology and the advanced and more specialized areas.

This degree offers Discipline Specific Core Courses [CC] in Animal Systematics, Animal Ecology, Animal Cell biology, Applied Zoology, Pest Management, Histology, Biological Chemistry, Genetics, Developmental Biology, Parasitology, Medical & Forensic Zoology, Animal Physiology, Molecular Biology, Entomology, Techniques in Biology and Evolutionary Biology.

In addition to the Core Courses, Ability Enhancement Compulsory Courses [AECC] have been added in the second year i.e. Semester III and Semester IV of the undergraduate course. In the third year i.e. Semester V and Semester VI, Discipline specific Elective Courses [DSEC] and Skill Enhancement Courses [SEC] have been offered. The students, therefore, have an opportunity to take courses in Environment Awareness, Language communication: English/Marathi, Aquarium Management, Poultry Management and Environmental Impact Assessment. In Semester VI the students also have a course dedicated to Project work.

The syllabus has been framed in such a way that the student gains each year, a broader perspective of the subject as he progresses towards completion of the degree program. Field trips, Educational visits and the Project work have been included for the student to experience the applications of the theory learnt in the classroom.

After completion of the program, it is expected that students will understand and appreciate: animal diversity, few applications of Zoology, the structure, functions and life processes at cellular, tissue, organ and system level, significance of evolution, and basic concepts of human health. The students would also gain an insight into laboratory and field work through the practical course, field work and the project.

While presenting this new syllabus to the teachers and students of F. Y. B. Sc. Zoology, I am extremely happy to state that efforts have been made to seek inputs of all the stake holders to make it more relevant.

The new course that will be effective from the academic year 2019- 2020 and will follow the Choice Based Credit System in a Semester mode. It has been primed keeping in view the distinctive requirements of B. Sc. Zoology students. The contents have been drawn-up to accommodate the widening prospects of the discipline of Life Sciences. They reflect the changing prerequisites of the students. This program has been introduced with 132 credits for the subject group while 08 credits to earn from any of the 08 groups offering a range of curricular, cocurricular and extracurricular activities. This pattern has been specially aimed towards the overall development of the students'. The calculation of credits and CGPA will be as per the guidelines of the University. The B. Sc. Zoology program provides an appropriate blend of classical and applied aspects of the subject. This newly designed curriculum will allow students to acquire the skill in handling scientific instruments planning and performing in the laboratory and exercising critical judgement, independent thinking and problem solving skills.

The Syllabus has been revised with the following aims

- To foster curiosity in the students for Zoology
- To create awareness amongst students for the basic and applied areas of Zoology
- To orient students about the importance of abiotic and biotic factors of environment and their conservation.
- To provide an insight to the aspects of animal diversity.
- To inculcate good laboratory practices in students and to train them about proper • handling of lab instruments.

Course Structure:

Course Structure with Credit Distribution of the Undergraduate Science Program in Zoology

Course	Course Code and Name of the Course		Credits
F. Y. B. Sc.	SEMESTER I	SEMESTER II	
CC	ZO - 111 Animal Diversity I	ZO-121 Animal Diversity II	2 + 2
CC	ZO - 112 Animal Ecology	ZO-122 Cell Biology	2 + 2
CC	ZO - 113 Zoology Practical Paper	ZO-123 Zoology Practical Paper	1.5 +1.5
S. Y. B. Sc.	SEMESTER III	SEMESTER IV	
CC	ZO - 231 Animal Diversity III	ZO - 241 Animal Diversity IV	2 + 2
CC	ZO - 232 Applied Zoology I	ZO - 242 Applied Zoology II	2 + 2
CC	ZO - 233 Zoology Practical Paper	ZO - 243 Zoology Practical Paper	2 + 2
AECC	EVS 231- Environment Awareness	EVA 241- Environment Awareness	2 + 2
AECC	LA 231 - English/Marathi	LA 241 - English /Marathi	2 + 2
T. Y. B. Sc.	SEMESTER V	SEMESTER VI	
DSEC	ZO - 351 Pest Management	ZO - 361 Medical & Forensic Zoology	2 + 2
DSEC	ZO - 352 Histology	ZO - 362 Animal Physiology	2 + 2
DSEC	ZO - 353 Biological Chemistry	ZO - 363 Molecular Biology	2 + 2
DSEC	ZO - 354 Genetics	ZO - 364 Entomology	2 + 2
DSEC	ZO - 355 Developmental Biology	ZO - 365 Techniques in Biology	2 + 2
DSEC	ZO - 356 Parasitology	ZO - 366 Evolutionary Biology	2 + 2
DSEC	ZO- 357 Zoology Practical Paper 1	ZO - 367 Zoology Practical Paper 1	2 + 2
DSEC	ZO- 358 Zoology Practical Paper 2	ZO - 368 Zoology Practical Paper 2	2 + 2
DSEC	ZO- 359 Zoology Practical Paper 3	ZO - 369 Zoology Practical Paper 3	2 + 2
SEC	ZO - 3510 Aquarium Management	ZO- 3610 Environmental Impact Assessment	2 + 2
SEC	ZO - 3511 Poultry Management	ZO - 3611 Project	2 + 2

Detailed Syllabus of S. Y. B. Sc.

Paper	Semester III Course Code & Course	Credits	No of Hours	Marks (Internal + University)	Semester IV Course Code & Course	Credits	No of Hours	Marks (Internal + University)
I	ZO - 231 Animal Diversity III	02	30	15+ 35= 50	ZO - 241 Animal Diversity IV	02	30	15+ 35 = 50
II	ZO - 232 Applied Zoology I	02	30	15+ 35 = 50	ZO - 242 Applied Zoology II	02	30	15+ 35 = 50
III	ZO - 233 Zoology Practical Paper	02	14 Practicals	15+ 35 = 50	ZO - 243 Zoology Practical Paper	02	14 Practicals	15+ 35 = 50
AECC	EVS 231- Environme nt Awareness	02	30	15+ 35 = 50	EVA 241- Environmen t Awareness	02	30	15+ 35 = 50
AECC	LA 231- English/ Marathi	02	30	15+ 35 = 50	LA 241- English/ Marathi	02	30	15+ 35 = 50

Animal Diversity III & IV

Objectives –

1. To understand the origin and advancement of higher vertebrates (tetrapoda).
2. To understand general characters of different groups of higher vertebrates.
3. To classify vertebrates and to become able to understand the possible group of vertebrates observed in nature.
4. To understand different behaviours and adaptations in higher vertebrates
5. To understand affinities among different groups of higher vertebrates.

Learning Outcomes for the course -

1. The students will be able to understand, classify and identify the diversity of higher vertebrates.
 2. The students will be able to understand the complexity of higher vertebrates
 3. The students will be able to understand different life functions of higher vertebrates.
 4. The students will be able to understand the linkage among different groups of higher vertebrates.
 5. The student will become aware regarding his role and responsibility towards nature as a protector, to understand his role as a trustee and conservator of life which he has achieved by learning, observing and understanding life.
-

Course Title: Animal Diversity - III

Course Code: ZO – 231,

Semester - III

(2 credits – 30 Hours)

No.	Title & Contents	Number of Lectures
	1. Introduction to Phylum Chordata –	(03)
1.1	Origin & Ancestry of Chordates.	
1.2	Comparative account of fundamental characters of Chordates with Non Chordates.	
1.3	Salient features of Phylum Chordata.	
1.4	Classification of Phylum Chordata upto classes – Pisces, Amphibia, Reptilia, Aves, Mammalia.	
	2. Introduction to Group – Protochordata.	(03)
2.1	Salient features of Protochordata.	
2.2	Salient features of subphylum with two example each - Names only. Hemichordata – <i>Balanoglossus</i> and <i>Rhabdopleura</i> , Urochordata - <i>Herdmania</i> and <i>Salpa</i> , Cephalochordata – <i>Branchiostoma</i> (Amphioxus) and <i>Asymmetron</i> .	
	3. Introduction to subphylum – Vertebrata	(02)
3.1	Salient features of Vertebrata.	
3.2	Introduction and General characters of sections with two examples - Names only. Agnatha – <i>Petromyzon</i> & <i>Myxine</i> & Gnathostomata – Frog & <i>Labeo</i> .	
	4. Introduction to Class – Pisces	(04)
4.1	Salient features of Class – Pisces.	
4.2	Introduction and Salient features of sections with two examples - Names only. Class – Chondrichthyes – <i>Scoliodon</i> and <i>Chimaera</i> & Osteichthyes – <i>Labeo</i> and <i>Catla</i>	
4.3	Types of Scales in Fishes.	
4.4	Types of Fins in Fishes.	

5. Introduction to Class – Amphibia

(03)

5.1 Salient features of Class – Amphibia.

5.2 Introduction to order – Apoda–*Ichthyophis*, Urodela–*Salamandra*(Salamander) and
Annura - *Rana*.

5.3 Parental care in Amphibia.

6. Study of *Scoliodon*

(15)

<i>Scoliodon</i> – 6.1 - Systematic position, Geographical distribution, Habit, Habitat	01
6.2 - External characters	01
6.3 - Digestive System, Food and feeding mechanism.	02
6.4 - Respiratory System – Structure of Holobranch only.	02
6.5- External & Internal Structure of heart, Working of heart.	02
6.6 - Nervous System – Brain only.	03
6.7 - Male urinogenital system & Female reproductive System.	03
6.8- Yolk sac placenta.	01

Applied Zoology I and II

Objectives :

1. To understand the basic life cycle of the honeybees, beekeeping tools and equipments.
2. To learnfor managing beehives for honey production and pollination.
3. To understand the basic information about fishery, cultural and harvesting methods of fishes.
4. To understand fish preservation techniques.
5. To understand the biology, varieties of silkworms and the basic techniques of silk production and harvesting of cocoons.
6. To learn the different silkworm species and their host plants.
7. To study types of agricultural pests and Major insect pests of agricultural importance.
8. To study Pest control practices.

Learning Outcomes of the course:

1. The learner understands the basics about beekeeping tools, equipment, and managing beehives.
 2. The learner understands the basic information about fishery, cultural and harvesting methods of fishes and fish preservation techniques.
 3. The learner understands the biology, varieties of silkworms and the basic techniques of silk production.
 4. The learner understands the types of agricultural pests, Major insect pests of agricultural importance and Pest control practices.
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Course Title - Applied Zoology I

Course Code - ZO - 232

Semester III

2 Credits - 30 lectures

1) Sericulture:	16
1.1 An introduction to Sericulture, Study of different types of silk moths, their distribution, Taxonomic position and varieties of silk produced in India : Mulberry, Tassar, Eri and Muga silk moths.	02
1.2 External Morphology and life cycle of <i>Bombyx mori</i> .	02
1.3 Cultivation of mulberry :	
a) Varieties for cultivation,	
b) Rain fed and irrigated mulberry cultivation- Fertilizer schedule, Pruning methods and leaf yield.	02
1.4 Harvesting of mulberry : a) Leaf plucking, b) Branch cutting,	
c) Whole shoot cutting.	01
1.5 Silk worm rearing :	
a) Varieties for rearing,	
b) Rearing house,	
c) Rearing techniques,	
d) Important diseases and pests.	03
1.6 Preparation of cocoons for marketing.	01
1.7 Post harvest processing of cocoons :	
a) Stiffling, sorting, storage, deflossing and riddling,	
b) Cocoon cooking, reeling equipment and reeling, washing and polishing.	03
1.8 Biotechnological and biomedical applications of silk.	02
2) Agricultural Pests and their control:	14
2.1 An introduction to Agricultural Pests, types of pests (agricultural, store grain, veterinary).	01
2.1 Major insect pests of agricultural importance (Marks of identification, life cycle, nature of damage and control measures).	06
a) Jowar stem borer,	
b) Red cotton bug,	
c) Brinjal fruit borer,	
d) Mango stem borer,	
e) Blister beetle,	
f) Rice weevil,	

g) Pulse beetle,	
h) Tick.	
2.3 Non insect pests: Rats, Crabs, Snails, and Squirrels	01
2.4 Pest control practices in brief: Cultural control, Physical control, Mechanical control, Chemical control, Biological control, Pheromonal control, Autocidal control and Concept of IPM in brief.	04
2.5 Plant protection appliances: Shoulder type Rotary duster, Knapsack sprayer, Cynogas Pump.	02

Course Title: Zoology Practical Paper

Course Code: ZO – 233

Semester - III

(2 credits – 60 Hours)

Animal Diversity - III

1. Museum study of Group Protochordata : *Balanoglossus*, *Herdmania*, *Petromyzon*. (D)
2. Museum study of Class Pisces: *Labeo*, *Scoliodon*, *Hippocampus*. (D)
3. Museum study of Class Amphibia : *Salamandra*, *Rana*, *Ichthyophis*. (D)
4. Study of types of scales in fishes: Placoid scale, Cycloid scale, Ctenoid scale & Ganoid scale. (D)
5. Study of types of tail fins in fishes: Homocercal, Heterocercal & Diphyrcercal. (D)
6. Study of external characters & digestive system of locally available fish. (E) - Compulsory
7. Study of brain of locally available fish. (D)
8. Temporary preparation of scales & its identification from locally available fish. - (E) Compulsory
9. Compulsory field visit to study pond ecosystem with reference to Pisces and amphibians, report writing and submission. (2 P)

Sericulture –

1. Study of external morphology and life-cycle of *Bombyx mori*. (D)
2. Study of five equipments in Sericulture. (E) - Compulsory
3. Preparation of a map showing distribution of silk moth and rearing/ sericulture practices in India. (E)
4. Compulsory submission of Photographs/ sketches of Mulberry, Tassar, Eri and Muga silkmoths. (E)

Agricultural Pests and their control -

1. Study of following insect pests with respect to marks of identification, nature of damage, economic importance and control measures. (D)
 - a) Jowar stem borer,
 - b) Red cotton bug,
 - c) Brinjal fruit borer,
 - d) Mango stem borer.
2. Study of following pests with respect to marks of identification, nature of damage, economic importance and control measures. (D)
 - a) Blister beetle,

- b) Rice weevil,
 - c) Pulse beetle,
 - d) Tick.
3. Study of any two non insect pests corresponding to theory course. (D)
 4. Compulsory submission of at least five Insect Pests/ Photographs/ Sketches. (E)
 5. Study of pest control appliances (as per theory course). (D)
 6. Compulsory field visit to Sericulture farm/ Agricultural farm, report writing and submission.
(2 P).

Minimum 14 practicals must be conducted with at least Seven practicals from each paper.

Course Title: Animal Diversity - IV

Course Code: ZO – 241

Semester - IV

(2 credits – 30 Hours)

1. Introduction to class –Reptilia (04)

- 1.1 Salient features of class Reptilia with one example (name only) – *Chelone*, *Calotes*.
- 1.2 Venomous and Non-venomous snakes – Cobra, Russell’s viper, Rat snake, Grass snake.
- 1.3 Snake venom, symptoms, effect and cure of snake bite, first aid treatment of snakebite.
- 1.4 Desert adaptations in reptiles in brief.

2. Introduction to class –Aves (05)

- 2.1 Salient features of class Aves with two examples (names only) – Sparrow, Parrot.
- 2.2 Flight adaptations in birds.
- 2.3 Types of Beaks and feet in birds.
- 2.4 Migration in birds – Altitudinal, Latitudinal.

3. Introduction to class - Mammalia. (04)

- 3.1 Salient features of class Mammalia with two examples (names only) – Rat, Rabbit.
- 3.2 Egg laying mammals.
- 3.3 Aquatic adaptations in mammals.
- 3.4 Flying adaptations in mammals.
- 3.5 Cursorial and fossorial adaptation in mammals

4. Study of Rat (17)

- 4.1 Systematic position, habit and habitat. 01
- 4.2 External characters. 01
- 4.3 Digestive system, food and feeding. 02
- 4.4 Respiratory system. 02
- 4.5 Blood vascular system – Structure of Heart. 02
- 4.6 Nervous system – Central Nervous system only. 03
- 4.7 Sense organs – Structure and functions of Eye & Ear. 03
- 4.8 Reproductive system. 03

Course Title - Applied Zoology II

Course Code - ZO-242

Semester IV

2 Credits- 30 lectures

1. Apiculture: 16

- 1.1 An introduction to Apiculture, Systematic position, Study of habit, habitat and nesting behaviour of *Apis dorsata*, *Apis indica*, *Apis florea* and *Apis mellifera*. 02
- 1.2 Life cycle, Colony organization and Division of labour. 02
- 1.3 Bee behaviour and communication (Round Dance and Wag-Tail Dance) . 02
- 1.4 Bee keeping equipments :
- a) Bee box (Langstroth type),
 - b) Honey extractor,
 - c) Smoker,
 - d) Bee-veil,
 - e) Gloves,
 - f) Hive tool,
 - g) Bee Brush,
 - h) Queen excluder. 02
- 1.5 Bee keeping and seasonal management. 02
- 1.6 Bee products (composition and uses) :
- a) Honey,
 - b) Wax,
 - c) Bee Venom,
 - d) Propolis,
 - e) Royal jelly,
 - f) Pollen. 02
- 1.7 Diseases and enemies of Bees :
- a) Bee diseases - Protozoan (Nosema), Bacterial (American foul brood), Viral (Sac brood), Fungal (Chalk brood).
 - b) Bee pests - Wax moth (Greater and Lesser), Wax beetle.
 - c) Bee predators - GreenBee eater, King crow, Wasp, Lizard. 02
- 1.8 Bee pollination and management of bee colonies for pollination. 02

2. Fisheries : 14

- 2.2 An introduction to fisheries and its types (in brief) : Freshwater fisheries, Marine fisheries, Brackish water fisheries. 02

2.3 Habit, habitat and culture methods of following freshwater forms :	03
a) Rohu (<i>Labeo rohita</i>),	
b) Catla (<i>Catla catla</i>),	
c) Mrigal (<i>Cirrhinus mrigala</i>).	
2.3 Harvesting methods of following marine forms:	03
a) <i>Harpodon</i> ,	
b) Mackerel,	
c) Pearl oyster.	
2.4 Crafts and Gears in Indian Fishery:	02
a) Crafts – Catamaran, Machwa, Dinghi.	
b) Gears – Gill net, Dol net, Rampani net, Cast net.	
2.5 Fishery byproducts:	02
a) Fish meal,	
b) Fish flour,	
c) Fish Liver oil,	
d) Fish manure,	
e) Fish fin soup.	
2.6 Fish preservation technique:	02
a) Chilling,	
b) Freezing,	
c) Salting,	
d) Drying,	
e) Canning.	

Course Title: Zoology Practical Paper

Course Code: ZO – 243

Semester - IV

(2 credits – 60 Hours)

Animal Diversity - IV

1. Museum study of Class Reptilia: Venomous & Non-venomous snake – Two each. (D)
2. Identification of Venomous & Non-venomous snakes with the help of pictorial taxonomic keys. – (D) -Compulsory
3. Museum study of Class Aves: Crow, *Kingfisher* & Duck. (D)
4. Study of types of beaks & feets in birds – Any two each. (D)
5. Museum study of Class Mammalia: Rat, Shrew & Bat. (D)
6. Study of external characters & digestive system of Rat. (D)
7. Study of Heart of Rat. - (D) -Compulsory
8. Study of brain of Rat. (D)
9. Study of reptilian / avian diversity in and around the campus (2 P) - (E) -Compulsory
10. Compulsory visit to Zoo / Wildlife sanctuary / Bird sanctuary, report writing and submission. (2 P)

Apiculture –

1. Study of external morphology, life cycle and polymorphism in Honey Bee. (D)
2. Temporary mounting of mouth parts, legs, wings and sting apparatus of worker bee. (E)
3. Study of Bee keeping Equipment: Bee box, Honey extractor, Smoker, Bee-veil, queen excluder. (D)- Compulsory
4. Study of Bee products: Honey, Wax, Venom, Royal jelly, Pollen. (D)
5. Estimation of carbohydrates from Honey in different samples. (D)- Compulsory
6. Study of Bee enemies: Wax moth, Bee eater, ant. (D)

Fisheries –

1. Identification, Classification and study of habit, habitat and economic importance of
a) Rohu (*Labeo rohita*), b) Catla (*Catla catla*), c) Mrigal (*Cirrhinus mrigala*). (D)
2. Identification, Classification and study of habit, habitat and economic importance of
a) Prawn, b) Crab, c) Lobster, d) Pearl Oyster. (D)
3. Study and maintenance of Aquarium. (D) - Compulsory

4. Study of crafts: **a)** Catamaran, **b)** Machwa, **c)** Dinghi (Photographs/models/line drawings). (D)
5. Study of gears in fishing: **a)** Gill net, **b)** Dol net, **c)** Rampani net, **d)** Cast net.
(Photographs/models/line drawings). (D)
7. Study of nutritional value of fish: Biochemical estimation of fish muscle proteins by using Biuret method. (E) - Compulsory
7. Compulsory study tour/field visit to Apiculture institute / Fish farm/ Aquarium. (E) (**2 P**).

Minimum 14 practicals must be conducted with at least Seven practicals from each paper.

Recommended Reference Books

Animal Diversity – III & IV

1. Text Books of Zoology, Invertebrates Vol- II, 1992, T.J.Parker and W.A. Haswel, Edited by Marshall and Williams, CBS publications and distribution, New Delhi.
2. Integrated Principles of Zoology, Eleventh Edition, Hickman CP, Roberts LS & Larson A. International Edition ISBN 0–07–118077–X, The McGraw-Hill Companies, Inc.,
3. Modern Text Book of Zoology, Vertebrates. R. L. Kotpal, 3rd edn. Rastogi Publications, Meerut.
4. Chordate Zoology, 1982, P.S.Dhami and J.K.Dhami, R. Chand and Co., New Delhi.
5. Biology, Campbell and Reece. 7th Edn. Pearson Education in South Asia, Delhi.
6. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
7. Pough H. Vertebrate life, VIII Edition, Pearson International.
8. Integrated Principles of Zoology, Eleventh Edition, Hickman C. P., Roberts L. S. & Larson A. International Edition ISBN 0–07–118077–X, The McGraw-Hill Companies, Inc.,
9. Arora M.P. Chordates I. Himalya Publications.
10. Organic Evolution. R.S. Lull. Light & Life Publishers.
11. Jordan E. L. & Verma P. S. 2003. Chordates Zoology. S. Chand & Company Ltd. New Delhi.
12. Biology, Campbell and Reece. 7th Edn. Pearson Education in South Asia, Delhi.

Applied Zoology I & II

1. Principles of Sericulture, 1994. Hisao Arguo, Oxford & Co.
2. An Introduction of Sericulture, 1995. G. Ganga, J. Sulochana, Oxford & IBH Publication Co. Bombay.
3. FAQ Manual of Sericulture. Vol I - Mulberry Cultivation, Vol II - Silkworm Rearing. Central Silk Board, Bangalore.
4. Mane, P.C., Chaudhari R. D. et al. Highly sensitive label-free bio-interfacial colorimetric sensor based on silk fibroin-gold nanocomposite for facile detection of chlorpyrifos pesticide. Scientific Reports 2020, 10, 4198. <https://doi.org/10.1038/s41598-020-61130-y>
5. Entomology & Pest Management. Pedigo L. P. Prentice Hall, India 1996.
6. General & Applied Entomology, Nayar K. K. & T. N. Ananthkrishnan & B. V. Davis, Tata McGraw Hill Publication, New Delhi.
7. Insects. M. S. Mani, National Book Trust, India, 2006.
8. Insects & Mites of Crops in India. M. R. G. K. Nair – by ICAR, New Delhi.
9. The Science of Entomology. W. S. Romoser and J. G. Stoffolano, McGraw Hill Publication, 1988.

10. Agricultural Insect Pests of India and their Control, Dennis S. Hill, Cambridge University Press.
11. Applied Entomology. Vol. I & II. K. P. Srivastava. Kalyani Publication, Ludhiana, New Delhi.
12. Principles of Insect Pest Management. G. S. Dhaliwal and Ramesh Arora, Kalyani Publications, Ludhiana.
13. Pest Management and Pesticides: Indian Scenario. Editor- B. Vasantaraj David, Namrutha Publications, Madras (Chennai).
14. Concepts of Insect Control. Ghosh M. R. Wiley Eastern Ltd. New Delhi.
15. Destructive and useful Insects, their habit and Control, 1973. C.L. Metcalf and W. P. Flint, Tata McGraw Hill Publications, New Delhi.
16. A Text Book of Entomology, 1974. V. K. Mathur and K. D. Upadhyay, Goel Printing Press, Barani.
17. Imm's general Text Book of Entomology, Vol I & II, Richard and Davis Owen.
18. Biology of Insects, 1992. S. C. Saxena. Oxford and IBH Publishing Co., New Delhi, Bombay, Calcutta.
19. Bee and Bee Keeping, 1978, Roger A. Morse, Conell University Press, London.
20. The Behaviour & Social Life of Honey Bees, C. R. Ribbandas, Dover Publication inc. New York.
21. Fishes. Mary Chandy. National Book Trust India, 2005.
22. Economic Zoology, Shukla Upadhyay, Rastogi Publication, Meerut, India, 1998.
23. Fisheries Developments, K. K. Trivedi, Oxford and IBH Pub. Co.
24. Marine Fishes in India, 1990, D.V. Bal & K. Virabhdra, Tata McGraw Hill Publication.
25. Fishery Management, 1990, S. C. Agarwal, Avinash Publication House, New Delhi.

Note – Use latest editions of the books.

Annexure-II

Details about Structure/Pattern of Syllabus:

1. **Title of the Course: F.Y.B.Sc. Geology Syllabus.**
2. **Course Level:** First year of 3 year B.Sc. Geology Degree course
3. **Syllabus to be implemented from the Academic year:** 2020-21
4. **Preamble of the Syllabus:** Our Earth is a cosmic body. It is one of the eight members of the Solar System. Geology is a science that deals with the study of the Earth. The subject of geology deals with the origin, history and evolution of the Earth. It also deals with its materials (rocks, minerals, ores, metals, coal and petroleum deposits etc) that constitute it, and the processes, both external and internal, that operate on, and within it. Since inception of this branch of Science, Geology has remained a field of active research and has expanded in all possible directions. It is broadly categorized as pure and an interdisciplinary science. Since geology is a very vast and varied subject, for better understanding it has been divided into a number of branches. The fundamental branches of Geology are Mineralogy, Petrology, Dynamic Geology, Physical Geology, Structural Geology, Economic Geology, Palaeontology & Stratigraphy. The applied branches of Geology are Hydrogeology, Geotectonics, Coal Geology, Petroleum Geology, Marine Geology, Environmental Geology, Mining Geology, Geomorphology, Geochemistry, Geophysics, Oceanography, Seismology, Gemmology, Engineering Geology, Photogeology (Remote Sensing), Historical Geology, Rock Mechanics, Nuclear Geology, Medical Geology.
Natural resources and their proper exploitation play a vital role in nation building. All the natural resources except the solar energy are directly linked with the earth. Therefore knowledge of different aspects of Geology has become crucial and indispensable to everyone in the society and will help man to manage the available resources and conserve them in the best possible way. There is a continual demand for Geologists in the workforce- education, industry and research. Career opportunities for the graduate students are available in the private and government enterprises, research institutes and as self consultants in the fields of groundwater, soil analysis, gemmology, cutting and polishing of semi precious stones, trading of building materials, small scale mining etc. Also, multinational oil companies are recruiting qualified petroleum geologists.
5. **Introduction:** The present syllabus is sufficient to meet the needs of students for building up their careers in Geology. However looking at the changing scenario at a local and global level, and due to the very existence of the earth which has been threatened by calamities like earthquakes, volcanic eruptions, landslides, floods, tsunamis or droughts, which are directly or indirectly related to geological action on the surface or subsurface. Also looking at the fast depleting natural inorganic resources and the fuel deposits, it has become imperative that geology which incorporates the science of these natural hazards and the associated disasters should be taught rather effectively at the under-Graduate and Post-Graduate levels. Awareness related to the modern concepts of Plate Tectonics, Remote Sensing, and Geographical Information System (GIS) etc. is a must for all Geology graduate students. Theoretical knowledge supplemented with extensive laboratory expertise and field training will help the students, to avail all opportunities available and even start their own consultancy firms. Therefore revision and updating of the curriculum is an essential component and a continuous process of any university system. There has to be a dynamic curriculum with necessary re-orientations, additions and modifications introduced in it from time to time by the respective university so that it is compatible and in tune with the fast paced developments in the subject. It should be able to provide easy placement opportunities for the

students and also good avenues for research activities. Introduction of innovative concepts, providing a multidisciplinary profile in the concerned subject and an updated education to the students at large should be the prime aim while revising/renewing the curriculum. Geology curricula are operated at two levels viz undergraduate and postgraduate. The undergraduate curricula are prepared to impart basic and fundamental concepts of the subject Geology from all possible aspects. In addition field training will have a priority since geology is basically a field science and more practical exposure will benefit the student community at large and produce good geologists for the nation.

6.Objectives to be achieved:

1. To help students build-up a progressive and successful career in Geology
2. To enrich students knowledge and train them in the pure geological sciences.
3. To Provide an updated education.
4. To impart more field oriented knowledge.
5. To inculcate sense of scientific, social responsibilities and environment
6. awareness.
7. To introduce the concepts of application and research in Geology.
8. Create a sense of preservation and conservation of natural resources.
9. To study structural dynamics of the earth.
10. To study Stratigraphy and Palaeontology that encompasses the aspects of the age of the earth, chronological arrangement of rocks and appearance and evolution of life through the geologic time.
11. To study the changes that occurred in the history of the earth and relate them to their field observations and also, in understanding the framework of the stratigraphy of India
12. To study basics of mineralogy and crystallography, which helps in understanding and building the overall knowledge in Geology.
13. To study the processes involved in the formation of igneous, sedimentary and metamorphic rocks, their textures, structures, classifications and their importance.
14. To study the dynamic nature of the Earth processes.
15. To study the geodynamics of the lithosphere and concept of isostasy, ocean floor spreading, continental drift and plate tectonics.

7. Faculty of the Course : As per U.G.C. Rules

8. Eligibility for Admission:

1. First Year B.Sc.:

Higher Secondary School Certificate (10+2) or its equivalent Examination
Or as per the University of Pune eligibility norms.

2. Second Year B.Sc.:

Keeping terms of First Year of B. Sc. with Geology as one of the subjects. In addition to the above students are eligible if they fulfill the conditions approved by the equivalence committee of Faculty of Science of the University of Pune.

3. Third Year B. Sc.:

Student shall clear all First Year B. Sc. Geology courses and satisfactorily keeping terms of Second Year of B. Sc. with Geology as one of the subjects.

Note: Admissions will be given as per the selection procedure / policies adopted by

the respective college, in accordance with conditions laid down by the University of Pune.

Reservation and relaxation will be as per the Government rules.

Standard of Passing

- i. In order to pass in the first year theory examination, the candidate has to obtain 20 marks out of 50 in each course of each semester. (Minimum 14 marks out of 35 must be obtained in the University Theory Examination.)
- ii. In order to pass in the Second Year and Third Year theory examination, the candidate has to obtain 20 marks out of 50 in each course of each semester. (Minimum 14 marks out of 35 must be obtained in the University Theory Examination.)
- iii. In order to pass in practical examination, the candidate has to obtain 40 marks out of 100 in each course. (Minimum 32 marks out of 80 must be obtained in the University Examination.)

9. Duration of the Course: Duration of B.Sc. (Geology) Degree programme shall be 3 years.

10. Intake Capacity of Students: As per U.G.C. norms

11. Examination:

Theory paper: University Examination – 35 marks (at the end of each semester)

Internal Examination – 15 marks

Practical course: University Examination – 35 marks (at the end of each semester)

Internal Examination – 15 marks

Theory examination will be of two hours duration for each theory course. There shall be 4 questions. The pattern of question papers shall be:

Question 1 - 5 sub-questions, each of 1 marks; objective type and based on entire syllabus

Question 2 and 3- 2 out of 3 sub-questions, each of 5 marks; short answer type questions; answerable in 10 – 15 lines

Question 4 - 1 out of 2 – long answer type questions; answerable in 20 – 25 lines.

I. Pattern of Examination:

- i. Internal exam, Term end exam, Practical, Oral, Project.
 - ii. Pattern of the question paper: As per University rules
- II. Standard of Passing:** In order to pass in the first year theory examination, the candidate has to obtain 20 marks out of 50 marks in each course. (Minimum 15 marks out of 35 must be obtained in the university theory exam)

III. ATKT Rules:

While going from F. Y. B. Sc. to S. Y. B. Sc. at least 16 courses (out of total 24) should be cleared; however all F. Y. B. Sc. courses should be cleared while going to T. Y. B. Sc. While going from S. Y. B. Sc. to T. Y. B. Sc., at least 12 courses (out of 20) should be cleared (Practical Course at S. Y. B. Sc. will be equivalent to 2 courses).

IV. Award of Class:

The class will be awarded to the student on the aggregate marks obtained during the second and third year in the Principal subject only. The award of the class shall be as follows:

1. Aggregate 70% and above First Class with Distinction
2. Aggregate 60% and more but less than 70% First Class
3. Aggregate 55% and more but less than 60% Higher Second Class
4. Aggregate 50% and more but less than 55% Second Class
5. Aggregate 40% and more but less than 50% Pass Class
6. Below 40% Fail

V. External Students: There shall be no external students

VI. Setting of Question Paper/Pattern of Question Paper:

For theory papers I and II for each semester and also for the practical examination question papers set by the Savitribai Phule Pune University, Pune. Centralized assessment for theory papers done as per the University instructions. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject.

VII. Verification/Revaluation: As per SPPU rules

12. **Structure of the Course:**

I. Compulsory Paper:

II. Optional Paper:

III. Question Paper and Paper:

IV. Medium of Instructions: English

13. Equivalence of previous syllabus along with proposed syllabus.:

Equivalent papers in Old course	Equivalent papers in Present course
GL 111 Fundamentals of Geology	GL 111 Fundamentals of Geology and Understanding the Planet Earth
GL 112 Mineralogy and Crystallography	GL 112 Mineralogy and Crystallography
GL 113 Practicals related to GL 111 and GL 112	GL 113 Practicals related to GL 111 and GL 112
GL 121 Stratigraphy and Palaeontology	GL 121 Stratigraphy and Sedimentation
GL 122 Petrology	GL 122 Petrology and Geochemistry
123 Practicals related to GL 121 and GL 122	123 Practicals related to GL 121 and GL 122

14. University Terms:

15. Subject wise Detailed Syllabus: Attached separately

16. Recommended Books:

1. Rutley's Elements of Mineralogy: H.H. Read
2. Text Book of Mineralogy: Dana and Ford
3. Principles of Petrology: Tyrrell
4. Manual of Mineralogy: Cornelius, S. Hurlbut and Cornel Klein

5. Invertebrate Palaeontology: Henry Woods
6. General Geology: Radhakrishnan
7. Invertebrate Paleontology: Shrock & Twenhofel
8. Miller, (1949) An Introduction to Physical Geology. East West Press Ltd.
9. Spencer, E.V., (1962) Basic concepts of Physical Geology. Oxford & IBH.
10. Mahapatra, G.B., (1994) A text book of Physical Geology. CBS Publishers.
11. Press and Siever (1998) Understanding Earth, WH Freeman & Co.
12. Emiliani, C. (1992). Planet earth: cosmology, geology, and the evolution of life and environment. Cambridge University Press
13. Wadia, D., (1973) Geology of India. McGraw Hill Book co.
14. Krishnan, M.S., (1982) Geology of India and Burma, 6th Edition. CBS Publ.
15. Ramakrishnan M, and Vaidynadhan, R (1994) Geology of India, Geological Society of India Publication, Bangalore. Vol. I &II.
16. Friedman & Sanders, (1978) Principles of Sedimentology. John Wiley and sons.
17. Pettijohn, F.J., (1975. Sedimentary rocks, Harper & Bros. 3rd Ed.
18. Sengupta. S., (1997) Introduction to sedimentology. Oxford-IBH.
19. Pettijohn F.J. (1984) Sedimentary Rocks (3rd Edition), CBS Publishers and Distributors, New Delhi.
20. Sengupta S.M. (2007) Introduction to Sedimentology (2nd Edition), CBS Publishers and Distributors, New Delhi.
21. Boggs S., Petrology of Sedimentary rocks (2nd edition), Cambridge University Press.
22. Greensmith J. (1989) Petrology of the Sedimentary rocks (7th Edition), CBS Publishers, New Delhi.
23. Tucker E.M. (2001) Sedimentary Petrology (3rd Edition), Blackwell Science Ltd.
24. Ram S. Sharma and Anurag Sharma (2013) Crystallography and Mineralogy - Concepts and Methods. Text Book Series, Geological Society of India, Bangalore
25. Dana, E.S. and Ford, W.E., (2002) A textbook of Mineralogy (Reprints).
26. Flint, Y., (1975) Essential of crystallography, Mir Publishers.
27. Phillips, F.C., (1963)An introduction to crystallography. Wiley, New York.

28. Berry, L.G., Mason, B. and Dietrich, R.V., (1982) Mineralogy. CBS Publ.
29. Read, H.H., (1968) Rutley's Element of Mineralogy (Rev. Ed.). Thomas Murby and Co.
30. Berry and Mason, (1961) Mineralogy. W.H. Freeman & Co. Kerr, B.F., (1995) Optical Mineralogy 5th Ed. McGraw Hill, New York.
31. Ram S. Sharma (2016) Metamorphic Petrology Concepts and Methods. Text Book Series, Geological Society of India, Bangalore
32. Bose M.K. (1997) Igneous Petrology. The World Press Pvt. Ltd. 568 p.
33. Ehlers, WG, and Blatt, H.(1987) Petrology, Igneous, Sedimentary and Metamorphic rocks, CBS Publishers
34. Turner, F.J., (1980) Metamorphic petrology. McGraw Hill.
35. Mason, R., (1978) Petrology of Metamorphic Rocks. CBS Publ.
36. Winkler, H.G.C., (1967) Petrogenesis of Metamorphic Rocks. Narosa Publ.
37. Best M.G. Igneous and Metamorphic Petrology, Blackwell Publications
38. Blatt H., Tracy R.J. and Owens B.E. (2006) Petrology – Igneous, sedimentary and Metamorphic rocks (3rd Edition), W.H. Freeman and Company, New York.
39. Collinson J.D and Thompson D.B (1989) Sedimentary Structures (2nd Edition), Unwin Hyman Ltd, Sydney.
40. Hatch F.H., Wells A.K and Wells M.K. (1984) Petrology of the igneous rocks. CBS Publishers, 551 p.
41. Turner F.J and Verhoogen J. (1960) Igneous and Metamorphic Petrology, McGraw- Hill.
42. Winter J. D. (2001) An Introduction to Igneous and Metamorphic Petrology, Prentice Hall, 697p
43. Rollinson, H. (2007) Using geochemical data – evaluation, presentation and interpretation. 2nd Edition. Publisher Longman Scientific & Technical.
44. Philpotts, A. and Ague, J. (2009). Principles of igneous and metamorphic petrology. Cambridge University Press.
45. Raymond, L. A. (2002). Petrology: the study of igneous, sedimentary, and metamorphic rocks. McGraw-Hill Science Engineering
46. Patwardhan, A.M. (2012) The dynamic Earth System, PHI Learning Pvt. Ltd.,
47. Moore E.M. and Twiss R.J. (1995) Tectonics, W. H. Freeman
48. Valdiya, K.S., (1984) Aspects of Tectonics: Focus on Southcentral Asia, Tata-McGraw

Hill, New Delhi,

49. Belousov, V.V. (1980) Geotectonics, Springer-Verlag Berlin Heidelberg

50. Condie, K.C.(1989) Plate Tectonics &Crustal Evolution, Butterworth-Heinemann

51. Billings, M.P. (1942) Structural Geology, Prentice Hall,

52. Badgley,P. C. (1965) Structural & Tectonic Principles, Harper & Row

17. Qualification of Teacher: As per U.G.C. norms

18. Detailed Syllabus CD (only word file) :

Savitribai Phule Pune University, Pune
F.Y. B.Sc. – Geology
Course Structure

Semester I (5.5 Credits)		
Core Courses		
Subject Code	Subject Title	Number of Credits
GL 111 T	Fundamentals of Geology and Understanding the Planet Earth	2 Credits
GL 112 T	Mineralogy and Crystallography	2 Credits
GL 113 P	Practicals related to GL 111 and GL 112	1.5 Credit
	Total	5.5 Credits
Semester II (5.5 Credits)		
Core Courses		
Subject Code	Subject Title	Number of Credits
GL 121 T	Stratigraphy and Sedimentation	2 Credits
GL 122 T	Petrology and Geochemistry	2 Credits
GL 123 P	Practicals related to GL 121 and GL 122	1.5 Credit
	Total	5.5 Credits

GL 111: Fundamentals of Geology and Understanding the Planet Earth (2Credits)

CC- I

(Lectures 36)

Topics	No. of Lectures
Credit I:	
A) Introduction Definition of Geology, its divisions, sub-divisions and scope	1
B) Planet Earth Origin of the Universe (Big Bang Theory), Origin of the Solar System (Nebular, Encounter and Tidal Hypothesis) a. Earth: Its size, shape and density. Temperature, pressure and magnetism within the Earth, Present day Hypsographic curve b. Age of the Earth: A brief account of the historical methods. Determination of age by U/Pb, Th/Pb, K/Ar and Carbon method of Dating.	6
C) Historical Geology (Introduction)	1
D) Geological time scale: Concept and Criteria	2
E) Fossils (Definition, Condition and Modes of preservation of fossils; Uses and Importance of fossils)	3
F) Mass Extinction Events (List of Events, Six different events and Causes of mass extinction)	3
G) Climate change (Introduction, Causes, Physical evidences for climate change)	2
Credit II:	
A) Earth's Atmosphere: (Introduction, Classification of Atmosphere, Introduction to Atmospheric circulation, land-air-sea interactions), Hydrosphere (Introduction to ocean currents, types, causes and significance), Lithosphere (Structure and composition) and Biosphere (Ecology and food chain)	3
B) Earth's Crust, Mantle and Core	1
C) Evolution of the Earth's Crust (Earth crustal evolution: Introduction, Early crust; Crustal dichotomy; Types of crust and Crustal growth rates)	2
D) Evolution of the Oceans (Introduction, Formation of the Oceans)	2
E) Rock deformation (Definition, Stress, Types of differential stress; Strain; Types of deformation; Types of Forces; Introduction to Fold, Fault, Joints and Fracture)	2
F) Plate Tectonics: Plate, Platform and Shield; Different tectonic settings on Earth, Mid oceanic ridges, rift valley and island arcs. Sea floor spreading.	2
G) Volcanoes: Genesis of volcanoes, central and fissure types of eruptions, products of volcanoes, effects of volcanoes and Earth's volcanic belts.	2
H) Earthquakes: Definition, terminology, causes, intensity and magnitude; Recording of earthquakes (modern recording methods), Use of seismic waves and their importance in interpreting the earth's internal structure; Seismic zones; History and susceptibility of the Indian subcontinent to earthquakes.	2
I) Meteorites (Definition, types and origin)	2

Topics	No. of lectures
Credit I: Mineralogy	
A) Introduction: Definition, branches and scope of mineralogy. Importance and conservation of minerals.	1
B) Chemistry of Minerals a. Atoms and Ions. b. Bonding forces in crystals:- Ionic, Covalent, Vander Waal's and Metallic bond, crystals with more than one type of bonds. c. Major element constituting of minerals. d. Geochemical affinity & geochemical classification of elements. e. Geometrical and electrical stability of minerals. (concept of relative size of ions, radius ratio, co-ordination number & ionic substitution) f. Isomorphism, polymorphism, pseudomorphism. g. Silicate structures	4
C) Formation of minerals: Introduction and description of geological processes of mineral formation; a. Crystallization from melt. b. Crystallization from solution. (Evaporation and precipitation) c. Crystallization from vapour. (Sublimation) d. Metamorphic processes. e. Alteration and related weathering. (oxidation and supergene enrichment)	3
D) Uses of Minerals in Industries: Ceramic, Refractory, Pharmaceutical, Paint, Glass, Cement, Fertilizer, Oil Industry, Electrical and Electronics.	2
E) Physical properties of minerals a. Colour, streak, luster, cleavage, fracture, hardness, form, magnetic and electrical properties, radioactivity, specific gravity & luminescence. (Phosphorescence and Fluorescence) b. Methods of determining specific gravity – Chemical balance, Walker's steelyard, Jolly's spring balance, pycnometer, heavy liquids	4
F) Optical mineralogy a. Nature of light – ordinary and plane polarized light. b. Double refraction of light. (with the help of calcite crystal) c. Nicol's prism and polaroids. d. Petrological microscope. e. Optical properties of Minerals:– • In plane polarized light: Colour, form, cleavage, cracks, relief, twinkling, pleochroism. • In between crossed nicols: Isotropism, anisotropism, extinction positions (straight, oblique and symmetrical), extinction angle, interference colours, twinning, crosshatching	4

Credit II: Crystallography	
A. Definition and conditions conducive for the formation of crystals.	1
B. Crystal morphology – faces, forms, edges, solid angles, interfacial angle and its measurement by contact Goniometer, law of constancy of interfacial angle.	2
C. Symmetry of crystals – Plane, axis and center of symmetry, crystallographic and geometrical symmetry. Crystallographic axes, lettering and order of crystallographic axes, parameters, axial ratio, indices, parameter system of Weiss, index system of Miller, Law of rational indices.	3
D. Various crystal lattices: Study of following crystallographic systems with respect to their elements of symmetry, crystallographic axes and their forms with indices.	12
i. Orthorhombic (Type: Barytes)	
ii. Tetragonal (Type: Zircon)	
iii. Cubic (Type: Galena)	
iv. Hexagonal (Type: Beryl)	
v. Monoclinic (Type: Gypsum)	
vi. Triclinic (Type: Axinite)	
vii. Trigonal	

REFERENCE BOOKS -

- 1) Rutley's Elements of Mineralogy by H.H. Read.
- 2) Mineralogy by Berry & Mason
- 3) Mineralogy by Dexter Perkins
- 4) An Introduction to the rock forming minerals by Deer, Howie, Zussman
- 5) Manual of Mineralogy by Klein & Hurlbut C.S.
- 6) Optical Mineralogy by Kerr P.F.
- 7) Optical Mineralogy by Whalstrom E.E.
- 8) Optical Mineralogy & Non opaque minerals by Philip W.R. & Griffen D.T.
- 9) Dana's textbook of Mineralogy by William E. Ford.
- 10) Optical Mineralogy by S. Ray and P.R.J. Naidu

Topics	No. of Practicals
Mineralogy A) Physical properties of minerals: Colour, form, streak, luster, cleavage, fracture, hardness and specific gravity.	1
B) Identification of following Megascopic minerals in hand specimens with the help of physical properties: (Any 15) Quartz, Rock crystal, Rose Quartz, Milky Quartz, Smoky quartz, Amethyst, Chalcedony, Agate, Jasper, Flint, Opal, Orthoclase, Plagioclase, Biotite, Muscovite, Garnet, Olivine, Hornblende, Apophyllite, Stilbite, Kyanite, Talc, Calcite, Fluorite, Gypsum, Baryte.	2
C) Optical Mineralogy: Study of optical properties of minerals in plane polarised light and between crossed nicols.	1
D) Microscopic minerals:(Any 6) Olivine, augite, hornblende, microcline, plagioclase, muscovite, biotite, calcite, garnet, quartz and orthoclase.	1
E) Crystallography Study of elements of symmetry, crystallographic axes and forms with indices of the following crystal systems representing all the fundamental crystal forms: a) Cubic System (Type:Galena) b) Orthorhombic System (Type:Baryte) c) Tetragonal System (Type:Zircon) d) Hexagonal System (Type:Beryl)	2
F) Toposheets and study of landform models: Reading of toposheets with reference to toposheet number, latitude and longitude, state/districts, scale, adjacent toposheet number and conventional signs.	1
No. of Practicals	8

B) Study of following secondary deposits with respect to sedimentary environments, definition, texture/structure, mineral composition and their varieties.

i) Residual- Laterite, Bauxite, Soil

ii) Rudaceous- Conglomerate, Breccia

iii) Arenaceous- Sandstones

iv) Siltstones

v) Argillaceous- Clays, Mudstone, Shale

vi) Chemical deposits- Siliceous, Carbonates, Ferruginous and Salts.

vii) Biochemical- Organic Limestone, Phosphatic Siliceous- and Carbonaceous Deposits.

Credit I : IGNEOUS PETROLOGY	
Definition of Petrology and Rock Cycle	1
Magma i. Magma and its composition and physic chemical characteristics ii. Bowen’s Reaction Series iii. Formation of crystal and glass	3
(A) Crystallisation of Magma i. Crystallisation of Unicomponent Magma ii. Bi- component Magma	2
(B) Textures and Structures i. Texture : Definition and Factors controlling Texture ii. Types of Textures : Equigranular and Inequigranular-Porphyritic, Poikilitic (Ophitic, Sub-Ophitic), Directive, Intergranular and Intersertal, Intergrowth Texture iii. Structures- Vesicular, Amygdaloidal, Blocky, Pillow, Columnar, Ropy and Flow.	4
(C) Igneous Classification i. Classification based on- Depth of formation, silica percentage, TAS, QAPF.	4
Credit II: GEOCHEMISTRY & METAMORPHIC PETROLOGY	
1. INTRODUCTION TO GEOCHEMISTRY a) Nucleosynthesis and Stellar Evolution Formation of elements, stability of Nucleii, structure of nucleus, isotopes, isobars, basic terms of radioactivity like α , β , γ decay. b) Structure of Earth Major elements and base elements in the Earth, Goldschmidt’s Classification, Lithophile, chalcophile, siderophile elements, Geochemical Periodic table based On the behavior of elements, geochemical composition of crust, mantle and core, Composition of bulk earth. c) Geochemical behavior in Igneous Processes • Behavior and distribution of trace elements between co-existing phases (solid, liquid, gases), factors governing the value of partition coefficients (in mafic and ultramafic systems), equilibrium melting (batch melting) and fractional melting. The T-P gradient of Earth’s crust and mantle. • Equilibrium crystallization and fractional crystallization from magma.	1 2 2
2. Radiogenic Isotope Geochemistry a. Basics of Radioactive decay: -Law of radioactive decay, geochronology, terms like isochrones and dating of rocks. b. Decay systems and their applications Detail Rb-Sr and Re-Os system and its application for all crustal processes and petroleum (source rock) dating, dating calculation.	2
3. Stable Isotope Geochemistry Introduction, low stable and radioactive isotope geochemistry in different with different application of $\delta^{18}O$, δD , $\delta^{13}C$, $\delta^{15}N$. Dating of fossils using ^{14}C carbon dating.	1

METAMORPHIC PETROLOGY	
A. Definition of Metamorphism, Agents of Metamorphism	2
B. Metamorphism and types of Metamorphism. a. Definition, General Characteristics, factors controlling textures and structures b. Thermal Metamorphism- Pure and Impure Limestone c. Dynamic/Cataclastic Metamorphism d. Regional Metamorphism and its products Argillaceous Rocks Basic Igneous Rocks	9
C. Concept of Metamorphic Facies Diagrammatic Representation of pressure, temperature conditions (with depth) of the different facies of contact, regional and plutonic metamorphism	3

GL 123: Practicals related to GL 121 and GL 122**(2Credit)**

Topics	No. of Practicals
A) Petrology Identification of the following megascopic and microscopic rocks with respect to their texture/structure, mineral composition and classification	
a) Igneous: Granite, gabbro, rhyolite, basalt (its varieties), pegmatite (Classification based on colour index, mineral composition and texture)	2
b) Sedimentary: Laterite, bauxite, breccia, conglomerate, sandstone, shale, mudstone and limestone.	2
c) Metamorphic: Slate, marble, quartzite, mica schist and mica gneiss.	1
B) Study of following Primary Sedimentary Structures in hand specimen with their Environmental Significance. 1. Bedding 2. Cross bedding 3. Graded bedding 4. Ripple marks 5. Mud/ Sun cracks	1
C) Stratigraphic correlation	1
D) One day Geological Fieldwork to be conducted in an area of geological interest and geological report to be submitted for the same.	1
No. of Practicals	8

List of Reference Books:

1. Read H.H. (1947): Rutley's Elements of Mineralogy. London: Thomas Murby & Co..
2. Ford W.E. (2006) Dana's Text Book of Mineralogy (Fourth Edition). CBS Publishers and Distributors Pvt Ltd
3. Tyrrell G.W. (1926): Principles of Petrology. Asia Publishing House
4. Cornelius, S. Hurlbut and Cornel Klein (2002): Manual of Mineralogy. John Wiley & Sons Inc.
5. Woods H. (1958): Invertebrate Palaeontology. Cambridge University Press.
6. Radhakrishnan (1987) General Geology. VVP Publishers
7. Shrock R. R. and Twenhofel W. H. (1935) Invertebrate Paleontology. McGraw Hill Book Company Inc.
8. Miller, (1949) An Introduction to Physical Geology. East West Press Ltd.

9. Spencer, E.V., (1962) Basic concepts of Physical Geology. Oxford & IBH.
10. Mahapatra, G.B., (1994) A text book of Physical Geology. CBS Publishers.
11. Press and Siever (1998) Understanding Earth, WH Freeman & Co.
12. Emiliani, C. (1992). Planet earth: cosmology, geology, and the evolution of life and environment. Cambridge University Press
13. Wadia, D., (1973) Geology of India. McGraw Hill Bookco.
14. Krishnan, M.S., (1982) Geology of India and Burma, 6th Edition. CBS Publ.
15. Ramakrishnan M, and Vaidynadhan, R (1994) Geology of India, Geological Society of India Publication, Bangalore. Vol. I&II.
16. Friedman & Sanders, (1978) Principles of Sedimentology. John Wiley and sons.
17. Pettijohn, F.J., (1975). Sedimentary rocks, Harper & Bros. 3rd Ed.
18. Sengupta. S., (1997) Introduction to sedimentology. Oxford-IBH.
19. Pettijohn F.J. (1984) Sedimentary Rocks (3rd Edition), CBS Publishers and Distributors, New Delhi.
20. Sengupta S.M. (2007) Introduction to Sedimentology (2nd Edition), CBS Publishers and Distributors, New Delhi.
21. Boggs S., Petrology of Sedimentary rocks (2nd edition), Cambridge University Press.
22. Greensmith J. (1989) Petrology of the Sedimentary rocks (7th Edition), CBS Publishers, New Delhi.
23. Tucker E.M. (2001) Sedimentary Petrology (3rd Edition), Blackwell Science Ltd.
24. Ram S. Sharma and Anurag Sharma (2013) Crystallography and Mineralogy - Concepts and Methods. Text Book Series, Geological Society of India, Bangalore
25. Dana, E.S. and Ford, W.E., (2002) A textbook of Mineralogy (Reprints).
26. Flint, Y., (1975) Essential of crystallography, Mir Publishers.
27. Phillips, F.C., (1963) An introduction to crystallography. Wiley, New York.
28. Berry, L.G., Mason, B. and Dietrich, R.V., (1982) Mineralogy. CBS Publ.
29. Read, H.H., (1968) Rutley's Element of Mineralogy (Rev. Ed.). Thomas Murby and Co.
30. Berry and Mason, (1961) Mineralogy. W.H. Freeman & Co. Kerr, B.F., (1995)

Optical Mineralogy 5th Ed. McGraw Hill, NewYork.

31. Ram S. Sharma (2016) Metamorphic Petrology Concepts and Methods. Text Book Series, Geological Society of India, Bangalore
32. Bose M.K. (1997) Igneous Petrology. The World Press Pvt. Ltd. 568p.
33. Ehlers, WG, and Blatt, H.(1987) Petrology, Igneous, Sedimentary and Metamorphic rocks, CBS Publishers
34. Turner, F.J., (1980) Metamorphic petrology. McGrawHill.
35. Mason, R., (1978) Petrology of Metamorphic Rocks. CBS Publ.
36. Winkler, H.G.C., (1967) Petrogenesis of Metamorphic Rocks. Narosa Publ.
37. Best M.G. Igneous and Metamorphic Petrology, Blackwell Publications
38. Blatt H., Tracy R.J. and Owens B.E. (2006) Petrology – Igneous, sedimentary and Metamorphic rocks (3rd Edition), W.H. Freeman and Company, New York.
39. Collinson J.D and Thompson D.B (1989) Sedimentary Structures (2nd Edition), Unwin Hyman Ltd, Sydney.
40. Hatch F.H., Wells A.K and Wells M.K. (1984) Petrology of the igneous rocks. CBS Publishers, 551p.
41. Turner F.J and Verhoogen J. (1960) Igneous and Metamorphic Petrology, McGraw-Hill.
42. Winter J. D. (2001) An Introduction to Igneous and Metamorphic Petrology, Prentice Hall, 697p
43. Rollinson, H. (2007) Using geochemical data – evaluation, presentation and interpretation. 2nd Edition. Publisher Longman Scientific & Technical.
44. Philpotts, A. and Ague, J. (2009). Principles of igneous and metamorphic petrology. Cambridge University Press.
45. Raymond, L. A. (2002). Petrology: the study of igneous, sedimentary, and metamorphic rocks. McGraw-Hill Science Engineering
46. Patwardhan, A.M. (2012) The dynamic Earth System, PHI Learning Pvt. Ltd.,
47. Moore E.M. and Twiss R.J. (1995) Tectonics, W. H. Freeman
48. Valdiya, K.S., (1984) Aspects of Tectonics: Focus on Southcentral Asia, Tata-McGraw Hill, New Delhi,
49. Belousov, V.V. (1980) Geotectonics, Springer-Verlag Berlin Heidelberg

50. Condie, K.C.(1989) Plate Tectonics &Crustal Evolution,Butterworth-Heinemann

51. Billings, M.P. (1942) Structural Geology, PrenticeHall,

52. Badgley,P. C. (1965) Structural & Tectonic Principles, Harper &Row

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Savitribai Phule Pune University

S.Y. B. Sc. Geology Syllabus Structure

S.Y.B.Sc. Geology CBCS syllabus: June 2020 Pattern

Paper no.	Title of the paper	Credit
GL 211	Structural Geology	2
GL 212	Principles of Stratigraphy and Sedimentation	2
GL 213	Practicals related to GL 211 & 212	1.5
GL 221	Global Tectonics and Geodynamics of the lithosphere	2
GL 222	Environmental Geology and Geogenic disasters	2
GL 223	Practicals related to GL 221 & 222	1.5

S.Y.B.Sc. Geology CBCS syllabus: June 2021 Pattern

Paper no.	Title of the paper	Credit
GL 211	Structural Geology	2
GL 212	Palaeontology	2
GL 213	Practicals related to GL 211 & 212	1.5
GL 221	Global Tectonics and Geodynamics of the lithosphere	2
GL 222	Environmental Geology and Geogenic disasters	2
GL 223	Practicals related to GL 221 & 222	1.5

Note:

1. The students enrolled for F. Y. B. Sc. Geology in the academic year 2019-2020, will go with June 2020 pattern.
2. The students who will enrol for F. Y. B.Sc. Geology in the academic year 2020-2021, will go with June 2021 pattern for S. Y. B. Sc.
3. June 2021 pattern with continue with further syllabus revision.

(2020 Pattern)

SEMESTER – III
CC - V
GL 211: Structural Geology (2 Credits)

- (i) **Course learning outcome:** The course deals with geological structures resulting from the action of these forces on rocks. The student will gain knowledge of the geometry of the rock structures, understand the mechanism of the evolution of rock structures and its application in the field.
- (ii) **Broad contents of the course:** The course is designed for the students to understand the geometry and mechanics of the various geological structures that result through the deformative processes operative within the earth.
- (iii) **Skills to be learned:** The students learn the skills of identifying different structures and measurements using Brunton compass which are fundamental to geological mapping. This course also helps to know how to use structures and help students' appreciate the dynamic nature of the Earth's lithosphere, learn how geologic maps are read and solve simple map problems using strike and preparations of cross sections.

Topic	No. of lectures
Credit 1: Fundamental Principles of Structures	
A. Attitude of a planar feature : a) Strike and dip (true dip and apparent dip). b) Strike-dip symbols for inclined, horizontal and vertical strata. c) Rake and plunge.	2
B. Brunton Compass, Clinometer Compass and GPS. a) Elements of a Brunton Compass and Clinometer Compass. b) Use of GPS. c) Strike direction, dip direction and dip amount. d) Fore-bearing and back-bearing.	2
C. Stress and Strain. a) Definition and concept of stress and strain. b) Three stages of deformation (Hooke's Law). c) Understanding stress and strain with reference to elastic and plastic deformation. d) Brittle and ductile deformation. e) Introduction to Stress-strain diagram.	5
D. Factors controlling rock deformation. a) Factors controlling behavior of materials such as – temperature,	6

time, pressure (confining pressure and pore pressure), solution and strain rate.	
E. Introduction to rock deformation and its mechanics. <ul style="list-style-type: none"> a) Definition of rock deformation. b) Components of rock deformation (Translation and Rotation) c) Definition and examples of plastic deformation. d) Mechanism of plastic deformation: Intergranular and intragranular movements, recrystallization with and without change in shape (Reckie's principle). 	3
	Total: 18
Credit 2: Introduction to Structural Features	
A. Joints. <ul style="list-style-type: none"> a) Definition and types of joints. b) Geometric and Genetic classification of Joints. 	2
B. Fractures. <ul style="list-style-type: none"> a) Concept of fracture. b) Genetic types of fracture (tension and shear fracture). c) Fracturing under differential forces. 	2
C. Shear Zones. <ul style="list-style-type: none"> a) Definition and types of shear zone (Simple and compound). b) Ideal plastic shear zone. c) Mylonites d) Shear zone indicators (Porphyroclast with recrystallized tails, S-C structure, Mica-fish, Imbrications and Boudinage). 	3
D. Faults. <ul style="list-style-type: none"> a) Terminologies associated with fault plane. b) Nature of movement along faults (Translational and Rotational). c) Effects on disrupted strata. d) Calculation of net slip. e) Concept of throw and heave. f) Classification of faults (Geometric and Genetic) 	5
E. Folds. <ul style="list-style-type: none"> a) Definition and parts of a fold. b) Nomenclature of folds. c) Plunging and Non-plunging folds. d) Types of folds (Flexure, shear and flow). e) Recognition of folds and plotting attitude of beds on a map. f) Determination of top of beds by Primary sedimentary structures. g) Classification of folds (Geometric and Genetic). 	6
	Total: 18

Books Recommended:

1. Ramsay, J.G. (1967) Folding and fracturing of rocks. McGraw-Hill, New York

2. Jain, A.K., (2014) An introduction to structural geology. Text Book series in Geological Sciences for Graduate Students. Geological Society of India, Bangalore.
3. Billings, M.P., (1972) Structural Geology. Prentice Hall.
4. Fossen, H., (2010) Structural Geology. Cambridge University Press.
5. Davis, G.R., (1984) Structural Geology of Rocks and Region. John Wiley
6. Singh, R. P., (1995) Structural Geology: A Practical Approach. Ganga Kaveri Publ., Varanasi
7. Hills, E.S., (1963) Elements of Structural Geology. Farrold and Sons, London.

(2020 Pattern)

SEMESTER - III

CC-VI

GL – 212: Principles of Stratigraphy and Sedimentation (2 Credits)

- (i) **Course learning outcome:** The study of Stratigraphy and Palaeontology encompasses the aspects of the age of the earth, chronological arrangement of rocks and appearance and evolution of life through the geologic time. The knowledge of the concepts in Stratigraphy, correlation, and Palaeontology would enable the students to understand the changes that occurred in the history of the earth and relate them to their field observations and also, in understanding the framework of the Stratigraphy of India.
- (ii) **Broad contents of the course:** Stratigraphy and Palaeontology, the two branches of Geology work together to unearth the secrets of age from rocks of the earth's crust. Stratigraphers study the composition and arrangement of layered or stratified rocks. Palaeontologists study the remains of plants and animals which have been preserved in the earth's crust by natural processes. With these objectives in mind it becomes pertinent to understand the basic concepts of Stratigraphy and Palaeontology.
- (iii) **Skills to be learned:** The students will be exposed to the principles of Stratigraphy including Order of Superposition. They will also be able to identify primary sedimentary structures and their depositional environments.

Topics	No. of Lectures
Credit I: Principles of Stratigraphy and Sedimentation	
A) STRATIGRAPHY i) Introduction, definition, principles of stratigraphy, development of stratigraphic concepts, importance of stratigraphy. ii) Stratigraphic classification & Nomenclature, study of stratigraphic elements, lithostratigraphy and its units, chronostratigraphy and its units, biostratigraphy and its units. Inter-relationship between lithostratigraphic, chronostratigraphic and biostratigraphic units. iii) Methods of collecting stratigraphic data - stratigraphic procedures on outcrop	8
Sedimentary Petrology A) Weathering (mechanical and chemical), erosion, denudation, Sediments, sedimentation and formation of sedimentary rocks –transportation, deposition,	4

<p>compaction, cementation and lithification Classification and description of sedimentary rocks. Sedimentary environment (definition and types)</p> <p>B) Derivation of sediments.</p> <p>i. Sources of sediments</p> <p>ii. Mineral composition of clastic / detrital sediments</p> <p>iii. Concept of matrix and cement and its effect on porosity and permeability</p> <p>C) Transportation of Detrital/ Clastic sediments:</p> <p>i. Modes of Transportation (Including phases of traction)</p> <p>ii. Definition of Competence, Capacity and Load of transporting Medium</p> <p>iii. Progressive changes in sediments during transport with respect to size, shape and mineral composition.</p>	<p>3</p> <p>3</p>
	Total 18
Credit II: Sedimentation	
<p>A) Textures and Primary structures of sedimentary rocks:</p> <p>a. Definition of texture & factors controlling textures of sedimentary rocks</p> <p>b. Clastic and non-clastic textures.</p> <p>primary sedimentary structures & their significance (a brief mention of their varieties):</p> <p>1. Bedding</p> <p>2. Lamination</p> <p>3 Cross bedding</p> <p>4 Graded bedding</p> <p>5 Ripple marks</p> <p>6. Chemical structures: stylolites, concretions, nodules</p> <p>7. Penecontemporaneous sedimentary Structures: Load-cast, flute-cast, mud-cracks, ball& pillow, clastic dykes, slump folds, Dewatering folds</p> <p>8. Study of organic sedimentary structures (in brief), Biogenic (Tracks and trails)</p>	<p>9</p>
<p>B) Study of following secondary deposits with respect to sedimentary environments, definition, texture/structure, mineral composition and their varieties.</p> <p>i) Residual- Latertite, Bauxite, Soil</p> <p>ii) Rudaceous- Conglomerate, Breccia</p> <p>iii) Arenaceous- Sandstones</p> <p>iv) Siltstones</p> <p>v) Argillaceous- Clays, Mudstone, Shale</p> <p>vi) Chemical deposits- Siliceous, Carbonates, Ferruginous and Salts.</p> <p>vi) Biochemical- Organic Limestone, Phosphatic Siliceous- and Carbonaceous Deposits.</p>	<p>9</p>
	Total 18

Books Recommended:

1. Wadia, D., (1973) Geology of India. McGraw Hill Book co.
2. Krishnan, M.S., (1982) Geology of India and Burma, 6th Edition. CBS Publ.

3. Ramakrishnan M, and Vaidynadhan, R (1994) Geology of India, Geological Society of India Publication, Bangalore. Vol. I &II.
4. Friedman & Sanders, (1978) Principles of Sedimentology. John Wiley and sons.
5. Pettijohn, F.J., (1975). Sedimentary rocks, Harper & Bros. 3rd Ed.
6. Sengupta. S., (1997) Introduction to sedimentology. Oxford-IBH.
7. Pettijohn F.J. (1984) Sedimentary Rocks (3rd Edition), CBS Publishers and Distributors, New Delhi. UGC Document on LOCF Geology 35
8. Ravindrakumar (2018) Fundamentals of Historical Geology and Stratigraphy of India, Newage Publications.
9. Sengupta S.M. (2007) Introduction to Sedimentology (2nd Edition), CBS Publishers and Distributors, New Delhi.
10. Boggs S., Petrology of Sedimentary rocks (2nd edition), Cambridge University Press.
11. Greensmith J. (1989) Petrology of the Sedimentary rocks (7th Edition), CBS Publishers, New Delhi.
12. Tucker E.M. (2001) Sedimentary Petrology (3rd Edition), Blackwell Science Ltd.
13. H. Blatt, G. Middleton and R. Murray (1980) Origin of sedimentary rocks, Princeton Hall.

(2020 Pattern)

SEMESTER - III
GL 213: Practicals related to GL 211 and GL 212

Topic	No. of Practicals
<p><u>A: Study of Geological Maps involving:</u></p> <ul style="list-style-type: none">a) One conformable and two conformable series.b) One conformable series with a vertical fault.c) One unconformity and one vertical fault / dyke.d) Completion of outcrop with the help of given topographic and lithological data. <p><u>Note:</u> One junction line may be partly shown with geologic / stratigraphic column.</p>	4
<p><u>B: Structural Problems:</u></p> <ul style="list-style-type: none">a) Problems involving hill slope (hill slope given / hill slope to be determined), true dip, true thickness, true width of outcrop and vertical thickness of bed.b) Problems involving true and apparent dip, true and apparent thickness, true and apparent width of outcrop and vertical thickness of bed (true dip and true thickness / vertical thickness / width of outcrop given).c) Problems involving hill slope, attitude of the exposures of top and bottom of the bed on the hill slope along with true thickness of the bed given, finding out true dip direction, true dip amount and other geometrical parameters of the bed. Comment on normal or overturned bed.d) Three point problems – drill hole data for a hidden planar feature at three non – collinear points given in the form of location, elevation and absolute depth of planar feature, finding out strike, true dip direction and true dip amount of the planar feature. To determine one of three parameters where the other two parameters are known.	3
Topic	
<p><u>A: Stratigraphy and sedimentation:</u></p> <ul style="list-style-type: none">a) Megascopic study of Sedimentary rocksb) Microscopic study of sedimentary rocksc) Preparation of lithologs and range charts	3
	Total: 10

(2020 Pattern)

SEMESTER - IV

CC-VII

GL – 221: Global Tectonics and Geodynamics of the lithosphere (2 Credits)

(i) Course learning outcome:

This course enables the students to appreciate the dynamic nature of the Earth processes. They will also be appraised about the geodynamics of the lithosphere and concept of isostasy, ocean floor spreading, continental drift, plate tectonics.

(ii) Broad contents of the course:

This course develops the concepts of plate tectonics on a global scale and analyses the physical processes responsible for the formation and destruction of the plates.

(iii) Skills to be learned:

The student will be introduced to the structure of the continental crust vs. oceanic crust and their geodynamic. They will also appreciate the modern concept of plate tectonics and its implications.

Topics	Nos of Lectures
Credit I: Geodynamics of the lithosphere	
Evolution of earth Composition, physical properties & characteristics of three spherical zones of the Earth namely crust, mantle and core	3
Structure of the lithosphere	2
lithosphere-asthenospheric interactions i) Concept of Lithosphere, Asthenosphere & Mesosphere	3
Low Velocity Zone (LVZ)	2
Continental crust and Oceanic crust	3
Geotherms	2
Concepts of isostasy	3
	Total 18
Credit II : Global Tectonics	
Direct & indirect observations in exploration of Earth's interior	3
Concept of Shield and Platform Early crustal evolution of the earth and Introduction to concepts of Cratons, Shields, Platform, Mobile belt with suitable Indian examples	3

Continental drift	2
Morphology of Ocean floor	2
Ocean floor spreading a) Magnetic anomalies & sea floor Spreading- Mechanics & applications	2
Plate tectonics a) Introduction to Wilson's cycle & Concept of plate tectonics b) Characteristic features of plate boundaries	3
Different tectonic settings on Earth-Mid Oceanic Ridges, Rift valleys and Island arcs (compressional and extensional)	3
	Total 18

Books Recommended:

1. Patwardhan, A.M. (2012) The dynamic Earth System, PHI Learning Pvt. Ltd.,
2. Moores E.M. and Twiss R.J. (1995) Tectonics, W. H. Freeman
3. Valdiya, K.S., (1984) Aspects of Tectonics: Focus on Southcentral Asia, Tata-McGraw Hill, New Delhi,
4. Belousov, V.V. (1980) Geotectonics, Springer-Verlag Berlin Heidelberg
5. Condie, K.C. (1989) Plate Tectonics & Crustal Evolution, Butterworth-Heinemann
6. Billings, M.P. (1942) Structural Geology, Prentice Hall,
7. Badgley, P. C. (1965) Structural & Tectonic Principles, Harper & Row
8. Valdiya K.S. (2014) Making of India, Springer.
9. Valdiya K.S. (1984) Aspects of tectonics, Tata McGrath Hill.

(2020 Pattern)

**SEMESTER - III
CC-VIII**

GL - 222: Environmental Geology and Geogenic disasters (2 Credits)

(i) Course learning outcome:

Know the basic fundamentals of earth science as applied to the interaction between human activity and the natural environment. Understand the occurrence and availability of both surface and subsurface water resources and the role of the hydrologic cycle and pollution. Understand the role of plate tectonics in causing earthquakes and how this understanding can aid the assessment of seismic hazard.

(ii) Broad contents of the course:

This course deals with water and its pollution and geogenic disasters.

(ii) Skills to be learned:

Students will be able to test and evaluate water quality for drinking and agricultural use. They will also have knowledge about various natural disasters.

Topics	Nos of Lectures
Credit I :Environmental Geology	
Interaction between human activity and the natural environment Concepts, Objectives, and Scope of Environmental Geology; Physical, Biological, and Socio-geological Environment, Bio-geochemical cycles	3
Surface and subsurface water resources	2
Hydrogeologic cycle and pollution, point, line and area sources of pollution	1
Sources of water pollution (natural and man-made), Case histories related to water pollution: Minamata disease (Japan), Arsenic poisoning (West Bengal), and Flourosis (Bhandara), Blue Baby Nitrate	3
Water quality parameters	2
BIS standards	1
Organic and inorganic pollutants,	2
Introduction to Air Pollution	1
Heavy metal pollution	1
Remedial measures	2
	Total 18
Credit II :Geo-genic disasters	
Definition, Types, Prediction, Natural hazard zones and impact assessment, Natural hazard zonation maps, Significance of Geology in Disaster Management Plan for Earthquakes	4
Richter scale, Building codes and public education	2

Volcanic Hazards Origin and types of volcanic activity, Nature of volcanic hazards, Prediction of volcanic eruptions, and mitigation of volcanic hazards.	3
Cyclones and Floods Introduction, definition, classification, causative factors, vulnerability, predictability (forecasting), mitigation measures, Cyclone and flood hazards in India	2
technological approaches (e.g., dams and levees) and land-use planning approaches to avoiding flood damages	1
Droughts, meteorological, agricultural and hydrologic types, mitigation of droughts	2
Introduction, causes and types of mass movements, Identification of landslides zones, control measures, avalanches and their causes, mitigation and concept of safety factor	3
Evaluation of technologies for landslide prevention	1
	Total 18

Books Recommended:

1. Verma, V.K., (1986) Geomorphology Earth surface processes and form. McGraw Hill.
2. Chorley, R. J., (1984) Geomorphology. Methuen.
3. Selby, M.J., (1996) Earths Changing Surface. Oxford University Press UK.
4. Thornbury W. D., (1997) Principles of Geomorphology Wiley Eastern Ltd., New Delhi.
5. Valdiya, K. S., (1987) Environmental Geology - Indian Context. Tata McGraw Hill New Delhi.
6. Keller, E. A., (2000) Environmental Geology. Shales E. Merrill Publishing Co., Columbus, Ohio.
7. Montgomery, C., (1984) Environmental Geology. John Wiley and Sons, London.
8. Bird, Eric, (2000) Coastal Geomorphology: An Introduction. John Wiley & Sons, Ltd. Singapore.
9. Liu, B.C., (1981) Earthquake Risk and Damage, Westview.
10. Sharma J. P., Environmental Studies, Laxmi Publications (P) Ltd, New Delhi

11. Blyth, F.G.H. and M. H. de Freitas(1984)Geology for Engineers,Butterworth-Heinemann Title
12. Krynine, D.P and Judd, W.R (2005) Principles of Engineering Geology and Geotechniques, CBS Publishers & Distributors
13. Ries, H. and T. L. Watson, (1949) Elements of Engineering Geology, New York, John Wiley & Sons, Inc.

(2020 Pattern)

SEMESTER - IV

GL: 223 Practicals related to GL 221 and 222

Practicals related to GL 221

Title of the Practical	
Marking of Craton/ Mobile belts/ Platforms/ Sedimentary Basins	1
Practicals related to Mid Oceanic Ridges	1
Problems related to P & S waves – Interior of the Earth	2
Mathematical problems related to Geotherm/ Isostasy	1

Practicals related to GL 222

Title of the Practical	
To find Water Quality Index	1
Preparation of Hazard zonation maps for India and World eg; Earthquake, landslide	1
Practicals related to Air Quality Analysis	1
Slope stability analysis, landslide w.r.t. jointing pattern	1
Fieldwork Component	1



Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Computer Science

(Faculty of Science & Technology)

F.Y.B.Sc. (Computer Science)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course: B. Sc. (Computer Science)

Preamble:

The B. Sc. (Computer Science) course is systematically designed three year degree program under the faculty of Science and Technology. The objective of the course is to prepare students to undertake careers involving problem solving using computer science and technologies, or to pursue advanced studies and research in computer science. The syllabus which comprises of Computer Science subject along with that of the three allied subjects (Mathematics, Electronics and Statistics) covers the foundational aspects of computing sciences and also develops the requisite professional skills and problem solving abilities using computing sciences.

Introduction:

At the first year of under-graduation, the basic foundations of two important skills required for software development are laid. A course in problem solving and programming along with a course in database fundamentals forms the preliminary skill set for solving computational problems. The practical courses are designed to supplement the theoretical training in the year. Along with Computer Science, the two theoretical and one practical course each in Statistics, Mathematics and Electronics help in building a strong foundation. Career Advancement courses are introduced in both semesters to cover additional areas of Computer Science.

At the second year of under-graduation, computational problem solving skills are further strengthened by a course in Data structures. Software engineering concepts that are required for project design are also introduced. Essential concepts of computer networking are also introduced in this year. The practical course included in both semesters complements the theory courses.

At the third year of under-graduation, all the subjects are designed to fulfill core Computer Science requirements as well as meet the needs of the software industry. Theory courses are adequately supplemented by hands-on practical courses. Skill Enhancement courses enable the students to acquire additional value-added skills.

Objectives:

- To develop problem solving abilities using a computer.
- To build the necessary skill set and analytical abilities for developing computer based solutions for real life problems.
- To train students in professional skills related to Software Industry.
- To prepare necessary knowledge base for research and development in Computer Science.
- To help students build-up a successful career in Computer Science and to produce entrepreneurs who can innovate and develop software products.

Titles of Papers, Credit Allocation and Scheme of Evaluation**Semester I (Total credits=22)**

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
CC-I	CS-111	Problem Solving using Computer and 'C' Programming	2		15	35	50
	CS-112	Database Management Systems	2		15	35	50
	CS-113	Practical course based on CS101 and CS102		1.5	15	35	50
CC-II*		Mathematics – I, II and III					
CC-III*		Electronics – I,II and III					
CC-IV*		Statistics – I, II and III					

Semester II (Total credits=22)

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
CC-V	CS-121	Advanced 'C' Programming	2		15	35	50
	CS-122	Relational Database Management Systems	2		15	35	50
	CS-123	Practical course based on CS201 and CS202		1.5	15	35	50
CC-VI*		Mathematics – I,II and III					
CC-VII*		Electronics – I, II and III					
CC-VIII*		Statistics – I,II and III					

S. Y. B. Sc.(Computer Science)**Semester III (Total credits=22)**

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
CC-IX	CS-231	Data Structures and Algorithms – I	2		15	35	50
	CS-232	Software Engineering	2		15	35	50
	CS-233	Practical course based on CS301		2	15	35	50
CC-X*		Mathematics – I, II and III					
CC-XI*		Electronics – I,II and III					
AECC-I*		Environment Science – I	2				
AECC-II*		Language Communication – I	2				

Semester IV (Total credits=22)

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
CC-XII	CS-241	Data Structures and Algorithms – II	2		15	35	50
	CS-242	Computer Networks - I	2		15	35	50
	CS-243	Practical course based on CS401		2	15	35	50
CC-XIII*		Mathematics – I,II and III					
CC-XIV*		Electronics – I, II and III					
AECC-III*		Environment Science – I	2				
AECC-IV*		Language Communication – I	2				

T. Y. B. Sc.(Computer Science)**Semester V (Total credits=22)**

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
DSEC - I	CS-351	Operating Systems - I	2		15	35	50
	CS-352	Computer Networks - II	2		15	35	50
	CS-357	Practical course based on CS501		2	15	35	50
DSEC - II	CS-353	Web Technologies - I	2				
	CS-354	Foundations of Data Science	2				
	CS-358	Practical course based on CS503		2			
DSEC - III	CS-355	Object Oriented Programming - I (Core Java)	2				
	CS-356	Theoretical Computer Science and Compiler Construction - I	2				
	CS-359	Practical Course based on CS505		2			
SECC - I	CS-3510	Python Programming / R Programming	1	1	15	35	50
SECC - II	CS-3511	Open Elective	1	1	15	35	50

Semester VI (Total credits=22)

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
DSEC - IV	CS-361	Operating Systems - II	2		15	35	50
	CS-362	Software Testing	2		15	35	50
	CS-367	Practical course based on CS601		2	15	35	50
DSEC - V	CS-363	Web Technologies - II	2				
	CS-364	Data Analytics	2				
	CS-368	Practical course based on CS603 and CS604		2			
DSEC - VI	CS-365	Object Oriented Programming - II (Advanced Java)	2				
	CS-366	Theoretical Computer Science and Compiler Construction - II	2				
	CS-369	Practical Course based on CS605		2			
SECC- III	CS-3610	Mobile Application Development OR Software Testing Tools	1	1	15	35	50
SECC - IV	CS-3611	Project OR Open Elective	1	1	15	35	50

Detailed Syllabus:

Semester- I		
Paper - I		
Course Type: Core Credit		Course Code: CS101
Course Title : Problem Solving Using Computer and ‘C’ Programming - I		
Teaching Scheme 2 Hours / Week	No. of Credits 2	Examination Scheme IE : 15 Marks UE: 35 Marks
Course Objectives		
<ol style="list-style-type: none"> 1. To introduce the foundations of computing, programming and problem- solving using computers. 2. To develop the ability to analyze a problem and devise an algorithm to solve it. 3. To formulate algorithms, pseudocodes and flowcharts for arithmetic and logical problems 4. To understand structured programming approach. 5. To develop the basic concepts and terminology of programming in general. 6. To implement algorithms in the ‘C’ language. 7. To test, debug and execute programs. 		
Course Outcomes:- On completion of this course, students will be able to :		
<ol style="list-style-type: none"> 1. Explore algorithmic approaches to problem solving. 2. Develop modular programs using control structures and arrays in ‘C’. 		
Course Contents		
Chapter 1	Problem Solving Aspects	5 Hours
<ol style="list-style-type: none"> 1.1. Introduction to problem solving using computers. 1.2. Problem solving steps. 1.3 Algorithms-definition, characteristics , examples ,advantages and limitations. 1.4 Flowcharts - definition, notations , examples , advantages and limitations, Comparison with algorithms. 1.5 Pseudo codes - notations, examples, advantages and limitations. 1.6 Programming Languages as tools, programming paradigms, types of languages 1.7 Converting pseudo-code to programs. 1.8 Compilation process (compilers , interpreters), linking and loading, syntax and semantic errors, testing a program 1.9 Good Programming Practices (naming conventions , documentation, indentation). 		
Chapter 2	‘C’ Fundamentals	7 Hours
<ol style="list-style-type: none"> 2.1 History of ‘C’ language. 2.2 Application areas. 2.2 Structure of a ‘C’ program. 2.3 ‘C’ Program development life cycle. 		

2.4 Function as building blocks. 2.5 'C' tokens 2.6 Character set, Keywords , Identifiers 2.7 Variables, Constants (character, integer, float, string, escape sequences, enumeration constant). 2.8 Data Types (Built-in and user defined data types). 2.9 Operators, Expressions, types of operators, Operator precedence and Order of evaluation. 2.10 Character input and output. 2.11 String input and output. 2.12 Formatted input and output.		
Chapter 3	Control Structures	6 Hours
3.1 Decision making structures:- if ,if-else, switch and conditional operator. 3.2 Loop control structures:- while ,do while, for. 3.3 Use of break and continue. 3.4 Nested structures. 3.5 Unconditional branching (goto statement).		
Chapter 4	Functions	6 Hours
4.1 Concept of function, Advantages of Modular design. 4.2 Standard library functions. 4.3 User defined functions:- declaration , definition, function call, parameter passing (by value), return statement. 4.4 Recursive functions. 4.5 Scope of variables and Storage classes.		
Chapter 5	Arrays	6 Hours
5.1 Concept of array. 5.2 Types of Arrays – One , Two and Multidimensional array. 5.3 Array Operations - declaration, initialization, accessing array elements. 5.4 Memory representation of two-dimensional array (row major and column major) 5.5 Passing arrays to function. 5.6 Array applications - Finding maximum and minimum, Counting occurrences, Linear search, Sorting an array (Simple exchange sort, bubble sort), Merging two sorted arrays, Matrix operations (trace of matrix, addition, transpose, multiplication, symmetric, upper/ lower triangular matrix)		
Reference Books:		
1. How to Solve it by Computer, R.G. Dromey, Pearson Education. 2. Problem Solving and Programming Concept, Maureen Sprankle, 7 th Edition, Pearson Publication.		

3. C: the Complete Reference, Schildt Herbert, 4th edition, McGraw Hill
4. A Structured Programming Approach Using C, Behrouz A. Forouzan, Richard F. Gilberg, Cengage Learning India
5. The 'C' programming language, Brian Kernighan, Dennis Ritchie, PHI
6. Programming in C ,A Practical Approach, Ajay Mittal , Pearson
7. Programming with C, B. Gottfried, 3rd edition, Schaum's outline Series, Tata McGraw Hill.
8. Programming in ANSI C, E. Balagurusamy, 7th Edition, McGraw Hill.

Semester- I Paper - II		
Course Type: Core Credit		Course Code: CS102
Course Title : Database Management Systems		
Teaching Scheme 02 Hours / Week	No. of Credits 2	Examination Scheme IE : 15 Marks UE: 35 Marks
Prerequisites <ul style="list-style-type: none"> Basic Knowledge of file system, storing data in file system and Operations on sets 		
Course Objectives <ul style="list-style-type: none"> To understand the fundamental concepts of database. To understand user requirements and frame it in data model. To understand creations, manipulation and querying of data in databases. 		
Course Outcomes On completion of the course, student will be able to– <ul style="list-style-type: none"> Solve real world problems using appropriate set, function, and relational models. Design E-R Model for given requirements and convert the same into database tables. Use SQL. 		
Course Contents		
Chapter 1	Introduction to DBMS	3 Hours
1.1. Introduction 1.2. File system Vs DBMS 1.3. Levels of abstraction & data independence 1.4. Structure of DBMS (Roles of DBMS Users) 1.5. Users of DBMS Advantages of DBMS		
Chapter 2	Conceptual Design	11 Hours
2.1. Overview of DB design process 2.2. Introduction to data models (E-R model, Relational model, Network model, Hierarchical model) 2.3. Conceptual design using ER data model (entities, attributes, entity sets, relations, relationship sets) 2.4. Constraints (Key constraints, Integrity constraints, referential integrity, unique constraint, Null/Not Null constraint, Domain, Check constraint, Mapping constraints) 2.5. Extended features – Specialization, Aggregation, Generalization 2.6. Pictorial representation of ER(symbols) 2.7. Structure of Relational Databases (concepts of a table) 2.8. DBMS Versus RDBMS 2.9. Case Studies on ER model		

Chapter 3	SQL	9 Hours
3.1. Introduction to query languages 3.2. Basic structure 3.3. DDL Commands 3.4. DML Commands 3.5. Forms of a basic SQL query (Expression and strings in SQL) 3.6. Set operations 3.7. Aggregate Operators and functions 3.8. Date and String functions 3.9. Null values 3.10. Nested Subqueries 3.11 SQL mechanisms for joining relations (inner joins, outer joins and their types) 3.12 Views 3.13. Examples on SQL (case studies)		
Chapter 4	Relational Database Design	7 Hours
3.1. Introduction to Relational-Database Design (undesirable properties of a RDB design) 3.2. Functional Dependency(Basic concepts, F+, Closure of an Attribute set, Armstrong's axioms) 3.3. Concept of Decomposition 3.4. Desirable Properties of Decomposition (Lossless join, Lossy join, Dependency Preservation) 3.5. Concept of normalization, Normal Forms (1NF,2NF and 3NF), Examples 3.6 Keys Concept with Examples : Candidate Keys and Super Keys, Algorithm to find the super keys / primary key for a relation		
Reference Books:		
1. Database System Concepts, Henry F. Korth, Abraham Silberschatz, S.Sudarshan,ISBN:9780071289597,Tata McGraw-Hill Education 2. Database Management Systems ,RaghuRamakrishnan,ISBN:9780071254342,Mcgraw-hill higher Education 3. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke,McGraw-Hill Science/Engineering/Math; 3 edition, ISBN: 9780072465631 4. Database Systems, Shamkant B. Navathe, RamezElmasri,ISBN:9780132144988,PEARSON HIGHER EDUCATION 5. Beginning Databases with PostgreSQL: From Novice to Professional, Richard Stones, Neil Matthew, ISBN:9781590594780, Apress 6. PostgreSQL, Korry Douglas, ISBN:9780672327568, Sams 7. Practical PostgreSQL (B/CD),JohnWorsley, Joshua Drake,ISBN:9788173663925Shroff/O'reilly 8. Practical Postgresql , By Joshua D. Drake, John C Worsley (O'Reillypublications) 9. "An introduction to Database systems", Bipin C Desai, Galgotia Publications		

Semester- I
Paper - III

Course Type: Core Credit

Course Code: CS103

**Title : Practical course on Problem Solving using Computer and ‘C’ programming
and
Database Management Systems**

Teaching Scheme 3 Hrs / week	No. of Credits 1.5	Examination Scheme IE : 15 Marks UE: 35 Marks
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Course Objectives

- To understand the program development life cycle.
- Solve simple computational problems using modular design and basic features of the ‘C’ language.
- Understand basic database management operations.
- Design E-R Model for given requirements and convert the same into database tables.

Course Outcomes:-

On completion of this course, students will be able to :

- Devise pseudocodes and flowchart for computational problems.
- Write, debug and execute simple programs in ‘C’.
- Create database tables in postgresSQL.
- Write and execute simple, nested queries.

Guidelines :

Lab Book: The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.

Submission:

Problem Solving Assignments:

The problem solving assignments are to be submitted by the student in the form of a journal containing individual assignment sheets. Each assignment includes the Assignment Title, Problem statement, Date of submission, Assessment date, Assessment grade and instructors sign.

Programming Assignments:

Programs should be done individually by the student in the respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

DBMS Assignments:

For each problem/case study, the student must design the database model in the form of an E-R

diagram. Table design should be based on the same and must include proper constraints and integrity checks. The students have to create, populate the tables and then perform the activities specified in each of the assignments. A pool of databases will get created as student progresses through the assignments and these databases can be repeatedly used in subsequent assignments. A separate softcopy of the queries must be maintained for each assignment.

Assessment:

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes and good programming practices.

Operating Environment:

For 'C' Programming :

Operating system: Linux

Editor: Any linux based editor like vi, gedit etc.

Compiler : cc or gcc

For DBMS:

Operating System: Linux Operating system

DBMS: PostgreSQL

Language: SQL

Suggested List of Assignments:**A) Problem Solving and C programming:****Assignment 1.**

Problem Solving using Pseudo code and Flowchart, Simple programs, Understanding errors and error handling.

Assignment 2.

Decision Making Control Structures.

Assignment 3.

Loop Control Structures

Assignment 4.

Functions (User Defined functions, Library functions and Recursion).

Assignment 5.

Arrays (1-D and 2-D).

B) Database Management Systems**Assignment 1.**

To create simple tables with only the primary key constraint (as a table level constraint & as a field level constraint) (include all data types)

Assignment 2.

To create more than one table, with referential integrity constraint, PK constraint.

Assignment 3.

To create one or more tables with following constraints, in addition to the first two constraints (PK & FK)

- a. Check constraint
- b. Unique constraint
- c. Not null constraint

Assignment 4.

To drop a table, alter schema of a table, insert / update / delete records using tables created in previous Assignments. (use simple forms of insert / update / delete statements)

Assignment 5.

To query the tables using simple form of select statement Select <field-list> from table [where <condition> order by <field list>] Select <field-list, aggregate functions > from table [where <condition> group by <> having <> order by <>]

Assignment 6.

To query table, using set operations (union, intersect)

Assignment 7.

To query tables using nested queries (use of 'Except', exists, not exists, all clauses)

Assignment 8.

To create views.

Books: Laboratory handbook prepared by the University.

Semester- II
Paper - I

Course Type: Core Credit

Course Code: CS201

Course Title : Advanced 'C' Programming

Teaching Scheme 2 Hours / Week	No. of Credits 2	Examination Scheme IE : 15 Marks UE: 35 Marks
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Prerequisites

- Problem Solving tools like algorithms, flowcharts and pseudocodes.
- Basic knowledge of 'C' language.

Course Objectives :-

- To study advanced concepts of programming using the 'C' language.
- To understand code organization with complex data types and structures.
- To work with files.

Course Outcomes:- Student will be able to :-

- Develop modular programs using control structures, pointers, arrays, strings and structures
- Design and develop solutions to real world problems using C.

Course Contents

Chapter 1	Pointers	8 Hours
1.1. Introduction to Pointers. 1.2. Declaration, definition, initialization, dereferencing. 1.3. Pointer arithmetic. 1.4. Relationship between Arrays & Pointers- Pointer to array, Array of pointers. 1.5. Multiple indirection (pointer to pointer). 1.6. Functions and pointers- Passing pointer to function, Returning pointer from function, Function pointer. 1.7. Dynamic memory management- Allocation(malloc(),calloc()), Resizing(realloc()), Releasing(free())., 1.8. Memory leak, dangling pointers. 1.9. Types of pointers.		
Chapter 2	Strings	6 Hours
2.1 String Literals, string variables, declaration, definition, initialization. 2.2 Syntax and use of predefined string functions 2.3 Array of strings. 2.4. Strings and Pointers 2.5. Command line arguments.		

Chapter 3	Structures And Unions.	8 Hours
3.1. Concept of structure, definition and initialization, use of typedef. 3.2. Accessing structure members. 3.3. Nested Structures 3.4. Arrays of Structures 3.5. Structures and functions- Passing each member of structure as a separate argument, Passing structure by value / address. 3.6. Pointers and structures. 3.7. Concept of Union, declaration, definition, accessing union members. 3.8. Difference between structures and union.		
Chapter 4	File Handling	6 Hours
4.1. Introduction to streams. 4.2. Types of files. 4.3. Operations on text files. 4.4. Standard library input/output functions. 4.5. Random access to files.		
Chapter 5	Preprocessor	2 Hours
6.1. Role of Preprocessor 6.2. Format of preprocessor directive 6.3. File inclusion directives (#include) 6.4. Macro substitution directive, argumented and nested macro 6.5. Macros versus functions		
Reference Books:		
1. C: the Complete Reference, Schildt Herbert, 4 th edition, McGraw Hill 2. A Structured Programming Approach Using C, Behrouz A. Forouzan, Richard F. Gilberg, Cengage Learning India 3. The 'C' programming language, Brian Kernighan, Dennis Ritchie, PHI 4. Programming in C ,A Practical Approach, Ajay Mittal , Pearson 5. Programming with C, B. Gottfried, 3 rd edition, Schaum's outline Series, Tata McGraw Hill. 6. Programming in ANSI C, E. Balagurusamy, 7 th Edition, McGraw Hill.		

Semester- II Paper - II		
Course Type: Core Credit		Course Code: CS202
Course Title : Relational Database Management Systems		
Teaching Scheme 2 Hours / Week	No. of Credits 2	Examination Scheme IE : 15 Marks UE: 35 Marks
Prerequisites <ul style="list-style-type: none"> • Basic Knowledge of DBMS • Knowledge of SQL Queries • Basics of relational design • Basics of ER model 		
Course Objectives <ul style="list-style-type: none"> • To teach fundamental concepts of RDBMS (PL/PgSQL) • To teach database management operations • Be familiar with the basic issues of transaction processing and concurrency control • To teach data security and its importance 		
Course Outcomes On completion of the course, student will be able to– <ul style="list-style-type: none"> • Design E-R Model for given requirements and convert the same into database tables. • Use database techniques such as SQL & PL/SQL. • Explain transaction Management in relational database System. • Use advanced database Programming concepts 		
Course Contents		
Chapter 1	Relational Database Design Using PLSQL	8 Hours
1.1 Introduction to PLSQL 1.2 PL/PgSQL: Datatypes, Language structure 1.3 Controlling the program flow, conditional statements, loops 1.4 Stored Procedures 1.5 Stored Functions 1.6 Handling Errors and Exceptions 1.7 Cursors 1.8 Triggers		

Chapter 2	Transaction Concepts and concurrency control	10 hours
<p>2.1 Describe a transaction, properties of transaction, state of the transaction.</p> <p>2.2 Executing transactions concurrently associated problem in concurrent execution.</p> <p>2.3 Schedules, types of schedules, concept of Serializability, Precedence graph for Serializability.</p> <p>2.4 Ensuring Serializability by locks, different lock modes, 2PL and its variations.</p> <p>2.5 Basic timestamp method for concurrency, Thomas Write Rule.</p> <p>2.6 Locks with multiple granularity, dynamic database concurrency (Phantom Problem).</p> <p>2.7 Timestamps versus locking.</p> <p>2.8 Deadlock and deadlock handling - Deadlock Avoidance(wait-die, wound-wait), Deadlock Detection and Recovery (Wait for graph).</p>		
Chapter 3	Database Integrity and Security Concepts	6 Hours
<p>3.1 Domain constraints</p> <p>3.2 Referential Integrity</p> <p>3.3 Introduction to database security concepts</p> <p>3.4 Methods for database security</p> <p> 3.4.1 Discretionary access control method</p> <p> 3.4.2 Mandatory access control</p> <p> 3.4.3. Role base access control for multilevel security.</p> <p>3.5 Use of views in security enforcement.</p> <p>3.6 Overview of encryption technique for security.</p> <p>3.7 Statistical database security.</p>		
Chapter 4	Crash Recovery	4 Hours
<p>4.1 Failure classification</p> <p>4.2 Recovery concepts</p> <p>4.3 Log base recovery techniques (Deferred and Immediate update)</p> <p>4.4 Checkpoints, Relationship between database manager and buffer cache. Aries recovery algorithm.</p> <p>4.5 Recovery with concurrent transactions (Rollback, checkpoints, commit)</p> <p>4.6 Database backup and recovery from catastrophic failure</p>		
Chapter 5	Other Databases	2 Hours
<p>5.1 Introduction to Parallel and distributed Databases</p> <p>5.2 Introduction to Object Based Databases</p> <p>5.3 XML Databases</p> <p>5.4 NoSQL Database</p> <p>5.5 Multimedia Databases</p> <p>5.6 Big Data Databases</p>		

Reference Books:

1. Database System Concepts, By Silberschatz A., Korth H., Sudarshan S., 6th Edition, McGraw Hill Education
2. Database Management Systems, Raghu Ramakrishnan, Mcgraw-Hill Education
3. Database Systems, Shamkant B. Navathe, Ramez Elmasri, PEARSON HIGHER EDUCATION
4. Fundamentals of Database Systems, By: Elmasri and Navathe, 4th Edition Practical PostgreSQL O'REILLY
5. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill Science/Engineering/Math; 3 edition, ISBN: 9780072465631
6. NoSQL Distilled, Pramod J. Sadalage and Martin Fowler, Addison Wesley
7. An Introduction to Database Systems", C J Date, Addison-Wesley
8. Database Systems : Concepts, Design and Application", S.K.Singh, Pearson, Education
9. NoSQL Distilled A Brief Guide to the Emerging World of Polyglot Persistence : by Pramod J. Sadalage, Martin Fowler, Addison-Wesley, Pearson Education, Inc.
10. MongoDB: The Definitive Guide , Kristina Chodorow, Michael Dirolf, O'Reilly Publications

<p style="text-align: center;">Semester- II Paper - III</p> <p style="text-align: center;">Course Type: Core Credit Course Code: CS203</p> <p style="text-align: center;">Title : Practical Course on Advanced ‘C’ Programming and Relational Database Management Systems</p>		
Teaching Scheme 3 Hours / week	No. of Credits 1.5	Examination Scheme IE : 15 Marks UE: 35 Marks
<p>Course Objectives</p> <ul style="list-style-type: none"> • To solve real world computational problems. • To perform operations on relational database management systems. 		
<p>Course Outcomes:-</p> <p>On completion of this course, students will be able to :</p> <ul style="list-style-type: none"> • Write, debug and execute programs using advanced features in ‘C’. • To use SQL & PL/SQL. • To perform advanced database operations. 		
<p>Guidelines :</p> <p>Lab Book: The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.</p> <p>Submission:</p> <p>Programming Assignments: Programs should be done individually by the student in respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.</p> <p>RDBMS Assignments: For each problem/case study, the student must design the database model in the form of an E-R diagram. Table design should be based on the same and must include proper constraints and integrity checks. The students have to create, populate the tables and then perform the activities specified in each of the assignments. A separate softcopy of the table creation statements and queries must be maintained for each assignment.</p> <p>Assessment</p> <p>Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall</p>		

assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes and good programming practices.

Operating Environment:

For 'C' Programming :

Operating system: Linux

Editor: Any linux based editor like vi, gedit etc.

Compiler : cc or gcc

For DBMS:

Operating System: Linux Operating system

DBMS: PostgreSQL 11 and higher

Language: PL/SQL

Suggested List of Assignments:**A) Advanced C Programming:****Assignment 1.**

Simple Pointers.

- a) Pointer initialization and use of pointers.
- b) Pointer Arithmetic.

Assignment 2.

Dynamic Memory Allocation.

Assignment 3.

String handling using standard library functions.

Assignment 4.

Structure and Unions.

Assignment 5.

File Handling.

Assignment 6.

C Preprocessors.

B) Relational Database Management Systems:**Assignment 1: Stored Procedure**

- 1) A Simple Stored Procedure
- 2) A Stored Procedure with IN, OUT and IN/OUT parameter

Assignment 2: Stored Function

- 1) A Simple Stored Function
- 2) A Stored Function that returns
- 3) A Stored Function recursive

Assignment 3 : Cursors

- 1) A Simple Cursor
- 2) A Parameterize Cursor

Assignment 4 : Exception Handling

- 1) Simple Exception- Raise Debug Level Messages
- 2) Simple Exception- Raise Notice Level Messages
- 3) Simple Exception- Raise Exception Level Messages

Assignment 5 : Triggers

- 1) Before Triggers (insert, update, delete)
- 2) After Triggers (insert, update, delete)

Books: Laboratory handbook prepared by the University.



Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Mathematics

(Faculty of Science & Technology)

F.Y.B.Sc. Mathematics (Computer Science)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course : B.Sc. Mathematics (Computer Science)

Preamble:

Savitribai Phule Pune University has decided to change the syllabi of various faculties from June, 2019. Taking into consideration the rapid changes in science and technology and new approaches in different areas of mathematics and related subjects board of studies in mathematics with concern of teachers of mathematics from different colleges affiliated to Savitribai Phule Pune University has prepared the syllabus of F. Y. B.Sc. (Computer Science) Mathematics. To develop the syllabus the U.G.C. Model curriculum is followed.

Aims:

- (i)** Give the students a sufficient knowledge of fundamental principles, methods and a clear perception of innumerable power of mathematical ideas and tools and know how to use them by modeling, solving and interpreting.
- (ii)** Reflecting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science and technology.
- (iii)** Enhancing students' overall development and to equip them with mathematical modeling abilities, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
- (iv)** Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.

Objectives:

- (i)** A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology and recognize basic geometrical figures and graphical displays, state important facts resulting from their studies.
- (ii)** A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning.
- (iii)** A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical Sciences.
- (iv)** A student be able to apply their skills and knowledge, that is, translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
- (v)** A student should be made aware of history of mathematics and hence of its past, present and future role as part of our culture.

Course Outcome:

Upon successful completion of this course, the student will be able to:

- i) A students should be able to work with graphs and identify certain parameters and properties of the given graphs.
- ii) A students should be able to perform certain algorithms, justify why these algorithms work, and give some estimates of the running times of these algorithms.
- iii) A students should be able to solve basic exercises of the type: given a graph with properties X , prove that the graph also has property Y .
- iv) A students should develop an appreciation for the literature on the subject and be able to read and present results from the literature.
- v) A students should be able to write cohesive and comprehensive solutions to exercises and be able to defend their arguments.

Structure of the course:-

	Semester - I		Semester -II	
Paper I	MTC-111	Matrix Algebra	MTC-121	Linear Algebra
Paper II	MTC-112	Discrete Mathematics	MTC-122	Graph Theory
Paper III	MTC-113	Mathematics Practical	MTC-123	Mathematics Practical

Proposed Structure of S. Y. B. Sc. Mathematics (Computer Science) Courses:

	Semester - III		Semester -IV	
Paper I	MT-231	Group Theory	MT-241	Calculus
Paper II	MT-232	Numerical Analysis	MT-242	Operations Research
Paper III	MT-233	Mathematics Practical	MT-243	Mathematics Practical

All three above courses are compulsory.

Equivalence of Previous syllabus along with new syllabus:

	Old course	New Course
Paper I	MTC-101 : Discrete Mathematics	MTC-111: Matrix Algebra and MTC-121 : Linear Algebra

Paper II	MTC-102 : Algebra and Calculus	MTC-112 : Discrete Mathematics and MTC-122 : Graph Theory
Paper III	MTC-103 : Mathematics Practical	MTC – 113 : Mathematics Practical and MTC – 113 : Mathematics Practical

Detailed Syllabus:

Semester - I

MTC-111: Matrix Algebra

Unit 1 : Introduction (4 lectures)

- 1.1 Matrix Operations
- 1.2 The Inverse of a Matrix
- 1.3 Characterization of invertible matrices

Unit 2 : Linear Equations in Linear Algebra-I (12 lectures)

- 2.1 System of Linear equations
- 2.2 Row reduction and echelon forms
- 2.3 Vector equations
- 2.4 The matrix equation $Ax=b$
- 2.5 Solution sets of linear systems

Unit 3 : Linear Equations in Linear Algebra -II (12 lectures)

- 3.1 Partitioned Matrices
- 3.2 Matrix factorization [Lu decomposition]
- 3.3 Linear Independence
- 3.4 Introduction to linear transformation
- 3.5 The matrix of linear transformation
- 3.6 Subspaces of \mathbb{R}^n
- 3.7 Dimension and Rank

Unit 4 : Determinants (8 lectures)

- 4.1 Introduction to determinants
- 4.2 Properties of determinants

4.3 Cramer's rule, Volume and linear transformations

Text Book : Linear Algebra and its Applications, David C Lay, Steven R. Lay, Judi J. MacDonald Pearson Publication,2016, Fifth Edition.

Unit 1: Chapter 2: Sec. 2.1, 2.2, 2.3

Unit 2: Chapter 1: Sec. 1.1, 1.2, 1.3, 1.4, 1.5

Unit 3: Chapter 2: Sec. 2.4, 2.5,2.8, 2.9, Chapter 1: 1.7, 1.8, 1.9

Unit 4: Chapter 3: Sec. 3.1, 3.2, 3.3

Reference Books :

1. Elementary Linear Algebra with supplemental Applications,Howard Anton and others ,Wiley Student Edition.
2. Matrix and Linear Algebra (aided with MATLAB),KantiBhushanDatta, Eastern Economic Edition.

MTC 112: Discrete Mathematics

UNIT 1 : LOGIC (7 Lectures)

- 1.1 Revision : Propositional Logic, Propositional Equivalences.
- 1.2 Rules of Inference : Argument in propositional Logic, Validity Argument(Direct and Indirect methods) Rules of Inference for Propositional Logic, Building Arguments.
- 1.3 Predicates and Quantifiers : Predicate, n-Place Predicate or ,n-ary Predicate, Quantification and Quantifiers, Universal Quantifier, Existential Quantifier, Quantifiers with restricted domains, Logical Equivalences involving Quantifiers.

Unit 2 : Lattices and Boolean Algebra (13 Lectures)

- 2.1 Relations, types of relations, equivalence relations, Partial ordering relations
- 2.2 Digraphs of relations, matrix representation and composition of relations.
- 2.3 Transitive closure and Warshall's Algorithm
- 2.3 Poset, Hasse diagram.
- 2.4 Lattices, Complemented lattice, Bounded lattice and Distributive lattice.
- 2.5 Boolean Functions : Introduction, Boolean variable, Boolean Function of degree n, Boolean identities, Definition of Boolean Algebra.
- 2.6 Representation of Boolean Functions : Minterm, Maxterm Disjunctive normal form, Conjunctive normal Form.

Unit 3 : Counting Principles (7 Lectures)

- 3.1 Cardinality of Set : Cardinality of a finite set.
- 3.2 Basics of Counting : The Product Rule, The Sum Rule, The Inclusion- Exclusion Principle.
- 3.3 The Pigeonhole Principle: Statement, the Generalized Pigeonhole Principle, Its Applications.

3.4 Generalized Permutations and Combinations : Permutation and

3.5 Combination with Repetitions, Permutations with Indistinguishable Objects

Unit 4: Recurrence Relations (9 Lectures)

4.1 Recurrence Relations: Introduction, Formation.

4.2 Linear Recurrence Relations with constant coefficients.

4.3 Homogeneous Solutions.

4.4 Particular Solutions.

4.5 Total Solutions.

TextBooks:

1. Discrete Mathematics and its applications, by Kenneth Rosen, Tata McGraw Hill, Seventh Edition.

2. Discrete Mathematical Structures, by Kolman, Busby, Ross, Rehman, Prentice Hall,

3. Elements of Discrete Mathematics, by C. L. Liu, Tata McGraw Hill,

Unit 1: Text Book 1: Chapter 1: Sec. 1.1, 1.2, 1.3, 1.4, 1.5

Unit 2: Text Book 2: Chapter 6: Sec. 6.1, 6.2, 6.3, 6.4, 6.5

Unit 3: Text Book 1: Chapter 2: Sec. 2.1, Chapter 5: Sec.5.1, 5.2, 5.3

Unit 4: Text Book 3: Chapter 10: Sec. 10.1, 10.2, 10.3, 10.4, 10.5, 10.6

MTC 113: Mathematics Practical

(Practical based on the applications of articles in MTC-111 and MTC - 112)

In Semester-I, we should conduct 3 written practical and 3 practical on maxima software for each paper MTC -111 and MTC -112.

List of Practical

Practical 1 : Problems on Unit 1 and 2 (Written) from MTC-111.

Practical 2 : Problems on Unit 3 (Written) from MTC-111.

Practical 3 : Problems on Unit 4 (Written) from MTC-111.

Practical 4 :Introduction to maxima software for MTC-111.

Practical 5 : Problems on unit 1 and unit 2 from MTC-111using maxima software.

Practical 6 : Problems on Unit 3 and Unit 4 from MTC-111using maxima software.

Practical 7: Problems on Unit 1 and Unit 2(Written) from MTC-112.

Practical 8 : Problems on Unit 3 (Written) from MTC-112.

Practical 9 : Problems on Unit 4(Written) from MTC-112.

Practical 10 :Introduction to maxima software for MTC-112.

Practical 11 : Problems on unit 1 and unit 2 from MTC-112 using maxima software.

Practical 12 : Problems on Unit 3 and Unit 4 from MTC-112 using maxima software.

Note:

1. The soft copy of practical on maxima software will be prepared and provided by the Board of Studies in mathematics.
2. Practical on maxima software can be performed on computer and android mobiles.
3. Android mobiles are allowed for practical examination on maxima software.
4. Practical examination of 25 marks on written problems, 10 marks for problems on maxima software (5 marks for writing syntax and 5 marks to perform the same on android mobile or computer).

Semester -II

MTC-121: Linear Algebra

Unit 1: Vector Spaces

(10 lectures)

- 1.1 Vector spaces and subspaces
- 1.2 Null spaces, column spaces and linear transformations.
- 1.3 Linearly independent sets : Bases
- 1.4 Coordinate systems
- 1.5 The dimension of a vector space
- 1.6 Rank

Unit 2: Eigen values and Eigen vectors

(10 lectures)

- 2.1 Eigen values and Eigen vectors
- 2.2 The characteristic equation
- 2.3 Diagonalization
- 2.4 Eigen vectors and Linear transformations

Unit 3: Orthogonality and Symmetric Matrices

(10 lectures)

- 3.1 Inner product, length and orthogonality
- 3.2 Orthogonal sets
- 3.3 Orthogonal Projections
- 3.4 Diagonalization of Symmetric Matrices
- 3.5 Quadratic forms

Unit 4: The Geometry of vector spaces

(6lectures)

- 4.1 Affine combinations
- 4.2 Affine independence
- 4.3 Convex combinations

Text Book :

Linear Algebra and its Applications (5th Edition) David C Lay, Steven R. Lay, Judi J. MacDonald Pearson Publication, Fifth Edition, 2016.

Unit 1: Chapter 4: Sec.4.1, 4.2, 4.3,4.4, 4.5, 4.6

Unit 2: Chapter 5: Sec. 5.1, 5.2, 5.3, 5.4

Unit 3: Chapter 6: Sec. 6.1, 6.2, 6.3, Chapter 7: 7.1,7.2

Unit 4: Chapter 8: Sec. 8.1, 8.2*,8.3

*From section 8.2 omit Barycentric coordinates.

Reference Books:

1. Elementary Linear Algebra with supplemental Applications, by Howard Anton and others, Wiley Student Edition, Fourth edition.
2. Matrix and Linear Algebra (aided with MATLAB), by Kanti Bhushan Datta, Eastern Economic Edition, Fourth edition.

MTC-122: Graph Theory**Unit 1: An Introduction to graph (10 lectures)**

- 1.1. Definitions, Basic terminologies and properties of graph, Graph models.
- 1.2. Special types of graphs, basic terminologies, properties and examples of directed graphs. Types of diagraphs.
- 1.3. Some applications of special types of graph.
- 1.4. Matrix representation and elementary results, Isomorphism of graphs.

Unit 2: Connected graph (8 lectures)

- 2.1. Walk, trail, path, cycle, elementary properties of connectedness. Counting paths between vertices (by Warshall's algorithm).
- 2.2. Cut edge (Bridge), Cut vertex, cut set, vertex connectivity, edge connectivity, and Properties.
- 2.3. Shortest path problem, Dijkstra's algorithm.

Unit 3. Euler and Hamilton path. (8 lectures)

- 3.1. The Konigsberg bridge problem, Euler trail, path, circuit and tour, elementary properties and Fleury's algorithm.
- 3.2. Hamilton path, circuit, elementary properties and examples.
- 3.3. Introduction of Travelling salesman problem, Chinese postman problem.

Unit 4. Trees (10 lectures)

- 4.1. Definitions, basic terminologies, properties and applications of trees.
- 4.2. Weighted graph, definition and properties of spanning tree, shortest spanning tree, Kruskal's algorithm, Prim's algorithm.

4.3. M-ary tree, binary tree, definitions and properties, tree traversal: preorder, inorder, postorder, infix, prefix, postfix notations and examples.

Text Book:

Kenneth Rosen, Discrete Mathematics and its applications, Tata McGraw Hill, Seventh Edition.

Unit 1: Chapter 8: Sec. 8.1, 8.2, 8.3

Unit 2: Chapter 8: Sec. 8.4

Unit 3: Chapter 8: Sec. 8.5, 8.6

Unit 4: Chapter 9: Sec. 9.1,9.2,9.3,9.4,9.5.

Reference Books:

1. John Clark and Derek Holton, A first look at Graph theory, Allied Publishers.
2. NarsinghDeo, Graph Theory with applications to computer science and engineering, Prentice Hall.
3. C.L.Liu, Elements of Discrete Mathematics, Tata McGraw Hill, Fourth edition
4. Douglas B. West, Introduction to Graph Theory, Pearson Education, second edition.

MTC 123: Mathematics Practical

(Practical based on the applications of articles in MTC- 121 and MTC- 122)

In Semester- II, we should conduct 4 written practical and 2 practical on maxima software for each paper MTC-121 and MTC-122.

List of Practical

Practical 1 : Problems on Unit 1 (Written) from MTC-121.

Practical 2 : Problems on Unit 2 (Written) from MTC-121.

Practical 3 : Problems on Unit 3(Written) from MTC-121.

Practical 4 :Problems on Unit 4(Written) from MTC-121.

Practical 5 : Problems on unit 1 and unit 2 from MTC-121using maxima software.

Practical 6 : Problems on Unit 3 and Unit 4 from MTC-121using maxima software.

Practical 7: Problems on Unit 1 (Written) from MTC-122.

Practical 8 : Problems on Unit 2 (Written) from MTC-122.

Practical 9 : Problems on Unit 3 (Written) from MTC-122.

Practical 10 :Problems on Unit 4 (Written) from MTC-122.

Practical 11 : Problems on unit 1 and Unit 2 from MTC-122 using maxima software.

Practical 12: Problems on Unit 3 and Unit 4 from MTC-122 using maxima software.

Note:

- 1 The soft copy of practical on maxima software will be prepared and provided by the Board of Studies in mathematics.
2. Practical on maxima software can be performed on computer and android mobiles.
3. Android mobiles are allowed for practical examination on maxima software.
4. Practical examination 25 marks on written problems, 10 marks for problems on maxima software (5 marks for writing syntax and 5 marks to perform the same on android mobile or computer).

Modalities For Conducting The Practical and The Practical Examination:

- 1) There will be one 3 hour practical session for each batch of 15 students per week.
- 2) The College will conduct the Practical Examination at least 15 days before the commencement of the Main Theory Examination. The practical examination will consist of written examination of 20 marks, 10 marks on maxima software and oral examination of 05 marks.
- 3) There will be no external examiner, the practical exam will be of the duration of 3 hours.
- 4) The subject teacher will set a question paper based on pattern as follows:
 - Q1.** Any 2 out of 4 each question of 5 marks on paper - I.
 - Q2.** Any 2 out of 4 each question of 5 marks on paper - II.
 - Q3.** (a) Any 1 out of 2 each question of 5 marks on maxima software from paper – I.
(b) Any 1 out of 2 each question of 5 marks on maxima software from paper – II.
- 5) Each student will maintain a journal to be provided by the college.
- 7) The internal 15 marks will be given on the basis of journal prepared by student and the cumulative performance of student at practical.
- 8) It is recommended that concept may be illustrated using computer software maxima and graphing calculators wherever possible.
- 9) Study tours may be arranged at places having important mathematical institutes or historical places.
- 10) **Special Instruction:**
 - a) There should be well equipped mathematics practical laboratory of size 20 X 20 sq. fts containing at least 10 computers.
 - b) Examiners should set separate question papers, solutions and scheme of marking for each batch and claim the remuneration as per rule.
 - c) Before starting each practical necessary introduction, basic definitions, intuitive inspiring ideas and prerequisites must be discussed.



Savitribai Phule Pune University

(Formerly University of Pune)

Faculty of Science & Technology

F.Y.B.Sc. Computer Science (Electronics)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course: F.Y. B. Sc. Electronics of B. Sc. (Computer Science)**Preamble of the Syllabus:**

The systematic and planned curricula for first year and second year Electronics shall motivate and encourage the students for pursuing higher studies in Electronics and Computer and for becoming an entrepreneur.

Introduction:

At **first year of under-graduation**: The basic topics related to the fundamentals of electronics are covered. Since electronics is an inherent part of technological advancements, the practical course is intended to achieve the basic skills required for computer science students.

At **second year under-graduation**: The level of the theory and practical courses shall be one step ahead of the first year B.Sc. Courses based on content of first year shall be introduced. Concepts of Communication, embedded system, Internet of things will be introduced at this stage.

Objectives:

- To provide knowledge of technological and practical aspects of electronics.
- To familiarize with current and recent technological developments.
- To enrich knowledge through activities such as industrial visits, seminars, projects etc.
- To train students in skills related to computer industry and market.
- To create foundation for research and development in Electronics/ Computer Science.
- To develop analytical abilities towards real world problems
- To help students to build-up a progressive and successful career.

Titles of Papers and Scheme of Study**F. Y. B. Sc. Electronic Science of B. Sc. (Computer Science)**

SEM	Paper / subject code	Paper	Paper Title	Credits	Lectures/ practical per week	Evaluation		
						C.A.	U.E.	Total
I	ELC-111	I	Semiconductor Devices and Basic Electronic Systems	2 (36 L)	3	15	35*	50
	ELC-112	II	Principles of Digital Electronics	2 (36 L)	3	15	35*	50
	ELC-113	III	Electronics Lab IA	1.5 (48 L)	4	15	35**	50
II	ELC-121	I	Instrumentation System	2 (36 L)	3	15	35*	50
	ELC-122	II	Basics of Computer Organisation	2 (36 L)	3	15	35*	50
	ELC-123	III	Electronics Lab IB	1.5 (48L)	4	15	35**	50

Detail Syllabus:**SEMESTER I****Paper I****ELC-111: Semiconductor Devices and Basic Electronic Systems****(2 Credits, 36 lectures)****Objectives :**

1. To study various types of semiconductor devices
2. To study elementary electronic circuits and systems

Term I**Unit 1. Semiconductor Diodes (6 L)**

Semiconductor, P and N type semiconductors, Formation of PN junction diode, it's working, Forward and Reverse bias characteristics, Zener diode: working principle, breakdown mechanism and characteristics, Working principle of Light emitting diode, photo diode, optocoupler, Solar cell working principle and characteristics

Unit 2. Bipolar Junction Transistor (BJT) (7 L)

Bipolar Junction Transistor (BJT) symbol, types, construction, working principle, Transistor amplifier configurations - CB, CC (only concept), CE configuration: input and output characteristics, Definition of α , β and γ , Concept of Biasing (numerical problems not expected), Potential Divider bias, Transistor as amplifier (Concept of Gain and Bandwidth expected), Transistor as a switch.

Unit 3. MOSFET (5 L)

MOSFET types, Working principle, Characteristics, Application of MOSFET as a Switch.

Unit 4. POWER SUPPLY (6 L)

Block Diagram of Regulated Power Supply, Rectifiers (half wave, full wave, Bridge), rectifier with capacitor-filter, Use of Zener Diode as a Voltage Regulator, IC 78XX and 79XX as regulator, Block Diagram and explanation of SMPS, Block diagram and explanation of UPS

Unit 5. OSCILLATORS (6 L)

Barkhausen Criteria, Low frequency Wein-bridge oscillator, High frequency crystal oscillator, IC 555 as astable multivibrator used as square wave generator / clock

Unit 6. DATA CONVERTERS (6 L)

Need of Digital to Analog converters, parameters, weighted resistive network, R-2R ladder network, need of Analog to Digital converters, parameters, Flash ADC, successive approximation ADC.

Text/reference books :

1. Electronic Devices and Circuits I – T. L. Floyd- PHI Fifth Edition
2. Principles of Analog Electronics - A.P.Malvino
3. Sedha R.S., A Text Book Of Applied Electronics, S.Chand& CompanyLtd

SEMESTER I**PAPER II****ELC 112: Principles of Digital Electronics
(2 Credits, 36 lectures)****Objectives:**

1. To get familiar with concepts of digital electronics
2. To learn number systems and their representation
3. To understand basic logic gates, Boolean algebra and K-maps
4. To study arithmetic circuits, combinational circuits and sequential circuits

Unit 1: Number Systems and Digital codes (10 L)

Introduction to Decimal, Binary and Hexadecimal number systems and their inter-conversions, binary addition and binary subtraction using 2's complement, Binary Coded Decimal number, Gray Codes, Gray to Binary and Binary to Gray conversion, Alphanumeric representation in ASCII codes.

Unit 2: Logic gates and Boolean Algebra (14)

Logic gates (NOT, AND, OR, NAND, NOR, XOR gate) with their symbol, Boolean equation and truth table, Universal gates

Introduction of CMOS and TTL logic families, Parameters like voltage levels, propagation delay, noise margin, fan in, fan out, power dissipation (TTL NAND, inverter, CMOS gates etc. not expected)

Rules and laws of Boolean algebra, De Morgan's theorem, simplification of Logic equations using Boolean algebra rules, Min terms, Max terms, Boolean expression in SOP and POS form, conversion of SOP/POS expression to its standard SOP/POS form Introduction to Karnaugh Map, problems based on SOP (upto 4 variables), digital designing using K Map for: Gray to Binary and Binary to Gray conversion,

Unit 3: Combinational Circuits (12 L)

Half adder and full adder, 4-Bit Universal adder/ Subtractor, applications of Ex-OR gates as parity checker and generator, study of Multiplexer (4:1) and Demultiplexer (1:4), Encoders - Decimal/BCD to binary, 3X4 matrix keyboard encoder, priority encoder, Decoder- BCD to seven segment decoder, IC 74138 and IC 7447, Digital comparator,

Reference Books:

1. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education
2. Digital Electronics: Jain R.P., Tata McGraw Hill
3. Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill
4. M.Morris Mano, "Digital Design" 3rd Edition, PHI, NewDelhi.
5. Ronald J. Tocci. "Digital Systems-Principles and Applications" 6/e. PHI. New Delhi. 1999.(UNITS I to IV)
6. G.K.Kharate-Digital electronics-Oxford university press
7. S.Salivahana & S.Arivazhagan-Digital circuits and design

SEMESTER I

Paper III
ELC-113: ELECTRONICS LAB IA (1.5 Credits)

The practical course consists of **10 experiments** out of which two will be preparatory experiments. These will be evaluated in an oral examination for 15% marks at internal and external semester examination. **Each Practical batch will have maximum 15 students.**

Preparatory Experiments (Minimum 2/3)

1. Identification of Components (Passive and Active) /Tools

- Minimum 10 different types of components must be given
- Identification based on visual inspection / data sheets be carried out

2. Use of Digital Multimeters

- Measurement of AC/DC voltage and Current – on different ranges
- Measurement of R & C
- Testing of Diodes & Transistors
- Measurement of β .
- Use of Multimeter in measurement of Resistance of LDR and Thermistor

3. Study of Signal Generator & CRO

- Understand how to use Signal Generator, CRO
- Study of front panel controls of both
- Measurement of amplitude and frequency of Sine/Square waveform
- Measurement of Phase with the help of RC circuit
- Demonstration of Lissajous figures
- Demonstrate the use of Component testing facility

Semester I List of Practical's (Minimum 08, 4 from each group)

Group A

1. Study of breakdown characteristics and voltage regulation action of Zener diode, Use of 3 Pin Regulator IC 78XX & 79XX as a regulator.
2. Study of half wave, full wave and bridge rectifier circuit with and without capacitor filters.
3. Study of Opto-coupler using LED and Photodiode (Package may be used here), it's application as burglar alarm.
4. Study of Bipolar Junction Transistor as a Switch.
5. Study of Single stage RC coupled CE transistor Amplifier (Gain/ Bandwidth).
6. Study of output and transfer characteristics of MOSFET.
7. Study of SMPS.
8. Study of IC 555 as an Astable Multivibrator.
9. Study of 4-Bit R-2R Ladder Network type of DAC.
10. Study of 3-bit Flash ADC.

Group B

11. Study of Logic Gates (Verification of Truth tables)
12. Study of Binary to Gray & Gray to Binary Converter (K- Map based design).
13. Study of Half Adder and Full Adder using Logic Gates.
14. Use of Ex-OR as a 4-bit Parity Checker and Generator.
15. Study of Decimal to BCD/ (Binary) Converter.
16. Study of Multiplexer and Demultiplexer (4:1 & 1:4).
17. Study of 3X4 matrix Keyboard Encoder / Priority Encoder.
18. Study of BCD to Seven Segment Display using IC 7447.

SEMESTER II**PAPER I****ELC 121: Instrumentation Systems
(2 Credits, 36 lectures)****Objectives :**

1. To study Instrumentation System
2. To study various blocks of Instrumentation System
3. To study Smart Instrumentation System

Unit 1: Introduction to Instrumentation System (6 L)

Block diagram of Instrumentation system, Definition of sensor, transducer and Actuators, Classification of sensors: Active and passive sensors. Specifications of sensors: Accuracy, range, linearity, sensitivity, resolution, reproducibility.

Unit 2: Sensors and Actuators (12 L)

Temperature sensor (Thermistor, LM-35), optical sensor (LDR), Passive Infrared sensor (PIR), Tilt Sensor, ultrasonic sensor, Motion sensor, Image Sensor, Actuators: DC Motor, stepper motor

Unit 3: Smart Instrumentation System and Smart Sensors (6 L)

Block diagram of Smart Instrumentation system, Concept of smart sensor, Film sensors, Nano sensor

Unit 4: OPAMP as signal Conditioner (12 L)

Concept, block diagram of Op amp, basic parameters (ideal and practical): input and output impedance, bandwidth, differential and common mode gain, CMRR, slew rate, IC741/ LM324, Concept of virtual ground, Op amp as inverting and non inverting amplifier, Unity gain follower, Opamp as adder, subtractor, Op amp as current to voltage and voltage to current convertor, Voltage to frequency converter, Op amp as comparator, Problems based on above Op Amp applications.

Reference Books:

1. Sensors and Transducers : D. Patranabis, PHI publication, 2nd Edition
2. Sensors and Transducers : Prof A.D.Shaligram
3. Op Amp and Linear Integrated Circuits: Ramakant Gaykwad

SEMESTER II**PAPER II****ELC 122 : Basics of Computer Organisation
(2 Credits, 36 lectures)**

Objectives:

1. To get familiar digital sequential circuits
2. To study Basic computer Organization
3. To study Memory architecture

Unit 1: Flip-flops (5 L)

RS Flip Flop using NAND gate, clocked RS Flip Flop, D Latch, J K Flip Flop, T Flip Flop

Unit 2: Shift registers and Counters (9 L)

Shift registers - SISO, SIPO, PISO, PIPO shift registers, Ring Counter using D Flip flop. Counters -Synchronous and Asynchronous type, 3-bit Up, Down and Up-Down counter, Concept of modulus Counters
(Timing Diagram of all above are expected)

Unit 3: Basics of Computer System (12 L)

Basic Computer Organization, Concept of Address Bus, Data Bus, Control Bus. CPU Block Diagram and Explanation of each block, Register based CPU organization, Concept of Stack & its organization, I/O organization: need of interface, block diagram of general I/O interface

Unit 4: Memory Organization (10 L)

Memory Architecture, Memory hierarchy, Types of Memories, Data Read/ Write process, Vertical and Horizontal Memory Expansion, Role of Cache memory, Virtual Memory.

Reference Books:

1. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education
2. Digital Electronics: Jain R.P., Tata McGraw Hill
3. Digital Logic and Computer Design : M. Morris Mano, Pearson Education
4. Computer Organization and Architecture, William Stallings, Pearson, 10th Edi.

SEMESTER II**Paper III****ELC-123: Electronics Lab IB**

The practical course consists of **10 experiments** out of which one will be activity equivalent to 2 practical sessions.

Activity will carry 15% marks at internal and external semester examination. Activity can be any one of the following :

- 1.Hobby projects
- 2.Industrial visit / live work experience
- 3.PCB Making
- 4.Market Survey of Electronic Systems
- 5.Circuit Simulations and CAD tools

GROUP A (Minimum 4/8)

1. To study temperature sensor LM 35
2. Use of LDR to control light intensity
3. Study of PIR and tilt sensor.
4. Study of stepper motor.
5. Use of OPAMP as comparator and its use in DC motor driving.
6. Build and test Inverting and non inverting amplifier using OPAMP.
7. Build and test adder and subtractor circuits using OPAMP.
8. Build and test voltage to frequency converter

GROUP B (Minimum 4/8)

1. Study of RS, JK and D flip flops using NAND gates
 2. Study of Four bit ALU
 3. Study of asynchronous Up/Down Counter
 4. Study of decade counter IC circuit configurations
 5. Study of 4-bit SISO Shift register and it's use as Ring Counter
 6. Study of read and write action of RAM (using IC 2112/4 or equivalent).
 7. Study of Diode Matrix ROM
 8. Study of Computer hardware system
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Savitribai Phule Pune University

(Formerly University of Pune)

Faculty of Science & Technology

F.Y.B.Sc. (Computer Science) Statistics

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course: B. Sc. (Computer Science) STATISTICS

Preamble of the Syllabus:

Statistics is a branch of science that can be applied practically in every walk of life. Statistics deals with any decision making activity in which there is certain degree of uncertainty and Statistics helps in taking decisions in an objective and rational way. The student of Statistics can study it purely theoretically which is usually done in research activity or it can be studied as a systematic collection of tools and techniques to be applied in solving a problem in real life.

In last 15 to 20 years, computers are playing a very crucial role in the society. The use of computers has horizontally spread and also penetrated vertically in the society. It has become a part and parcel of common man. Thus there is a huge demand for computer education.

The University of Pune has done a pioneering work in this area and a three year degree course B. Sc. (Computer Science) of University of Pune is very popular among the student community and I. T. Industry. This course covers various subjects which are required directly or indirectly for becoming a computer professional. Statistics is one such important subject which is required and is extensively used in a vast spectrum of computer based applications. Data Mining and Warehousing, Big Data Analytics, Theoretical Computer Science, Reliability of a computer Program or Software, Machine Learning, Artificial Intelligence, Pattern Recognition, Digital Image Processing, Embedded Systems are just a few applications to name where Statistics can be extensively used.

Introduction: The syllabus of Statistics for First Year of this course covers basic concepts and terminology in Statistics and covers basic tools and methods required for data analysis. The teachers teaching this syllabus and students should give emphasis on understanding the concepts and ability to apply statistical tools and techniques and not on the theoretical discussion. It is expected that at the end of the course, a student should be well equipped to learn and apply acquired techniques in computer based applications.

Structure of the Subject

Structure of the subject and the pattern of examination and question papers are as specified below.

Structure of F. Y. B. Sc. (Computer Science) Statistics

Semester	Paper code	Paper	Paper title	credits	Marks		
					CIA	ESE	Total
1	CSST 111	I	Descriptive Statistics I	2	15	35	50
	CSST 112	II	Mathematical Statistics	2	15	35	50
	CSST113	III	Statistics Practical Paper I	1.5	15	35	50
2	CSST121	I	Methods of Applied Statistics	2	15	35	50
	CSST122	II	Continuous Probability Distributions and Testing of Hypothesis	2	15	35	50
	CSST123	III	Statistics Practical Paper II	1.5	15	35	50

Semester I**Paper-I****CSST 111 :Descriptive Statistics**

No. of Credits :2No. of lectures: 40

TOPICS/CONTENTS:**UNIT1: Data Condensation and Presentation of Data (9L)**

- 1.1 Definition, importance, scope and limitations of statistics.
- 1.2 Data Condensation: Types of data (Primary and secondary), Attributes and variables, discrete and Continuous variables.
- 1.3 Graphical Representation: Histogram, Ogive Curves, Steam and leaf chart. [Note: Theory paper will contain only procedures. Problems to be included in practical]
- 1.4 Numerical problems related to real life situations.

UNIT2: Descriptive Statistics(14L)

- 2.1 Measures of central tendency: Concept of central tendency, requisites of good measures of central tendency.
- 2.2 Arithmetic mean: Definition, computation for ungrouped and grouped data, properties of arithmetic mean (without proof) combined mean, weighted mean, merits and demerits.
- 2.3 Median and Mode: Definition, formula for computation for ungrouped and grouped data, graphical method, merits and demerits. Empirical relation between mean, median and mode (without proof)
- 2.4 Partition Values: Quartiles, Box Plot.
- 2.5 Concept of dispersion, requisites of good measures of dispersion, absolute and relative measures of dispersion.
- 2.6 Measures of dispersion : Range and Quartile Deviation definition for ungrouped and grouped data and their coefficients, merits and demerits,
Variance and Standard deviation: definition for ungrouped and grouped data, coefficient of variation, combined variance & standard deviation, merits and demerits.
- 2.7 Numerical problems related to real life situations.

UNIT3: Moments, Skewness and Kurtosis**(10L)**

- 3.1 Concept of Raw and central moments: Formulae for ungrouped and grouped data (only first four moments), relation between central and raw moments upto fourth order. (without proof)
- 3.2 Measures of Skewness: Types of skewness, Pearson's and Bowley's coefficient of skewness, Measure of skewness based on moments.
- 3.3 Measure of Kurtosis: Types of kurtosis, Measure of kurtosis based on moments.
- 3.4 Numerical problems related to real life situations

UNIT4: Theory of Attributes**(7L)**

- 4.1 Attributes: Concept of a Likert scale, classification, notion of manifold classification, dichotomy, class- frequency, order of a class, positive classfrequency, negative class frequency, ultimate class frequency, relationship among different class frequencies (up to two attributes), 4.2 Consistency of data upto 2 attributes.
- 4.3 Concepts of independence and association of two attributes.
- 4.4 Yule's coefficient of association (Q), $-1 \leq Q \leq 1$, interpretation.

References:

1. Statistical Methods, George W. Snedecor, William G, Cochran, John Wiley & sons
2. Programmed Statistics, B.L. Agarwal, New Age International Publishers.
3. Modern Elementary Statistics, Freund J.E. 2005, Pearson Publication
4. Fundamentals of Applied Statistics (3rd Edition), Gupta and Kapoor, S.Chand and Sons, New Delhi, 1987.
5. An Introductory Statistics, Kennedy and Gentle
6. Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). The World Press Pvt. Ltd., Calcutta

Semester I**Paper-II****CSST 112 :Mathematical Statistics**

No. of Credits : 2

No. of lectures: 40

TOPICS/CONTENTS:**UNIT 1:Theory of Probability****(10L)**

- 1.1 Counting Principles, Permutation, and Combination.
- 1.2 Deterministic and non-determination models.
- 1.3 Random Experiment, Sample Spaces (Discrete and continuous)
- 1.4 Events: Types of events, Operations on events.
- 1.5 Probability - classical definition, probability models, axioms of probability, probability of an event.
- 1.6 Theorems of probability (without proof)
 - i) $0 \leq P(A) \leq 1$ ii) $P(A) + P(A') = 1$ iii) $P(\Phi) = 0$ iv) $P(A) \leq P(B)$ when $A \subset B$
 - iv) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- 1.7 Numerical problems related to real life situations.

UNIT 2: Conditional Probability and Independence**(8L)**

- 2.1 Concepts and definitions of conditional probability, multiplication theorem
 $P(A \cap B) = P(A) \cdot P(B|A)$
- 2.2 Bayes' theorem (without proof). True positive, false positive and sensitivity of test as application of Bayes' theorem.
- 2.3 Concept of Posterior probability, problems on posterior probability.
- 2.4 Concept and definition of independence of two events.
- 2.5 Numerical problems related to real life situations.

UNIT 3: Random Variable**(10L)**

- 3.1 Definition of random variable (r.v.), discrete and continuous random variable.
- 3.2 Definition of probability mass function (p.m.f.) of discrete r.v. and Probability density function of continuous r.v..
- 3.3 Cumulative distribution function (c.d.f.) of discrete and continuous r.v. and their properties. (Characteristic properties only)

3.4 Definition of expectation and variance of discrete and continuous r.v., theorem on expectation and variance (statement only).

3.4 Determination of median and mode using p.m.f. only.

3.5 Numerical problems related to real life situations.

UNIT 4 : Standard Discrete Distributions

(12L)

4.1 Discrete Uniform Distribution: definition, mean, variance.

4.2 Binomial Distribution: definition, mean, variance, additive property, Bernoulli distribution as a particular case with $n = 1$.

4.3 Geometric Distribution (p.m.f $p(x) = pq^x$, $x = 0, 1, 2, \dots$): definition, mean, variance.

4.4 Poisson Distribution: definition, mean, variance, mode, additive property, limiting case of $B(n, p)$

4.5 Illustration of real life situations.

4.6 Numerical problems related to real life situations.

* Only statement of mean and variance, derivation is not expected.

References:

1. A First course in Probability, Sheldon Ross. Pearson Education Inc.
2. Statistical Methods (An Introductory Text), Medhi J. 1992, New Age International.
3. Modern Elementary Statistics, Freund J.E. 2005, Pearson Publication.
4. Probability, Statistics, Design of Experiments and Queuing Theory with Applications of Computer Science Trivedi K.S. 2001, Prentice Hall of India, New Delhi.
5. Fundamentals of Mathematical Statistics (3rd Edition), Gupta S. C. and Kapoor V. K. 1987 S. Chand and Sons, New Delhi.
6. Mathematical Statistics (3rd Edition), Mukhopadhyay P. 2015, Books And Allied (P), Ltd.
7. Introduction to Discrete Probability and Probability Distributions, Kulkarni M.B., Ghatpande S.B. 2007, SIPF Academy
8. Programmed Statistics, B.L. Agarwal, New Age International Publishers.

Semester I**Paper-III****CSST113: Statistics Practical**

No. of Credits : 1.5

TOPICS/CONTENTS

Pre-requisites: Knowledge of the topics in theory papers I and II

Objectives: At the end of the course students are expected to be able

- i) To tabulate and make frequency distribution of the given data.
- ii) To use various graphical and diagrammatic techniques and interpret.
- iii) To compute various measures of central tendency, dispersion, Skewness and kurtosis.
- iv) To fit the Binomial and Poisson distributions.
- v) To compute the measures of attributes.
- vi) The process of collection of data, its condensation and representation for real life data.
- vii) To study free statistical softwares and use them for data analysis in project.

Sr. No.	Title of the practical
1	Tabulation and construction of frequency distribution. (Use of at least two data sets more than 50 observations- each for constructing frequency distribution)
2	Diagrammatic and graphical representation using EXCEL and data interpretation. (problems on the basis of SET and NET examination in Paper I to be taken)
3	Summary statistics for ungrouped data and comparison for consistency using EXCEL.
4	Summary statistics for grouped frequency distribution. (Problems based on central tendency, dispersion, measures of skewness: Karl Pearson's and Quartile measure to be covered)
5	Measure of Skewness and kurtosis based on moments.
6	Fitting of Binomial distribution and computation of expected frequencies. (Use the observed and expected frequencies for the next semester χ^2 test)
7	Fitting of Poisson distribution and computation of expected frequencies. (Use the observed and expected frequencies for the next semester χ^2 for test.) (Give one data set for fitting both Poisson and Binomial distributions.)
8	Measure of attributes. (Two attributes only)
9	Study of free statistical softwares and writing a report on it. (individual activity)
10	Project(Part-I) -Data collection, its condensation and representation.

Notes:

- 1) For project, a group of maximum 8 students be made.
- 2) All the students in a group are given equal marks for project.
- 3) Different data sets from primary or secondary sources may be collected.

Semester II**Paper-I****CSST 121 :Methods of Applied Statistics**

No. of Credits: 2 No. of lectures: 40

TOPICS/CONTENTS:**UNIT 1:Correlation (For ungrouped data) (10L)**

1.1 Concept of bivariate data, scatter diagram, its interpretation, concept of correlation, Positive correlation, negative correlation, zero correlation.

1.2 Karl Pearson's coefficient of correlation, properties of correlation coefficient, Interpretation of correlation coefficient, coefficient of determination with interpretation.

1.3 Spearman's rank correlation coefficient (formula with and without ties).

1.4 Numerical problems

UNIT 2: Regression (for ungrouped data) (12L)

2.1 Concept of linear and nonlinear regression.

2.2 Illustrations, appropriate situations for regression and correlation

2.3 Linear regression :Fitting of both lines of regression using least square method.

2.4 Concept of regression coefficients.

2.5 Properties of regression coefficients : $b_{xy} \cdot b_{yx} = r^2$, $b_{xy} \cdot b_{yx} \leq 1$, $b_{xy} = r (\sigma_x / \sigma_y)$

and $b_{yx} = r (\sigma_y / \sigma_x)$.

2.6 Nonlinear regression models: Second degree curve, exponential curves of the type $Y=ab^x$ and $Y=ax^b$.

2.7 Numerical problems related to real life situations

UNIT3: Multiple Regression and Multiple, partial Correlation (For Trivariate Data)(10L)

3.1 Concept of multiple regressions, Yule's Notations.

3.2 Fitting of multiple regression planes.[Derivation of equation to the plane of regression of X_1 on X_2 and X_3 is expected. Remaining two equations to be written analogously.]

3.3 Concept of partial regression coefficients, interpretations.

3.4 Concept of multiple correlation: Definition of multiple correlation coefficient and its formula..

3.5 Concept of partial correlation. Definition of partial correlation coefficient and its formula.

UNIT4: Time series**(8L)**

4.1 Meaning and utility

4.2 Components of time series

4.3 Additive and multiplicative models

4.4 Methods of estimating trend : moving average method, least squares method and exponential smoothing method(with graph and interpretation).

4.5 Numerical problems related to real life situations

References:

- 1 Introduction to Linear Regression Analysis, Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining, Wiley
- 2 Time Series Methods, Brockwell and Davis, Springer, 2006.
- 3 Time Series Analysis, 4th Edition, Box and Jenkin, Wiley, 2008.
- 4 Fundamentals of Applied Statistics (3rd Edition), Gupta and Kapoor, S. Chand and Sons, New Delhi, 1987.
- 5 Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). The World Press Pvt. Ltd., Calcutta

Semester II**Paper-II****CSST122: Continuous Probability Distributions and Testing of Hypotheses**

No. of Credits : 2

No. of lectures: 40

TOPICS/CONTENTS:**UNIT 1:Standard Continuous Probability Distributions (10L)**

1.1 Uniform Distribution: statement of p.d.f., mean, variance, nature of probability curve.

Theorem (without proof): The distribution function of any continuous r.v. if it is invertible follows $U(0, 1)$ distribution

1.2 Exponential Distribution: statement of p.d.f. of the form, $f(x) = (1/\theta) e^{-x/\theta}$, mean, variance, nature of probability curve, lack of memory property. (with proof)

1.3 Paratodistribution :Form of pdf $f(x):\alpha/ x^{(\alpha+1)}$; $x \geq 1, \alpha > 0$. Mean, variance, symmetry, applications

1.3 Normal Distribution: statement of p.d.f., identification of parameters, nature of probability density curve, standard normal distribution, symmetry, distribution of $aX+b$, $aX+bY+c$ where X and Y are independent normal variables, computations of probabilities using normal probability table, normal approximation to binomial and Poisson distribution, central limit theorem (statement only), normal probability plot. Box Muller transformation

1.4 Numerical problems related to real life situations.

UNIT 2:Concepts and definitions related to testing of hypothesis (4L)

2.1 Concepts of population and sample.

2.2 Definitions: random sample from a probability distribution, parameter, statistic, standard error of estimator.

2.3 Concept of null hypothesis and alternative hypothesis (Research hypothesis), critical region, level of significance, type I and type II error, one sided and two sided tests, Test of hypothesis, p-value.

UNIT 3:Parametric Tests**(20L)**

1.1 Large Sample Tests

3.1.1 $H_0: \mu = \mu_0$ Vs $H_1: \mu \neq \mu_0, \mu < \mu_0, \mu > \mu_0$ (One sided and two sided tests)3.1.2 $H_0: \mu_1 = \mu_2$ Vs $H_1: \mu_1 \neq \mu_2, \mu_1 < \mu_2, \mu_1 > \mu_2$ (One sided and two sided tests)3.1.3 $H_0: P = P_0$ Vs $H_1: P \neq P_0, P < P_0, P > P_0$ (One sided and two sided tests)3.1.4 $H_0: P_1 = P_2$ Vs $H_1: P_1 \neq P_2, P_1 < P_2, P_1 > P_2$ (One sided and two sided tests)

3.1.5 Numerical problems related to real life situations.

3.2 Test based on F- distribution

3.2.1 F-test for testing significance of equality of two population variances.

3.3 Tests based on t – distribution

3.3.1 $H_0: \mu_1 = \mu_2$ Vs $H_1: \mu_1 \neq \mu_2, \mu_1 < \mu_2, \mu_1 > \mu_2$ (One sided and two sided tests)

3.3.2 Paired t-test.

3.4 Tests based on Chi square distribution

3.4.1 Chi-square test for goodness of fit

3.4.2 Test for independence of attributes (mxn and 2x2)

3.5 Numerical problems related to real life situations.

UNIT 4 :Simulation (6L)

4.1 Introduction, concept of simulation , random numbers, pseudo random numbers , Advantages , Disadvantages of Simulation. Applications

4.2 Methods of simulation, Linear congruential generator and simulation from Uniform, Exponential and Normal Distribution.

References

1. A First course in Probability, Sheldon Ross.Pearson Education Inc.
2. Statistical Methods (An Introductory Text),Medhi J. 1992 , New Age International.
3. Modern Elementary Statistics ,Freund J.E. 2005, Pearson Publication.
4. Probability, Statistics, Design of Experiments and Queuing Theory with Applications of Computer Science,Trivedi K.S. 2001,Prentice Hall of India, New Delhi.
- 5.Gupta S. C.and Kapoor V. K.1987 Fundamentals of Mathematical Statistics(3rd Edition)S. Chand and Sons,New Delhi.
6. Mukhopadhyay P. 2015, Mathematical Statistics (3rd Edition), Books And Allied (P), Ltd.
7. Simulation Modelling and Analysis Law A. M. and Kelton W.D. 2007,Tata McGraw Hill.
8. Programmed Statistics, B.L. Agarwal, New Age International Publishers.
9. Common Statistical Tests Kulkarni M.B.,Ghatpande, S.B.,Gore S.D.1999 Satyajeet Prakashan,

Semester II

Paper-III

CSST 123: Statistics Practical

No. of Credits : 1.5

Pre-requisites: Knowledge of the topics in theory papers I and II

Objectives: At the end of the course students are expected to be able

- i) To understand the relationship between two variables using scatter plot.
- ii) To compute coefficient of correlation, coefficient of regression.
- iii) To fit various regression models and to find best fit.
- iv) To fit the Normal distribution.
- v) To understand the trend in time series and how to remove it.
- vi) To apply inferential methods for real data sets.
- vii) To generate model sample from given distributions.
- viii) To understand the importance and functions of different statistical organizations in the development of nation.

Sr. No.	Title of the Practical
1	Linear correlation and regression (use of scatter plot for explaining the linear relationship between two variables)
2	Fitting of non-linear regression. (use of scatter plot for explaining the non-linear relationship between two variables)
3	Fitting of normal distribution and computation of expected frequencies.
4	Fitting of linear regression model (Simple and Multiple) and non-linear regression models and finding the best fit by using EXCEL.
5	Model sampling from continuous uniform, exponential and normal distributions using Excel.
6	Large sample tests.
7	F test, t test, χ^2 test using EXCEL (one problem each with equal and unequal variance) (χ^2 test – for goodness of fit-use fitted problems of Binomial, Poisson and Normal distribution in previous practical problems)
8	Time Series- Estimation of trend by using the method of moving averages
9	Write a report on application of some statistical technique in the field of computers.(individual activity)
10	Project (Part-II) - Analysis of data collected in semester-I

Notes:

- i) For project, a group of maximum 8 students be made.
- ii) All the students in a group are given equal marks for project.
- iii) Students will be asked to use Statistical methods which they have learnt and use of free statistical software for data analysis.



Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Computer Science

(Faculty of Science & Technology)

S.Y.B.Sc. (Computer Science)

**Choice Based Credit System Syllabus
To be implemented from Academic Year
2020-2021**

S. Y. B. Sc.(Computer Science)**Semester III**
(Total credits=22)

Course type	Paper Code	Paper title	Credits	Evaluation		
				CA	UE	TOTAL
CC-VIII	CS 231	Data Structures and Algorithms – I	2	15	35	50
	CS 232	Software Engineering	2	15	35	50
	CS 233	Practical course on CS 231 and CS 232	2	15	35	50
CC-IX		Mathematics - I	2	15	35	50
		Mathematics - II	2	15	35	50
		Practical course in Mathematics	2	15	35	50
CC-X		Electronics - I	2	15	35	50
		Electronics - II	2	15	35	50
		Practical course in Electronics	2	15	35	50
AECC-I		Environment Science – I	2			
AECC-II		Language Communication – I	2			

Semester IV***(Total credits=22)***

Course type	Paper Code	Paper title	Credits	Evaluation		
				CA	UE	TOTAL
CC-XI	CS 241	Data Structures and Algorithms – II	2	15	35	50
	CS 242	Computer Networks - I	2	15	35	50
	CS 243	Practical course on CS 241 and CS 242	2	15	35	50
CC-XII		Mathematics - I	2	15	35	50
		Mathematics - II	2	15	35	50
		Practical course in Mathematics	2	15	35	50
CC-XIII		Electronics - I	2	15	35	50
		Electronics - II	2	15	35	50
		Practical course in Electronics	2	15	35	50
AECC-I		Environment Science – II	2			
AECC-II		Language Communication –II	2			

- Each theory Lecture time for S.Y. B.Sc Computer Science is of 50 min (3 lectures/ week for 2 credit course)
- Each practical session time for S.Y. B.Sc Computer Science is of 4 hrs 20 minutes (260 min)
- Practical batch size =12

<p style="text-align: center;">Savitribai Phule Pune University S.Y.B.Sc. (Computer Science) Computer Science Paper - I Course Code: CS 231 Title : Data Structures and Algorithms – I</p>		
Teaching Scheme 3 Lectures / week (50 mins duration)	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
<p>Prerequisites: Basic knowledge of algorithms and problem solving Knowledge of C Programming Language</p>		
<p>Course Objectives</p> <ol style="list-style-type: none"> 1. To learn the systematic way of solving problem 2. To understand the different methods of organizing large amount of data 3. To efficiently implement the different data structures 4. To efficiently implement solutions for specific problems 5. To apply linear data structures. 		
<p>Course Outcomes: On completion of the course, student will be able to</p> <ol style="list-style-type: none"> 1. To use well-organized data structures in solving various problems. 2. To differentiate the usage of various structures in problem solution. 3. Implementing algorithms to solve problems using appropriate data structures. 		
Course Contents		
Chapter 1	Introduction to Data Structures and Algorithm Analysis	4 lectures
<p>1.1 Introduction</p> <ol style="list-style-type: none"> 1.1.1 Need of Data Structure 1.1.2 Definitions - Data and information, Data type, Data object, ADT, Data Structure 1.1.3 Types of Data Structures <p>1.2 Algorithm analysis</p> <ol style="list-style-type: none"> 1.2.1 Space and time complexity, Graphical understanding of the relation between different functions of n, examples of linear loop, logarithmic, quadratic loop etc. 1.2.2 Best, Worst, Average case analysis, Asymptotic notations (Big O, Omega Ω, Theta θ), Problems on time complexity calculation. 		
Chapter 2	Array as a Data Structure	10 lectures
<p>2.1 ADT of array, Operations</p> <p>2.2 Array applications - Searching</p> <ol style="list-style-type: none"> 2.2.1 Sequential search, variations - Sentinel search, Probability search, ordered list search 2.2.2 Binary Search 2.2.3 Comparison of searching methods <p>2.3 Sorting Terminology- Internal, External, Stable, In-place Sorting</p> <ol style="list-style-type: none"> 2.3.1 Comparison Based Sorting - Lower bound on comparison based sorting, Methods- Bubble Sort, Insertion Sort, Selection Sort, Algorithm design strategies - Divide and Conquer strategy, Merge Sort, Quick Sort, complexity analysis of sorting methods. 		

2.3.2 Non Comparison Based Sorting: Counting Sort, Radix Sort, complexity analysis.		
2.3.3 Comparison of sorting methods		
Chapter 3	Linked List	10 lectures
3.1 List as a Data Structure, differences with array.		
3.2 Dynamic implementation of Linked List, internal and external pointers		
3.3 Types of Linked List – Singly, Doubly, Circular		
3.4 Operations on Linked List - create, traverse, insert, delete, search, sort, reverse, concatenate, merge, time complexity of operations.		
3.5 Applications of Linked List – polynomial representation, Addition of two polynomials		
3.6 Generalized linked list – concept, representation, multiple-variable polynomial representation using generalized list.		
Chapter 4	Stack	6 lectures
4.1 Introduction		
4.2 Operations – init(), push(), pop(), isEmpty(), isFull(), peek(), time complexity of operations.		
4.3 Implementation- Static and Dynamic with comparison		
4.4 Applications of stack		
4.4.1 Function call and recursion, String reversal, palindrome checking		
4.4.2 Expression types - infix, prefix and postfix, expression conversion and evaluation (implementation of infix to postfix, evaluation of postfix)		
4.4.3 Backtracking strategy - 4 queens problem (implementation using stack)		
Chapter 5	Queue	6 lectures
5.1 Introduction		
5.2 Operations - init(), enqueue(), dequeue(), isEmpty(), isFull(), peek(), time complexity of operations, differences with stack.		
5.3 Implementation - Static and Dynamic with comparison		
5.4 Types of Queue - Linear Queue, Circular Queue, Priority Queue, Double Ended Queue (with implementation)		
5.5 Applications – CPU Scheduling in multiprogramming environment, Round robin algorithm		
Reference Books:		
1. Classic Data Structures-D. Samanta, Prentice Hall India Pvt. Ltd.		
2. Fundamentals of Data Structures in C- Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, 2 nd Edition, Universities Press.		
3. Data Structures using C and C++-Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum, Pearson Education		
4. Data Structures: A Pseudo code approach with C, Richard Gilberg, Behrouz A. Forouzan, Cengage Learning.		
5. Introduction to Data Structures in C-Ashok Kamthane, Pearson Education		
6. Algorithms and Data Structures, Niklaus Wirth, Pearson Education		

Savitribai Phule Pune University S.Y.B.Sc. (Computer Science) Computer Science Paper -II Course Code: CS 232 Title : Software Engineering		
Teaching Scheme 3 lectures / week (50 mins duration)	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
Prerequisites ER Modeling		
Course Objectives 1. To get knowledge and understanding of software engineering discipline. 2. To learn analysis and design principles for software project development.		
Course Outcomes On completion of the course, student will be able to- 1. Compare and chose a process model for a software project development. 2. Identify requirements analyze and prepare models. 3. Prepare the SRS, Design document, Project plan of a given software system.		
Course Contents		
Chapter 1	Title : Introduction To Software Engineering and Process Models	8 lectures
1.1 Definition of Software 1.2 Nature of Software Engineering 1.3 Changing nature of software 1.4 Software Process 1.4.1 The Process Framework 1.4.2 Umbrella Activities 1.4.3 Process Adaptation 1.5 Generic Process Model 1.6 Prescriptive Process Models 1.6.1 The Waterfall Model 1.6.2 Incremental Process Models 1.6.3 Evolutionary Process Models 1.6.4 Concurrent Models 1.6.5 The Unified Process		
Chapter 2	Title : Agile Development	5lectures
2.1 What is Agility? 2.2 Agile Process 2.2.1 Agility Principles 2.2.2 The Politics Of Agile Development 2.2.3 Human Factors 2.3 Extreme Programming(XP) 2.3.1XP Values 2.3.2XP Process 2.3.3 Industrial XP		

2.4 Adaptive Software Development(ASD)		
2.5 Scrum		
2.6 Dynamic System Development Model (DSDM)		
2.7 Agile Unified Process (AUP)		
Chapter 3	Title : Requirements Analysis	7 lectures
3.1 Requirement Elicitation,		
3.2 Software requirement specification (SRS)		
3.2.1 Developing Use Cases (UML)		
3.3 Building the Analysis Model		
3.3.1 Elements of the Analysis Model		
3.3.2 Analysis Patterns		
3.3.3 Agile Requirements Engineering		
3.4 Negotiating Requirements		
3.5 Validating Requirements		
Chapter 4	Title : Requirements Modeling	10 lectures
4.1 Introduction to UML		
4.2 Structural Modeling		
4.2.1 Use case model		
4.2.2 Class model		
4.3 Behavioral Modeling		
4.3.1 Sequence model		
4.3.2 Activity model		
4.3.3 Communication or Collaboration model		
4.4 Architectural Modeling		
4.4.1 Component model		
4.4.2 Artifact model		
4.4.3 Deployment model		
Chapter 5	Title : Design Concepts	6lectures
5.1 Design Process		
5.1.1 Software Quality Guidelines and Attributes		
5.1.2 Evolution of Software Design		
5.2 Design Concepts		
5.2.1 Abstraction		
5.2.2 Architecture		
5.2.3 Patterns		
5.2.4 Separation of Concerns		
5.2.5 Modularity		
5.2.6 Information Hiding		
5.2.7 Functional Independence		
5.2.8 Refinement		
5.2.9 Aspects		
5.2.10 Refactoring		
5.2.11 Object Oriented Design Concepts		
5.2.12 Design Classes		
5.2.13 Dependency Inversion		
5.2.14 Design for Test		
5.3 The Design Model		
5.3.1 Data Design Elements		
5.3.2 Architectural Design Elements		

- 5.3.3 Interface Design Elements
- 5.3.4 Component-Level Diagram
- 5.4.5 Deployment-Level Diagram

Reference Books:

1. Software Engineering : A Practitioner's Approach - Roger S. Pressman, McGraw hill(Eighth Edition) ISBN-13: 978-0-07-802212-8, ISBN-10: 0-07-802212-6
2. A Concise Introduction to Software Engineering - Pankaj Jalote, Springer ISBN: 978-1-84800-301-9
3. The Unified Modeling Language Reference Manual - James Rumbaugh, Ivar Jacobson, Grady Booch ISBN 0-201-30998-X

<p style="text-align: center;">Savitribai Phule Pune University S.Y.B.Sc. (Computer Science) Computer Science Paper - III Course Code: CS 233 Title : Practical course on CS 231 (Data Structures and Algorithms I) and CS 232 (Software Engineering)</p>		
Teaching Scheme 4 hrs 20 mins / week Batch Size : 12	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
<p>Operating Environment: For Data Structures:</p> <ul style="list-style-type: none"> • Operating system: Linux • Editor: Any linux based editor like vi, gedit etc. • Compiler : cc or gcc <p>Lab Book: The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.</p> <p>Programming Assignments: Programs should be done individually by the student in their respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.</p> <p>Assessment: Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include-timely completion, performance, innovation, efficient codes and good programming practices.</p> <ul style="list-style-type: none"> • Internal Evaluation : <ul style="list-style-type: none"> ○ 10 marks will be given based on a mini project of Software Engineering. ○ 5 marks will be allocated for Assignment completion and practical attendance. • University Evaluation : <ul style="list-style-type: none"> ○ The Practical slip will be of 35 Marks which will be based on Data structures. 		
Course Contents:		
<p>Suggested Assignments for Data Structures – I</p> <p>Assignment1: Searching Algorithms Implementation of searching algorithms to search an element using: Linear Search, Sentinel Search, Binary Search (with time complexity)</p> <p>Assignment 2: Sorting Algorithms - I Implementation of sorting algorithms: Bubble Sort, Insertion Sort, Selection Sort</p> <p>Assignment 3: Sorting Algorithms - II Implementation of sorting algorithms: Quick Sort, Merge Sort , Counting Sort</p>		

Assignment 4: Singly Linked List

1. Dynamic implementation of Singly Linked List to perform following operations: Create, Insert, Delete, Display, Search, Reverse
2. Create a list in the sorted order.

Assignment 5: Doubly Linked List

1. Dynamic implementation of Doubly circular Linked List to perform following operations: Create, Insert, Delete, Display, Search

Assignment 6: Linked List Applications

1. Merge two sorted lists.
Addition of two polynomials in a single variable.

Assignment 7: Stack

1. Static and Dynamic implementation of Stack to perform following operations: Init, Push, Pop, Peek, Isempty, Isfull

Assignment 8: Applications of Stack

1. Implementation of an algorithm that reverses string of characters using stack and checks whether a string is a palindrome.
2. Infix to Postfix conversion.
3. Evaluation of postfix expression.

Assignment 9: Linear Queue

1. Static and Dynamic implementation of linear Queue to perform following operations: Init, enqueue, dequeue Peek, IsEmpty, IsFull.

Assignment 10: Circular and Priority Queue

1. Implementation of circular queue
2. Implementation of priority queue

Suggested Assignments for Software Engineering mini Project**3**

1. Prepare detailed statement of problem for the selected mini project
2. Identify suitable process model for the same.
3. Develop Software Requirement Specification for the project.
4. Identify scenarios and develop UML Use case
5. Other artifacts: Class Diagram, activity diagram, sequence diagram, component diagram and any other diagrams as applicable to the project.

Sample project titles: (These are just samples, students are suggested to take up different case studies)

1. Online mobile recharge system
2. Credit calculation system
3. Image sharing and editing system
4. Internal examination system
5. e-learning management system

<p style="text-align: center;">Savitribai Phule Pune University S.Y.B.Sc. (Computer Science) Computer Science Paper - I Course Code: CS 241 Title : DATA STRUCTURES AND ALGORITHMS-II</p>		
Teaching Scheme 3 Lectures / week (50 mins. duration)	No. of Credits 02	Examination Scheme IE : 15 marks UE: 35 marks
Prerequisites : <ul style="list-style-type: none"> • Knowledge of C Programming Language • Basic knowledge of algorithms • Basic knowledge of linear data structures 		
Course Objectives <ul style="list-style-type: none"> • To learn the systematic way of solving problems • To design algorithms • To understand the different methods of organizing large amount of data • To efficiently implement the non-linear data structures 		
Course Outcomes: On completion of this course students will be able to <ul style="list-style-type: none"> • Implementation of different data structures efficiently • Usage of well-organized data structures to handle large amount of data • Usage of appropriate data structures for problem solving 		
Course Contents		
Chapter 1	Tree	10 lectures
1.1 Concept and Terminologies 1.2 Types of Binary trees - Binary tree, skewed tree, strictly binary tree, full binary tree, complete binary tree, expression tree, binary search tree, Heap 1.3 Representation – Static and Dynamic 1.4 Implementation and Operations on Binary Search Tree - Create, Insert, Delete, Search, Tree traversals– preorder, inorder, postorder (recursive implementation), Level-order traversal using queue, Counting leaf, non-leaf and total nodes, Copy, Mirror. 1.5 Applications of trees <ul style="list-style-type: none"> 1.5.1 Heap sort, implementation 1.5.2 Introduction to Greedy strategy, Huffman encoding (implementation using priority queue) 		
Chapter 2	Efficient Search Trees	8 lectures
2.1 Terminology: Balanced trees - AVL Trees, Red Black tree, splay tree, Lexical search tree -Trie 2.2 AVL Tree- concept and rotations 2.3 Red Black trees - concept, insertion and deletion. 2.4 Multi-way search tree - B and B+ tree - Insertion, Deletion		
Chapter 3	Graph	12 lectures
3.1 Concept and terminologies 3.2 Graph Representation –Adjacency matrix, Adjacency list, Inverse Adjacency list, Adjacency multilist 3.3 Graph Traversals – Breadth First Search and Depth First Search (with implementation) 3.4 Applications of graph		

3.4.1 Topological sorting 3.4.2 Use of Greedy Strategy in Minimal Spanning Trees (Prims and Kruskals algorithm) 3.4.3 Single source shortest path - Dijkstra's algorithm 3.4.4 Dynamic programming strategy, All pairs shortest path - Floyd Warshall algorithm 3.4.5 Use of graphs in social networks		
Chapter 4	Hash Table	6 lectures
4.1 Concept of hashing 4.2 Terminologies – Hash table, Hash function, Bucket, Hash address, collision, synonym, overflow etc. 4.3 Properties of good hash function 4.4 Hash functions : division function, MID square , folding methods 4.5 Collision resolution techniques 4.5.1 Open Addressing - Linear probing, quadratic probing, rehashing 4.5.2 Chaining - Coalesced , separate chaining		
Reference Books:		
<ol style="list-style-type: none"> 1. Fundamentals of Data Structures in C- Ellis Horowitz, SartajSahni, Susan Anderson-Freed, 2nd Edition, Universities Press. 2. Data Structures using C and C++-YedidyahLangsam, Moshe J. Augenstein, Aaron M. Tenenbaum, Pearson Education 3. Data Structures: A Pseudo code approach with C, Richard Gilberg ,Behrouz A. Forouzan, Cengage Learning. 4. Introduction to Data Structures in C-Ashok Kamthane, Pearson Education 5. Algorithms and Data Structures, Niklaus Wirth, Pearson Education 6. Introduction to Algorithms—Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein--MIT Press 7. Fundamentals of Computer Algorithms-- Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, Universities Press 8. The Algorithm Design Manual - Steven S Skiena, Springer 		

Savitribai Phule Pune University S.Y.B.Sc. (Computer Science) Computer Science Paper - I Semester II Course Code: CS 242 Title : Computer Networks-I		
Teaching Scheme 3 lectures / week (50 mins. duration)	No. of Credits 02	Examination Scheme IE : 15 marks UE: 35 marks
Prerequisites Principles of Digital Electronics Communication Principles		
Course Objectives To prepare students with basic networking concepts: data communication, protocols and standards, various topologies and applications of network.		
Course Outcomes <ol style="list-style-type: none"> 1. Have a good understanding of the OSI and TCP/IP Reference Models and in particular have a good knowledge of Layers. 2. Understand the working of various protocols. 3. Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies 		
Course Contents		
Chapter 1	Introduction to Networks and Network Models	4 lectures
1.1 Data communication, components, data representation 1.2 Networks, network criteria, network types - LAN, WAN, Switching, The Internet, Accessing the Internet 1.3 Network Software- Protocol hierarchies, Design Issues of the layer, Connection Oriented and Connectionless Services, 1.4 Reference models - OSI Reference Models, TCP/IP Reference model, Connection devices in different layers, Comparison of OSI and TCP/IP Reference Models.		
Chapter 2	Lower Layers	10 lectures
2.1 Communication at the physical layer, data rate limits - Noiseless channel (Nyquist bit rate), noisy channel (Shannon capacity), Performance - bandwidth, throughput, latency, bandwidth-delay product, jitter 2.2 Design issues of Data Link Layer, Services - Framing, flow control, error control, congestion control, Link layer addressing 2.3 Framing Methods - Character Count, Flag bytes with Byte Stuffing, Flags bits with Bit Stuffing, Physical Layer Coding Violations 2.4 The Channel allocation problem, Static and dynamic allocation, Media Access Methods - Taxonomy of multiple-access protocols 2.5 Switching and TCP/IP layers, Types - circuit switching, packet switching and message switching 2.6 Wired LANs - Standard Ethernet characteristics, Addressing, Access method, implementation, Fast and Gigabit Ethernet 2.7 Wireless LANs - Architectural comparison, Characteristics, Access control, IEEE 802.11		

architecture, Physical layer, MAC sublayer, Bluetooth architecture, Layers		
Chapter 3	Network Layer	12 lectures
<p>3.1 Network layer services - Packetizing, Routing and forwarding, other services</p> <p>3.2 Open and closed loop congestion control</p> <p>3.3 IPv4 addressing- Address space, classful addressing, Subnetting, Supernetting, classless addressing, Network address resolution (NAT)</p> <p>3.4 Forwarding of IP packets- based on destination address, based on label</p> <p>3.5 Network Layer Protocols- Internet Protocol (IP), IPv4 datagram format, Fragmentation, options</p> <p>3.6 Mobile IP-addressing, agents, Three phases</p> <p>3.7 Next Generation IP- IPv6 address representation, address space, address types, IPv6 protocol, packet format, extension header, Difference between IPv4 and IPv6</p> <p>3.8 Routing - General idea, Algorithms - Distance vector routing, link state routing, path-vector routing</p>		
Chapter 4	Transport Layer	10 Lectures
<p>4.1 Transport layer Services- Process-to-process communication, Addressing, Encapsulation and decapsulation, Multiplexing and demultiplexing, Flow control, Pushing or pulling, Flow control, Buffers, Sequence numbers, Acknowledgements, sliding window, congestion control</p> <p>4.2 Connectionless and Connection-oriented service, Port numbers</p> <p>4.3 Transport layer protocols- User datagram protocol, user datagram, UDP services</p> <p>4.4 Transmission Control Protocol - TCP Services, TCP Features, TCP Segment format, three-way handshake for connection establishment and termination, State transition diagram, windows in TCP.</p>		
Reference Books:		
<ol style="list-style-type: none"> 1. Computer Networks-Andrew S. Tanenbaum, 5th Edition, Pearson Education 2. Data Communication and Networking- BehrouzFourouzan, 5th Edition, McGraw Hill Pvt. Ltd. 		

Savitribai Phule Pune University S.Y.B.Sc. (Computer Science) Computer Science Paper - III Course Code: CS 243 Title : Practical course on CS 241(Data Structures and Algorithms II) and CS 242 (Computer Networks I)		
Teaching Scheme 4 hrs 20 mins / week Batch size : 12	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
<p>Lab Book: The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.</p> <p>Programming Assignments: Programs should be done individually by the student in the respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.</p> <p>Assessment: Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include-timely completion, performance, innovation, efficient codes and good programming practices.</p> <ul style="list-style-type: none"> • Internal Evaluation : <ul style="list-style-type: none"> ○ 10 marks will be given based on Networking assignments. ○ 5 marks will be allocated for Assignment completion and practical attendance • University Evaluation : <ul style="list-style-type: none"> ○ The Practical slip will be of 35 Marks which will be based on Advanced Data structures. <p>Operating Environment: For Data Structures:</p> <ul style="list-style-type: none"> • Operating system: Linux • Editor: Any linux based editor like vi, gedit etc. • Compiler : cc or gcc 		
Course Contents :-		

Assignment 1 Binary Search Tree and Traversals

1. Implement Binary Search Tree (BST) to perform following operations on BST– Create, Recursive Traversals - Inorder, Preorder, Postorder
2. Perform following operations: insert, delete

Assignment 2 Binary Search Tree Operations

1. Implement Binary Search Tree (BST) to perform following operations on BST–copy and mirror image of BST, counting leaf, non-leaf and total nodes.
2. Level-order traversal of binary search tree using queue.

Assignment 3 Applications of Binary Tree

1. Sort set of elements using Heap sort
2. Encode a set of characters using Huffman encoding

Assignment 4 Graph implementation

1. Implement Graph as adjacency matrix and adjacency list
2. Calculate indegree and outdegree of vertices
3. Graph traversals: BFS and DFS.

Assignment 5 Graph Applications - I

1. Implementation of Topological sorting
2. Implementation of Prims/Kruskals Minimum spanning tree algorithm

Assignment 6 Graph Applications - II

1. Implementation of Dijkstra's shortest path algorithm for finding Shortest Path from a given source vertex using adjacency cost matrix.
2. Implementation of Floyd Warshall algorithm for all pairs shortest path.

Assignment 7 Hash Table

1. Implementation of static hash table with Linear Probing.
2. Implementation of static hash table with chaining.

Assignment 8 Hash Table-2

1. Implementation of linked hash table with chaining.

Assignment 9 Networking Assignment**Assignment 10 Networking Assignment**

University of Pune
Board of Studies in Mathematics
S. Y. B. Sc. (Computer Science)
Syllabus of Mathematics

Introduction:

Savitribai Phule Pune University, Pune has decided to change the syllabi of various faculties from June, 2020. Taking into consideration the rapid changes in science and technology and new approaches in different areas of mathematics and related subjects Board of studies in Mathematics with concern of teachers of Mathematics from different colleges affiliated to Savitribai Phule Pune University, Pune has prepared the syllabus of S.Y.B.Sc. Computer Science Mathematics. To develop the syllabus the U.G.C. Model curriculum is followed.

Aims:

- i) Give the students a sufficient knowledge of fundamental principles ,methods and a clear perception of innumerable power of mathematical ideas and tools and know how to use them by modeling ,solving and interpreting.
- ii) Reflecting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science.
- iii) Enhancing students overall development and to equip them with mathematical modeling abilities, problem solving skills , creative talent and power of communication necessary for various kinds of employment .
- iv) Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.

Objectives:

- (i) A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology and recognize basic geometrical figures and graphical displays, state important facts resulting from their studies.
- (ii) A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning.
- (iii) A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical Sciences.

(iv) A student be able to apply their skills and knowledge, that is, translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.

(v) A student should be made aware of history of mathematics and hence of its past, present and future role as part of our culture.

* **Medium of Instruction:** English

* **Eligibility:** F.Y.B.Sc. Computer Science, as per University rules.

Structure of the course:

Semester - I			Semester -II	
Paper I	MTC-231	Groups and Coding Theory	MTC-241	Computational Geometry
Paper II	MTC-232	Numerical Techniques	MTC-242	Operations Research
Paper III	MTC-233	Mathematics Practical: Python Programming Language-I	MTC-243	Mathematics Practical: Python Programming Language-II

* All three above courses are compulsory.

* **External Students:** Not allowed.

* **Variation / Revaluation:** Allowed for Paper- I and Paper-II.

* **Qualifications for Teacher:** M.Sc. Mathematics (with NET /SET as per existing rules)

Equivalence of Previous syllabus along with new syllabus:

	Semester-III		Semester-IV	
	New Course	Old Course	New Course	Old Course
Paper I	MTC-231: Groups and Coding Theory	MTC-211 : Applied Algebra	MTC-241: Computational Geometry	MTC-221: Computational Geometry
Paper II	MTC-232: Numerical Techniques	MTC-212: Numerical Analysis	MTC-242: Operations Research	MTC-222: Operations Research

Paper III	MTC-233: Mathematics Practical: Python Programming Language-I	MTC-213 : Mathematics Practical	MTC-243: Mathematics Practical: Python Programming Language-II	MTC-223: Mathematics Practical
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Semester III

MTC-231 : Groups and Coding Theory

Unit 1. Integers **[05 Lectures]**

- 1.1 Division Algorithm (without Proof)
- 1.2 G.C.D. using division algorithm and expressing it as linear combination
- 1.3 Euclid's lemma
- 1.4 Equivalence relation (revision), Congruence relation on set of integers, Equivalence class partition

Unit 2. Groups **[03 Lectures]**

- 2.1 Binary Operation
- 2.2 Group: Definition and Examples
- 2.3 Elementary Properties of Groups

Unit 3. Finite Groups and Subgroups **[10 Lectures]**

- 3.1 Order of a group, order of an element
- 3.2 Examples $(\mathbb{Z}_n, +)$ and $(U(n), *)$
- 3.3 Subgroup definition, Finite subgroup test, subgroups of \mathbb{Z}_n
- 3.4 Generator, cyclic group, finding generators of \mathbb{Z}_n (Corollary 3,4 without proof)
- 3.5 Permutation group, definition, composition of two permutations, representation as product of disjoint cycles, inverse and order of a permutation, even/ odd permutation
- 3.6 Cosets: Definition, Examples and Properties, Lagrange Theorem (without Proof)

Unit 4. Groups and Coding Theory **[18 Lectures]**

- 4.1 Coding of Binary Information and Error detection
- 4.2 Decoding and Error Correction
- 4.3 Public Key Cryptography

Text Books:-

1. **Contemporary Abstract Algebra By J. A, Gallian (Seventh Edition)**
Unit 1: Chapter 0, Unit 2: Chapter 2, Unit 3: Chapter 3 ,4, 5 and 7
2. **Discrete Mathematical Structures By Bernard Kolman, Robert C. Busby and Sharon Ross (6th Edition) Pearson Education Publication**
Unit 4: Chapter 11

MTC-232 : Numerical Techniques

Unit 1: Algebraic and Transcendental Equation

[04 Lectures]

- 1.1 Introduction to Errors
- 1.2 False Position Method
- 1.3 Newton-Raphson Method

Unit 2: Calculus of Finite Differences and Interpolation

[16 Lectures]

- 2.1 Differences
- 2.2. Forward Differences
- 2.3 Backward Differences
- 2.4 Central Differences
- 2.5 Other Differences (δ , μ operators)
- 2.6 Properties of Operators
- 2.7 Relation between Operators
- 2.8 Newton's Gregory Formula for Forward Interpolation
- 2.9 Newton's Gregory Formula for Backward Interpolation
- 2.10 Lagrange's Interpolation Formula
- 2.11 Divided Difference
- 2.12 Newton's Divided Difference Formula

Unit 3: Numerical Integration

[08 Lectures]

- 3.1 General Quadrature Formula
- 3.2 Trapezoidal Rule
- 3.3 Simpson's one-Third Rule
- 3.4 Simpson's Three-Eight Rule

Unit 4: Numerical Solution of Ordinary Differential Equation

[08 Lectures]

- 4.1 Euler's Method
- 4.2 Euler's Modified Method
- 4.3 Runge-Kutta Methods

Text Book:-

1. A textbook of Computer Based Numerical and Statistical Techniques, by A. K.

Jaiswal and Anju Khandelwal. New Age International Publishers.

Unit 1: Chapter 2: Sec. 2.1, 2.5, 2.7

Unit 2: Chapter 3: Sec. 3.1, 3.2, 3.4, 3.5, Chapter 4: Sec. 4.1, 4.2, 4.3,
Chapter 5: Sec. 5.1, 5.2, 5.4, 5.5

Unit 3: Chapter 6: Sec. 6.1, 6.3, 6.4, 6.5, 6.6, 6.7

Unit 4: Chapter 7: Sec. 7.1, 7.4, 7.5, 7.6

Reference Books:-

1. S.S. Sastry; Introductory Methods of Numerical Analysis, 3rd edition, Prentice Hall of India, 1999.
2. H.C. Saxena; Finite differences and Numerical Analysis, S. Chand and Company.
3. K.E. Atkinson; An Introduction to Numerical Analysis, Wiley Publications.
4. Balguruswamy; Numerical Analysis.

MTC-233: Mathematics Practical: Python Programming Language-I

Unit 1: Introduction to Python

1.1 Installation of Python

1.2 Values and types: int, float and str,

1.3 Variables: assignment statements, printing variable values, types of variables.

1.4 Operators, operands and precedence: +, -, /, *, **, % PEMDAS(Rules of precedence)

1.5 String operations: + : Concatenation, * : Repetition

1.6 Boolean operator:

1.6.1 Comparison operators: ==, !=, >, =, <=

1.6.2 Logical operators: and, or, not

1.7 Mathematical functions from math, cmath modules.

1.8 Keyboard input: input() statement

Unit 2: String, list, tuple

2.1 Strings:

2.1.1 Length (Len function)

2.1.2 String traversal: Using while statement, Using for statement

2.1.3 String slice

2.1.4 Comparison operators (>, <, ==)

2.2 Lists:

2.2.1 List operations

2.2.2 Use of range function

2.2.3 Accessing list elements

2.2.4 List membership and for loop

2.2.5 List operations

2.2.6 Updating list: addition, removal or updating of elements of a list

2.3 Tuples:

- 2.3.1 Defining a tuple,
- 2.3.2 Index operator,
- 2.3.3 Slice operator,
- 2.3.4 Tuple assignment,
- 2.3.5 Tuple as a return value

Unit 3: Iterations and Conditional statements

- 3.1 Conditional and alternative statements, Chained and Nested Conditionals: if, if-else, if-elif-else, nested if, nested if-else
- 3.2 Looping statements such as while, for etc, Tables using while.
- 3.3 Functions:
 - 3.3.1 Calling functions: type, id
 - 3.3.2 Type conversion: int, float, str
 - 3.3.3 Composition of functions
 - 3.3.4 User defined functions, Parameters and arguments

Unit 4: Linear Algebra

- 4.1 Matrix construct, eye(n), zeros(n,m) matrices
- 4.2 Addition, Subtraction, Multiplication of matrices, powers and invers of a matrix.
- 4.3 Accessing Rows and Columns, Deleting and Inserting Rows and Columns
- 4.4 Determinant, reduced row echelon form, nullspace, column space, Rank
- 4.5 Solving systems of linear equations (Gauss Elimination Method, Gauss Jordan Method, LU- decomposition Method)
- 4.6 Eigenvalues, Eigenvectors, and Diagonalization

Unit 5: Numerical methods in Python

- 5.1 Roots of Equations
- 5.2 Newton-Raphson Method
- 5.3 False Position (Regula Falsi) Method
- 5.4 Numerical Integration:
 - 5.1.1 Trapezoidal Rule,
 - 5.1.2 Simpson's 1/3rd Rule,
 - 5.1.3 Simpson's 3/8th Rule

Text Books:-

1. Downey, A. et al., **How to think like a Computer Scientist: Learning with Python, John Wiley, 2015.**
Sections: 1, 2, 3
2. Robert Johansson, **Introduction to Scientific Computing in Python**
Section: 4

Reference Books:-

1. Lambert K. A., **Fundamentals of Python - First Programs, Cengage Learning India, 2015.**
2. Guzdial, M. J., **Introduction to Computing and Programming in Python, Pearson**

India.

- 3. Perkovic, L., Introduction to Computing Using Python, 2/e, John Wiley, 2015.**
- 4. Zelle, J., Python Programming: An Introduction to Computer Science, Franklin, Beedle & Associates Inc.**
- 5. Sandro Tosi, Matplotlib for Python Developers, Packt Publishing Ltd.(2009)**

Practicals:

Practical 1: Introduction to Python, Python Data Types-I (Unit 1)

Practical 2: Python Data Types- II (Unit 2)

Practical 3: Control statements in Python-I (Unit 3- 3.1, 3.2)

Practical 4: Control statements in Python-II (Unit 3- 3.3)

Practical 5: Application : Matrices (Unit 4 – 4.1-4.3)

Practical 6: Application : Determinants, system of Linear Equations (Unit 4- 4.4, 4.5)

Practical 7: Application : System of equations (Unit 4- 4.5)

Practical 8: Application : Eigenvalues, Eigenvectors (Unit 4 – 4.6)

Practical 9: Application : Eigenvalues, Eigenvectors (Unit 4 – 4.6)

Practical 10: Application : Roots of equations (Unit 5 – 5.1)

Practical 11: Application : Numerical integration (Unit 5 – 5.2, 5.3)

Practical 12: Application : Numerical integration (Unit 5 – 5.4)

Semester - IV

MTC-241: Computational Geometry

Unit 1. Two dimensional transformations:

[12 Lectures]

- 1.1 Introduction.
- 1.2 Representation of points.
- 1.3 Transformations and matrices.
- 1.4 Transformation of points.
- 1.5 Transformation of straight lines
- 1.6 Midpoint Transformation
- 1.7 Transformation of parallel lines
- 1.8 Transformation of intersecting lines
- 1.5 Transformation: rotations, reflections, scaling, shearing.
- 1.6 Combined transformations.
- 1.7 Transformation of a unit square.
- 1.8 Solid body transformations.
- 1.9 Translations and homogeneous coordinates.
- 1.10 Rotation about an arbitrary point.
- 1.11 Reflection through an arbitrary line.

Unit 2. Three dimensional transformations:

[08 Lectures]

- 2.1 Introduction.
- 2.2 Three dimensional – Scaling, shearing, rotation, reflection, translation.
- 2.3 Multiple transformations.
- 2.4 Rotation about – an axis parallel to coordinate axes, an arbitrary line
- 2.5 Reflection through – coordinate planes, planes parallel to coordinate planes , an arbitrary plane

Unit 3. Projection [08 Lectures]

- 3.1 Orthographic projections.
- 3.2 Axonometric projections.
- 3.3 Oblique projections
- 3.4 Single point perspective projection

Unit 4. Plane and space Curves: [08 Lectures]

- 4.1 Introduction.
- 4.2 Curve representation.
- 4.3 Parametric curves.
- 4.4 Parametric representation of a circle and generation of circle.
- 4.5 Bezier Curves – Introduction, definition, properties (without proof), Curve fitting (up to $n = 3$), equation of the curve in matrix form (upto $n = 3$)

Textbook:

1. D. F. Rogers, J. A. Adams, Mathematical elements for Computer graphics, Mc Graw Hill Intl Edition.

Unit 1: Chapter 2: Sec. 2-1 to 2.17

Unit 2: Chapter 3: Sec. 3.1 to 3.10,

Unit 3: Chapter 3: Sec. 3.12 to 3.14

Unit 4: Chapter 4: Sec. 4.1, 4.2, 4.5, Chapter 5: Sec. 5.1, 5.8

Reference books:

1. Computer Graphics with OpenGL, Donald Hearn, M. Pauline Baker, Warren Carithers, Pearson (4th Edition)
2. Schaum Series, Computer Graphics.

MTC-242: Operations Research

Unit 1: Linear Programming Problem I [12 Lectures]

- 1.1 Introduction Definition and Examples
- 1.2 Problem solving using Graphical method
- 1.3 Theory of Linear Programming, Slack and surplus variables, Standard form of LPP, Some important definitions, Assumptions in LPP, Limitations of Linear programming, Applications of Linear programming, Advantages of Linear programming Techniques
- 1.4 Simplex method, Big- M-method

Unit 2: Linear Programming Problem II [08 Lectures]

- 2.1 Special cases of LPP : Alternative solution, Unbounded solution, Infeasible solution
- 2.2 Duality in Linear Programming, Primal to dual conversion, Examples

Unit 3: Assignment Models [06 Lectures]

- 3.1 Assignment Model -Introduction
- 3.2 Hungarian method for Assignment problem

Unit 4: Transportation Models [10 Lectures]

- 4.1 Introduction, Tabular representation

- 4.2 Methods of IBFS (North-West rule, Matrix-minima, Vogel's Approximation), Algorithms
- 4.3 The Optimality Test of Transportation Model (MODI method only)

Text Book:-

Operation Research (12th Edition), by S.D.Sharma.

- Unit 1: Chapter 1: Sec. 1.1, 1.3-1, 1.3-2, 1.5, 1.6, 1.8, 1.9, 1.10, 1.11, 1.12,
Chapter 3: Sec. 3.1, 3.2, 3.3, 3.4, 3.5-4,
- Unit 2: Chapter 3: Sec. 3.8-1,3.8-2, Chapter 5: Sec. 5.1-1, 5.2-1,5.3,5.7-1, 5.7-2
- Unit 3: Chapter 9: Sec. 9.1, 9.2, 9.4-1, 9.4-2, 9.5, 9.6, 9.7-1, 9.7-2
- Unit 4: Chapter 10: 10.1, 10.2, 10.5, 10.8-1,10.9, 10.10

Reference Books:-

1. Operations Research by H. A. Taha
2. Operations Research by R. Panneerselvam, Prentice Hall of India.
3. Principles of Operations Research by H. M. Wagner, Prentice Hall of India.
4. Operations Research by Gupta and Hira.
5. Operation Research by J.K. Sharma

MTC-243: Mathematics Practical: Python Programming Language-II

Unit 1: 2D, 3D Graphs

- 1.1 Installation of numpy, matplotlib packages
- 1.2 Graphs plotting of functions such as ... etc.
- 1.3 Different formats of graphs.
- 1.3 Three-dimensional Points and Lines
- 1.4 Three-dimensional Contour Plots
- 1.5 Wireframes and Surface Plots
- 1.6 Graphs plotting of functions such as... etc.

Unit 2: Computational Geometry

- 1.1 Points: The distance between two points, Lists of Points - the PointList class, Integer point lists, Ordered Point sets, Extreme Points of a PointList, Random sets of Points not in general position
- 1.2 Points: Displaying Points and other geometrical objects, Lines, rays, and line segments, The geometry of line segments, Displaying lines, rays and line segments
- 2.3 Polygon :** Representing polygons in Python, Triangles, Signed area of a triangle, Triangles and the relationships of points to lines, is Collinear, is Left, is Left On, is Right, is Right On, Between
- 2.4 Two dimensional rotation and reflection**
- 2.5 Three dimensional rotation and reflection**
- 2.6 Generation of Bezier curve with given control points

Unit 3: Study of Operational Research in Python

- 3.1 Linear Programming in Python
- 3.2 Introduction to Simplex Method in Python

Practicals:

- Practical 1:** Graph Plotting (Unit 1 – 1.1 – 1.3)
- Practical 2:** Graph Plotting (Unit 1 – 1.4 – 1.7)
- Practical 3:** Application to Computational Geometry (Unit 2 – 2.1)
- Practical 4:** Application to Computational Geometry (Unit 2 – 2.2)
- Practical 5:** Application to Computational Geometry (Unit 2 – 2.3)
- Practical 6:** Study of Graphical aspects of Two dimensional transformation matrix using matplotlib
- Practical 7:** Study of Graphical aspects of Three dimensional transformation matrix using matplotlib
- Practical 8:** Study of Graphical aspects of Three dimensional transformation matrix using matplotlib
- Practical 9:** Study of effect of concatenation of Two dimensional and Three dimensional transformations
- Practical 10:** Generation of Bezier curve using given control points
- Practical 11:** Study of Operational Research in Python (Unit 3.1)
- Practical 12:** Study of Operational Research in Python (Unit 3.2)

Text Books:-

1. Jaan Kiusalaas, **Numerical Methods in Engineering with Python**, Cambridge University Press, (2005)
Sections: 3
2. Robert Johansson, **Introduction to Scientific Computing in Python**
Section: 1
3. Jason Brownlee, **Basics of Linear Algebra for Machine Learning, Discover the Mathematical Language of Data in Python**
Sections: 2

Reference Books:-

1. Lambert K. A., **Fundamentals of Python - First Programs**, Cengage Learning India, 2015.
2. Guzdial, M. J., **Introduction to Computing and Programming in Python**, Pearson India.
3. Perkovic, L., **Introduction to Computing Using Python**, 2/e, John Wiley, 2015.
4. Zelle, J., **Python Programming: An Introduction to Computer Science**, Franklin, Beedle and Associates Inc.
5. Jim Arlow, **Interactive Computational Geometry in Python**

Note:

- (i) In paper -I , paper-II and paper-III, each course is of 50 marks (35 marks theory and 15 marks internal examination).
- (ii) Paper III: Mathematics Practical - MTC-233 and MTC-243 is practical course and

is of 50 marks. Practicals shall be performed on computer.

Examination:

A) Pattern of examination: Paper- I, Paper-II and paper-III: Semesterwise

B) Pattern of question papers: For Paper -I and Paper-II

Q 1. Attempt any 05 out of 07 questions each of 01 marks. [05 Marks]

Q 2. Attempt any 02 out of 04 questions each of 05 marks. [10 Marks]

Q 3. Attempt any 02 out of 04 questions each of 05 marks. [10 Marks]

Q 4. Attempt any 02 out of 04 questions each of 10 marks. [10 Marks]

C) Instructions Regarding Practical:

Paper-III:Mathematics Practical:

(i) Mathematics Practical, external examiner shall be appointed by Savitribai Phule Pune University, Pune.

(ii) The minimum duration of practical examination is 3 hours.

(iii) The semester examination is of 35 marks 15 marks are from internal evaluation (Journal, attendance and viva-voce or internal test etc.)

(iv) The slips for the questions on programming and problem solving using python shall be prepared and provided and these can be used at least for 3 years.

D) Standard of passing:

For Paper- I, Paper-II and Paper -III: 14 Marks out of 35 and 06 marks out of 15 marks and total should be 20 marks for each course.

SAVITRIBAI PHULE PUNE UNIVERSITY
(Formerly University of Pune)



S.Y. B. Sc. (Computer Science), Electronics

Choice Based Credit System Syllabus

To be implemented from
Academic Year 2020-2021

(Under the faculty of Science and Technology)

Savitribai Phule Pune University

(Formerly University of Pune)

SYLLABUS OF

S. Y. B. Sc. (Computer Science), Electronics

Choice Based Credit System

To be implemented from A.Y. 2020-21

Structure of S. Y. B. Sc.(Computer Science) Electronics

Semester	Paper Code	Paper	Paper title	No. of Credit	Lectures/Week	Evaluation		
						CA	UE	Total
III	ELC-231	I	Microcontroller Architecture & Programming	2	3 (each lecture of 50 minutes)	15	35	50
	ELC-232	II	Digital Communication and Networking	2	3 (each lecture of 50 minutes)	15	35	50
	ELC-233	III	Practical Course I	2	1 pract / week (each practical of 04 hours & 20 minutes)	15	35	50
IV	ELC-241	I	Embedded System Design	2	3 (each lecture of 50 minutes)	15	35	50
	ELC-242	II	Wireless Communication and Internet of Things	2	3 (each lecture of 50 minutes)	15	35	50
	ELC-243	III	Practical Course II	2	1 pract / week (each practical of 04 hours & 20 minutes)	15	35	50

S.Y.B.Sc.(Computer Science), Electronics- Semester III
Paper-I: Microcontroller Architecture & Programming (ELC 231)

Objectives:

1. To study the basics of 8051 microcontroller
2. To study the Programming of 8051 microcontroller
3. To study the interfacing techniques of 8051 microcontroller
4. To design different application circuits using 8051 microcontroller

Course Outcomes : On completion of the course, student will be able

1. To write programs for 8051 microcontroller
2. To interface I/O peripherals to 8051 microcontroller
3. To design small microcontroller based projects

COURSE CONTENTS**UNIT- 1: Basics of Microcontroller & Intel 8051 architecture** **[08]**

Introduction to microcontrollers, difference in controller and processor.

Architecture of 8051, Internal block diagram, Internal RAM organization, SFRs, pin functions of 8051, I/O port structure & Operation, External Memory Interface.

UNIT-2: Programming model of 8051 **[10]**

Instruction classification, Instruction set, Addressing Modes: Immediate, register, direct, indirect and relative, assembler directives (ORG, END), features with examples, I/O Bit & Byte programming using assembly language for LED and seven segment display (SSD) interfacing.

Introduction to 8051 programming in C.

UNIT- 3: Timer /Counter, Interrupts **[10]**

Timer / counter: TMOD, TCON, SCON, SBUF, PCON Registers, Timer modes, programming for time delay using mode 1 and mode 2.

Interrupts: Introduction to interrupt, Interrupt types and their vector addresses, Interrupt enable register and interrupt priority register (IE, IP)

UNIT- 4: Interfacing, Serial Communication**[08]**

Programming of serial port without interrupt, Serial Communication: Synchronous and asynchronous serial communication, Use of timer to select baud rate for serial communication. Interfacing : ADC, DAC, LCD, stepper motor.

Recommended books:

1. 8051 microcontroller and Embedded system using assembly and C : Mazidi and McKinley, Pearson publications
2. The 8051 microcontroller – Architecture, programming and applications: K.Uma Rao and Andhe Pallavi, Pearson publications.

S.Y.B.Sc. Computer Science), Electronics, Semester III
Paper-II, Digital Communication and Networking, ELC- 232

Objectives:

1. To introduce to all aspects of data communication system
2. To introduce various digital modulation schemes
3. To identify the need of data coding and error detection/correction mechanism.
4. To study bandwidth utilization techniques : multiplexing and Spectrum spreading
5. To know data link layer protocol: Media Access Control
6. To study OSI and TCP/IP models of Networking.

Course Outcomes : On completion of the course, student will be able

1. Define and explain terminologies of data communication
2. Understand the impact and limitations of various digital modulation techniques
3. To acknowledge the need of spread spectrum schemes.
4. Identify functions of data link layer and network layer while accessing communication link
5. To choose appropriate and advanced techniques to build the computer network

COURSE CONTENTS

UNIT 1: Introduction to Electronic Communication**(9)**

Introduction to Communication: Elements of Communication system, types of noise sources, Electromagnetic spectrum, signal and channel bandwidth,

Types of communication: simplex, half duplex, full duplex, baseband and broadband,

Serial communication: asynchronous and synchronous,

Information Theory: Information entropy, rate of information (data rate, baud rate), channel capacity, Nyquist theorem, Signal to noise ratio, Noise Figure, Shannon theorem,

Error handling codes: Necessity, Hamming code, CRC

UNIT 2: Modulation and Demodulation**(5)**

Introduction to modulation and demodulation: Concept and need of modulation and demodulation,

Digital Modulation techniques: Pulse Code Modulation (PCM), FSK, QPSK, QAM.

UNIT 3: Multiplexing, Spectrum Spreading and Media Access Control (12)

Multiplexing techniques: Frequency division multiplexing, wavelength division multiplexing, Time division multiplexing

Spread Spectrum techniques: Frequency hopping Spread Spectrum, Direct Sequence Spread Spectrum

Media Access Control (MAC):

Random Access Protocol: ALOHA, CSMA, CSMA/CD, CSMA/CA,

Controlled Access Protocols: Reservation, Polling, Token passing,

Channelization Protocols: FDMA, TDMA, CDMA.

UNIT 4: Computer Networking (10)**Introduction to computer networks**

Types of networks : LAN, MAN, WAN, Wireless networks, Switching, Internet,

Network topology : point to point, Star, Ring, Bus, Mesh, Tree, Daisy Chain, Hybrid

Network devices : Repeater, Switch, Networking cables, Router, Bridge, Hub, Brouter, Gateway.

Wired LANs:-

Ethernet: Ethernet protocol, standard Ethernet, 100 MBPS Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet,

Computer network model: OSI and TCP/IP.

Recommended books:

- 1.Communication Electronics: Principles and Applications, Frenzel, Tata Mc Graw Hill publication, 5th edition.
2. Data Communication and Networking, Forouzan, Mc Graw Hill publication, 5th edition
3. Computer Networks, Tanenbaum, PHI publication, 5th edition

**S.Y.B.Sc.(Computer Science), Electronics, Semester III
Paper III, Practical Course (ELC-233)****Objectives:**

1. To get hands on training of Embedded C
2. To study experimentally interfacing of microcontroller
3. To design, build and test modulator and demodulators of digital communication
4. To build and test experimentally various techniques of wired communication
5. To develop practical skills of network setup

Course Outcomes : On completion of the course, student will be able

1. To design and build his/her own microcontroller based projects.
2. To acquire skills of Embedded C programming
3. To know multiplexing and modulation techniques useful in developing wireless application
4. Do build and test own network and do settings.

Guidelines for Practical:

- Practical batch size : 12
- Minimum no of Practical to be performed : 10
- At least five practical from each Group
- Electronics lab should have set up for embedded programming (Computers and microcontroller target and interfacing boards)

COURSE CONTENTS**Group A: (Any 5)**

1. Arithmetic, logical & code conversion problems using assembly/C programming
2. Interfacing of thumbwheel & seven segment display to 8051 microcontroller
3. Traffic light controller using 8051 microcontroller
4. Interfacing LCD to 8051Microcontroller
5. Waveform generation using DAC Interface to 8051Microcontroller

6. Event counter using opto-coupler, seven segment LED/LCD display interface to 8051Microcontroller
7. Speed Control of stepper motor using 8051 microcontroller

Group B: (Any 5)

1. Study of 3 or 4 Bit Pulse Code Modulation technique
2. Study of Frequency Shift Keying
3. Study of Time Division Multiplexing
4. Study of Frequency Division Multiplexing
5. Study of Code Division Multiple Access System
6. Study of Error detection and correction by using Hamming Code technique
7. Study of Computer network components : Cables, Connectors, Routers, Switches, Ethernet and related interfacing cards
8. To study Configuration of IP and MAC address and to study Local Area Network setup

S.Y.B. Sc. (Computer Science), Electronics, Semester IV**Paper I : Embedded System Design (ELC-241)****Objectives:**

1. To understand the concept of Embedded systems.
2. To study the design flow and available tools for an Embedded system.
3. To understand the implementation of embedded system using firmware and hardware components.
4. To acquire programming skills for the development of Embedded system design.
5. To develop practical skills for designing embedded system Applications.

Course Outcomes : On completion of the course, student will be able

1. To understand the difference between general computing and the Embedded systems.
2. To know the fundamentals of embedded systems.
3. Understand the use of Single board Computer (Such as Raspberry Pi) for an embedded system application.
4. Familiar with the programming environment to develop embedded systems and their interfaces with peripheral devices.
5. To develop familiarity with tools used to develop in an embedded environment.

COURSE CONTENTS**Unit 1:Introduction to Embedded systems using single board computers (SBC) (08)**

Single boards computer block diagram, types, Comparison of SBC models, Specifications, I/O devices (Storage, display, keyboard and mouse), Network access devices

Unit 2: Architecture of System on Chip (SOC) (08)

Architecture of SoC, Basic version Broad Coprocessor, Pin Description of Raspberry Pi, Architectural features: CPU Overview, CPU Pipeline stages, CPU Cache Organization, Branch Prediction & Folding (Concept), GPU Overview

Unit 3:Programming using Python (10)

Overview of Rasberian OS (Operating System), Installation, different types of Operating Systems

Basic Python Programming (Script programming): Variable & data types, Flow Control structures, Conditional statements (If...Then...else),
Functions: I/O function (GPIO, Digital), Time functions, Library functions
Basic Arithmetic Programs: Addition, Subtraction, Multiplication, Division

Unit 4 : Interfacing of devices using Python Programming**(10)**

Basic interfacing: LED, Switch, LCD

Internal Advanced: Bluetooth, Wifi, Ethernet,

External advanced: Camera, Serial Communication GSM, Ultrasonic Sensor, PIR, Finger Print reader.

Recommended Books:

1. Raspberry Pi CookBook: Software & Hardware problems and Solutions By Simon Monk(O'Reilly Media Inc.)
2. Raspberry Pi Hardware Reference by Warren Gay (Apress)
3. Raspberry Pi User Guide By Eben Upton, Greath Halfacree (John Wiley & Sons, Inc.)
4. Learning Python with Raspberry Pi, by Alex Bradbury, Ben Everard, John Wiley & Sons, Inc
5. Learn Raspberry Pi programming with Python By Wolfram Donat (Apress)

S.Y.B.Sc.(Computer Science), Electronics, Semester IV
Paper II: Wireless Communication and Internet of Things (ELC242)

Objectives:

1. To learn and understand applications of wireless communication system
2. To learn and understand cellular system
3. To learn and understand architecture of short range Wireless Technologies
4. To learn and understand basics of Internet of Things
5. To study applications of IoT

Course Outcomes: Students will be able to

1. Know working of wireless technologies such as Mobile communication, GSM, GPRS
2. Become familiar with 3G and 4G Cellular Network Technologies for Data Connections.
3. Understand working principles of short range communication application
4. Get introduce to upcoming technology of Internet of Things
5. Explore themselves and develop new IoT based applications

COURSE CONTENTS

Unit1: Wireless Communication: Cellular Telephony (12)**Overview of wireless communication,**

Introduction of cellular telephony system: Frequency reuse, handoff strategies, Co-channel and adjacent channel interference, block diagram of mobile handset

Overview of Cellular Telephony generations: 1G to 5G,3G (W-CDMA, UMTS), 4G(LTE)

GSM: architecture, frame structure, mobility management,

GPRS : architecture, application

Unit 2 : Short Range Wireless Technologies and Location Tracking (12)**Short range Technologies :**

Bluetooth: Bluetooth architecture, Bluetooth protocol stack, Bluetooth frame structure

Zigbee: Architecture, topologies, applications, Z wave: Protocol architecture, applications

RFID: working of RFID system, types of RFID tags, RFID frequencies, applications

Location Tracking: GPS system: components of GPS system (space segment, control segment, user segment), GPS receiver, Applications

Unit 3: IoT Architecture (08)

Introduction to IOT : Evolution of IOT, M2M and/or IOT, Seven layer architecture of IoT, Role of cloud in IoT, cloud topologies, Cloud access, Protocols in IoT, Cross connectivity across IoT system components:

- Device to Gateway-short range Wireless: cellphone as gateway, dedicated wireless Access points
- Gateway to cloud: Long range connectivity, (wired, cellular, Satellite, WAN)
- Direct Device to Cloud connectivity ,

Networking technologies: Low power local area networking (LPLAN), Low power wide area networking (LPWAN) technologies, comparison of LoRa, sigfox NB-IoT, Cat –M.

Unit 4: IoT Applications (04)

Application domains,

Challenges in IoT : Power consumption, Physical security, durability, Secure Connectivity, Secure Data Storage, Data volume, Scalability

Case studies:

Case Study 1: Smart Irrigation system for Agricultural field

Case Study 2:Home Automation

Case Study 3: Smart Cities

Recommended books:

1. Wireless Communications Principles and Practice, Rappaport, Pearson publication
2. Mobile Communications, Jochen Schiller, Pearson publication
3. Internet of Things : Principles and Paradigms, Rajkumar Buyya and Dastjerdi, MK publishers
4. Internet of Things, Mayur Ramgir, Pearson publication

**S.Y.B.Sc.(Computer Science), Electronics, Semester IV
Paper III, Practical Course (ELC-243)****Objectives:**

1. To use basic concepts for building various applications of embedded electronics.
2. To build experimental setup and test the circuits.
3. To develop skills of analyzing test results of given experiments.
4. Developing Trained Personals for educating and training for upcoming graduates in wireless communication.
5. Implement basic IoT applications on embedded platform

Course Outcomes : On completion of the course, students will be able

1. To design and develop own smart applications using Rasberry-Pi
2. To write Python program for simple applications
3. To build own IoT based system

Guidelines :

- Practical batch size : 12
- Minimum no of Practical to be performed : 10
- Eight compulsory experiments: At least four practical from each Group
- One activity equivalent to 2 experiments by the student.
 - a. Continuation of F. Y. activity.
 - b. Electronics project Based on the Theory Courses learnt
 - c. Documentation type experiments
 - d. Presentation/Seminar on Electronics /advanced topic/research topics.

Prerequisite: Rasberry Pi boards, Arduino / LoRa boards

COURSE CONTENTS**Group A (any 4)**

1. Programming of Raspberry Pi to control LEDs attached to the GPIO pins
2. Programming of Raspberry Pi to get feedback from a switch connected to the GPIO pins

3. Programming of Raspberry Pi to detect temperature using temperature sensor

4. Programming of Raspberry Pi to detect light intensity using photocell sensor
5. Programming of Raspberry Pi for Motion detection
6. Programming of Raspberry Pi for image detection

Group B (any 4)

1. Study of GSM system (Message transmission & Reception).
2. To study working of SIM card in GSM handset
3. Study of GPRS system
4. Study of Zig-bee for one application
5. Study of RFID system
6. Introduction to Python programming.
7. To study Arduino based LED switching using mobile
8. Temperature and humidity sensing using Arduino
9. LoRa Interfacing.



Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Botany

(Faculty of Science & Technology)

F.Y.B.Sc. Botany

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course: B. Sc Botany

1. Structure of Course:

Structure B.Sc. Botany syllabus					
Year	Semester	Course Type	Course code	Course Name	Credits
1	1	Compulsory Course	BO 111	Plant life and utilization I	2
			BO 112	Plant morphology and Anatomy	2
			BO 113	Practical based on BO 111 & BO 112	1.5
	2	Compulsory Course	BO 121	Plant life and utilization II	2
			BO 122	Principles of plant science	2
			BO 123	Practical based on BO 121 & BO 122	1.5
2	3	Compulsory Course	BO 231	Botany Theory Paper 1	2
			BO 232	Botany Theory Paper 2	2
			BO 233	Botany Practical Paper	2
	4	Compulsory Course	BO 241	Botany Theory Paper 1	2
			BO 242	Botany Theory Paper 2	2
			BO 243	Botany Practical Paper	2
3	5	Discipline Specific Elective Course	BO 351	Botany Theory Paper 1	2
			BO 352	Botany Theory Paper 2	2
			BO 353	Botany Theory Paper 3	2
			BO 354	Botany Theory Paper 4	2
			BO 355	Botany Theory Paper 5	2
			BO 356	Botany Theory Paper 6	2
			BO 357	Botany Practical Paper 1	2
			BO 358	Botany Practical Paper 2	2
			BO 359	Botany Practical Paper 3	2
	Skill Enhancement course	BO 3510	Botany Theory Paper 7	2	
		BO 3511	Botany Theory Paper 8	2	
3	6	Discipline Specific Elective Course	BO 361	Botany Theory Paper 1	2
			BO 361	Botany Theory Paper 2	2
			BO 362	Botany Theory Paper 3	2
			BO 363	Botany Theory Paper 4	2
			BO 364	Botany Theory Paper 5	2
			BO 365	Botany Theory Paper 6	2
			BO 366	Botany Practical Paper 1	2
			BO 367	Botany Practical Paper 2	2
	BO 368	Botany Practical Paper 3	2		
	Skill Enhancement course	BO 3610	Botany Theory Paper 7	2	
BO 3611		Botany Theory Paper 8	2		

2. Equivalence of Previous Syllabus:

Old Course (2013 Pattern)	New Course (2019 CBCS Pattern)
Fundamentals of Botany: PAPER – I Term- I: Plant Diversity	BO 111 Plant life and utilization I
Botany Theory Paper II Term I – Industrial Botany	BO 112 Plant morphology and Anatomy
Fundamentals of Botany: PAPER - I Term- II: Morphology and Anatomy	BO 121 Plant life and utilization II
Botany Theory Paper II Term- II – Industrial Botany	BO 122 Principles of plant science
F. Y. B. Sc. Botany Practical Paper - III based on Theory Paper I and Paper II	BO 113 Practical based on BO 111 & BO 112 and BO 123 Practical based on BO 121 & BO 122

SEMESTER-I: PAPER-I**BO-111: PLANT LIFE AND UTILIZATION I (30 Lectures)****CREDIT-I****15 Lectures (15 Hours)****1. INTRODUCTION****3 L**

General outline of plant kingdom (**Lower Cryptogams**: Thallophytes- Algae, Fungi & Lichens; **Higher Cryptogams**: Bryophytes and Pteridophytes; **Phanerogams**: Gymnosperms and Angiosperms- Dicotyledons and Monocotyledons). Distinguishing characters of these groups and mention few common examples from each.

2. ALGAE**9 L**

2.1: Introduction

2.2: General Characters

2.3: Classification (Bold and Wynne 1978) up to classes with reasons

2.4: Life Cycle of *Spirogyra* w.r.t. Habit, Habitat, Structure of thallus, structure of typical cell, Reproduction- Vegetative, Asexual and Sexual, systematic position with reasons

2.5: Utilization of Algae in Biofuel Industry, Agriculture, Pharmaceuticals, Food and Fodder

3. LICHENS**3 L**

3.1: Introduction

3.2: General Characters

3.3: Nature of Association, forms- Crustose, Foliose and Fruticose.

3.4: Utilization of lichens.

CREDIT-II**15 Lectures (15 Hours)****4. FUNGI****9 L**

4.1: Introduction

4.2: General Characters

4.3: Classification (Ainsworth, 1973)

4.4: Life Cycle of Mushroom- *Agaricus bisporus* w.r.t. Habit, Habitat, Structure of thallus, Structure of Sporocarp, Structure of Gill, Reproduction- Asexual and sexual, Systematic position.

4.5: Utilization of Fungi in Industry, Agriculture, Food and Pharmaceuticals.

5. BRYOPHYTES**6 L**

5.1: Introduction

5.2: General Characters

5.3: Classification (G.M. Smith 1955)

5.4: Life Cycle of *Riccia* w.r.t. Habit, habitat, external and internal structure of thallus, Reproduction- vegetative, asexual and sexual- Structure of sex organs, fertilization, structure of mature sporophyte, structure of spore, systematic position with reasons.

5.5: Utilization: Bryophytes as ecological indicators, agriculture, fuel, industry and medicine.

(Development of sex organs not expected for all the above mentioned life cycles).

REFERENCES:

1. Ainsworth, Sussman and Sparrow (1973). The Fungi. Vol. IV-A and IV-B. Academic Press.
2. Bilgrami, K.S. and Saha, L.C. (1992) A Textbook of Algae. CBS Publishers and Distributors, Delhi.
3. Gangulee, Das and Dutta (2002). College Botany. Vol. I, New Central Book Agency (P) Ltd.
4. Dube, H.C. (1990). An Introduction to Fungi. Vikas Publishing House Pvt. Ltd., Delhi.
5. Krishnamurty, V. (2000). Algae of India and neighboring countries, Chlorophyta, Oxford and IBH, New Delhi.
6. Parihar, N.S. (1980). Bryophyta, An Introduction of Embryophyta. Vol. I. Central Book Distributors, Allahabad.
7. Puri, P. (1980). Bryophyta: Broad prospective. Atma Ram & Sons, Delhi.
8. Smith, G.M. (1971). Cryptogamic Botany. Vol. I: Algae & Fungi. Tata McGraw Hill Publishing Co., New Delhi.
9. Smith, G.M. (1971). Cryptogamic Botany. Vol. II: Bryophytes & Pteridophytes. Tata McGraw Hill Publishing Co., New Delhi.
10. Vashista, B.R., Sinha, A.K. and Singh, V.B. (2005). Botany for degree students- Algae, S. Chand Publication.
11. Vashista, B.R., Sinha, A.K. and Singh, V.B. (2005). Botany for degree students- Fungi, S. Chand Publication.
12. Vashista, B.R., Sinha, A.K. and Singh, V.B. (2005). Botany for degree students- Bryophytes, S. Chand Publication.

SEMESTER-I: PAPER-II**BO-112: PLANT MORPHOLOGY AND ANATOMY (30 Lectures)****CREDIT-I****15 Lectures (15 hours)****1. MORPHOLOGY:****2 L**

1.1: Introduction, definition, descriptive and interpretative morphology.

1.2: Importance in identification, nomenclature, classification, phylogeny and Plant breeding.

2. MORPHOLOGY OF REPRODUCTIVE PARTS:**2.1: INFLORESCENCE:****3 L**

2.1.1 Introduction and definition

2.1.2 Types:

a) Racemose -Raceme, Spike, Spadix, Corymb, Umbel, Catkin and Capitulum.

b) Cymose -Solitary, Monochasial- Helicoid and scorpioid; Dichasial and Polychasial.

c) Special types -Verticillaster, Cyathium and Hypanthodium.

2.1.3 Significance

2.2: FLOWER:**7 L**

2.2.1 Introduction and definition

2.2.2 Parts of a typical flower: Bract, Pedicel, Thalamus- forms, Perianth- Calyx and Corolla, Androecium and Gynoecium.

2.2.3 Symmetry: Actinomorphic and zygomorphic, Sexuality- Unisexual and bisexual, Insertion of floral whorls on thalamus- Hypogyny, Epigyny and perigyny, Merous condition-Trimerous, tetramerous and pentamerous.

2.2.4 Floral whorls:

a) **Calyx:** Nature- Polysepalous, Gamosepalous; Aestivation- types, Modifications of Calyx- Pappus, Petaloid and Spurred.b) **Corolla:** Forms of Corolla-

i) Polypetalous- Cruciform and Papilionaceous.

ii) Gamopetalous- Infundibuliform, Bilabiate, Tubular and Campanulate.

iii) Aestivation- types and significance.

c) **Perianth:** Nature- Polytepalous, Gamotepalous.d) **Androecium:** Structure of typical stamen, Variations- cohesion and adhesion.e) **Gynoecium:** Structure of typical carpel, number, position, cohesion and adhesion; placentation- types and significance.**2.3: FRUITS:****3 L**

2.3.1 Introduction and definition

2.3.2 Types of fruits:

a) **Simple:** Indehiscent - Achene, Cypsela, Nut and Caryopsis.

Dehiscent - Legume, Follicle and Capsule,

b) **Fleshy:** Drupe, Berry, Hesperidium and Pepo.c) **Aggregate:** Etaerio of Berries and Etaerio of Follicles.d) **Multiple fruits:** Syconus and Sorosis.

CREDIT- II**15 Lectures (15 Hours)****3. ANATOMY:****2 L**

3.1 Introduction and definition

3.2 Importance in Taxonomy, Physiology, Ecological interpretations, Pharmacognosy and Wood identification.

4. TYPES OF TISSUES:**8 L**

Outline with brief description, simple and complex tissues.

4.1: **Meristmatic tissues:** Meristem, characters and types based on origin, position and plane of division, functions.4.2: **Permanent tissues:** Simple tissues - parenchyma, collenchymas, chlorenchyma and sclerenchyma.4.3: **Complex/Vascular tissues:** Components of xylem and phloem, types of vascular bundles and functions.4.4: **Epidermal tissues:** Epidermis, structure of typical stomata, trichomes, motor cells; functions.**5. INTERNAL ORGANIZATION OF PRIMARY PLANT BODY:****5 L**

5.1: Internal structure of dicotyledon and monocotyledon root.

5.2: Internal structure of dicotyledon and monocotyledon stem.

5.3: Internal structure of dicotyledon and monocotyledon leaf.

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BO 113: PRACTICALS BASED ON BO 111 & BO 112 (1.5 CREDITS)

- | | |
|---|------|
| 1. Study of Life Cycle of <i>Spirogyra</i> . | 1 P |
| 2. Study of Life Cycle of <i>Agaricus</i> . | 1 P |
| 3. Study of Life Cycle of <i>Riccia</i> | 1 P. |
| 4. Study of forms of Lichens- Crustose, Foliose and fruticose. | 1 P |
| 5. Study of Mushroom Cultivation. | 1 P |
| 6. One day visit to study Algae, Fungi, Bryophytes and Lichens. | 1 P |
| 7. Study of Inflorescence. | 2 P |
| a. Racemose: Raceme, Spike, Spadix, Catkin, Corymb, Umbel and Capitulum | |
| b. Cymose: Solitary cyme, Uniparous cyme: helicoid and scorpiod, Biparous cyme and Multiparous cyme. | |
| c. Special type: Verticillaster, Hypanthodium and Cyathium. | |
| 8. Study of flower with respect to Calyx, Corolla and Perianth, Androecium and Gynoecium. | 2 P |
| 9. Study of fruits with suitable examples. | 2 P |
| a) Simple fruit: Dry: Achene, Cypsella and Legume; Fleshy: Berry and Drupe. | |
| b) Aggregate fruit: Etaerio of follicles and Etaerio of Berries. | |
| c) Multiple fruit: Syconus and Sorosis. | |
| 10. Study of internal primary structure of dicotyledonous root and stem e.g. Sunflower. | 1 P |
| 11. Study of internal primary structure of monocotyledonous root and stem e.g. Maize. | 1 P |
| 12. Study of internal primary structure of dicotyledonous and monocotyledonous leaf e.g. Sunflower and Maize. | 1 P |

SEMESTER-II: PAPER-I**BO-121: PLANT LIFE AND UTILIZATION-II (30 Lectures)****CREDIT-I****15 Lectures (15 hours)**

1. **INTRODUCTION:** Introduction to plant diversity- Pteridophytes, Gymnosperms and Angiosperms with reference to vascular plants. 3 L
2. **PTERIDOPHYTES:** General characters, Outline classification according to Sporne (1976) up to classes with reasons. Life cycle of *Nephrolepis* w.r.t. Habit, habitat, distribution, morphology, anatomy of stem and leaf, Reproduction – vegetative and sexual. 10 L
3. Utilization and economic importance of Pteridophytes. 2 L

CREDIT-II**15 Lectures (15 hours)**

1. **GYMNOSPERMS:** General characters, Outline classification according to Sporne (1977) up to classes with reasons. Life cycle of *Cycas* w.r.t. Habit, Habitat, Distribution, Morphology and Anatomy of Stem, leaf and reproductive organs- Male cone, Microsporophyll, microspores and megasporophyll, megaspore; structure of seed; Utilization and economic importance of gymnosperms. 8 L
2. **ANGIOSPERMS:** General characters, Outline of classification of Bentham and Hooker's system up to series, comparative account of monocotyledons and dicotyledons. 4L
3. Utilization and economic importance of Angiosperms: In food, fodder, fibers, horticulture and medicines. 3L

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SEMESTER-II: PAPER-II**BO-122: PRINCIPLES OF PLANT SCIENCE (30 Lectures)****CREDIT-1: PLANT PHYSIOLOGY AND CELL BIOLOGY****15 Lectures (15 Hours)**

1. Introduction, definition and scope of plant physiology. 1 L
2. Diffusion – definition, importance of diffusion in plants, imbibition as a special type of diffusion. 1 L
3. Osmosis – definition, types of solutions (hypotonic, isotonic, hypertonic), endosmosis, exo-osmosis, osmotic pressure, turgor pressure, wall pressure, importance of osmosis in plants. 2 L
4. Plasmolysis – definition, mechanism and significance. 1 L
5. Plant growth - introduction, phases of growth, factors affecting growth, 2 L
6. Structure of plant cell, differences between prokaryotic and eukaryotic cell. 2 L
7. Plant cell wall – components of primary cell wall, structure and functions. 1 L
8. Ultrastructure and functions of chloroplast 2 L
9. Cell cycle in plants- importance of cell cycle in plants, divisional stages of mitosis and meiosis. 3 L

CREDIT-II: MOLECULAR BIOLOGY**(15 Lectures) 15 Hours**

1. Introduction and scope of molecular biology, central dogma of molecular biology. 2 L
2. Structure of DNA, nucleoside and nucleotide 2 L
3. Watson Crick model of DNA and its characteristic features, types of DNA (A, B and Z DNA). 3 L
4. Types of chromosomes. 2 L
5. Structure and types of RNA. 3 L
6. DNA replication- Types of replication (conservative, semi-conservative and dispersive), enzymes involved, leading and lagging strands, Okazaki fragments. 3 L

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BO 123: PRACTICALS BASED ON BO 121 & BO 122 (1.5 CREDITS)

- | | |
|---|-----|
| 1. Study of life cycle of <i>Nephrolepis</i> . | 1 P |
| 2. Study of life cycle of <i>Cycas</i> . | 1 P |
| 3. Study of Bentham and Hooker's system of classification outline up to series with example | 1 P |
| 4. Study of comparative account of Dicotyledonous and Monocotyledonous plants w.r.t to external morphological characters. | 1 P |
| 5. Study of utilization and economic importance of Angiosperms- food, fodder, fibers, horticulture and medicines. | 1 P |
| 6. One day visit to study diversity of vegetation. | 2 P |
| 7. To observe characteristic features of prokaryotic and eukaryotic plant cell. | 1 P |
| 8. Staining of suitable nuclear material by Basic Fuchsin | 1 P |
| 9. Study of mitosis- preparation of slides using onion root tips to observe divisional stages. | 1 P |
| 10. Study of meiosis- preparation of slides using <i>Tradescantia/ Rhoec/ Maize /</i> Onion flower buds to observe divisional stages. | 2 P |
| 11. Estimation of chlorophyll-a and chlorophyll-b by using suitable plant material. | 1 P |
| 12. Plasmolysis- endosmosis, exosmosis, incipient plasmolysis using <i>Rhoec</i> leaf peeling and Demonstration of Osmosis- curling experiment. | 1 P |
| 13. Study of DPD by using suitable plant sample | 1 P |



Savitribai Phule Pune University
(Formerly University of Pune)

Three Year B.Sc. Degree Program in Botany
(Faculty of Science & Technology)

S.Y.B.Sc Botany

Choice Based Credit System Syllabus

To be implemented from Academic Year 2020- 2021

Title of the Course: B. Sc Botany**1. Structure of Course:**

Structure B.Sc. Botany syllabus					
Year	Semester	Course Type	Course code	Course Name	Credits
1	1	Compulsory Course	BO 111	Plant life and utilization I	2
			BO 112	Plant morphology and Anatomy	2
			BO 113	Practical based on BO 111 & BO 112	1.5
	2	Compulsory Course	BO 121	Plant life and utilization II	2
			BO 122	Principles of plant science	2
			BO 123	Practical based on BO 121 & BO 122	1.5
2	3	Compulsory Course	BO 231	Taxonomy of Angiosperms and Plant Ecology	2
			BO 232	Plant Physiology	2
			BO 233	Practical based on BO 231 & BO 232	2
	4	Compulsory Course	BO 241	Plant Anatomy and Embryology	2
			BO 242	Plant Biotechnology	2
			BO 243	Practical based on BO 241 & BO 242	2
3	5	Discipline Specific Elective Course	BO 351	Botany Theory Paper 1	2
			BO 352	Botany Theory Paper 2	2
			BO 353	Botany Theory Paper 3	2
			BO 354	Botany Theory Paper 4	2
			BO 355	Botany Theory Paper 5	2
			BO 356	Botany Theory Paper 6	2
			BO 357	Botany Practical Paper 1	2
			BO 358	Botany Practical Paper 2	2
			BO 359	Botany Practical Paper 3	2
			Skill Enhancement course	BO 3510	Botany Theory Paper 7
	BO 3511	Botany Theory Paper 8		2	
3	6	Discipline Specific Elective Course	BO 361	Botany Theory Paper 1	2
			BO 361	Botany Theory Paper 2	2
			BO 362	Botany Theory Paper 3	2
			BO 363	Botany Theory Paper 4	2
			BO 364	Botany Theory Paper 5	2
			BO 365	Botany Theory Paper 6	2
			BO 366	Botany Practical Paper 1	2
			BO 367	Botany Practical Paper 2	2
			BO 368	Botany Practical Paper 3	2
			Skill Enhancement course	BO 3610	Botany Theory Paper 7
	BO 3611	Botany Theory Paper 8		2	

2. Equivalence of Previous Syllabus:

Old Course (2014 Pattern)	New Course (2020 CBCS Pattern)
BO-211: Taxonomy of Angiosperms and Plant community	BO 231: Taxonomy of Angiosperms and Plant Ecology
BO-212: Plant Physiology	BO 232: Plant Physiology
BO-221: Plant Anatomy and Embryology	BO 241: Plant Anatomy and Embryology
BO-222: Plant Biotechnology	BO 242: Plant Biotechnology
Practical based on theory courses (Paper I and Paper II)	Semester III: Practical based on BO 231 & BO 232 Semester IV: Practical based on BO 241 & BO 242

**S.Y.B.Sc. Botany CBCS Pattern
(Semester III, Paper I) 2020-2021**

BO 231: Taxonomy of Angiosperms and Plant Ecology - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
Credit-I		15
1.	Introduction to Angiosperms Taxonomy Definition, scope, objectives and importance of taxonomy Exploration, Description, Identification, Nomenclature and classification Concept of Systematics with brief historical background	02
2.	Systems of classification Comparative account of various systems of classification Artificial system- Carl Linnaeus Natural system- Bentham and Hooker Phylogenetic system- Engler and Prantl APG system- A brief review	05
3.	Study of Plant Families Study of following families with reference to systematic position (As per Bentham and Hooker's system of classification), salient features, floral formula, floral diagram and any five examples with their economic importance – Annonaceae, Brassicaceae, Myrtaceae, Rubiaceae, Solanaceae, Apocynaceae, Nyctaginaceae and Amaryllidaceae	08
Credit-II		15
4.	Botanical Nomenclature Concept of nomenclature, brief history, Binomial nomenclature International Code for Nomenclature of Algae, Fungi and Plants (ICN)- Principles, Rules and Recommendations; 'Type' specimen and its types (Holotype, Paratype, Isotype, Lectotype, Neotype). Concept of Typification. Ranks and endings of taxa names, Coining of Genus and Species names Single, double and multiple authority citations	05
5.	Introduction to ecology Definition, concept, scope, and interdisciplinary approach, autecology and synecology. Species diversity: definition, concept, scope, and types: Alpha, Beta and Gamma diversity. Methods of vegetation sampling: quadrat method, transect method, plot less method Genetic Diversity: definition, nature and origin of genetic variations Species Diversity: definition, origin of species diversity, diversity indices, species abundance Ecosystem Diversity: definition, major ecosystem types of the world, Hotspots in India – concept and basis of 'hotspot' identification.	06
6.	Ecological grouping of the plants Ecological grouping of the plants with reference to their significance of adaptive external and internal features: a) Hydrophytes, b) Mesophytes c) Xerophytes d) Halophytes with examples.	04

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IMPORTANT WEBSITES

THE FAMILIES OF FLOWERING PLANTS- L. Watson and M.J. Dallwitz

<https://www.delta-intkey.com/angio/index.htm>

ANGIOSPERM PHYLOGENY WEBSITE, version 14.

<http://www.mobot.org/MOBOT/research/APweb/>

THE PLANTS OF THE WORLD ONLINE PORTAL

<http://www.plantsoftheworldonline.org/>

INTERNATIONAL PLANT NAME INDEX (IPNI)

<https://www.ipni.org/>

TROPICOS

<https://www.tropicos.org/home>

BIODIVERSITY HERITAGE LIBRARY

<https://www.biodiversitylibrary.org/>

BOTANICUS DIGITAL LIBRARY

<https://www.botanicus.org/>

INTERNET ARCHIVE- DIGITAL LIBRARY

<https://archive.org/>

DATABASE OF PLANTS OF INDIAN SUBCONTINENT

<https://sites.google.com/site/efloraofindia/>

BOTANICAL SURVEY OF INDIA

https://bsi.gov.in/content/1416_1_FloraofIndia.aspx

FLOWERS OF INDIA

<http://www.flowersofindia.net/>

eFLORAS OF WORLD

<http://www.efloras.org/>

**S.Y.B.Sc. Botany CBCS Pattern
(Semester III, Paper II) 2020-2021
BO 232: Plant Physiology - 2 Credits (30 Lectures)**

Credit I:

- | | |
|--|-----------|
| 1. Introduction to Plant Physiology | 2L |
| Scope and applications of plant physiology | |
| 2. Absorption of water | 3L |
| 2.1 Role of water in plants | |
| 2.2 Mechanisms of water absorption with respect to crop plants | |
| 2.3 Factors affecting rate of water absorption | |
| 3. Ascent of sap | 3L |
| 3.1 Introduction and definition. | |
| 3.2 Transpiration pull or cohesion-tension theory, evidences and objections | |
| 3.3 Factors affecting ascent of sap | |
| 4. Transpiration | 7L |
| 4.1 Definition | |
| 4.2 Types of transpiration – cuticular, lenticular and stomatal | |
| 4.3 Structure of stomata | |
| 4.4 Mechanism of opening and closing of stomata –Steward’s hypothesis, active K ⁺ transport mechanism | |
| 4.5 Factors affecting the rate of transpiration | |
| 4.6 Significance of transpiration | |
| 4.7 Antitranspirants | |
| 4.8 Guttation | |
| 4.9 Exudation | |
| Credit II: | |
| 5. Nitrogen metabolism | 7L |
| 5.1 Introduction and role of nitrogen in plants | |
| 5.2 Nitrogen fixation by <i>Rhizobium</i> and BGA | |
| 5.2.1 Symbiotic nitrogen fixation, nitrogenase enzyme- structure and function | |
| 5.2.2 Non-symbiotic nitrogen fixation | |
| 5.3 Importance and production technique of BGA | |
| 5.4 Denitrification, ammonification and nitrification | |
| 5.5 Reductive amination and transamination | |
| 6. Seed dormancy and germination | 4L |
| 6.1 Definition, types of seed dormancy and germination | |
| 6.2 Methods to break seed dormancy | |
| 6.3 Metabolic changes during seed germination | |
| 6.4 Role of phytohormones to improve seed germination | |
| 6.5 Vigor Index | |
| 7. Physiology of flowering | 4L |
| 7.1 Photoperiodism – Concept, definition, short day plants, long day plants and day neutral plants. | |

- 7.2 Phytochrome theory, role of phytohormones in induction and inhibition of flowering
- 7.3 Applications of photoperiodism
- 7.4 Vernalization–concept and definition, mechanism of vernalisation, applications of vernalisation and devernialization

References:

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S.Y.B.Sc. Botany CBCS Pattern
Practical (Semester III Paper III) 2020-2021
BO 233: Practical based on BO 231 & BO 232

Practical based on Taxonomy of Angiosperms and Plant Ecology, and Plant Physiology

Sr. No.	Title	No. of Practical
Taxonomy of Angiosperms and Plant Ecology		
1	Study of tools of taxonomy and ecological instruments (any four each)	1
2	Description of flowering plant in botanical terms	1
3	Study of plant families (any four)	3
4	Study of ecological adaptations in Hydrophytes with any two examples	1
5	Study of ecological adaptations in Xerophytes with any two examples	1
6	Study of vegetation by list count quadrat method.	1
Plant Physiology		
7	Perform phytochemical test for starch and protein in germinating and non germinating seeds	1
8	Isolation of Leaf Protein Concentration (LPC) from suitable plant material.	1
9	Determination of Diffusion Pressure Deficit (DPD)	1
10	Determine rate of transpiration under different conditions of Sunlight, Shade and Wind	1
11	Demonstration of the following a. Commercial biofertilizers b. Imbibition in seeds c. Ringing experiment d. Arc Auxanometer e. Spectrophotometer f. Nitrogen fixing bacteria / BGA (specimen/ slide)	1
12	Calculate seed germination percentage and vigor index	1
13	Botanical excursion tour and visit to Floriculture industry / Soil testing center / Seed testing center	1

N.B. Botanical excursion tour and submission of report along with herbarium of any five weeds of the following (List of Weeds attached).

List of weeds

- Acanthospermum hispidum DC. Asteraceae**
Aerva javanica (Burm.f.) Juss. ex Schult. Amaranthaceae
Aeschynomene americana L. Fabaceae Tropical America
Ageratum conyzoides L. Asteraceae America
Alternanthera paronychioides St. Hill. Amaranthaceae Tropical America
Alternanthera philoxeroides (Mast.) Griseb. Amaranthaceae America
Alternanthera pungens Kunth Amaranthaceae Tropical America
Alternanthera sessilis (L.) R.Br. ex DC. Amaranthaceae Tropical America
Amaranthus spinosus L. Amaranthaceae Tropical America
Antigonon leptopus Hk. & Arn. Polygonaceae America
Argemone mexicana L. Papaveraceae West Indies

Asclepias curassavica L. Apocynaceae Tropical America
Bidens pilosa L. Asteraceae Tropical America
Blainvillea acmella (L.) Philipson Asteraceae Tropical America
Blumea eriantha DC. Asteraceae Tropical America
Blumea lacera (Burm.f.) DC. Asteraceae Tropical America
Boerhavia erecta L. Nyctaginaceae Tropical America
Cardamine hirsuta L. Brassicaceae Tropical America
Cassia absus L. Caesalpiniaceae Tropical America
Cassia occidentalis L. Caesalpiniaceae South America
Cassia pumila Lam. Caesalpiniaceae Tropical America
Cassia tora L. Caesalpiniaceae South America
Celosia argentea L. Amaranthaceae Tropical America
Chrozophora rottleri (Geis.) Spreng. Euphorbiaceae Tropical Africa
Cleome viscosa L. Capparaceae Tropical America
Conyza canadensis (L.) Cronquist Asteraceae South America
Coronopus didymus (L.) Smith Brassicaceae South America
Cronton bonplandianum Baillon Euphorbiaceae South America
Crotalaria pallida Dryand Fabaceae Tropical America
Crotalaria retusa L. Fabaceae Tropical America
Cryptostegia grandiflora R.Br. Apocynaceae Madagascar
Cuscuta chinensis Lam. Cuscutaceae Mediterranean
Cuscuta reflexa Roxb. Cuscutaceae Mediterranean
Cyperus difformis L. Cyperaceae Tropical America
Cyperus iria L. Cyperaceae Tropical America
Datura innoxia Mill. Solanaceae Tropical America
Dicoma tomentosa Cass. Asteraceae Tropical America
Digera muricata (L.) Mart. Amaranthaceae North America
Eclipta prostrata (L.) L. Asteraceae Tropical America
Eichhornia crassipes (Mart.) Solms Pontederiaceae Tropical America
Emilia sonchifolia (L.) DC. Asteraceae Tropical America
Eupatorium adenophorum Spreng. Asteraceae Central America
Eupatorium odoratum L. Asteraceae South America
Euphorbia heterophylla L. Euphorbiaceae Tropical America
Euphorbia hirta L. Euphorbiaceae Tropical America
Galinsoga parviflora Cav. Asteraceae Tropical America
Hyptis suaveolens (L.) Poit. Lamiaceae South America
Ipomoea carnea Jacq. Convolvulaceae Tropical America
Ipomoea hederifolia L. Convolvulaceae Tropical America
Ipomoea obscura (L.) Ker Gawl. Convolvulaceae Tropical Africa
Ipomoea pes-tigridis L. Convolvulaceae Tropical Africa
Lagascea mollis Cav. Asteraceae Tropical America
Lantana camara L. Verbenaceae Tropical America
Malachra capitata (L.) L. Malvaceae Tropical America

Malvastrum coromandelianum (L.) Garcke Malvaceae Tropical America
Martynia annua L. Pedaliaceae Tropical America
Mecardonia procumbens (Mill.) Small Scrophulariaceae Tropical America
Mikania micrantha Kunth Asteraceae Tropical America
Oxalis corniculata L. Oxalidaceae Europe
Parthenium hysterophorus L. Asteraceae Tropical America
Physalis minima L. Solanaceae Tropical America
Pistia stratiotes L. Araceae Tropical America
Portulaca oleracea L. Portulacaceae South America
Prosopis juliflora (Sw.) DC. Mimosaceae Mexico
Ruellia tuberosa L. Acanthaceae Tropical America
Scoparia dulcis L. Scrophulariaceae Tropical America
Solanum nigrum L. Solanaceae Tropical America
Solanum torvum Sw. Solanaceae West Indies
Sonchus oleraceus L. Asteraceae Mediterranean
Spilanthes radicans Jacq. Asteraceae South America
Synedrella nodiflora (L.) Gaertn. Asteraceae West Indies
Tridax procumbens L. Asteraceae Tropical America
Waltheria indica L. Sterculiaceae Tropical America
Xanthium indicum Koenig Asteraceae Tropical America
Youngia japonica (L.) DC. Asteraceae South America

SEMESTER IV**S.Y.B.Sc. Botany CBCS Pattern
(Semester IV, Paper I) 2020-2021****BO 241: Plant Anatomy and Embryology- 2 Credits (30 Lectures)**

Credit-I Plant anatomy:	(15 Lectures)
1. Introduction	2L
1.1 Definition	
1.2 Scope of plant anatomy	
2. Epidermal tissue system	3L
2.1 Structure, types and functions of epidermis	
2.2 Structure, types and functions of Stomata	
2.3 Epidermal outgrowths- non-glandular and glandular	
2.4 Motor cells	
3. Mechanical tissue system	3L
3.1 Principles involved in distribution of mechanical tissues with one example each	
a) Inflexibility,	
b) Incompressibility,	
c) Inextensibility and	
d) Shearing stress	
3.2 Vascular tissue system: Structure and function of xylem, phloem and cambium	
4. Normal secondary growth	3L
4.1 Introduction	
4.2 Normal secondary growth in dicotyledonous stem	
4.3 Development of annual rings, periderm, bark, tyloses and lenticel	
5. Anomalous secondary growth	4L
5.1 Introduction	
5.2 Causes of anomalous secondary growth	
5.3 Anomalous secondary growth in:	
a) Dicotyledonous stem (<i>Bignonia</i>),	
b) Dicotyledonous root (<i>Raphanus</i>),	
c) Monocotyledonous stem (<i>Dracaena</i>)	
Credit-II Plant Embryology	(15 Lectures)
7. Introduction	1L
7.1 Definition and scope of plant embryology	
8. Microsporangium and male gametophyte	4L
8.1 Structure of tetrasporangiate anther	
8.2 Types of tapetum	
8.3 Sporogenous tissue	
8.4 Microsporogenesis: process and its types	
8.5 Types of microspore tetrad	
8.6 Male gametophyte: structure and development of male gametophyte	

9 Megasporangium and female gametophyte	4L
9.1 Structure	
9.2 Types of ovules	
9.3 Types of megaspore tetrads	
9.4 Female gametophyte: structure of typical embryo sac	
9.5 Types of embryo sacs – monosporic, bisporic and tetrasporic	
10. Pollination and Fertilization:	3L
10.1 Introduction and definition	
10.2 Types of pollination	
10.3 Germination of pollen grain	
10.4 Entry of pollen tube- porogamy, mesogamy and chalazogamy	
10.5 Double fertilization and its significance.	
11. Endosperm and embryo	3L
11.1 Endosperm: Types – nuclear, helobial and cellular.	
11.2 Structure of Dicotyledonous and Monocotyledonous embryo.	

References:

1. Plant Anatomy, Chandurkar P J, Plant Anatomy Oxford and IBH publication Co. New Delhi 1971
2. B P Pandey, Plant Anatomy. S Chand and Co. Ltd, New Delhi 1978
3. Greulach V A and Adams J E Plant- An introduction to Modern Biology, Toppen Co. Ltd, Tokyo,
4. Eams and Mc Daniel, An Introduction to Plant Anatomy, McGraw –Hill Book Co. Ltd and Kogakusha Co, Tokyo, Japan
5. Adriance S Foster Practical Plant Anatomy, D Van Nostrand Co. INC, New York
6. Esau, Plant Anatomy, Wiley Toppan Co. California, USA
7. Pijush Roy, Plant Anatomy. New Central Book Agency Ltd, Kolkata
8. Pandey S N and Ajanta Chadha, Plant Anatomy and Embryology, Vikas Publishing House, Pvt, Ltd, New Delhi
9. Bhojwani S S and Bhatnagar S P, An Embryology of Angiosperms
10. Maheshwari P, An introduction to Embryology of Angiosperm
11. Nair P K K Essentials of Palynology.

**S.Y.B.Sc. Botany CBCS Pattern
(Semester IV, Paper II) 2020-2021
BO 242: Plant Biotechnology (2 Cr- 30 Lectures)**

Credit I:

Chapter 1 Introduction to Plant Biotechnology	3L
1.1 History and definition	
1.2 Scope and importance of plant biotechnology	
1.3 Current status of biotechnology in India.	
Chapter 2 Plant Tissue Culture	8L
2.1 Concept of plant tissue culture and cellular totipotency	
2.2 Basic techniques: Types of culture, Media preparation, sterilization, inoculation, incubation, hardening	
2.3 Applications with reference to: Micropropagation, Somaclonal variation, Haploid production, Protoplast fusion & Somatic hybrids, Embryo rescue, Production of secondary metabolites.	
2.4 Commercial Plant Tissue culture laboratories in Maharashtra and India.	
Chapter 3 Single Cell Protein (SCP)	4L
3.1 Concept and definition	
3.2 Importance of proteins in diet	
3.3 Production of SCP from <i>Spirulina</i> and Yeast	
3.4 Importance & acceptability of SCP	
Credit II:	
Chapter 4 Plant Genetic Engineering	5L
4.1 Introduction, concept	
4.2 Tools of genetic engineering (restriction enzymes, ligases, plasmid vectors)	
4.3 Gene cloning Technique	
4.4 Applications of plant genetic engineering: insect pest resistance, abiotic stress tolerance, herbicide resistance	
Chapter 5 Genomics, Proteomics and Bioinformatics	5L
5.1 Genomics- concept, types, methods used for whole genome sequencing	
5.2 Proteomics-concept, types, methods used in proteome analysis	
5.3 Bioinformatics-concept, database and its classification, data retrieval tools.	
Chapter 6 Bioremediation	2L
6.1 Introduction and concept	
6.2 Microbial remediation	
6.3 Phytoremediation	
Chapter 7 Biofuel technology	3L
7.1 Definition, Concept and types of Renewable and nonrenewable energy sources	
7.2 Definition and concept of Biogas, Bioethanol, Biobutanol, Biodiesel & Biohydrogen	

References

1. B.D. Singh (4th Edn 2012) Biotechnology-expanding horizons, Kalyani Publishers.
2. K.S. Bilgrami & A.K. Pandey (2007) Introduction to Biotechnology CBS Publishers and Distributors PVT LTD
3. M.K. Razdan (2002) Introduction to Plant Tissue Culture. Oxford and IBH Publishing Co., New Delhi.
4. H.S. Chawla (2005) Introduction to Plant Biotechnology. Oxford and IBH Publishing Co. New Delhi.

**S.Y.B.Sc. Botany CBCS Pattern
Practical (Semester IV Paper III) 2020-2021
BO 243: Practical based on BO 241 & BO 242**

Sr. No.	Title	No. of Practical
Plant Anatomy and Embryology		
1	Study of epidermal tissue system – non-glandular and glandular trichomes, multilayered epidermis, typical stomata (Dicotyledonous and Monocotyledonous).	2
2	Study of mechanical tissues and their distribution in root, stem and leaves.	1
3	Study of normal secondary growth in dicot stem – <i>Annona /Moringa</i> (Double stained temporary preparation).	1
4	Study of anomalous secondary growth in <i>Bignonia</i> and <i>Dracaena</i> stem (Double stained temporary preparation).	1
5	Study of tetrasporangiate anther and types of ovules with the help of permanent slides	1
6	Study of dicot and monocot embryo.	1
Plant Biotechnology		
7	Instruments/equipments used in plant tissue culture laboratory: Principle and working of Autoclave, oven, laminar air flow cabinet, micropipette, culture bottles/tubes with cotton plug	1
8	Preparation & sterilization of MS medium	1
9	Surface sterilization and Inoculation of nodal sector, leaf, anther and maize embryo	2
10	Laboratory cultivation of <i>Spirulina</i>	1
11	Demonstration practical on transgenic crops viz; Bt-Cotton, Golden rice	1
12	Demonstration of principle and working of agarose gel electrophoresis, centrifuge, spectrophotometer	1
13	Visit to plant tissue culture laboratory	1



Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Mathematics

(Faculty of Science & Technology)

F.Y.B.Sc. (Mathematics)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course: B. Sc (Mathematics)

Preamble:

SavitribaiPhule Pune University has decided to change the syllabi of various faculties from June,2019. Taking into consideration the rapid changes in science and technology and new approaches in different areas of mathematics and related subjects board of studies in mathematics with concern of teachers of mathematics from different colleges affiliated to SavitribaiPhule Pune University has prepared the syllabus of F. Y. B.Sc. Mathematics. To develop the syllabus the U.G.C. Model curriculum is followed.

Aims:

- (i)** Give the students a sufficient knowledge of fundamental principles, methods and a clear perception of innumerable power of mathematical ideas and tools and know how to use them by modeling, solving and interpreting.
- (ii)** Reflecting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science and technology.
- (iii)** Enhancing students' overall development and to equip them with mathematical modeling abilities, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
- (iv)** Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.

Objectives:

- (i)** A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology and recognize basic geometrical figures and graphical displays, state important facts resulting from their studies.
- (ii)** A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning.
- (iii)** A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical Sciences.
- (iv)** A student be able to apply their skills and knowledge, that is, translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
- (v)** A student should be made aware of history of mathematics and hence of its past, present and future role as part of our culture.

Course Outcome:

Upon successful completion of this course, the student will be able to:

- i) The mathematical maturity of students in their current and future courses shall develop.
- ii) The student develops theoretical, applied and computational skills.
- iii) The student gains confidence in proving theorems and solving problems.

Structure of the course:

	Semester - I		Semester -II		Credit
Paper I	MT-111	Algebra	MT-121	Analytical Geometry	2
Paper II	MT-112	Calculus - I	MT-122	Calculus - II	2
Paper III	MT-113	Mathematics Practical	MT-123	Mathematics Practical	1.5

Proposed Structure of S. Y. B. Sc. Mathematics Courses:

	Semester - III		Semester -IV		
Paper I	MT-231	Calculus of Several Variables	MT-241	Linear Algebra-I	2
Paper II	MT-232 (A)	Laplace Transform and Fourier Series	MT-242(A)	Vector Calculus	2
	MT-232 (B)	Computational Geometry	MT-242(B)	Numerical Analysis	2
Paper III	MT-233	Mathematics Practical	MT-243	Mathematics Practical	2

Proposed Structure of T. Y. B. Sc. Mathematics Courses:

	Semester- V		Semester- VI		Credit
MT 351	Matric Spaces	MT 361	Complex Analysis	2	
MT 352	Real Analysis-I	MT 362	Real Analysis-II	2	
MT 353	Problem Course on MT 351 and MT 352	MT 363	Problem Course on MT 361 and MT 362	2	
MT 354	Group Theory-I	MT 364	Ring Theory-I	2	
MT 355	Ordinary Differential Equations-I	MT 365	Partial Differential Equations-I	2	
MT 356	Problem Course on MT 354 and MT 355	MT 366	Problem Course on MT 364 and MT 365	2	

Select Any Two out of six courses				
MT357:A	Operations Research	MT367: A	Optimization Techniques	2
MT357:B	Number Theory	MT367: B	Graph theory	2
MT357:C	C- Programming	MT367: C	Lebesgue Integration	2
MT357:D	Lattice Theory	MT367: D	Financial Mathematics	2
MT357:E	Python Course -I	MT367: E	Python Course-II	2
MT357:F	Machine Learning Course- I	MT367: F	Machine Learning Course- II	2
MT 338	Practical based on papers selected from 357 A to 357 F	MT 348	Practical based on papers selected from 367 A to 367 F	2
MT-3510	Skill Enhancement course in maths	MT- 3511	Skill Enhancement course in maths	2
MT-3610	Skill Enhancement course in maths	MT- 3611	Skill Enhancement course in maths	2

All three above courses are compulsory.

1. Equivalence of Previous syllabus along with new syllabus:

	Old course	New Course
Paper I	MT-101 : Algebra and Geometry	MT-111: Algebra and MT-121 : Analytical Geometry
Paper II	MT-102 : Calculus and Differential Equations	MT-112 : Calculus - I and MT-122 : Calculus – II
Paper III	MT-103 : Mathematics Practical	MT – 113 : Mathematics Practical and MT – 113 : Mathematics Practical

Details of Syllabus:**Semester – I****MT 111- Algebra****Unit 1: Sets Relations and Functions (8 Lectures)**

- 1.1 Sets, Relations, Equivalence relations, Equivalence classes and partitions of a set
- 1.2 Functions, Basic terminology, Types of Functions, Inverse of a Function, Composition of Functions (Excluding theorems only examples).

Unit2: Divisibility Theory in the Integers(10 Lectures)

- 2.1 Mathematical Induction:Well-Ordering Principle.
- 2.2 The Division Algorithm, The Greatest Common Divisor, Euclid's Lemma, The Least Common Multiple, The Euclidean Algorithm.

Unit 3: Primes and the theory of Congruence (8 Lectures)

- 3.1 The Fundamental Number of Arithmetic: Prime Numbers, Euclid's Lemma.
- 3.2 The theory of Congruence: Basic Properties of congruence.
- 3.3 Fermat's Theorem

Unit 4: Complex Numbers (10 Lectures)

- 4.1 Sums and Products, Basic Algebraic Properties, Moduli, Complex Conjugates, Exponential form, Products and Quotients, De-Moivre's theorem.
- 4.2 Roots of Complex Numbers: The n^{th} roots of unity.
- 4.3 Regions in Complex Plane.

Text Books:

1. **A Foundation Course in Mathematics, Ajit Kumar, S. Kumeresan and Bhaba Kumar Sarma, Narosa Publication House.**
Unit 1: Chapter 2: Sec. 2.1 to 2.5, Chapter 3: Sec. 3.1 to 3.6, Chapter 4: Sec. 4.1 to 4.4.
2. **Elementary Number Theory, David M. Burton, Tata McGraw Hill, Sixth Edition.**
Unit 2: Textbook 2: Chapter 1: Sec. 1.1, Chapter 2: Sec. 2.2 to 2.4
Unit 3: Textbook 2: Chapter 3: Sec. 3.1, Chapter 4: Sec. 4.1, 4.2, Chapter 5: Sec. 5.2.
3. **Complex Variables and Applications, James Ward Brown and Ruel V. Churchill, Mc-Graw Hill, Seventh Edition.**

Unit 4: Textbook 3: Chapter 1: Sec 1 to 10.

Reference Books:

1. Textbook of Algebra, S. K. Shah and S. C. Garg, Vikas Publishing House Pvt. Ltd. Edition 2017.
2. Introduction to Real Analysis by R.G. Bartle and D.R. Sherbert, John Wiley and Sons Inc, Fourth Edition.

MT 112: CALCULUS - I**Unit 1: Real Numbers (06 Lectures)**

- 1.1 The Algebraic and Order Properties of \mathbb{R} :
Algebraic properties of \mathbb{R} , Order properties of \mathbb{R} , Well-Ordering Property of \mathbb{N} .
Arithmetic mean-Geometric mean inequality, Bernoulli's inequality.
(Revision: essential properties should be revised with illustrative examples)
- 1.2 Absolute Value and the Real Line:
Absolute value function and its properties, triangle inequality and its consequences, neighborhood of a point on real line.
- 1.3 The Completeness Property of \mathbb{R} :
Definitions of Upper bound, Lower bound, supremum, infimum of subsets of \mathbb{R} , completeness property of \mathbb{R} .
- 1.4 Applications of the Supremum Property:
Archimedean property and its consequences, The density theorem (without proof).

Unit 2. Sequences (10 Lectures)

- 2.1 Sequences and Their Limits:
Definition and examples of sequences of real numbers, Definition of limit of sequence and uniqueness of limit, Examples on limit of sequence.
- 2.2 Limits Theorems:
Definition of bounded sequence, Every convergent sequence is bounded, Algebra of limits.
- 2.3 Monotone Sequences:
Definition and examples of monotone sequences, Monotone convergence theorem and examples.
- 2.4 Subsequences and Bolzano -Weierstrass Theorem:
Definition of subsequence and examples, Divergence criteria, Monotone Subsequence theorem (without proof), Bolzano -Weierstrass theorem (first proof).

Unit 3. Limits (08 lectures)

- 3.1 Functions and their Graphs:

Functions, domain and range, graphs of functions, representing a function numerically, Vertical line test, Piecewise defined functions, increasing and decreasing functions, even and odd functions symmetry, common functions

3.2 Limits of Functions:

Definition of cluster point and examples, definition of limit of a function, sequential criterion for limits, divergence criteria.

3.3 Limit Theorems:

Algebra of limits (proofs using sequential criterion) ,Squeeze theorem.

3.4 Some extension of limit concepts:

one-sided limits, infinite limits (without proof) .

Unit 4: Continuity

(12 lectures)

4.1 Continuous Functions:

Definition of continuous function at a point , sequential criterion for continuity, Divergence criterion, combination of continuous functions.

4.2 Continuous Functions on Intervals:

Properties of continuous functions on an interval, Boundedness theorem (without proof), The minimum -maximum theorem(without proof), Location of root theorem (Without proof), Bolzano's intermediate value theorem. Continuous function maps closed bounded interval to closed bounded interval, Preservation of interval theorem.

Textbook Books:

1. Introduction to Real Analysis by R.G. Bartle and D.R. Sherbert, John Wiley and Sons Inc, Fourth Edition.

Unit 1: Chapter 2: Sec 2.1 (2.1.1 to 2.1.13), Sec. 2.2(2.2.1 to 2.2.9), 2.3, 2.4(2.4.1, 2.4.3 to 2.4.6, 2.4.8, 2.4.9).

Unit 2: Chapter 3: Sec. 3.1(3.1.1 to 3.1.7, 3.1.10, 3.1.11), Sec. 3.2(3.2.1 to 3.2.11), Sec. 3.3(3.3.1, 3.3.4), Sec. 3.4 (3.4.1 to 3.4.3, 3.4.5 to 3.4.8).

Unit 3: Chapter 4: Sec. 4.1(4.1.1, 4.1.3 to 4.1.9), Sec. 4.2(4.2.1 to 4.2.8), Sec. 4.3 (4.3.1 to 4.3.9).

Unit 4: Chapter 5: Sec. 5.1, Sec. 5.2, Sec 5.3 (5.3.1 to 5.3.5, 5.3.7 to 5.3.10).

2. Thomas Calculus, Thirteenth edition, Pearson Publication.

Unit 3: Text book-2: Chapter 1: Sec. 1.1.

Reference books:

- 1 Introduction to Real analysis, William F.Trench, Free edition, 2010.
- 2 Calculus of a single variable Ron Larson , Bruce Edwards, tenth edition.
- 3 Elementary Analysis, The Theory of Calculus, Kenneth A. Ross, Springer Publication, second edition.
- 4 Calculus and its Applications, Marvin L. Bittinger, David J. Ellenbogen and Scott A. Surgent, Addison Wesley, tenth edition.

MT 113: Mathematics Practical

(Practicals based on the applications of articles in MT 111 and MT 112)

In Semester-I, we should conduct 3 written practical and 3 practical on maxima software for each paper MT-111 and MT-112.

List of Practical

Practical 1 : Problems on Unit 1 and Unit 2(Written) from MT-111.

Practical 2 : Problems on Unit 3 (Written) from MT-111.

Practical 3 : Problems on Unit 4(Written) from MT-111.

Practical 4 :Introduction to maxima software forMT-111.

Practical 5 : Problems on unit 1 and unit 2 from MT-111using maxima software.

Practical 6 : Problems on Unit 3 and Unit 4 from MT-111using maxima software.

Practical 7: Problems on Unit 1 and Unit 2(Written) from MT-112.

Practical 8 : Problems on Unit 3 (Written) from MT-112.

Practical 9 : Problems on Unit 4(Written) from MT-112.

Practical 10 :Introduction to maxima software for MT-112.

Practical 11 : Problems on unit 1 and unit 2 from MT-112using maxima software.

Practical 12 : Problems on Unit 3 and Unit 4 from MT-112 using maxima software.

Note:

1 The soft copy of practicals on maxima software will be prepared and provided by the Board of Studies in mathematics.

2. Practical on maxima software can be performed on computer and android mobiles.

3. Android mobiles are allowed for practical examination on maxima software .

4. Practical examination of 25 marks on written problems, 10 marks for problems on maxima software (5 marks for writing syntax and 5 marks to perform the same on android mobile or computer).

Semester - II

MT 121-Analytical Geometry

Unit 1: Analytical Geometry of Two Dimension (10 Lectures)

- 1.1. Change of axes: translation and rotation.
- 1.2. Conic Sections: General equation of second degree in two variables
- 1.3. Reduction to standard form, center of conic, nature of conic.

Unit 2: Planes (10 Lectures)

- 2.1. Direction cosines and direction ratios, Equation of plane, Normal form, Transform to the normal form, Plane passing through three non-collinear points, Intercept form, Angle between two planes.
- 2.2. Distance of a point from a plane, Distance between parallel planes, Systems of planes, two sides of planes, Bisector planes.

Unit 3: Lines in three dimension (8 lectures)

- 3.1. Equations of a line in Symmetric and unsymmetrical forms, Line passing through two points, Angle between a line and a plane.
- 3.2. Perpendicular distance of a point from a plane, Condition for two lines to be coplanar (without proof).

Unit 4: Sphere (8 Lectures)

- 4.1. Equation of a sphere in different forms, plane section of a sphere.
- 4.2. Equation of a circle, sphere through a given circle
- 4.3. Intersection of a sphere and a line, Equation of tangent plane to sphere.

Text Books:

1. **Analytic Geometry in Two and Three Dimensions : Von Steuben**

Unit1: Sec, 8.4

2. **Analytical Solid Geometry: Shantinarayan; S. Chand and Company Ltd, New Delhi, 1998.**

Unit2: Sec. 1.6,1.7, Sec. 2.1 to 2.7

Unit3: Sec. 3.1 to 3.4, 3.7

Unit4: Sec. 6.1 to 6.6.

Reference Book:

1. P.K.Jain and Khalil Ahmad, A Text Book of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd. 1999.

Reference books:

1. Introduction to Real analysis, William F.Trench, Free edition, 2010.
2. Calculus of a single variable Ron Larson , Bruce Edwards, tenth edition.
3. Elementary Analysis, The Theory of Calculus, Kenneth A. Ross, Springer Publication, second edition.
4. Calculus and its Applications, Marvin L. Bittinger, David J. Ellenbogen and Scott A. Surgent, Addison Wesley, tenth edition.
5. Ordinary and partial Differential equations,M.D. Raisingania, S. Chand andCompany,2009.

MT 123: Mathematics Practical

(Practical based on the applications of articles in MT 121 and MT 122)

In Semester-II, we should conduct 4 written practical and 2 practical on maxima software for each paper MT-121 and MT-122.

List of Practical

- Practical 1 : Problems on Unit 1 (Written) from MT-121.
Practical 2 : Problems on Unit 2 (Written) from MT-121.
Practical 3 : Problems on Unit 3(Written) from MT-121.
Practical 4 :Problems on Unit 4(Written) from MT-121.
Practical 5 : Problems on unit 1 and unit 2 from MT-121using maxima software.
Practical 6 : Problems on Unit 3 and Unit 4 from MT-121using maxima software.
Practical 7: Problems on Unit 1 (Written) from MT-122.
Practical 8 : Problems on Unit 2 (Written) from MT-122.
Practical 9 : Problems on Unit 3(Written) from MT-122.
Practical 10 :Problems on Unit 4(Written) from MT-122.
Practical 11 : Problems on unit 1 and Unit 2 from MT-122using maxima software.
Practical 12: Problems on Unit 3 and Unit 4from MT-122 using maxima software.

Note:

- 1 The soft copy of practical on maxima software will be prepared and provided by the Board of Studies in mathematics.
2. Practicals on maxima software can be performed on computer and android mobiles.
3. Android mobiles are allowed for practical examination on maxima software .
- 4.Practical examination 25 marks on written problems, 10 marks for problems on maxima software (5 marks for writing syntax and 5 marks to perform the same on android mobile or computer).

Modalities For Conducting The Practical and The Practical Examination:

- 1) There will be one 3 hour practical session for each batch of 15 students per week.
- 2) The College will conduct the Practical Examination at least 15 days before the commencement of the Main Theory Examination. The practical examination will consist of written examination of 20 marks, 10 marks on maxima software and oral examination of 05 marks.
- 3) There will be no external examiner, the practical exam will be of the duration of 3 hours.
- 4) The subject teacher will set a question paper based on pattern as follows:
 - Q1.** Any 2 out of 4 each question of 5 marks on paper - I.
 - Q2.** Any 2 out of 4 each question of 5 marks on paper - II.
 - Q3.** (a) Any 1 out of 2 each question of 5 marks on maxima software from paper – I.
(b) Any 1 out of 2 each question of 5 marks on maxima software from paper – II.
- 5) Each student will maintain a journal to be provided by the college.
- 7) The internal 15 marks will be given on the basis of journal prepared by student and the cumulative performance of student at practical.
- 8) It is recommended that concept may be illustrated using computer software maxima and graphing calculators wherever possible.
- 9) Study tours may be arranged at places having important mathematical institutes or historical places.
- 10) **Special Instruction:**
 - a) There should be well equipped mathematics practical laboratory of size 20 X 20 sq. fts containing at least 10 computers.
 - b) Examiners should set separate question papers, solutions and scheme of marking for each batch and claim the remuneration as per rule.
 - c) Before starting each practical necessary introduction, basic definitions, intuitive inspiring ideas and prerequisites must be discussed.



Savitribai Phule Pune University, Pune

(Formerly University of Pune)

Second Year B.Sc in Mathematics

(Faculty of Science & Technology)

Revised Syllabi for

S.Y.B.Sc. - Mathematics

(For Colleges Affiliated to Savitribai Phule Pune University, Pune)

Choice Based Credit System Syllabus

To be implemented from the Academic Year 2020-2021

SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
Board of Studies in Mathematics Syllabus for S. Y. B. Sc

Subject: MATHEMATICS
(With effect from June 2020)

Introduction:

Savitribai Phule Pune University, Pune has decided to change the syllabi of various faculties from June 2020. Taking into consideration the rapid changes in science and technology and new approaches in different areas of mathematics and related subjects Board of studies in Mathematics with concern of teachers of Mathematics from different colleges affiliated to Savitribai Phule Pune University, Pune has prepared the syllabus of S.Y.B.Sc. Mathematics. To develop the syllabus the U.G.C. Model curriculum is followed.

Aims:

- Give the students a sufficient knowledge of fundamental principles, methods and a clear perception of innumerable power of mathematical ideas and tools and know how to use them by modeling ,solving and interpreting.
- Reflecting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science.
- Enhancing students overall development and to equip them with mathematical modeling abilities, problem solving skills, creative talent and power of communication necessary for various kinds of employment .
- Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.

Objectives:

- A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology and recognize basic geometrical figures and graphical displays ,state important facts resulting from their studies.
- A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning.
- A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical Sciences.
- A student be able to apply their skills and knowledge, that is, translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
- A student should be made aware of history of mathematics and hence of its past, present and future role as part of our culture.

Eligibility: F. Y. B. Sc., as per University rules.

Structure of the course:

Semester - III			Semester -IV	
Paper I	MT-231	Calculus of Several Variables	MT-241	Linear Algebra
Paper II	MT-232(A)	Numerical Methods and Its Applications	MT-242(A)	Vector Calculus
	MT-232(B)	Graph Theory	MT-242(B)	Dynamical Systems
Paper III	MT-233	Mathematics Practical based on MT - 231 and MT - 232	MT-243	Mathematics Practical based on MT - 241 and MT-242

- All three above courses are compulsory.
- In Semester-III, select any one from **MT-232(A) and MT-232(B)**.
- In Semester-IV, select any one from **MT-242(A) and MT-242(B)**.

Medium of Instruction: English.

Examination:

A) Pattern of examination: Semester.

B) Standard of passing: 20 marks out of 50 marks for each papers.

But for MT- 231, MT -232(A), MT -232(B), MT -241, MT -242(A), MT -242(B), MT -233 and MT-243 for passing a student should obtain minimum 14 marks out of 35 in the theory examination and overall total marks for theory and internal should be minimum 20.

C) Pattern of question papers: For MT- 231, MT -232(A), MT -232(B), MT -241, MT -242(A), MT -242(B).

Q1. Attempt any 05 out of 07 questions each of 01 marks. [05 Marks]

Q2. Attempt any 02 out of 04 questions each of 05 marks. [10 Marks].

Q.3. Attempt any 02 out of 04 questions each of 05 marks. [10 Marks].

Q4. Attempt any 02 out of 04 questions each of 10 marks. [10 Marks].

D) External Students: Not allowed.

E) Verification /Revaluation: Allowed for MT- 231, MT -232(A), MT -232(B), MT - 241, MT -242(A), MT -242(B).

The pattern of question paper for MT -233, MT-243 is given in the detailed syllabus.

Equivalence of Previous syllabus along with new syllabus:

	Semester-III		Semester-IV	
	New Course	Old Course	New Course	Old Course
Paper I	MT-231: Calculus of Several Variables	MT-211 : Multivariable Calculus-I	MT-241:Linear Algebra	MT-221: Linear Algebra
Paper II	MT-232(A): Numerical Methods and Its Applications	MT-212(A): Discrete Mathematics	MT-242(A): Vector Calculus	MT-222(A): Multivariable Calculus - II
	MT-232(B): Graph Theory	MT- 212(B): Laplace Transform and Fourier Series	MT-242(B): Dynamical Systems	MT-212(B): Numerical Analysis
Paper III	MT-233: Mathematics Practical based on MT-231 and MT-232	MT-213 : Mathematics Practical based on MT-211 and MT-212	MT-243: Mathematics Practical based on MT-241 and MT-242	MT-223: Mathematics Practical based on MT-221 and MT-222

Qualifications for Teacher: M.Sc. Mathematics (with NET /SET as per existing rules).

Semester – III

MT-231: Calculus of Several Variables

Unit-1 Limits and Continuity **[06 lectures]**

1.1 Functions of Several Variables :- Functions of two variables, Domain and Range, Graphs, Level Curves, Functions of Three or More Variables

1.2 Limits and Continuity.

Unit-2 Partial Derivatives and Differentiability **[10 lectures]**

2.1 Definition and examples.

2.2 Higher Derivatives, Clairaut’s Theorem (Statement Only) , Partial Differential Equations, Wave equation.

2.3 Differentiable function, Differentials

2.4 Chain Rule, Homogeneous Functions, Euler's theorem

Unit-3 Extreme Values

[08 lectures]

3.1 Extreme values of functions of two variables.

3.2 Necessary conditions for extreme values.

3.3 Second Derivative Test (without proof).

3.4 Lagrange Multipliers (with one constraints)

Unit-4 Multiple Integrals

[12 lectures]

4.1 Iterated Integrals, Fubini's Theorem (Statement only)

4.2 Double integral over general regions, Change of order of integration for two variables.

4.3 Double integral in Polar coordinates.

4.4 Triple integrals , Evaluation of triple integrals. Triple integrals in spherical coordinates

4.5 Jacobians , Change of variables in multiple integrals .(Results without proofs)

Text book: Multivariable Calculus 7th Edition By James Stewart, Brooks/Cole, Cengage Learning, 2012, 2008.

Unit 1:- Chapter 14: Sec- 14.1, 14.2

Unit 2:- Chapter 14: Sec- 14.3(except the Cobb-Douglas production function), 4.4 (except Tangent Planes and Linear Approximations), Sec-14.5

Unit 3:- Chapter 14: Sec 14.7, 14.8 (except two constraints)

Unit 4:- Chapter 15: Sec 15.2, 15.3, 15.4, 15.7 (without Riemann sum and Application), 15.9, 15.10

Reference Books:

1. Basic Multivariable Calculus, J. E. Marsden, A. J. Tromba , A. Weinstein, Springer Verlag (Indian Edition).
2. Shanti Narayan, R.K. Mittal, A Text-book of Vector Calculus, S.Chand and Company.
3. D.V. Widder, Advanced Calculus (2nd Edition), Prentice Hall of India ,NewDelhi,(1944).
4. T.M. Apostol , Calculus Vol. II (2nd Edition), John Wiley, New York, (1967).

MT-232(A): Numerical Methods and It's Applications

Unit1: Solution of Algebraic and Transcendental Equations

[10 Lectures]

1.1 Errors and their computations

1.2 Bisection method.

1.3 The method of False position

1.4 Newton- Raphson method

Unit 2: Interpolation

[12 Lectures]

2.1 Finite Difference Operators and their relations (Forward, Backward difference and Shift operator).

2.2 Differences of a polynomial

2.3 Newton's Interpolation Formulae (Forward and Backward)

2.4 Lagrange's Interpolation Formula

Unit 3: Numerical Differentiation and Integration [06 Lectures]

3.1 Numerical Differentiation (Derivatives using Newton's forward difference formula)

3.2 Numerical Integration, General quadrature formula.

3.3 Trapezoidal rule.

3.4 Simpsons's 1/3rd rule.

3.5 Simpsons's 3/8th rule.

Unit 4: Numerical solution of first order ordinary differential equations [08 Lectures]

4.1 Taylor's Series method

4.2 Picard's method of successive approximations

4.3 Euler's method.

4.4 Modified Euler's methods.

4.5 Runge - Kutta Methods.

Text book:

1. S.S. Sastry, Introductory Methods of Numerical Analysis, 5th edition, Prentice Hall of India.

Unit 1: Chapter 1: section 1.3, Chapter 2: section 2.2, 2.3, 2.5

Unit 2: Chapter 3: section 3.3, 3.5, 3.6, 3.9(3.9.1 only)

Unit 3: Chapter 4: section 6.2 (excluding 6.2.1 to 6.2.3), 6.4

Unit 4: Chapter 5: section 8.2, 8.3, 8.4 (excluding 8.4.1).

Reference Books:

1. C.F. Gerald and O.P. Wheatley, Applied Numerical Analysis, Addison Wesley;

7thedition (2003).

2. K.E. Atkinson; An Introduction to Numerical Analysis, Wiley Publications.

3. T. Sauer, Numerical analysis, 3rd edition, Pearson.

4. M. K. Jain, SRK Iyengar and R.K. Jain, Numerical Methods For Scientific & Engg 5e,

New Age International (P) Ltd (2008).

MT-232(B) : Graph Theory

Unit 1. Introduction

[04 Lectures]

1.1 What is a Graph?

1.2 Application of Graphs

1.3 Finite and Infinite Graphs

1.4 Incidence and Degree

1.5 Isolated Vertex, Pendant Vertex and Null Graph

Unit 2. Paths and Circuits

[12 Lectures]

- 2.1 Isomorphism
- 2.2 Subgraphs
- 2.4 Walks, Paths, and Circuits
- 2.5 Connected Graphs, Disconnected Graphs, and Components
- 2.6 Euler Graphs
- 2.7 Operations on Graphs
- 2.8 More on Euler Graphs
- 2.9 Hamiltonian Paths and Circuits
- 2.10 The Traveling Salesman Problem

Unit 3. Trees and Fundamental Circuits

[14 Lectures]

- 3.1 Trees
- 3.2 Some Properties of Trees
- 3.3 Pendant Vertices in a Tree
- 3.4 Distance and Centers in a Tree
- 3.5 Rooted and Binary Trees
- 3.6 On Counting Trees
- 3.7 Spanning Trees
- 3.8 Fundamental Circuits
- 3.10 Spanning Trees in a Weighted Graph

Unit 4. Cut-Sets and Cut-Vertices

[06 Lectures]

- 4.1 Cut-Sets
- 4.2 Some Properties of a Cut-Set
- 4.3 All Cut-Sets in a Graph
- 4.4 Fundamental Circuits and Cut-Sets
- 4.5 Connectivity and Separability

Recommended Book :

1. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science"
Printice-Hall, of India Pvt. Lt. New Delhi.

Unit 1 : Chapter 1: Sec.1.1 to 1.5

Unit 2: Chapter 2: Sec. 2.1 to 2.10 (Excluding 2.3)

Unit 3: Chapter 3: Sec. 3.1 to 3.10 (Excluding 3.9)

Unit 4: Chapter 4 : Sec. 4.1 to 4.5

Reference books:

1. John Clark and Derek Holton, A First Look at Graph Theory (Allied Publishers)
2. Robin J. Wilson, Introduction to Graph Theory, Fourth Edition (low price edition)
3. Introduction to Graph Theory, Douglas West 2nd edition.
4. A Textbook of Graph Theory, Balakrishnan, R., Ranganathan, K.

Outcomes of Course:

Upon completion of the course, the students will achieve the following.

- (i) **The mathematical maturity of students in their current and future courses shall develop.**

- (ii) The student develops theoretical, applied and computational skills.**
- (iii) The student gains confidence in proving theorems and solving problems.**

MT 233: Mathematics Practical

(Practicals based on the applications of articles in MT - 231 and MT - 232)

In Semester-III, we should conduct 4 written practical and 2 practical on maxima software for each paper MT-231 and MT-232.

List of Practical

Practical 1 : Problems on Unit 1(Written) from MT-231.

Practical 2 : Problems on Unit 2 (Written) from MT-231.

Practical 3 : Problems on Unit 3 (Written) from MT-231.

Practical 4 : IProblems on Unit 4 (Written) from MT-231.

Practical 5 : Problems on unit 1 and unit 2 from MT-231using maxima software.

Practical 6 : Problems on Unit 3 and Unit 4 from MT-231using maxima software.

Practical 7 : Problems on Unit 1 (Written) from MT-232.

Practical 8 :Problems on Unit 2 (Written) from MT-232.

Practical 9 : Problems on Unit 3 (Written) from MT-232.

Practical 10 : IProblems on Unit 4 (Written) from MT-232.

Practical 11 : Problems on unit 1 and unit 2 from MT-232 using maxima software.

Practical 12 : Problems on Unit 3 and Unit 4 from MT-2322 using maxima software.

Note:

1. The soft copy of practicals on maxima software will be prepared and provided by the Board of Studies in mathematics.
2. Practicals on maxima software can be performed on computer only.
3. Practical examination of 25 marks on written problems, 10 marks for problems on maxima software (5 marks for writing syntax and 5 marks to perform the same on computer).

Semester - IV
MT-241: Linear Algebra

Unit-1: Matrices and System of Linear Equations [06 lectures]

- 1.1 Row echelon form of a matrix, reduced row echelon form of a matrix.
- 1.2 Definition of rank of a matrix using row echelon or row reduced echelon form.
- 1.3 System of linear equations- Introduction, matrix form of linear system, definition of row equivalent matrices.
- 1.4 Consistency of homogeneous and non-homogeneous system of linear equations using rank, condition for consistency.
- 1.5 Solution of System of Equations: Gauss elimination and Gauss-Jordan elimination method, examples.

Unit-2: Vector Spaces-I [10 lectures]

- 2.1 Definition and Examples.
- 2.2 Subspaces.
- 2.3 Linear Dependence and Independence.
- 2.4 Basis of Vector Space

Unit-3: Vector Spaces-II [08 lectures]

- 3.1 Dimension of a Vector Space.
- 3.2 Row, Column and Null Space of a matrix.
- 3.3 Rank and nullity.

Unit-4: Linear Transformations [12 lectures]

- 4.1 Definition and Examples, Properties, Equality.
- 4.2 Kernel and range of a linear Transformation
- 4.3 Rank-Nullity theorem.
- 4.4 Composite and Inverse Transformation.
- 4.5 Matrices and Linear Transformation.
- 4.6 Basic Matrix Transformations in \mathbb{R}^2 and \mathbb{R}^3
- 4.7 Linear Isomorphism.

Text Book::

Howard Anton, Chris Rorres, Elementary Linear Algebra, Application Version, Ninth Edition, Wiley, 11th edition.

Unit-1: Chapter-1: Sec. 1.1, 1.2.

Unit-2: Chapter- Sec. 4: 4.1 to 4.4.

Unit-3: Chapter- Sec. 4: 4.5, 4.7, 4.8

Unit- 4: Chapter- Sec.8: 8.1 to 8.4, 1.8, 4.9.

Reference Books:

- (1) K. Hoffman and R. Kunze, Linear Algebra, 2nd edition(2014), Prentice Hall of India, New Delhi
- (2) Steven J. Leon, Linear Algebra with Applications, 4th edition(1994), Prentice Hall of India. New Delhi
- (3) Vivek Sahai, Vikas Bist, Linear Algebra, 4th Reprint 2017, Narosa Publishing House, New Delhi
- (4) Promode Kumar Saikia, Linear Algebra, 2009, Pearson, Delhi
- (5) S. Lang, Introduction to Linear Algebra, 2nd edition,1986, Springer-Verlag, New York, Inc.

MT 242(A): Vector Calculus

Unit 1: Vector-Valued Functions **[08 lectures]**

- 1.1 Curves in Space, Limits and Continuity, Derivatives and Motion, Differentiation Rules for Vector Function, Vector Functions of Constant Length.
- 1.2 Integrals of Vector Functions.
- 1.3 Arc Length along a Space Curve, Speed on a Smooth Curve, Unit Tangent Vector.
- 1.4 Curvature of a Plane Curve, Circle of Curvature for Plane Curves, Curvature and Normal Vectors for a Space Curve.

Unit 2: Integrals **[12 Lectures]**

- 2.1 Line Integral of Scalar Functions, Additivity, Line integral in the Plane.
- 2.2 Vector Fields, Gradient Fields, Line Integral of Vector Fields, Line Integrals with respect to dx , dy , dz .
- 2.3 Work done by a Force over a Curve in Space, Flow Integrals and Circulation for Velocity Fields, Flow across the Simple Closed Plane Curve.
- 2.4 Path Independence, Conservative and Potential Functions.
- 2.5 Divergence, Two forms for Green's Theorem, Green's Theorem in the Plane (Proof for special regions),

Unit 3: Surface Integrals **[08 Lectures]**

- 3.1 Parameterizations of Surfaces, Implicit surfaces.
- 3.2 Surface integrals, Orientation of Surfaces.
- 3.3 Surface Integrals of Vector Fields.

Unit 4: Applications of Integrals **[08 Lectures]**

- 4.1 The Curl Vector Field, Stokes' Theorem(without proof), Conservative Fields and Stokes' Theorem.

4.2 Divergence in three Dimensions, Divergence Theorem (without proof).

4.3 Unifying the Integral Theorems.

Text Book:

- Thomas' Calculus (14th Edition) by Hass, Heil, Weir, Pearson Indian Education Services Pvt. Ltd.
Unit 1: Chapter 13: Sec- 13.1, 13.2, 13.3, 13.4
Unit 2: Chapter 16: Sec-16.1, 16.2, 16.3, 16.4
Unit 3: Chapter 16: Sec- 16.5, 16.6
Unit 4: Chapter 16: Sec- 16.7, 16.8

Reference books:

- (1) Basic Multivariable Calculus by J.E. Marsden, A.J. Tromba, A. Weinstein, Springer Verlag (Indian Edition)
- (2) Advanced Calculus by M.R. Spiegel, Schaum Series.
- (3) Advanced Calculus (2nd Edition) by D.V. Widder, Prentice Hall of India, New Delhi (1944).
- (4) Advanced Calculus by John M. H. Olmsted, Eurasia Publishing House, New Delhi (1970)
- (5) Calculus Vol. II (2nd Edition) by T.M. Apostol, John Wiley, New York (1967).

MT-242(B): Dynamical Systems

Unit 1: Eigenvalues and Eigenvectors [08 Lectures]

- 1.1 Eigenvalues and Eigenvectors
- 1.2 Diagonalisation (matrices with real and distinct eigenvalues)

Unit 2: First-Order Equations and Planar Linear Systems [12 Lectures]

- 2.1 The Simplest Example
- 2.2 The Logistic Population Model
- 2.3 Second-Order Differential Equations
- 2.4 Planar Systems
- 2.5 Preliminaries from Algebra
- 2.6 Planar Linear Systems
- 2.7 Eigenvalues and Eigenvectors
- 2.8 Solving Linear Systems
- 2.9 The Linearity Principle.

Unit 3: Phase Portraits for Planar Systems [08 Lectures]

- 3.1 Real Distinct Eigenvalues
- 3.2 Complex Eigenvalues
- 3.3 Repeated Eigenvalues
- 3.4 Changing Coordinates

Unit 4: Classification of Planar Systems and Exponential of a matrix [08 Lectures]

4.1 The Trace-Determinant Plane

4.2 Exponential of a matrix.

Textbooks :

1) Elementary Linear Algebra by Howard Anton and Chris Rorres (9th edition), Applications Version.

Unit 1: Chapter 7 : Section 7.1 (Examples, Theorems with Statements only) , Section 7.2 (2×2 and 3×3 matrices with real and distinct eigenvalues, Theorems with Statements only)

2) Differential Equations, Dynamical Systems and An Introduction to Chaos (2nd edition) by Morris Hirsch, Stephen Smale and Robert Devaney, Academic Press.

Unit 2: Chapter 1 : Section - 1.1 to 1.2, Chapter 2 : Section - 2.1 to 2.7.

Unit 3: Chapter 3 : Section, 3.1 to 3.4,

Unit 4: Chapter 4 :Section 4.1, Chapter 6 : Section 6.4 (2×2 matrices with distinct real, repeated real and complex eigenvalues, 3×3 matrices with distinct real eigenvalues).

Reference Books :

1. K.B.Datta, Matrix and Linear Algebra, Prentice hall of India Pvt.Ltd, New Delhi 2000.

2. Differential Equations and Dynamical Systems (Third Edition) by Lawrence Perko, Texts in Applied Mathematics 7, Springer.

Outcomes of Course:

Upon completion of the course, the students will achieve the following.

- (i) The mathematical maturity of students in their current and future courses shall develop.**
- (ii) The student develops theoretical, applied and computational skills.**
- (iii) The student gains confidence in proving theorems and solving problems.**

MT 243: Mathematics Practical

(Practical based on the applications of articles in MT- 241 and MT -242)

In Semester-IV, we should conduct 4 written practical and 2 practical on maxima software for each paper MT-241 and MT-242.

List of Practical

Practical 1 : Problems on Unit 1 (Written) from MT-241.

Practical 2 : Problems on Unit 2 (Written) from MT-241.

Practical 3 : Problems on Unit 3(Written) from MT-241

Practical 4 : Problems on Unit 4(Written) from MT-241.

Practical 5 : Problems on unit 1 and unit 2 from MT-241 using maxima software.

Practical 6 : Problems on Unit 3 and Unit 4 from MT-241 using maxima software.

Practical 7 : Problems on Unit 1 (Written) from MT-242.

Practical 8 : Problems on Unit 2 (Written) from MT-242.

Practical 9 : Problems on Unit 3(Written) from MT-242.

Practical 10 : Problems on Unit 4(Written) from MT-242.

Practical 11 : Problems on unit 1 and Unit 2 from MT-242 using maxima software.

Practical 12 : Problems on Unit 3 and Unit 4 from MT-242 using maxima software.

Note:

1 The soft copy of practical on maxima software will be prepared and provided by the Board of Studies in mathematics.

2. Practicals on maxima software shall be performed on computer only..

3. Practical examination 25 marks on written problems, 10 marks for problems on maxima software (5 marks for writing syntax and 5 marks to perform the same on computer only).

Modalities For Conducting The Practical and The Practical Examination:

1) There will be one 4 hour 10 minutes (250 minutes) practical session for each batch of 15 students per week.

2) The College will conduct the Practical Examination at least 15 days before the commencement of the Main Theory Examination. The practical examination will consist of written examination of 20 marks, 10 marks on maxima software and oral examination of 05 marks.

3) There will be external examiner; the practical exam will be of the duration of 3hours.

4) The teacher will set a question paper at the time of paper setting meeting conducted by Savitribai Phule Pune University, Pune based on pattern as follows

Q1. Any 2 out of 4 each question of 5 marks on paper - I.

Q2. Any 2 out of 4 each question of 5 marks on paper - II.

Q3. (a) Any 1 out of 2 each question of 5 marks on maxima software from paper – I.

(b) Any 1 out of 2 each question of 5 marks on maxima software from paper – II.

5) Each student will maintain a journal to be provided by the college.

7) The internal 15 marks will be given on the basis of journal prepared by student and the cumulative performance of student at practical.

8) It is recommended that concept may be illustrated using computer software maxima and graphing calculators wherever possible.

9) Study tours may be arranged at places having important mathematical institutes or historical places.

10) Special Instruction:

- a) There should be well equipped mathematics practical laboratory of size 20x20 sq. fts containing at least 20 computers.
- b) Examiners should set separate question papers, solutions and scheme of marking for each batch and claim the remuneration as per rule.
- c) Before starting each practical necessary introduction, basic definitions, intuitive inspiring ideas and prerequisites must be discussed.



Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Electronic Science

(Faculty of Science & Technology)

F.Y.B.Sc. (Electronic Science)

Choice Based Credit System (CBCS) Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course: B. Sc (Electronic Science)**Preamble:**

Electronics technology has revolutionized various fields including communication, consumer appliances, medical, defense and so on. The advances in technology are making systems smaller, smarter and powerful. Electronics is an important branch of Science devoted to design implementation and analysis of circuits and systems. Knowledge of Electronics is based on fundamental laws of Physics and though new chips/SOC's are fabricated every day, basic principles remain the same.

The goal of the three-year course is to instill in students a confidence that they can get a grip of the subject and apply it for designing, testing and analyzing systems. The course will also make use of problem-solving approach wherein the students will be trained to apply the acquired knowledge to design and analyze circuits for specific applications. The students will be familiarized with programming languages, various development tools, modeling and simulation tools through lab sessions.

The syllabus has been designed such that basic fundamental concepts, knowledge and specific practical skills of the students are developed. The students will be first introduced to various components, devices and their applications, Network theorems and applications of electronics in day to day life. Digital Electronics fundamentals, Operational amplifier circuits, and its applications will be covered in the second semester. In the Second year the students will be taught the basic principles of communication, Analog and digital circuit design and Microcontrollers. In the third year the students will be given an insight to concepts of Embedded System Design, VLSI Technology, Communication systems and various discipline specific courses with a Project in the final semester.

Titles of Papers and Scheme of Study Evaluation**F. Y. B. Sc. Electronic Science**

Sem	Paper Code	Paper	Paper title	Credits	Lectures/Week			Evaluation		
					Th	Tut	Pr.	CA	UE	Total
I	EL- 111	I	Basics of Applied Electronics	2	3			15	35	50
	EL- 112	II	Electronic Devices and Circuits	2	3			15	35	50
	EL-113	III	Electronics Lab IA	1.5			3.15	15	35	50
II	EL-121	I	Fundamentals of Digital Electronics	2	3			15	35	50
	EL-122	II	Analog and Digital device Applications	2	3			15	35	50
	EL-123	III	Electronics Lab IB	1.5			3.15	15	35	50

S. Y. B. Sc. Electronic Science

Sem	Paper Code	Paper	Paper title	Credits	Lectures/Week			Evaluation		
					Th	Tut	Pr.	CA	UE	Total
III	EL-231	I	Analog Communication	2	4			15	35	50
	EL-232	II	Digital System Design	2	4			15	35	50
	EL-233	III	Electronics Lab IIA	2			4	15	35	50
IV	EL-241	I	Analog Circuit Design	2	4			15	35	50
	EL-242	II	Microcontroller	2	4			15	35	50
	EL-243	III	Electronics Lab IIB	2			4	15	35	50

T. Y. B. Sc. Electronic Science

Sem		Paper Code	Paper	Paper title	Credits
V	Discipline Specific Elective Course	EL-351	I	Theory Paper 1	2
		EL-352	II	Theory Paper 2	2
		EL-353	III	Theory Paper 3	2
		EL-354	IV	Theory Paper 4	2
		EL-355	V	Theory Paper 5	2
		EL-356	VI	Theory Paper 6	2
		EL-357	VII	Electronics Lab IIIA	2
		EL-358	VIII	Electronics Lab IIIB	2
		EL-359	IX	Electronics Lab IIIC	2
	Skill Enhancement Course	EL-3510	X	Theory Paper 7	2
		EL-3511	XI	Theory Paper 8	2
VI	Discipline Specific Elective Course	EL-361	I	Theory Paper 1	2
		EL-362	II	Theory Paper 2	2
		EL-363	III	Theory Paper 3	2
		EL-364	IV	Theory Paper 4	2
		EL-365	V	Theory Paper 5	2
		EL-366	VI	Theory Paper 6	2
		EL-367	VII	Lab IVA: Project	2
		EL-368	VIII	Lab IVB: Project	2
		EL-369	IX	Lab IVC: Project	2
	Skill Enhancement Course	EL-3610	X	Theory Paper 7	2
		EL-3611	XI	Theory Paper 8	2

Semester I**Paper I: EL- 111: Basics of Applied Electronics (2 Credits, 36 lectures)**

Semester 1**Theory Lectures: 36****Objective**

1. *To understand importance of Electronics in day today life*
2. *To understand basics of electronic circuits*
3. *To make the students learn through problem solving*
4. *To understand few electronic systems*

Learning outcomes:**After completion of this course student will be able:**

1. *To identify different parameters/functions/specifications of components used in electronic circuits*
2. *To solve problems based on network theorems.*
3. *To perform simulations using simulator for analyzing network performance*

Unit 1: Fundamentals of Electronics (14 L)

Introduction to Electronics, applications of Electronics

Electronic Components: Resistors, Capacitors, Inductors, Relays, Batteries, Switches, cables and connectors, fuses (Only basic concept, working, Specifications and application is expected)

Series and parallel combination of resistors, capacitors and inductors

Voltage and Current Sources: Input and output impedance of AC and DC voltage and/or current sources

Variable and constant voltage and current sources

Unit 2: Network Theorems (10L)

Kirchoff's Voltage Law and Kirchoff's Current Law, Thevenin, Norton , superposition and maximum power transfer theorems

DC and AC analysis of network

Numerical problems based on these network theorems

Unit 3: Introduction to electronic systems (12 L)

Building blocks, working principle and features of Smart Phone System, Security systems: Surveillance Camera System CCTV, Public Address System and thermostat

TEXT BOOKS AND REFERENCE BOOKS:

1. Electronic Principles by Malvino
2. Consumer Electronics by J. S. Chitode Technical Publications, Jan-2007
3. Mobile Cellular Telecommunications Analog and Digital System-By Lee.

Paper II: EL- 112: Electronic Devices and Circuits (2 Credits, 36 lectures)

Objectives:

Semester 1

Theory lectures:36

1. To know about basics of Semiconductor Devices and its parameters
2. To know about the details of diode, transistors, FET and MOSFETS
3. To build and understand application circuits of electronic devices.
4. To encourage the students for making use of simulation software for testing the circuits before experimentation.

Learning outcomes:

After completion of this course student will be able:

1. To analyze performance parameters based on study of characteristics of electronic devices like diode, transistors etc
2. To choose proper electronic devices as per the need of application
3. To perform simulations for designing and analyzing diode/transistor circuits
4. To build and test the circuits like street light controller using electronic devices

Unit 1: PN Junction Diodes (14L)

Junction Diode, Construction, working and V-I characteristics, Depletion region, Barrier Potential, Forward and Reverse bias condition – Junction capacitance.

Diode current equation–Effect of temperature on reverse saturation current

Types of diodes: rectifier diodes, Zener diode

Applications: Voltage regulator using Zener diode, Rectifiers: Half wave, full wave and bridge rectifiers ripple factor, Use of diode in mobile charger and power supply (includes transformer, diodes, C- filter, regulator IC(78XX or 78XX series))

Unit 2: BJT, FET and MOSFET Basics and Applications(12L)

BJT: Symbol, terminals, types, basic operation, configurations and characteristics (Showing different regions)

Applications: Transistor as switch, Transistor as amplifier Transistor as impedance matching network

FET: Terminals, Symbol, Basic operation and FET as Voltage Variable Resistance

MOSFET: Terminals, Symbol, Basic operation, characteristics and MOSFET as switch

Unit 3: Photo Electric Devices:(10L)

Light-Emitting Diodes (LEDs): Symbol and its use in circuit, IR transmitter and receiver applications ,Photo diode circuit , Photo transistors, LDR and its use in street light controller and Opto-Isolators (MCT2E) and its use in isolation

TEXT BOOKS:

1. Electronic Devices and Circuit Theory --- Robert L. Boylestad & Louis Nashelsky.
2. Electronic Devices and Circuits I – T.L.Floyd- PHI Fifth Edition

REFERENCE BOOKS:

1. Integrated Electronics –Millmam & Halkias.
2. Electronic Devices & Circuits – Bogart.
3. Sedha R.S., A Text Book Of Applied Electronics, S.Chand & Company Ltd

Semester I**EL- 113: ELECTRONICS LAB IA (1.5 Credits)**

Number of Practicals:10**Objectives:**

1. *To teach students how to draw different symbols and circuit diagrams*
2. *To develop skill of circuit connections*
3. *To familiarize the student with different components and devices used in the laboratory and the device manuals*
4. *To familiarize students with laboratory instruments like Ammeter, voltmeter, DMM, Signal Generator, Function Generator, CRO and tools like cutter, stripper etc.*
5. *To train them to design and analyze the circuits for specific purpose*
6. *To teach the students how to analyze the results and calculate performance parameters*
7. *To motivate them to work on different mini projects*

Learning outcomes:**After completion of this course student will be able**

1. *To identify different components and devices as well as their types*
2. *To understand basic parameters associated with each device*
3. *To know operation of different instruments used in the laboratory*
4. *To connect circuit and do required performance analysis*
5. *To compare simulated and actual results of given particular experiment*

Section A: List of Experiments(Any 05)

1. Assignment type experiment: finding values of Electronic components like resistors from color code, capacitors, inductors and their types, know the components like cables, fuses, wires and tools like stripper, cutter, soldering gun etc
2. Know your laboratory instruments: Signal Generators and CRO,DMM
3. To verify Kirchoff's Voltage and current laws
4. To verify Thevenin's Theorem
5. .To verify Norton'sTheorem
6. .To verify Maximum Power Transfer Theorem

7. To verify Superposition theorem
8. To study application circuit of LED
9. How it works: GSM, GPS and Bluetooth(Assignment experiment)
10. Simulation experiment using pSpice (any of the above experiment)

Section B: List of Experiments(Any 05)

1. To study forward and reverse characteristics of Diode characteristics
 2. To study diode rectifier circuits
 3. To design Zener voltage regulator
 4. To design Transistor as a switch(LEDON/OFF)
 - 5.To Study of three terminal voltage regulators
 7. To study MOSFET as a Switch
 8. Simulation experiment using pSpice (any of the above experiment)
-

Semester II

Paper I: EL-121: Fundamentals of Digital Electronics (2 Credits, 36 lectures) Semester II

Theory lectures: 36

Objectives:

1. To know about different number systems and codes
2. To understand logic gates and truth tables
3. To understand combinational logical circuits
4. To understand sequential logical circuits
5. To encourage the students for making use of simulation software for testing and building the circuits before experimentation.

Learning outcomes:

After completion of this course student will be able

1. To solve problems based on interconversion of number systems
2. To reduce the expression using Boolean theorems
3. To reduce expressions using K maps in SOP and POS forms
4. To understand how to use flip flops to build modulus counter
5. To familiarize with applications of counters like ring counter or event counter

Unit 1 : Basics of Digital Electronics(16L)

Number Systems: Decimal, Binary, Hexadecimal, BCD, Gray code and their inter-conversions, ASCII, Complements (1's, 2's), Rules of binary Addition, Subtraction.

Logic gates: positive and negative logic, AND, OR, NOT, EX-OR, NAND, NOR, EX-NOR and truth tables, NAND and NOR universal gates

Boolean Algebra and Theorems: Boolean Theorems, De-Morgan's laws. Digital logic gates, Multi level NAND & NOR gates. Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh Map Method: 3 variables), don't care condition.

Basic concept of Arithmetic and logical unit (ALU)

Unit-2 Combinational Logic Circuits (10 L)

Adders-Half & full adder, Subtractor-Half and full subtractors, Parallel binary adder, Magnitude Comparator, Digital lock using magnitude comparator Multiplexers (2:1,4:1) and Demultiplexers (1:2,4:1), Encoder (8-line-to-3-line) and Decoder (3-line-to-8-line). Parity generator and checker

Unit 3: Sequential Logic Circuits (10 L)

Flip Flops and truth tables: S-R FF , J-K FF, T and D type FFs, Master-Slave FFs, Flip flop as memory device

Shift Registers and their types, serial to parallel and parallel to serial converters using shift registers
Counters : Asynchronous-Mod16, Mod-10, Mod-8, up down counter, Synchronous-Ring counter, Event counter

TEXT BOOKS:

1. M.Morris Mano, "Digital Design " 3rdEdition, PHI,New Delhi.
2. Ronald J. Tocci. "Digital Systems-Principles and Applications" 6/e. PHI. New Delhi. 1999.(UNITS I to IV)
3. G.K.Kharate :Digital electronics-Oxford University Press
4. S.Salivahana &S. Arivazhagan-Digital circuits and design
5. Fundamentals of Digital Circuits byAnandKumar

Reference Books :

1. Herbert Taub and Donald Schilling. "Digital Integrated Electronics" . McGrawHill.1985.
2. Malvino and Leach. " Digital Principles and Applications". TMGHill Edition.

Paper II: EL- 122: Analog and Digital Device applications (2 Credits, 36 lectures)
Semester II**Total lectures: 36****Objectives:**

1. *To know basics of operational amplifier*
2. *To compare performance parameters of opamp ICs available in market*
3. *To understand basic application circuits of opamp.*
4. *To basics of timer IC 555 and its applications*
5. *To understand data converters and their performance parameters*

Learning outcomes:**After completion of this course student will be able**

1. *To compare different opamps as per specifications or performance parameters*
2. *To understand opamp circuits and its usefulness in different applications*
3. *To know operating principle of IC 555 in different configurations*
4. *To understand different types of DAC and their performance parameters*
5. *To study different types of ADC and their performance parameters*

Unit 1 : Operational Amplifiers(10 L)

Definition, Basic op-amp Ideal op-amp, Block diagram of op-amp, ideal and practical characteristics of inverting, non inverting configuration, virtual ground

Introduction of OPAMP ICs(comparative study)

Unit 2: Applications of Opamp and IC 555 (14 L)

Wave shaping circuits using integrator and differentiator, ON-OFF controller using comparator or Schmitt trigger, Function generator, Audio amplifier, V to I converter, PWM generation

IC-555 –functional block diagram , formula of output frequency, duty cycle, pin diagram, astable, monostable and bistable operation

Application circuits: Moisture detector circuit, PWM generation, FSK generator, 50% duty cycle circuit using diode

Unit 3: Data Converters (12 L)

D/A converter: R-2R Ladder network, Binary Weighted DAC

A/D converter:-Counter type ADC, Successive Approximation ADC

Basic operation and block diagram: Digital thermometer

TEXT BOOKS:

1. G.K.Kharate-Digital electronics-oxford university press
2. M.Morris Mano, “ Digital Design “ 3rdEdition, PHI, New Delhi.
3. Op Amp and Linear Integrated Circuits By Ramakant Gaykwad
4. Linear Integrated Circuits By Roy Choudary

REFERENCE BOOKS :

1. Jacob Millan, MicroElectronics, McGrawHill.
2. Mithal G K, Electronic Devices and Circuits, ThanaPublishers.
3. Allan Mottershead ,Electronic Devices and Circuits – An Introduction-PrenticeHall

Semester II

EL- 123: ELECTRONICS LAB IB (1.5 Credits)

Number of Practicals:10

Objectives:

1. To build opamp configurations and study its performance
2. To build application circuits of opamp and study its performance
3. To build application circuits of IC555
4. To understand types of ADC and DAC and its performance parameters like accuracy, resolution etc
5. To teach the students how to analyze the results and calculate performance parameters
6. To understand features of laboratory instruments like Ammeter, voltmeter, DMM, Signal Generator, Function Generator, CRO

Learning outcomes:

After completion of this course student will be able

1. To connect opamp circuits and analyze the output
2. To build application circuits of opamp
3. To design the output frequency of IC 555 as astable/monostable multivibrator
4. To compare simulated and actual results of given circuit

Section A: List of Experiments (Any 05)

1. Op-Amp as inverting and non-inverting
2. Op-Amp as integrator and differentiator
3. Op-Amp as adder & subtractor
4. Op-Amp as voltage to current converter
5. Op-Amp as sine wave generator (Wien bridge oscillator)
6. Op-Amp as function generator
7. Astable multivibrator determination of frequency (using IC-555)
8. Schmitt trigger using IC-555 timer
9. Smoke detector circuit
10. Simulation experiment using pSpice (any of the above experiment)

Section B: List of Experiments(Any 05)

1. Study of logic families (assignment type practical)
 2. Verification of IC-logic gates
 3. Realization of basic gates using discrete components (resistor, diodes & transistor)
 4. Realization of basic gates using Universal gates (NAND & NOR gates)
 5. Verify Half adder and full adder using gates
 6. Verify Half subtractor and full subtractor using gates.
 7. Verify the truth table of RS , JK, T-F/F using NAND gates
 8. 4-bit binary parallel adder and subtractor using IC7483
 9. BCD to Seven Segment Decoder using IC-7447/7448
 10. Simulation experiment using pSpice (any of the above experiment)
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
under the Faculty of Science and technology

S. Y. B. Sc. Electronic Science Syllabus
To be implemented from June 2020
(CBCS Pattern)

SVITRIBAI PHULE PUNE UNIVERSITY,PUNE

S. Y. B. Sc. Electronic Science Syllabus

To be implemented from June 2020

(CBCS Pattern)

Structure of S. Y. B. Sc. Electronic Science

Sem	Paper Code	Paper	Paper title	credits	Periods/week		Evaluation		
					L*	P*	CIE*	UE*	Total
III	EL-231	I	Communicati on Electronics	2	3		15	35	50
	EL- 232	II	Digital System Design	2	3		15	35	50
	EL-233	III	Practical Course	2		4	15	35	50
IV	EL-241	I	Analog Circuit Design	2	3		15	35	50
	EL-242	II	Microcontroller and Python programming	2	3		15	35	50
	EL-243	III	Practical Course	2		4	15	35	50

*Abbreviations

L:Lectures/week

P: Practicals/week

CIE: Continuous Internal Examination

UE: University Examination

SAVITRIBAI PHULE PUNE UNIVERSITY,PUNE
CBCS(2020 PATTERN)
S.Y.B.Sc. (Electronic Science)-Semester-III
EL-231: Paper – I: Communication Electronics

Credits	Number of periods/week	Number of lectures of 50 minutes duration	CIE marks	UE marks	Total marks
02	03	36	15	35	50

Course outcomes:

This course provides basic knowledge of analog(continuous wave) and digital communication systems . After study through lectures and assignment, student will be able to

CO1	Understand different blocks in communication systems, types of noise in communication systems and its different parameters
CO2	Understand need of modulation, modulation process and amplitude modulation and demodulation methods
CO3	Analyse generation of FM Modulation and demodulation methods and comparison between amplitude and frequency modulation
CO4	Identify different radio receivers and their performance parameters.
CO5	Solve problems based on AM and FM performance parameters
CO6	Compare pulse modulation techniques such as PAM, PPM, PWM and compare TDM and FDM techniques used in communication
CO7	Understand need of sampling and sampling theorem as well as know about performance parameters of digital communication
CO8	Analyze difference between ASK, FSK , PSK as well as PCM and its applications

Unit	Contents	Lectures allotted
1	Introduction to Electronic Communication: Introduction to communication- means and modes, Block diagram of an electronic communication system, Electromagnetic spectrum , Brief idea of frequency allocation for radio communication system in India (TRAI) concept of Noise, signal-to-noise (S/N) ratio, Noise figure and noise temperature Need of modulation and demodulation	6
2	Continuous-wave modulation techniques: Amplitude modulation: AM waveform, mathematical expression of AM, concept of sideband, Definition and problems: modulation index, power distribution. AM using transistor, AM Receiver: demodulator circuit using diode and super-heterodyne receiver, characteristics of receiver: selectivity, sensitivity, Image frequency and dynamic range. Block diagram of AM communication system Frequency modulation: FM waveform, mathematical representation, frequency spectrum, bandwidth and modulation index., problems based on modulation index, frequency deviation, average power. FM Modulation using varactor diode. FM Demodulator: Foster-Seeley detector. Block Diagram of FM communication system.	16

	Comparison of AM and FM	
3	Pulse modulation techniques: Types of analog pulse modulation: concept and generation of PAM, PWM, PPM, Spectra of pulse modulation, concept of time division multiplexing and frequency division multiplexing	6
4	Introduction to digital communication : Block diagram of digital communication system, advantages of digital communication system, bit rate, baud rate and bandwidth. Serial and parallel communication, concept of sampling, Sampling theorem, PCM concept of keying techniques: ASK, FSK, PSK Block diagram of MODEM	8
	Total lectures	36

References Books:

1. Communication Electronics :Principles and applications by Louis E Frenzel 3rd edition
TMH Publications
 2. Electronics Communication Systems by Denis Roddy, John Coolen, PHI publication.
 3. Kennedy, George & Davis, Bernard / “Electronic Communication Systems” / Tata
McGraw-Hill / 4th Ed.
 4. Singh, R.P. & Sapre, S.D. / “Communication Systems: Analog & Digital” / Tata
McGraw- Hill.
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
CBCS(2020 PATTERN)
S.Y.B.Sc. (Electronic Science)-Semester III
EL-232: Paper- II: Digital Circuit Design

Credits	Number of periods/week	Number of lectures of 50 minutes duration	CIE marks	UE marks	Total marks
02	03	36	15	35	50

Course outcomes:

This course provides basic knowledge about systematic methodology of designing digital systems . After study through lectures and assignment, student will be able to

CO1	Distinguish between different logic families based on their performance parameters
CO2	Analyze basic combinational logic circuits for simple applications
CO3	Design combinational logic circuits using K maps for identified applications
CO4	Design Sequential logic circuits using state diagram, excitation table for identified applications
CO5	Understand and compare different types of ADC and their performance parameters using data sheets/manuals
CO6	Understand and compare different types of DAC and their performance parameters using data sheets/manuals

Unit	Contents	Lectures
1	Logic families: Revision of logic gates using diodes, transistors and MOSFETS Introduction to logic families and its performance parameters, Comparative study of TTL, CMOS, ECL with reference to performance parameters	4
2	Combinational logic circuit design: OR gate for Event detection, AND gate for Frequency measurement, EX-OR gate for Parity generation and checker, NOT gate for square wave generator, NAND gate for key debouncer circuit Design of code converters using K maps: BCD to Seven segment , Concept of adder using Look ahead carry generator , Keyboard encoder circuits : Priority encoder , Error detection technique : hamming code	12
3	Sequential logic circuit design: State table, State diagram, excitation table and transition table, Design of counters using state machines: asynchronous, modulus and up-down counter, Design of sequence generator.	10
4	Data converters: Revision of Data converters.: R-2R, binary weighted, counter type, successive approximation ADC: flash, Dual slope Comparative performance analysis of ADC :0808, 0804 and ICL7106 and DACs: 0808, 0804	10
	Total	36

Reference books:

1. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India.
 2. R. P.Jain, Modern Digital Electronics, 4th edition, Tata MacGraw Hill Education India,
 3. K. R. Botkar, Integrated Circuits, 3rd Edition, Khanna Publications
 4. Thomas Floyd and Jain, Digital Fundamentals, 4th Edition, Pearson Education International
 5. Manuals: National semiconductor, EXAR, Intersil, Signetics, Analog Devices
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SAVITRIBAI PHULE PUNE UNIVERSITY,PUNE
CBCS(2020 PATTERN)
S.Y.B.Sc. Electronic Science -Semester IV
EL-241: Paper - I: Analog Circuit Design

Credits	Number of periods/week	Number of lectures of 50 minutes duration	CIE marks	UE marks	Total marks
02	03	36	15	35	50

Course outcomes:

This course provides basic knowledge about systematic methodology of designing analog systems . After study through lectures and assignment, student will be able to

CO1	Design single/multistage amplifier using transistor and analyze their frequency response base on gain-bandwidth product due to coupling /bypass capacitors
CO2	Classify and compare different power amplifiers
CO3	Understand and design push pull amplifier and need of heat sinks
CO4	Distinguish between Opamp Feedback circuits based on their configurations
CO5	Analyze the effect of negative and positive feedback on characteristics of Opamp
CO6	Understand and analyze the need of positive feedback in oscillator circuits
CO7	Design , develop and build circuits for identified applications

Unit	Contents	Lectures
1	Amplifiers: Small signal amplifiers: A.C and D.C. analysis, frequency response, gain Bandwidth product. Design of single stage amplifier, effect of coupling capacitor and bypass capacitor on frequency response (qualitative approach), Design of two stage amplifier	6
2	Power amplifier: Classification of power amplifiers on the basis of conduction: class-A, class-B, class-AB, class-C. Class-A amplifier: resistive load/transformer coupled load, efficiency calculation. Concept of harmonic distortion. Class B amplifier: Push-pull amplifier concept, complimentary symmetry class-B push pull amplifier, crossover distortion, class AB push pull amplifier, Types of heat sinks.	12
3	Opamp based Systems : Concept of negative feedback Types of feedback circuits: current shunt, current series, voltage shunt and voltage series, Effect of Negative feedback: on gain ,Bandwidth, input and output impedance, Circuits: Adder, differential amplifier, integrator, differentiator, First order butterworth active filter Concept of Positive Feedback: Barkhousan criterion, Oscillator circuits -Wien bridge , Phase Shift ,astable multivibrator	14
4	Application Systems: Design of Audio Amplifier, Design of Public Address System Design of function generator	04
	Total	36

Reference Books:

1. Ramakant Gaikwad, Operational amplifiers and linear Integrated Circuits, 3rd edition, PHP
 2. G. B. Clayton, Operational amplifier , ELBS
 3. Boylested , Electronic devices and circuits, PHP
 4. B.L. Thereja ,Principles of Electronics , S.Chand and Company
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
CBCS(2020 PATTERN)

S. Y. B. Sc. Electronic Science – Semester IV
EL-242: Paper II: Microcontroller and Python Programming

Credits	Number of periods/week	Number of lectures of 50 minutes duration	CIE marks	UE marks	Total marks
02	03	36	15	35	50

Course outcomes:

This course introduces students with microcontroller using Arduino as well as develops programming ability using python language . After study through lectures and assignment, student will be able to

CO1	Identify the features and architectural details of microcontroller(arduino)
CO2	Write code/program using open source programming language(arduino) for basic identified applications
CO3	Understand programming basics of python programming language
CO4	Understand special features of python programming language such as importing modules, directory, tupules
CO5	Design , build and implement applications using arduino and python

Unit	Contents	Lectures
1	Introduction to Microcontroller Introduction to Arduino ,: Microcontrollers used in Arduino, Pin configuration and architecture, Concept of digital and analog ports.	4
2	Building blocks of Arduino programming: variables and data types, Comparison Operators(arithmetic,logical and relational, modulo and assignment) Statements: If-Else Statement, Switch statement Control structures:While and For Loop Writing arduino programs: LED blinking and Push button Serial Port Communication Function blocks: Analogread(), digitalread() functions Intensity control of LED with Pulse Width Modulation using analogWrite()	10
3	Introduction to Python Understanding Python variables, Python basic Operators, Understanding python blocks, Declaring and using Numeric data types: int, float, complex, Using string data type and string operations, Defining list and list slicing, Use of Tuple data type, Conditional blocks using if, else and elif, Simple for loops in python, For loop using ranges, string, list and dictionaries, Use of while loops in python, Loop manipulation using pass, continue, break and else Programming using Python conditional and loops block	12
4	Python Functions , Modules And Packages Organizing python codes using functions, Organizing python projects into modules, Importing own module as well as external modules, Programming using functions, modules and external packages Building blocks of python programs, Understanding string in built methods, List manipulation using in built methods, Dictionary manipulation, Programming using string, list and dictionary in built functions , tupules	10

	LED blinking using Arduino with python programming	
	Total	36

Reference books:

1. Think Python, Allen Downey, O'Reilly, 2012
 2. Introduction to Problem Solving with Python, E. Balagurusamy
 3. Arduino-Based Embedded Systems : By Rajesh Singh, Anita Gehlot, Bhupendra Singh, and Sushabhan Choudhury.
 4. Arduino Made Simple by Ashwin Pajankar
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SAVITRIBAI PHULE PUNE UNIVERSITY,PUNE
CBCS(2020 PATTERN)
S. Y. B. Sc. Practical Course

Credits/semester	Duration of one practical	CIE marks/semester	UE marks/semester	Total marks/semester
02	4 hours 20 mins	15	35	50

Laboratory requirements: Instruments

1. Power Supply(single and dual)
2. Signal Generator and function generators
3. CRO
4. Digital multimeters
5. Communication training kits/breadboards/tag boards

Software requirements

1. Arduino 10.0 programming environment and add on hardware modules
2. Python 3.0 and above

Guidelines for conducting practical:

As the practical in each semester is of 2 credits i.e.duration of 4 hours and 20 minutes. General guidelines for teachers to engage the students are as follows

1. Utilization of allotted time for hardware practicals

- a. Understanding the purpose of performing particular expt
- b. Understanding the knowhow of the expt such as circuit diagram, connections, performing the expt, analyzing and verifying the results, plotting the graphs, interpretation of results
- c. Expt can be performed on breadboard/circuit boards/tag boards
- d. Getting familiar with datasheets for ICs or components
- e. extension of expt (if possible)
- f. Continuous assessment activity(Viva etc.)
- g. Simulation of experiment using softwares like proteus,pSpice etc
- h. Project like /skill development activity
- i. Poster presentation/project documentation

2. Utilization of allotted time for software experiment

- a. Understand the software (Arduino and python) : its features and facilities
- b. Self learning through small programs *for through understanding
- c. Understand step by step procedure to execute the program
- d. Understand interfacing of various modules to Arduino
- e. Exploring different features of Python programming
- f. Learning algorithms and flowcharts
- g. Building different application programs using arduino and python
- h. Project like/skill development activity

Note: One can extend the activities as per need of the particular experiment

Number of students per batch: 12

Evaluation Process:

- University Examination : 35 marks
- Continuous Internal Examination : 15 marks

Following are different methods of assessing the studies for internal practical examination

1. Oral
2. Journal
3. Mock tests
4. Attendance
5. Performance
6. Project/PLE/Industrial visit

Reference books:

- TTL manuals:National Semiconductor, Signetics
 - CMOS manual
 - EXAR manual
 - Smart Power manual
 - National semiconductor manual
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
CBCS(2020 PATTERN)
S.Y.B.Sc. (Electronic Science)
EL-233: Paper- III: Practical Course: SEMESTER III

Course outcomes:

This course provides hands on experience in communication and digital circuits, which can be conducted by standard circuits. Investigate the operation of several communication circuits and digital circuits (Combinational and sequential). Upon completion of this course student will be able to

CO1	Describe and explain the techniques of generation of AM/ FM and demodulation
CO2	Design FSK generation using standard IC XR 2206 referring data manuals
CO3	Describe and explain the TDM/ FDM generation technique
CO4	Demonstrate PPM/PWM/PAM and PCM techniques using standard circuits in data manuals
CO5	Design and build minimum complexity digital circuits using logic gates
CO6	Design and analyze different combinational and sequential logic circuits using standard ICs in data manuals
CO7	Design ADC/ DAC using data manuals and study its performance parameters

Total experiments: 10

Group B: List of Practicals (Communication Electronics): Any Five

1. Design ,build and test Amplitude Modulator using transistor
 2. Design ,build and test FM generation using VCO/IC 8038/varactor diode
 3. Design ,build and test Frequency Shift Keying(FSK) using XR 2206
 4. Design ,build and test Time division multiplexing/Frequency division multiplexing
 5. Design ,build and test Balance modulator and demodulator using IC 1408
 6. Design ,build and test PPM/PWM /PAM
 7. Demonstration of PCM/delta modulation
 8. Design build and test FM Receiver
-

Group B:List of Practicals (Digital Circuit Design): Any Five

1. Design ,build and test BCD to 7 segment decoder
 2. Design ,build and test Event counter/Frequency counter/square wave generator using logic gates
 3. Study of 4- Bit Arithmetic Unit using IC 74181
 4. Design ,build and test DAC using R-2R ladder network
 5. Design ,build and test ADC using IC 0808/IC 7109/IC 741/IC 324
 6. Design ,build and test Sequence generator for stepper motor
 7. Design ,build and test Priority keyboard encoder using IC 74148
 8. Design ,build and test hamming code error detection circuit
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
CBCS(2020 PATTERN)
S.Y.B.Sc. (Electronic Science)
EL-243: Paper- III: Practical Course: SEMESTER IV

Course outcomes:

This course provides hands on experience in communication and digital circuits, which can be conducted by standard circuits. Investigate the operation of several communication circuits and digital circuits (Combinational and sequential). Upon completion of this course student will be able to

CO1	Describe and explain the design procedure of different types of active filters and analyze its frequency response
CO2	Demonstrate positive feedback for oscillator circuits using standard ICs
CO3	Describe and explain design procedure for two stage amplifiers and application circuits
CO4	Design practical circuits for identified applications
CO5	Develop working setup and write programs using programming techniques of arduino
CO6	Demonstrate and explain interfacing hardware to arduino microcontroller
CO7	Solve problems using programming techniques of python

Total Expts: 10

Group A: List of Practicals (Analog Circuit Design): Any Five

1. Design, build and test butterworth first order Low Pass Filter and High Pass Filter using OPAMP IC-741
 2. Design, build and test Wein bridge oscillator/Phase shift oscillator
 3. Design, build and test Push pull amplifier
 4. Design, build and test Astable multivibrator using opamp
 5. Design, build and test of two stage amplifier using transistor
 6. Design, build and test audio amplifier
 7. Liquid level detector
 8. Mini project/industrial visit/PLE
-

Group B: List of Practicals (Arudino and python programming): Any Five
arduino programming practicals:

1. To study and understand Interfacing LED array to arduino
2. To study and understand Interfacing keyboard to arduino
3. To study and understand Interfacing sensor to arduino
4. To study and understand interfacing bluetooth to arduino

Python programming practicals:

5. Enter the number from the user and depending on whether the number is even or odd, print out an appropriate message to the user.
 6. Write a program to generate the Fibonacci series.
 7. Write a function that reverses the user defined value
 8. Write a recursive function to print the factorial for a given number
-



Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Botany

(Faculty of Science & Technology)

T.Y.B. Sc Botany

Choice Based Credit System Syllabus

To be implemented from Academic Year 2021- 2022

Title of the Course: B. Sc Botany

1. Structure of Course:

Structure B.Sc. Botany syllabus					
Year	Semester	Course Type	Course code	Course Name	Credits
1	1	Compulsory Course	BO 111	Plant life and utilization I	2
			BO 112	Plant morphology and Anatomy	2
			BO 113	Practical based on BO 111 & BO 112	1.5
	2	Compulsory Course	BO 121	Plant life and utilization II	2
			BO 122	Principles of plant science	2
			BO 123	Practical based on BO 121 & BO 122	1.5
2	3	Compulsory Course	BO 231	Taxonomy of Angiosperms and Plant Ecology	2
			BO 232	Plant Physiology	2
			BO 233	Practical based on BO 231 & BO 232	2
	4	Compulsory Course	BO 241	Plant Anatomy and Embryology	2
			BO 242	Plant Biotechnology	2
			BO 243	Practical based on BO 241 & BO 242	2
3	5	Discipline Specific Elective Course	BO 351	Algae and Fungi	2
			BO 352	Archegoniate	2
			BO 353	Spermatophyta and Paleobotany	2
			BO 354	Plant Ecology	2
			BO 355	Cell and Molecular Biology	2
			BO 356	Genetics	2
			BO 357	Practical based on BO 351 & BO 352	2
			BO 358	Practical based on BO 353 & BO 354	2
	Skill Enhancement course	BO 3510	Medicinal Botany	2	
		BO 3511	Plant Diversity and Human Health	2	
		3	6	Discipline Specific Elective Course	BO 361
BO 362	Biochemistry				2
BO 363	Plant Pathology				2
BO 364	Evolution and Population genetics				2
BO 365	Advanced Plant Biotechnology				2
BO 366	Plant Breeding and Seed Technology				2
BO 367	Practical based on BO 361 & BO 362				2

		BO 368	Practical based on BO 363 & BO 364	2
		BO 369	Practical based on BO 365 & BO 366	2
	Skill Enhancement course	BO 3610	Nursery and Gardening Management	2
		BO 3611	Biofertilizers	2

2. Equivalence of Previous Syllabus:

Old Course (2015 Pattern)	New Course (2020 CBCS Pattern)
Semester V	Semester V
BO. 331 Cryptogamic Botany	BO 351 Algae and Fungi
BO. 332 Cell and Molecular Biology	BO 352 Archegoniate
BO. 333 Genetics and Evolution	BO 353 Spermatophyta and Paleobotany
BO. 334 Spermatophyta and Palaeobotany	BO 354 Plant Ecology
BO. 335 Horticulture and Floriculture	BO 355 Cell and Molecular Biology
BO. 336 Computational Botany	BO 356 Genetics
--	BO 3510 Medicinal Botany
--	BO 3511 Plant Diversity and Human Health
Semester VI	Semester VI
BO.341 Plant Physiology and Biochemistry	BO 361 Plant Physiology and Metabolism
BO.342 Plant Ecology and Biodiversity	BO 362 Biochemistry
BO.34 Plant Pathology	BO 363 Plant Pathology
BO.344 Medicinal and Economic Botany	BO 364 Evolution and population genetics
BO.345 Plant Biotechnology	BO 365 Advanced Plant Biotechnology
BO.346 Plant Breeding and Seed Technology	BO 366 Plant Breeding and Seed Technology
--	BO 3610 Nursery and Gardening Management
--	BO 3611 Biofertilizers

T.Y.B.Sc. Botany CBCS Pattern
(Semester V, Paper I) 2020-2021
BO 351: Cryptogamic Botany (Algae and Fungi)- 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
Credit-I Algae		15
1.	Introduction: Cryptogams- meaning. Types- Lower Cryptogams, brief Review with examples	01
2.	Algae: General characters, distribution, Thallus organization, habit and Habitat reproduction and Classification (G.M.Smith 1955) up to classes.	04
3.	Study of life cycle of algae with reference to taxonomic position, Occurrence, Thallus structure, and reproduction of <i>Nostoc</i> , <i>Oedogonium</i> <i>Chara</i> , <i>Sargassum</i> and <i>Batrachospermum</i> .	08
4	Economic importance of algae- Role in industry, agriculture, fodder and medicine.	02
Credit-II Fungi		15
5	Fungi: General characters, Habit and habitats, thallus organization, cell wall composition, nutrition and Classification. (Alexopoulos and Mims 1979) up to classes.	03
6.	Study of life cycle of fungi with reference to taxonomic position, thallus structure, and reproduction of <i>Mucor</i> (<i>Zygomycotina</i>), <i>Saccharomyces</i> (<i>Ascomycotina</i>), <i>Puccinia</i> (<i>Basidiomycotina</i>), <i>Penicillium</i> and <i>Cercospora</i> (<i>Deuteromycotina</i>) [Two members of Deutero.]	08
7.	Symbiotic Associations - Lichens, Mycorrhiza and their significance	04

Suggested readings:

1. Vashistha B. R. et al., Botany for degree students-Algae
2. Das, Datta and Gangulee-College Botany Vol. I
3. Sharma, O.P. –Algae
4. Kumar H.D. 1988. Introductory Phycology. Affiliated East-West Press Ltd New Delhi.
5. Vashishta B.R. et al., Botany for degree students- Fungi
6. Sharma, P.D.-The Fungi

7. Sharma, O.P.-Fungi Economic importance of fungi

8. Alexopoulos C. J , Mims C.W. and Blacwel M.I 1996. Introductory Mycology. John Wiley and Sons Inc.

**T.Y.B.Sc. Botany CBCS Pattern
(Semester V, Paper II) 2020-2021
BO 352: Archegoniate- 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
Credit-I Bryophytes		15
1.	Introduction to Archegoniate	01
2.	Introduction, general characters, distribution of Bryophytes to land habit, classification of Bryophytes according to G.M. Smith (1955) up to classes with reasons	02
3.	Range of thallus organisation, origin of Bryophytes - Pteridophytes and Algal hypothesis, evolution of sporophyte	02
4	Study of Life Cycle of Bryophytes with respect to Taxonomic position, Morphology, Anatomy, Reproduction, Gametophytes and sporophytes of <i>Marchantia</i> , <i>Anthoceros</i> and <i>Funaria</i>	09
5	Ecological and economic importance of Bryophyte	01
Credit-II Pteridophytes		15
6	Introduction, Vascular Cryptogams, General characteristics, Classification according to K.R. Sporne (1975) up to classes with reasons, Diversity and Distribution of Pteridophytes.	02
7.	Resemblances of Pteridophytes with Bryophytes, Differences between Pteridophytes and Bryophytes, Origin of Pteridophytes -Algal and Bryophytes, Evolution of Pteridophytes- Telome Theory and Enation Theory.	03
8.	Study of Life Cycle of Pteridophytes with respect to Taxonomic position, Morphology, Anatomy, Reproduction, Sporophytes and Gametophytes of <i>Psilotum</i> , <i>Selaginella</i> and <i>Equisetum</i>	09
09	Ecological and Economical Importance of Pteridophytes	01

Note:development of sex organs and Sporophytes is not expected.)

Suggested readings:

1. Chopra G.L. and Yadav D.L. A Text book of Bryophytes.
2. Das, Datta and Gangulee-College Botany Vol I
3. Parihar, N.S. An introduction to Embryophyta: Bryophyte-I
4. Puri Prem. Brayophytes, Atmaram and Sons. Delhi.
5. Parihar N.S. 1991. Bryophyta. Central Book Depot, Allahabad.
6. Sporne K.R. 1991. The Morphology of Pteridophytes. B.I Publishing Pvt. LtdBombay.
7. Vashishta B.R. Botany for degree students Bryophytes- Vol-III
8. Vashishta B.R. Botany for degree students Pteridophytes.

**T.Y.B.Sc. Botany CBCS Pattern
(Semester V, Paper III) 2020-2021
BO 353: Spermatophyta and Paleobotany - 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
	Credit-I ANGIOSPERMS	15
1.	Origin of angiosperms: with reference to time, place and ancestry- 1) Pseudanthial theory 2) Transitional-Combinational Theory	02
2.	Speciation & Endemism Species concept (Biological, Taxonomic & Phylogenetic Species Concept), Speciation (Allopatric, Sympatric & Parapatric), Endemism and its types (Palaeoendemism, Holoendemism and Neoendemism)	04
3.	Classification: Outline, Merit and Demerits of Cronquist's System and APG IV system of classification. Study of following families with reference to systematic position (As per Bentham & Hooker), Diagnostic characters, floral formula, floral diagram and any five examples with their economic importance – Nymphaeaceae, Oleaceae, Amaranthaceae, Cannaceae	06
4	Herbaria and Botanical Gardens Functions of Herbarium, Important herbaria (World: Kew herbarium; India: Central National Herbarium, Kolkata). Botanic gardens of the world (Royal Botanic Garden, Kew) and India	03
	Credit-II GYMNOSPERMS and PALEOBOTANY	15

6	Introduction, general characters, economic importance and classification according to Chamberlain (1934).	02
7.	Study of life cycle of Pinus and Gnetum with reference to distribution, morphology, anatomy, reproduction, gametophyte, sporophyte, seed structure and alternation of generations.	10
8.	Fossil- Definition, process of fossil formation, types of fossils.-Impression, Compression, Petrification, Pith cast and Coal ball.	03

Suggested readings:

1. Cronquist, A. 1968. The Evolution and Classification of Flowering Plants. Thomas Nel and Sons, Ltd. London.
2. Lawrence, G.H.M 1951. Taxonomy of Vascular Plants.
3. Singh V. and D.K Jain, 1981 Taxonomy of Angiosperms. Rastogi Publication, Meerut.
4. Swingle D.B. 1946. A Text book of Systematic Botany. Mc Graw Hill Book Co. New York.
5. Takhtajan A. 1969. Flowering Plants; Origin and Disposal.
6. Pande B.P 1997. Taxonomy of Angiosperms. S.Chand.
7. Gurucharan Singh 2005- Plant systematics
8. Naik V.N. - Taxonomy of Angiosperms.
9. Shivrajan V.V. -Introduction to Principles plant taxonomy
10. V. V. Sivarajan, N. K. P. Robson 1991. Introduction to the Principles of Plant Taxonomy IIInd Edi.
11. Sharma O.P. Plant Taxonomy Tata McGraw-Hill
12. Botanical Journal of the Linnean Society, 2009, 161, 105–121.
13. <http://www.mobot.org/MOBOT/research/APweb/>

**T.Y.B.Sc. Botany CBCS Pattern
(Semester V, Paper IV) 2020-2021
BO 354: Plant Ecology - 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
	Credit-I	15
1.	Introduction, interrelationship between the living world and the environment, levels of organization, components and dynamism of ecosystem, homeostasis, niche concept, concept of limiting factors	03
2.	Biogeography: Floristic realms, speciation and its types, biogeographic regions of India, Plant indicators	03

3.	Population ecology: Definition, characteristics, population growth form, r and k selection	03
4.	Community ecology: Introduction and Definition, community structure, physiognomy, Raunkiaer's life form classification, keystone species, edge and ecotone	04
5.	Biogeochemical cycles: The carbon cycle, Nitrogen cycle, Phosphorus cycle, and Hydrologic cycle	02
Credit-II		15
6.	Ecological Impact Assessment (EIA) Introduction, Historical Review of EIA, Objectives of EIA, Stages of EIA process: Screening; Scoping; Baseline study; Impact prediction and assessment; Mitigation; Producing Environmental Impact Statement (EIS); EIS review; Decision making; Monitoring, Compliance and Enforcement; Benefits of EIA.	05
7.	Environmental Audit Meaning and concept, need, objectives, benefits, types, audit protocol, process, certification, personnel environmental audit	04
8.	Remote Sensing Definition, basic principles, process of ecological data acquisition and interpretation, global positioning system, application of remote sensing in ecology.	04
9.	Ecological management: Concepts, sustainable development, sustainability indicators	2

References:

1. Current sciences special issue remote sensing for national development Volume 61 numbers 3 and 4 August 1991
2. Daubenmire R.F. 1974. Plants and Environment- A Text Book of Plant Ecology (3rd edition). John Wiley & Sons. New York.
3. E.P. Odum. 1996. Fundamentals of Ecology. Natraj Publishing, Dehradun.
4. G.J. Rau and C.D. Weeten, "Environmental Impact Analysis Hand book, McGraw Hill, 1980.
5. George Joseph Fundamentals of remote sensing (Second edition, 2005) by Universities press (India) Private Ltd., Hyderabad.
6. John R. Jensen (2000) Remote sensing of the environment, Dorling Kindersley India Pvt. Ltd,
7. Kendeigh S.C. 1980. Ecology with Special Reference to Animals and Man. Prentice Hall of India Pvt. Ltd., New Delhi.
8. Kermondy F.J. 1996. Concepts of Ecology. Prentice Hall of India Pvt. Ltd. New Delhi.
9. Kumar H.D. 1996. Modern Concepts of Ecology (3rd edition). Vikas Publishing House Pvt., Ltd. Delhi.

10. Kumar H.D. 1997. General Ecology. Vikas Publishing Pvt. Ltd., Delhi.
11. Larry W. Canter, " Environment Impact Assessment", McGraw-Hill Book Company, New York
12. M. Anji Reddy Textbook of Remote sensing and GIS (Third edition, 2006) by BS Publication, Hyderabad
13. Singh JS, Singh SP, & Gupta SR, (2006) Ecology, Environment and Resource Conservation. Anamayapubl, New Delhi
14. Smith L.R. 1996. Ecology and Field Biology (5th edition). Harper Collns College Publishers, USA.
15. Smith L.R. and Mith T.M. 1998. Elements of Ecology. (4th edition). An imprint of Addison Wesley, Longman ink., California
16. Weaver. J.E. and Clements. S.E. 1966. Plant Ecology. Tata McGraw Publishing Co. Ltd. Bombay.

**T.Y.B.Sc. Botany CBCS Pattern
(Semester V, Paper V) 2020-2021
BO 355: Cell and Molecular Biology - 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
Credit-I Cell Biology		15
1.	Introduction to Cell Biology: Definition, Brief history of Cell Biology, Units of measurement for cell, Interdisciplinary nature of Cell Biology	01
2	Cell organelles: Ultrastructure, components and functions of Cell wall and cell membranes, mitochondria and Chloroplast, endoplasmic Reticulum, Golgi apparatus, Lysosomes, Vacuoles, Peroxisomes & Glyoxysomes	06
3.	Nucleus: Morphology and ultrastructure of nucleus, nucleolus and nucleolar organizer Nuclear envelope – structure of nuclear pore complex, transport of molecules across nuclear envelope.	03
4.	Chromosomes: Euchromatin and heterochromatin Histones, Packing of DNA into chromosomes in eukaryotes, Karyotype and ideogram, Polytene chromosomes and lampbrush chromosomes.	03
5	Cell signaling: Introduction and definition, Signaling molecules and receptors, Calcium signaling pathway in plants	02
Credit-II Molecular Biology		15
5	Genetic material DNA: historical perspective from 1953 to 2020, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment.	02

6.	DNA replication (Prokaryotes and Eukaryotes): Molecular mechanism of DNA replication. Enzymes involved in both prokaryotic and eukaryotic DNA replication and their inhibitors (antibiotics).	03
7.	Gene expression:Transcription (Prokaryotes in details and passing remarks on Eukaryotes) Types of RNA: mRNA, tRNA, rRNA; types of promoters; types of RNA polymerase enzymes in eukaryotes; molecular mechanism of transcription.	04
8	Translation (Prokaryotes and Eukaryotes): Definition, concept and properties of genetic code; molecular mechanism of translation.	03
9	Regulation of gene expression: Concept of operon, <i>lac</i> operon and <i>trp</i> operon, positive and negative control, one gene one enzyme hypothesis.	03

Suggested readings:

1. Cell and Molecular Biology , S. C. Rastogi
2. Cytology, T. S. Verma and V. K. Agarwal 3. Cell Biology, C. B. Pawar
4. Cell and Molecular Biology, P. K. Gupta
5. Fundamentals of Molecular Biology, Veer Bala Rastogi
6. Fundamentals of Molecular Biology, G. K. Pal and Ghaskadabi
7. Cell Biology, Molecular Biology, Genetic, Evolution and Ecology, Verma and Agarwal
8. Cell and Molecular Biology, Robertis and DeRobertis
9. Molecular Cell Biology, 4th Edition, Lodish S. Baltimore
10. Molecular Biology of Gene, Watson J. D.
11. Biochemistry and Molecular Biology of Plants, Buchanan B. B.
12. Molecular and Cell Biology, Wolfe S.L.

**T.Y.B.Sc. Botany CBCS Pattern
(Semester V, Paper VI) 2020-2021
BO 356: Genetics - 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
	Credit-I	15
1.	Introduction to Genetics. History, Definition, Concept, branches and applications of Genetics.	01
2	Mendelism Genetical terminology, Monohybrid cross, Law of dominance, Incomplete dominance, Law of segregation, Dihybrid cross, Dihybrid ratio, Law of	04

	independent assortment, Back cross and Test cross.	
3.	Neo Mendelism (Gene Interaction) Genetic interaction, Epistatic interactions –supplementary gene (recessive epistasis 9:3:4), Inhibitory genes (13:3), Masking genes (12:3:1), Non-Epistatic inter-allelic genetic interactions-Complementary genes (9:7), Duplicate genes (15:1)	03
4.	Multiple alleles Definition, Concept, Characters of multiple alleles, Examples of multiple alleles – Blood group in human and self-incompatibility in Nicotiana.	02
5	Linkage, Recombination and Crossing Over Linkage- Definition and Types, Crossing over: Definition and Types, Construction of a linkage map by two point test cross and three point test cross, Recombination: Concept, definition and types	04
6	Mutation: Concept, definition and types	01
Credit-II		15
5	Numerical alterations of chromosomes.: Euploidy, Aneuploidy-Concept and Types, Aneuploidy in Plants and Human, Polyploidy in Plants & Animals, Induced Polyploidy, applications of Polyploidy	03
6.	Structural alterations of chromosomes.: Types, cytology and genetic effects of Deletion, Duplication Inversion and Translocation with examples.	04
7.	Cytoplasmic & Quantitative Inheritance: Concept of quantitative inheritance, Inheritance of quantitative trait in Maize (Cob length), Cytoplasmic inheritance Definition and concept, Chloroplast- Variegation in Four O'clock plants, Mitochondria- Petite mutants in yeast.	04
8	Sex Linked Inheritance: Concept of Sex chromosomes and autosomes, Inheritance of X- linked genes –Inheritance of colour blindness in humans, Inheritance of Y-linked (Holandric genes) in humans, Sex influenced genes, Sex-limited genes.	04

Suggested readings:

1. Atherly, A.G., Girton, J.R. and McDonald, J.F 1999. The Science of Genetics Saunders College Publishing, Frot Worth, USA.
2. Hartle D.L and Jones, E.W 1998 Genetics: Principles and Analysis (Fourth Edition). Jones and Bartlett Publishers, Massachusetts, USA.
3. Khush, G.S 1973. Cytogenetics of Aneuploids. Academic Press, New York, Lewis, R. 1997. Human Genetics: Concepts and Application (Second Edition). WCB McGraw Hill, USA.
4. Russel, P.J. 1998. Genetics (Fifth Edition). The Benjamin/Cummings Publishing Company IND., USA.
5. Snustad, D.P and Simmons, M.J 2000. Principles of Genetics (Second Edition). John Wiley and Sons Inc., USA.
6. Gardner and Simmons Snustad 2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons, Singapore.
7. Sarin C 2004 (Sixth Edition) Genetics. TATA McGraw-Hill Publishing Company Ltd., New Delhi.
8. Ahluwalia K.B 2005 (First Edition). Genetics. New Age International Private Ltd. Publishers, New Delhi.
9. Burus and Bottino 1989. (Sixth Edition). The Science of Genetics. Macmillan Publishing Company, New York (USA).
10. Pawar C.B 2003 (First Edition). Genetics Vol. I and II. Himalaya Publishing House, Mumbai.
11. Strickberger 2005. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
12. Allard R.W 1995. Principles of Plant Breeding. John Wiley and Sons, Inc., Singapore.
13. Sharma J.R 1994 Principles and practices of Plant Breeding. Tata McGraw-Hill Publishers Company Ltd., New Delhi.
14. Verma and Agarwal, Genetics, S. Chand Co, New Delhi.
15. Singh B.D 2004. Genetics. Kalyani Publication, Ludhiana.
16. Gupta P.K Genetics and Cytogenetics, Rastogi Publications.
17. Gupta P. K. Genetics Rastogi Publications.
18. Phundan Singh Genetics, Kalyani Publications.
19. Verma P.S and Agarwal V.K. (2006) Cell Biology, Genetics, Molecular Biology, Evolution, Ecology. S.Chand and Company, New Delhi.
20. Shukla R.S. & Chandel P.S. Cytogenetics, Evolution & Biostatistics. S.Chand Publications.
21. Tomar & Singh Evolutionary Biology, Rastogi Publications.

22. Darbeshwar Roy Crop Evolution & Genetic Resources.

**T.Y.B.Sc. Botany CBCS Pattern
Practical (Semester V Paper VII) 2020-2021
BO 357: Practical based on BO351 and BO352 (2 Credits)**

Sr. No.	Title	No. of Practical
1.	Study of Algae with respect to systematic position, thallus structure and reproduction of <i>Nostoc</i> , <i>Oedogonium</i> , <i>Chara</i> , <i>Sargassum</i> , <i>Palmaria/Chondrus</i> .	04
2	Study of Fungi respect to systematic position, thallus structure and reproduction of <i>Mucor</i> , <i>Saccharomyces</i> , <i>Penicillium</i> , <i>Puccinia</i> and <i>Cercospora</i> .	04
3.	Study of <i>Marchantia</i> with respect to systematic position, morphology of thallus –rhizoids and scales, Gemma Cup, structure of sporophyte, reproduction.	01
4.	Study of <i>Anthoceros</i> with respect to systematic position, structure of gametophyte, anatomy of thallus, structure of Sporophytes, reproduction.	01
5	Study of <i>Funaria</i> with respect to systematic position, morphology of thallus- leaf, rhizoids, operculum, Anatomy of axis, leaf, reproduction	01
6	Study of Sporophyte evolution in Bryophytes with the help of permanent slides.	01
7	Study of <i>Psilotum</i> with respect to Taxonomic position, Morphology of sporophyte, anatomy and reproductive structure	01
8	Study of <i>Selaginella</i> with respect to Taxonomic position, Morphology of sporophyte, Anatomy and reproductive structures.	01
9	Study of <i>Equisetum</i> with respect to taxonomic position, Morphology of Sporophyte, anatomy and reproductive structure	01
10	Study of Stealar evolution in Pteridophytes with the help of permanent slides	01

Note: Botanical Excursion and submission of Tour Report with Photographs is compulsory.

T.Y.B.Sc. Botany CBCS Pattern
Practical (Semester V Paper VIII) 2020-2021
BO 358: Practical based on BO353 and BO354 (2 Credits)

Sr. No.	Title	No. of Practical
1.	Study of following families with reference to systematic position (following Bentham & Hooker), Diagnostic characters, floral formula, floral diagram of Nymphaeaceae, Oleaceae, Amaranthaceae, Cannaceae	04
2	Preparation of Botanical keys: Indented and bracketed keys by using vegetative and reproductive characters	01
3	Study of internal and external morphology of Gnetum	01
4.	Study of internal and external morphology of Pinus	01
5.	Study of the following with the help of slides and/ or specimens. i) Impression ii) Compression iii) Petrification	01
6	Study of polluted water body with ref. to BOD (D zero day and D fifth day).	02
7	Study of physicochemical properties of water body by using Sacchi disc, pH meter and electric conductivity meter	02
8	Acquisition of ecological data of particular locality by using GPS/ altimeter/geographic maps etc	02
9	Study of suitable ecosystem by line/belt transect method/ nested quadrat method	02

Note: Excursion tours of long and short duration are compulsory

T.Y.B.Sc. Botany CBCS Pattern
Practical (Semester V Paper IX) 2020-2021
BO 359: Practical based on BO355 and BO356 (2 Credits)

Sr. No.	Title	No. of Practical

1.	Cytological techniques-preparation of Fixatives, preparation of stains (Aceto carmine and Aceto-orcein).	01
2	Isolation of nuclei and characterization	01
3	Study of various stages of mitosis and meiosis	01
4	Induction of C metaphase in suitable plant material	01
4	Study of Chromosomes Morphology (from colchicines pretreated Onion root tip cells)	01
6	Isolation of plant genomic DNA by suitable method.	01
7	Estimation of Plant DNA by DPA method	01
8	Extraction and estimation of RNA by Orcinol Method	01
9	To study the monohybrid and dihybrid crosses with suitable data and its analysis by Chi-Square test.	01
10	Induction of tetraploidy in onion root cells and preparation of squash for observation of tetraploid cells.	01
11	Preparation of salivary gland chromosomes in <i>Chironomous</i> larvae.	01
12	Study of human genetic traits viz. PTC taste sensitivity, earlobe and rolling tongue, height, Skin colour, Hair colour, Eye colour in known population.	01
13	Genetic problems on gene mapping using three point test cross data.	01
14	Study of structural heterozygotes (multiple translocations) in <i>Rhoeo</i> .	01
15	Problems on quantitative inheritance. (Cob length in Maize)	01
16	Problems on Multiple Alleles. (Blood group in Human)	01

Skill Enhancement course

**T.Y.B.Sc. Botany CBCS Pattern
(Semester V, Paper X) 2020-2021
BO 3510: Medicinal Botany - 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
Credit-I		15
1.	Medicinal Plants: History, Scope and Importance	01
2	Indigenous Medicinal Sciences; Definition and Scope	01
3.	Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments	04
4.	Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine.	02
5	Unani: History, concept: Umoor-e- tabiya, tumors treatments/ therapy, polyherbal formulations.	02
6	Conservation of endangered and endemic medicinal plants: Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens.	05
Credit-II		15
5	Propagation of Medicinal Plants: Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.	05
6.	Ethnobotany and Folk medicines: Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethnobotany.	05
7.	Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases.	05

Suggested Readings

1. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
2. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.

Skill Enhancement course**T.Y.B.Sc. Botany CBCS Pattern
(Semester V, Paper XI) 2020-2021****BO 3511: Plant Diversity and Human Health - 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
	Credit-I	15
1.	Plant diversity and its scope- Genetic diversity, Species diversity, Plant diversity at the ecosystem level,	03
2	Agrobiodiversity and cultivated plant taxa, wild taxa. Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes.	05
3.	Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agrobiodiversity, Projected scenario for biodiversity loss,	04
4.	Management of Plant Biodiversity: Organizations associated with biodiversity management-Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations.	03
	Credit-II	15
5	Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem diversity, In situ and ex situ conservation, Social approaches to conservation, Biodiversity awareness programmes, Sustainable development.	08
6.	Role of plants in relation to Human Welfare; a) Importance of forestry their utilization and commercial aspects b) Avenue trees, c) Ornamental plants of India. d) Alcoholic beverages through ages. Fruits and nuts: Important fruit crops their commercial importance. Wood and its uses.	07

Suggested Readings

Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.

**T.Y.B.Sc. Botany CBCS Pattern
(Semester VI, Paper I) 2020-2021
BO 361: Plant Physiology and Metabolism - 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
Credit-I		15
1.	Mineral nutrition: Classification of mineral elements, macro and micronutrients; Role of essential elements; Transport of ions across cell membrane, Ionophores, Carriers and Channels	03
3.	Photosynthesis: Mechanism of photosynthesis- Electromagnetic spectrum Ultra-Structure of Chloroplast, Organization of Light-Absorbing Antenna Systems, Light Reaction: (Cyclic and Non-cyclic photophosphorylation), Dark Reaction: Calvin-Benson Cycle, Photorespiration, C4 cycle and CAM pathway of carbon fixation).	07
4.	Respiration: Types of respiration (Aerobic and anaerobic), Mechanism of aerobic respiration (Glycolysis, TCA cycle, Terminal oxidation and phosphorylation in respiratory chain); Pentose Phosphate Pathway.	05
Credit-II		15
5	Stomatal Biology: Light-dependent Stomatal Opening, Mediation of Blue-light Photoreception in Guard Cells by Zeaxanthin, Reversal of Blue Light-Stimulated Opening by Green Light, The Resolving Power of Photophysiology (Overview).	04
6.	Translocation in phloem: Composition of phloem sap, girdling experiment; Pressure flow model.	03
7.	Plant growth regulators: Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.	05
8	Photomorphogenesis: Red and far red light responses on photomorphogenesis; Phytochrome (discovery and mode of action).	03

Suggested Readings:

1. Lincoln Taiz, Eduardo Zeiger, Ian Max Moller and Angus Murphy 2015. Plant Physiology and Development (Sixth Edition) Sinauer Associates, Inc Publishers Sunderland, Massachusetts U.S.A.

2. Epstein, E., and Bloom, A. J. (2005) Mineral Nutrition of Plants: Principles and Perspectives, 2nd ed. Sinauer Associates, Sunderland, MA.
3. Salisbury F.B and Ross C.W (1992). Plant physiology (Fourth Edition) Wadsworth Publishing Company, California, USA.
4. V. K. Jain (2017) Fundamentals of Plant Physiology S. Chand Publications.

**T.Y.B.Sc. Botany CBCS Pattern
(Semester VI, Paper II) 2020-2021
BO 362: Biochemistry - 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
Credit-I		15
1.	Foundation of Biochemistry: From molecules to the first cell (origin of a cell), Miller and Urey experiment. Biomolecules of a cell, functional groups in biomolecules, conformations and configurations of biomolecules.	03
2	Water: The solvent of life: Physical properties of water, structure of water molecule, polarity of water molecule, weak interactions in aqueous solutions.	02
3.	Amino acids and proteins: Structure, classification, properties and functions of amino acids. Structure (primary, secondary, tertiary and quaternary), properties and functions of proteins. Biological disorders of amino acid metabolism. Commercial applications.	05
4.	Enzymes: Definition, nature of enzymes and co-factors, classification and properties of enzymes, active site. Mechanism of enzyme action: free energy, activation energy, binding energy, transition state, lock and key hypothesis, induced fit theory. Factors affecting enzyme activity: pH, temperature, substrate concentration, enzyme concentration. Enzyme inhibition: Competitive, uncompetitive, non-competitive. Reversible and irreversible inhibition, feedback inhibition.	05
Credit-II		15
5	Carbohydrates: Definition, classification of carbohydrates- Monosaccharides: aldoses and ketoses, configurations, linear to ring structure; Oligosaccharides: glycosidic bond, reducing and non-reducing sugars; Polysaccharides: homopolysaccharides, heteropolysaccharides,	08

	examples, their structures, locations and role. Properties and functions of carbohydrates. Commercial applications.	
6.	Lipids: Definition, classification of lipids: simple, conjugate and derived lipids, properties and functions of lipids. Biological disorders of lipid metabolism. Commercial applications.	05
7.	Vitamins: Definition, classification of vitamins. source and functions of vitamins.	02

Suggested Readings:

1. Nelson, D. L., & Cox, M. M. (2017). *Lehninger principles of biochemistry* (7th ed.). W.H. Freeman.
2. Buchanan, B. B., Gruissem, W., & Jones, R. L. (2000). *Biochemistry & molecular biology of plants*. Rockville, Md.: American Society of Plant Physiologists.
3. Taiz, L. Zeiger, E., Moller, I.M. and Murphy, A. (2015) *Plant Physiology and Development*. 6th Edition, Sinauer Associates, Sunderland, CT.
4. Jain, J. L., Jain, S. & Jain, N. (2020) *Fundamentals of Biochemistry*, Revised edition, S. Chand Publishing
5. Verma S.K. and Verma M. (2007) *A text book of Plant Physiology, Biochemistry and Biotechnology*, S. Chand Publishing.

**T.Y.B.Sc. Botany CBCS Pattern
(Semester VI, Paper III) 2020-2021
BO 363: Plant Pathology - 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
	Credit-I	15
1.	Fundamentals of Plant Pathology: Introduction, Important terminology- Incitants, Host, Symptoms, Parasite, Pathogen, Inoculum, Penetration, Infection, Incubation, Disease. Economic importance of plant diseases, History of plant pathology, Introduction to Indian Agriculture Research Institute (IARI), International Crop Research Institute for Semi-Arid Tropics (ICRISAT), Contribution of Anton De Bary and Prof. B.B. Mundkur.	02
2	Disease Development: Concept of disease cycle, Inoculation, Prepenetration, Penetration, Infection, Dissemination. Epidemics-Forms,	02

	Decline, Exponential model.	
3.	Defense Mechanisms: Concept and Definition, Types-Preexisting-Structural and chemical, Induced- Structural and Biochemical.	02
4.	Methods of Studying Plant Diseases. Macroscopic study, Microscopic study, Koch's postulates. Types of culture Media, Pure culture methods- Streak plate, Pour plate, Spread plate.	02
5	Fungal Plant Diseases Introduction to fungi as plant pathogens. Study of Diseases- Downy mildew of Grapes, Head smut of Jowar, Tikka diseases of Groundnut with reference to causal organism, symptoms and disease management.	04
6	Bacterial Plant Diseases. Introduction to bacteria as plant pathogens, Study of Diseases- Citrus Canker, Black arm of Cotton with reference to causal organism, symptoms and disease management.	03
Credit-II		15
5	Mycoplasma Plant Diseases: Introduction to Mycoplasma as plant pathogens, Study of Diseases- Grassy shoot disease of sugarcane, Little leaf of brinjal with reference to causal organism, symptoms and disease management.	03
6.	Nematodal Plant Diseases: Introduction to Nematodes as plant pathogens. Study of Diseases- Root knot diseases of vegetables, Soyabean cyst Nematodes with reference to causal organism, symptoms, Integrated management of Nematodal diseases.	02
7.	Viral Plant Diseases: Introduction of Virus as plant pathogens. Study of Diseases- Papaya Mosaic Disease, Bunchy top of Banana with reference to causal organism, symptoms and causal organism	02
8	Non-Parasitic Diseases. The impact and abiotic causes- Temperature, Soil moisture and relative humidity, Poor oxygen, Poor light, Air pollutants, mineral deficiencies. Herbicidal injury, Study of Mango necrosis, Black Heart of Potato.	04
9	Principles of plant diseases control: General account, Quarantine,	04

	Eradication, cultural control practices, Biological control. Curative measures, chemical control, Use of Effective Microorganism solution (EMS), Microbial Pesticides.	
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Suggested Readings:

1. Singh R. S. (2019) Introduction to Principles of Plant Pathology 4Ed (PB2019) Paperback.
2. Plant Pathology 2/e PB....Sharma PD Paperback – 1 January 2016
3. A.V.S.S. Sambamurty (2010) Principles of plant pathology, Wiley distributor
4. George Agrios (2004) Plant Pathology 5th Edition, Academic Press

**T.Y.B.Sc. Botany CBCS Pattern
(Semester VI, Paper IV) 2020-2021
BO 364: Evolution and Population genetics- 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
	Credit-I	15
1	Organic Evolution: Distinction between Origin of life and Organic Evolution, Historical account of Origin of life, Origin of Earth Vs Origin of life: Gaia Hypothesis, Earliest Fossils, Prebiotic Evolution, Abiotic synthesis of organic matter, Primordial soup, origin of membranes, Oparin's Coacervate model, Theory of Panspermia, Early life and RNA and Origin of genetic code	06
2	Organic Evolution: The concept of organic evolution, Theories of Evolution, Pre-Darwinian period, Theory of Inheritance of acquired characters (Lamarck's), Darwinism- Theory of Natural Selection, Post-Darwinian period- Modern synthetic theory	05
2	Evidences of Evolution Direct evidences and conclusions from fossil records, Indirect evidences, Evidences from Genetics, Evidences from bio-geographical relations	04
	Credit-II	15
4	Evolution Through Ages: Fossils and Geological Time scale: Fossils and	05

	Fossilization, Conditions of fossilization, Dating of fossils: Uranium Lead method, Radio-carbon method, U-series and ESR method, Geological Time scale: Eras, Periods, epochs, and duration in millions of years and plant life.	
5.	Population Genetics and Evolution: Concept of Mendelian population, Gene Pool and its models, Hardy-Weinberg law of gene frequencies, Factors affecting allelic frequency, Genetic polymorphism	04
5.	Speciation and Isolating Mechanisms: Introduction, Morphological Criteria for Species and Races, Allopatric and Sympatric Populations, Isolating Mechanisms: Pre zygotic Isolation mechanisms: Concept, Spatial & Ecological;, Seasonal Isolation, Ethological Isolation, Mechanical Isolation, Post zygotic Isolation mechanisms: Concept, Hybrid in viability, Hybrid sterility & Hybrid breakdown.	06

Suggested readings:

1. P. K Gupta, Cytology, Genetics and Evolution , Rastogi Publications
2. Verma P.S and Agarwal V.K. (2006) Cell Biology, Genetics, Molecular Biology, Evolution, Ecology. S. Chand and Company, New Delhi
3. Shukla R.S. & Chandel P.S. Cytogenetics, Evolution & Biostatistics. S. Chand Publications,
4. Tomar & Singh, Evolutionary Biology, Rastogi Publications
5. Suryaprakash Mishra. A textbook of Cell Biology, Genetics and Evolution, Kalyani Publication
6. N Shukla, Population Genetics, DISCOVERY PUBLISHING, PVT. LTD.
7. Veer Bala Rastogi .Organic Evolution (Evolutionary Biology), Scientific International Pvt. Ltd.
8. N. Anurgam, Evolution, Saras Publications
9. N. Anurgam, Organic Evolution, Saras Publications

**T.Y.B.Sc. Botany CBCS Pattern
(Semester VI, Paper V) 2020-2021**

BO 365: Advanced Plant Biotechnology - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I	15
1	Biotechnology:	02

	Introduction, Traditional and modern Biotechnology. Impact of Biotechnology on Health care, Agriculture, and Environment	
2	Plant Tissue Culture: Concepts of Cell theory & Cellular totipotency, Landmarks in plant tissue culture. Pluripotency, Differentiation, dedifferentiation, redifferentiation, Hormones used in PTC, 'Explant' for plant tissue culture and Response of explants in vitro– callus formation, organogenesis (direct and indirect) and embryogenesis (direct and indirect). Micro propagation of Banana (in detail from Selection of explant to hardening and marketing)	06
3.	Techniques of Genetic Engineering and Methods of gene transfer in Plants- Introduction to Molecular tools: Definition and role of Nucleases, Polymerases, Ligases, Polynucleotide kinases, Alkaline Phosphatases. Types of vectors- Definition and characters (2-4) of Plasmids, Phages, Cosmids, BAC, YAC, Plant viruses, Animal viruses. Methods of gene transfer in Plants – Direct gene transfer – Definition and concept of Electroporation, Microinjection, and Gene gun Indirect gene transfer- Agrobacterium mediated gene transfer method, Ti-plasmid: structure and functions, T-DNA Gene amplification technique -Polymerase chain reaction DNA finger printing	07
Credit-II		15
4	Cryopreservation and Germplasm Conservation Definition and concept, techniques of cryopreservation, cold storage, long term and short term storage, applications. Germplasm Conservation: Preservation of Cell, tissue, organ, whole organism. Concept of Gene Bank, DNA Bank, Seed Bank, Pollen Bank etc.	03
5.	Biotechnology and Society	05

	Biotechnology- Benefits, GM foods and its safety, Recombinant foods and religious beliefs, Recombinant therapeutic product for human health care. Patenting of biotechnological inventions and Intellectual property rights.	
5.	<p>Microbial Biotechnology:</p> <p>Biochemistry of fermentation, Microorganism used in fermentation, fermentable substrate, Ethanol fermentation methods, Distilleries producing alcohols. Commercial production: Alcoholic beverages, organic acids, citric acids. Advantages of fermentation.</p> <p>Transgenic Plants as Bioreactors: Metabolic engineering of starch, cyclodextrins, fructans, Bioplastics, Genetically engineered plants as protein factories, Production of therapeutic proteins from plants.</p>	06
6	<p>Nano-biotechnology</p> <p>Definition and concept, Applications of nanotechnology in agriculture (fertilizers and pesticides).</p>	01

Suggested readings:

1. R. C. Dube (2008) - A Text Book of Biotechnology, S. Chand
2. P.K. Gupta-Elements of Biotechnology
3. Satyanarayana-Biotechnology
4. Kalyan Kumar De-Plant tissue culture
5. Pal J.K. and Ghaskadabi S.S. (2008) Fundamentals of Molecular Biology.
6. Verma and Agrawal- Molecular Biology
7. Devi P.2008-Principle and Methods of plant Molecular Biology, Biochemistry and Genetics Agrobios, Jodhpur, India.
8. Glick B.R. and Tompson J.E. 1993 Methods in Plant Molecular Biology and Biotechnology CRC Press Boca Raton, Florida.
9. Hall R.D. (Ed.) 1999 Plant cell culture Protocol human press Inc., New Jersey, USA

10. Kumar H.D. 2002 A Text Book of Biotechnology 2nd Edn. Affiliated Easyt West Press Private Ltd New Delhi.
11. Ramawat K.G. 2003 Plant Biotechnology, S. Chand & Co. Ltd . Ramnagar New Delhi. 110055
12. Trivedi P.C.2000 Plant Biotechnology, Panima Publishing Carpation, New Delhi.
13. Rajdan- Plant tissue culture.
13. Kalyan Kumar De-Plant tissue culture
14. Pal J.K. and Ghaskadabi S.S. (2008) Fundamentals of Molecular Biology.
15. .Razdan M.K. - Introduction to Plant Tissue culture (Oxford & IBH Publ, New Delhi)

**T.Y.B.Sc. Botany CBCS Pattern
(Semester VI, Paper VI) 2020-2021
BO 366: Plant Breeding and Seed Technology - 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
	Credit-I –Plant Breeding	15
1	Introduction: Definition, Scope and objectives and History of Plant breeding in India	01
2	Techniques and practices of plant breeding	02
	A. Plant Introduction <ul style="list-style-type: none"> • Definition • Types (Primary and Secondary) • Procedure • Merits and Demerits • Important Achievements 	
	B. Selection methods <ul style="list-style-type: none"> • Concept, • Types of selections –mass selection, pure line selection and clonal selection. • Advantage and disadvantages of selection • Achievements of selection breeding 	03
	C. Hybridization <ul style="list-style-type: none"> • Definition, Concept and Objectives • Precaution to be taken during hybridization • Types: Intervarietal and Distant • General procedure of hybridization • Methods of hybridization: Pdigree and bulk • Hybrid vigour and heterosis 	04
3	Advanced techniques in Plant breeding	03
	A. Mutation breeding	

	<ul style="list-style-type: none"> • Definition and concept • Mutagens (Physical and Chemical) • Mutants • Types of mutation (Spontaneous and Induced) • Application of mutation breeding • Limitations of mutation breeding 	
	<p>B. Tissue Culture</p> <ul style="list-style-type: none"> • Definition and concept • Totipotency • Application of tissue, embryo and anther culture in seed production 	02
Credit-II - SEED TECHNOLOGY		15
4	<p>Introduction to Seed Technology</p> <ul style="list-style-type: none"> • Seed as a basic input in agriculture • Classes of seed <ol style="list-style-type: none"> 1. Nucleus 2. Breeder 3. Foundation 4. Certified <p>Role of seed technology</p>	02
5.	<p>Seed legislation</p> <ul style="list-style-type: none"> • Introduction • Seed legislation in India (Seed Act) 	01
6	<p>Seed Production</p> <ul style="list-style-type: none"> • Introduction • National Seed Corporation (NSC) and its objectives • State Seed Corporation (SSC) and its objectives • General procedure for Seed Production <ul style="list-style-type: none"> ○ Location and Season ○ Land requirement ○ Importance of soil and water testing ○ Cultural practices ○ Isolation distance ○ Plant protection ○ Weed Control ○ Rouging ○ Harvesting ○ Threshing ○ Seed Processing 	03
7	<p>Seed Certification</p> <ul style="list-style-type: none"> • Definition, Objectives and Concept • Phases of Seed Certification • General procedure of seed certification • Field inspection • Duties of seed inspector 	02
8	Seed Testing	03

	<p>A. Physical Purity Analysis</p> <ul style="list-style-type: none"> • Definition of purity components • Physical Purity Work Board • Procedure <p>B. Moisture Testing</p> <ul style="list-style-type: none"> • Concept • Air oven method • Digital Moisture Meter <p>C. Germination testing</p> <ul style="list-style-type: none"> • Definition and objectives • Procedure and methods for germination testing (Paper, Sand and Soil) • Seedling evaluation (Normal Seedlings, Abnormal Seedlings, Multigerm Seed Units and Non-germinated Seeds) 	
9	<p>Seed Pathology and Entomology</p> <ul style="list-style-type: none"> • Definition • Seed Borne pathogens <ul style="list-style-type: none"> ○ Fungi ○ Bacteria ○ Viruses • Influence of seed borne pathogens on seed production • Common insect pest and its impact on seed production 	02
10	<p>Seed Storage</p> <ul style="list-style-type: none"> • Definition and Concept • Seed treatment • Management of seed storage structures <ul style="list-style-type: none"> ○ Sanitization ○ Dehumidification ○ Fumigation 	02

Suggested readings:

1. Laxmi lal somani and Devidas patel (2020) Textbook of seed science and technology, Agrotech publishing co.
2. Vijay Pal Singh Panghal and Axay Bhuker (2020) Seed Science and Technology. Kalyani publisher
3. Gardner and Simmons Snustad 2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons, Singapore.
4. Sharma J.R 1994 Principles and practices of Plant Breeding. Tata McGraw Hill Publishers Company Ltd., New Delhi.
5. Singh B.D 1996 Plant Breeding – Principles and methods. Kalyani Publications, Ludhiana.
6. Allard R.W 1995. Principles of Plant Breeding. John Wiley and Sons, Ice., Singapore.
7. Agarwal R.L. --- Seed Technology, Oxford & IBH Publishing Co Pvt.Ltd

8. TNAU (ICAR) Principles of Seed technology (2020)

T.Y.B.Sc. Botany CBCS Pattern
Practical (Semester V Paper VII) 2020-2021
BO 367: Practical based on BO361 and BO362 (2 Credits)

Sr. No.	Title	No. of Practical
1.	Determination of osmotic potential of plant cell sap by plasmolysis method	01
2	Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.	01
3	Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.	01
4	To study the effect of light intensity and bicarbonate concentration on O ₂ evolution in photosynthesis.	01
5	Comparison of the rate of respiration in any two parts of a plant.	01
6	Separation of amino acids by paper chromatography.	02
7	Demonstration experiments (any four) i). Bolting. ii). Effect of auxins on rooting. iii). Suction due to transpiration. iv). R.Q. v). Respiration in roots.	01
8	Estimation of total free amino acids by spectrophotometry	01
9	Separation of amino acids by paper chromatography.	01
10	Estimation of soluble proteins by Lowery <i>et. al.</i> method.	01
11	Demonstration of Enzyme activity: Amylase /invertase /catalase	01

12	Estimation of reducing sugars by DNSA method.	01
13	Estimation of Vitamin C (Ascorbic acid) from plants.	01
14	Qualitative tests for starch, lipids and proteins.	01
15	Determination of the iodine number of lipids using Hanus method.	01

**T.Y.B.Sc. Botany CBCS Pattern
Practical (Semester V Paper VIII) 2020-2021
BO 368: Practical based on BO363 and BO364 (2 Credits)**

Sr. No.	Title	No. of Practical
1.	Preparation of any one culture media for isolation of plant pathogens.	01
2	Culture technique- Streak plate methods, pour plate methods, Spread plate methods.	01
3	Study of any two of fungal (Downy mildew of Grapes, Head smut of Jowar, Tikka diseases of Groundnut) diseases	01
4	Study of any two of each bacterial and mycoplasma diseases	01
5	Study of any two of each viral and non-parasitic diseases of plants.	01
6	Preparation of 1% Bordeaux mixture and Bordeaux paste 10%.	01
7	Preparation of Jivamruta.	01
8	Study of Koch's Postulates.	01
9	Study of Fungicides and Microbial pesticides.	01
9	Study of Geological time scale	01
10	Study of types of Fossils : i) Coal ball ii) Rhynia vii) Lyginopteris iii) Pentoxylon iv) Nipaniophyllum v) Lepidodendron	01
11	Demonstration of any three evidences of Organic Evolution	01
12	Numerical Problems based on Allele frequency and Genotype frequency	01
13	Numerical Problem based on Hardy-Weinberg Equilibrium	01

14	Study of Sympatric and Allopatric speciation with suitable example	01
15	Study of Isolation mechanism : Prezygotic & Postzygotic(Any one example from each)	01
16	Submission of Report on Visit to Paleobotany Laboratory/Museum/Fossil Garden	01

**T.Y.B.Sc. Botany CBCS Pattern
Practical (Semester V Paper IX) 2020-2021
BO 369: Practical based on BO365 and BO366 (2 Credits)**

Sr. No.	Title	No. of Practical
1.	Preparation and sterilization of MS Medium and Callus Induction using leaf primordia	01
2	Production of secondary metabolites in any suitable plant material	01
3	Artificial seed production by Sodium Alginate method encapsulation (somatic embryogenesis)	01
4	Demonstration to equipments used in genetic engineering like gene gun, PCR, gel doc, microcentrifuge, electrophoresis, micropipettes, incubator, shaker etc. (live/videos/photographs/visit to research labs)	01
5	Study of Transgenic plants- Arabidopsis thaliana as a model plant, Bt- Brinjal, Flr-svr Tomato, and other GM crops like soybean, maize, tobacco as a pharmaceuticals, banana as a edible vaccine etc. (live/videos/photographs/visit to research labs)	01
6	Preparation of plant based nano-particles	01
7	Demonstration to Fermentation of fruit juice and wine production from grapes/pomegranate/jamun/ apple/ber (live/videos/photographs/visit to research labs)	01
8	Problems on genetic engineering (set of problems will be given on restriction enzymes, vectors etc.)	01

9	Demonstration of Hybridization Techniques (Emasculation, Hand Pollination, Bagging and Tagging) in cotton and tomato.	01
9	Effect of chemical mutagens on seed germination and seedling growth.	01
10	Study of pollen viability and floral morphology of crops	01
11	To test seed moisture by hot air oven method	01
12	To study germination methods (Paper, Sand and Soil)	01
13	Physical purity analysis of seed sample	01
14	Visual examination of dry seeds for disease symptoms	01
15	To study any one common seed insect pest w.r.t to their life cycle, way of infestation/damage, symptoms and control measures.	01
16	Visit to a Plant Breeding Research Centre/ Seed Industry and report submission	01

Note: Submission of minimum 10 seed samples along with their botanical names, family, variety etc. to the department at the time of final practical examination

Skill Enhancement course

T.Y.B.Sc. Botany CBCS Pattern (Semester VI, Paper X) 2020-2021

BO 3610: Nursery and Gardening Management- 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I Nursery Management	15
1	Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants.	03
2	Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion –Seed production technology - seed testing and certification.	03
3.	Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants– greenhouse - mist chamber, shed root, shade house and glass house.	09

Credit-II Gardening Management		15
4	Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design -computer applications in landscaping - Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.	08
5.	Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.	07

Suggested Readings

1. Bose T.K. & Mukherjee, D., Gardening in India, Oxford & IBH Publishing Co., New Delhi. 1972.
2. Sandhu, M.K., Plant Propagation, Wile Eastern Ltd., Bangalore, Madras. 1989.
3. Kumar, N., Introduction to Horticulture, Rajalakshmi Publications, Nagercoil. 1997.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi. 1993.
6. Janick Jules. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA. 1979.

**T.Y.B.Sc. Botany CBCS Pattern
(Semester VI, Paper X) 2020-2021
BO 3611: Biofertilizers- 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
Credit-I		15
1	Introduction: 1.1 Introduction, Scope and importance of Biofertilizers 1.2 General account of the microbes used as Biofertilizers	02
2	Bacterial Biofertilizers 2.1. Isolation of Rhizobium, Identification, Mass multiplication, Carrier based inoculants. 2.2. Azospirillum isolation and mass multiplication, carrier based	09

	<p>inoculants and associative effect of different organisms</p> <p>2.3. Azotobacter, classification and characteristics</p> <p>2.4. Crop response to Azotobacter inoculums, Mass multiplication of Azotobacter</p> <p>2.5. Applications of Azospirillum</p> <p>2.6. Phosphate solubilizing Bacteria</p>	
3.	<p>Algal Biofertilizers</p> <p>3:1. Cyanobacteria (Blue Green Algae): Isolation of Anabaena from Azolla, Mass Multiplication of Anabaena</p> <p>3.2. Azolla - Anabaena relationship</p> <p>3.3. Biological Nitrogen fixation</p> <p>3.4. Blue Green algae in a rice cultivation.</p> <p>3.5. Applications of BGA</p>	04
Credit-II		15
4	<p>Fungal Biofertilizers</p> <p>4.1. Introduction, Occurrence and Distribution of Mycorrhizal association.</p> <p>4:2. Types of Mycorrhizal association, growth and yield - colonization of VAM - Vesicular Arbuscular Mycorrhiza</p> <p>4.3. Mycorrhizal applications in agriculture</p>	09
5.	<p>Compost and Manure</p> <p>5.1. Organic Farming, green manuring, organic manures and their uses</p> <p>5.2. Recycling by composting method of biodegradable, municipal, agricultural and industrial wastes</p> <p>5.3. Biocompost making methods, Types and methods of vermicomposting</p> <p>5.4. Benefits of vermicompost, field applications</p>	06

Suggested readings

1. Dubey, R. C. (2005). A text book of Biotechnology. S. Chand & Co. New Delhi, India.
2. Kumaresan, V. (2005). Biotechnology. Saras Publication, New Delhi, India.
3. Sathe, T. V. (2004). Vermiculture and Organic Farming. Daya Publishers, Delhi, India.
4. Jshon, Jothi Prakash, E. (2004). Outline of Plant Biotechnology. Emkay Publication, New Delhi, India.
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6. Vayas, S. C., Vayas S. and Modi, H. (1990). Biofertilizers and Organic Farming. Ekta Publication, Nanded, India.

Webliography

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2. Biofertilizers vikaspedia.in
3. www.solverchem.com

Savitribai Phule Pune University [SPPU]

B.Sc. (Chemistry)
(Three Years Integrated Degree Program)

Choice Based Credit System [CBCS]
2019 Pattern

Third Year Bachelors of Science
(T. Y. B. Sc. CHEMISTRY)

From
Academic Year 2021-22

Board of Studies in Chemistry
Savitribai Phule Pune University [SPPU]
Pune-411007

Structure of T. Y. B. Sc. Chemistry

(According to CBCS – 2019 Pattern of SPPU)

Semester	DSEC/SEC	Nature	Paper Code	Code and Title	Credits/Lectures
V	DSEC-I	Theory	CH-501	Physical Chemistry-I	Credit-2, 36 L
		Theory	CH-502	Analytical Chemistry-I	Credit-2, 36 L
		Practical	CH-503	Physical Chemistry Practical-I	Credit-2, 73 L
	DSEC-II	Theory	CH-504	Inorganic Chemistry-I	Credit-2, 36 L
		Theory	CH-505	Industrial Chemistry	Credit-2, 36 L
		Practical	CH-506	Inorganic Chemistry Practical-I	Credit-2, 73 L
	DSEC-III	Theory	CH-507	Organic Chemistry-I	Credit-2, 36 L
		Theory	CH-508	Chemistry of Biomolecules	Credit-2, 36 L
		Practical	CH-509	Organic Chemistry Practical-I	Credit-2, 73 L
	SEC- I	Theory	CH-510	(A) Introduction of Medicinal Chemistry OR (B) Polymer Chemistry	Credit-2, 36 L
SEC- II	Theory	CH-511	(A) Environmental Chemistry OR (B) Chemo informatics	Credit-2, 36 L	
VI	DSEC-IV	Theory	CH-601	Physical Chemistry-II	Credit-2, 36 L
		Theory	CH-602	Physical Chemistry -III	Credit-2, 36 L
		Practical	CH-603	Physical Chemistry Practical-II	Credit-2, 73 L
	DSEC-V	Theory	CH-604	Inorganic Chemistry-II	Credit-2, 36 L
		Theory	CH-605	Inorganic Chemistry-III	Credit-2, 36 L
		Practical	CH-606	Inorganic Chemistry Practical-II	Credit-2, 73 L
	DSEC-VI	Theory	CH-607	Organic Chemistry-II	Credit-2, 36 L
		Theory	CH-608	Organic Chemistry-III	Credit-2, 36 L
		Practical	CH-609	Organic Chemistry Practical-II	Credit-2, 73 L
	SEC III	Theory	CH-610	(A) Chemistry of Soil and Agrochemicals OR (B) Introduction of Forensic Chemistry	Credit-2, 36 L
	SEC IV	Theory	CH-611	(A) Analytical Chemistry-II OR (B) Chemistry of Cosmetics and Perfumes	Credit-2, 36 L

Important points:

- i. Each credit is equivalent to 18 lectures of 50 minutes for theory courses and 36 lecture of 50 minutes for practical courses.
- ii. There will be 12 practical sessions per semester of 4 hours 20 minutes each.
- iii. Total weeks for teaching and internal evaluation are 15. Out of the 15 weeks, 12 weeks for teaching and 03 weeks for internal evaluation. (Theory as well as Practical).
- iv. For more details refer to UG rules and regulations (CBCS for Science program under Science & Technology) on SPPU website.

Evaluation Pattern (As per CBCS rules, SPPU, 2019 Pattern)

1. Each theory and practical course carry 50 marks equivalent to 2 credits.
2. Each course will be evaluated with Continuous Internal Assessment (CIA) and University Assessment (UEX) mechanism.
3. Continuous internal assessment shall be of 15 marks (30%) while university Evaluation shall be of 35 marks (70%).
4. To pass each course, a student has to secure 40% mark in continuous assessment as well as university assessment i.e. minimum 6 marks in continuous assessment and 14 in university assessment in the respective course.
5. For Continuous internal assessment minimum two tests per paper must be organized, of which one must be written test of 10 marks.
6. Method of assessment for internal exams: written test, MCQ type test, Viva-Voce, Project, survey, field visits, tutorials, assignments, group discussion, etc. (on approval of the head of centre).
7. Theory - University Assessment Question Paper Pattern (According to CBCS - 2019 Pattern of SPPU) Note that in theory question paper weightage will be given to each topics equivalent to number of lectures assigned in the syllabus.

Preamble:

The syllabus of Chemistry for third year has been redesigned for **Choice Based Credit System (CBCS: 2019 pattern)** and to be implemented from academic year 2021-22. In CBCS pattern semester system has been adopted for B. Sc. degree programme. Different types of courses are introduced at degree level viz. **Discipline Specific Core Course (DSCC)**, **Ability Enhancement Compulsory Course (AECC)**, **Discipline Specific Elective Course (DSEC)** and **Skill Enhancement Course (SEC)**. DSCC courses has been introduced at FY/SY level and AECC courses at SY level. At TY level DSEC and SEC courses are to be introduced. Third year syllabus comprises of six theory and three practical courses of DSEC type and two theory SEC per semester.

Equivalence with Previous Syllabus (2013 Pattern)

2013 Pattern	2019 Pattern
Sem-III (T.Y.B.Sc.)	Sem-V (T.Y.B.Sc.)
Core courses	Discipline Specific Elective Courses (DSEC)
CH-331: Physical Chemistry	CH: 501: Physical Chemistry-I
CH-332: Inorganic Chemistry	CH: 504: Inorganic Chemistry-I
CH-333: Organic Chemistry	CH: 507: Organic Chemistry-I
CH-334: Analytical Chemistry	CH: 502: Analytical Chemistry-I
CH-335: Industrial Chemistry	CH: 505: Industrial Chemistry
CH-336: Optional course (Any one) A- Nuclear Chemistry, B- Polymer Chemistry C- Intro. To Biochemistry, D- Env. And Green Chemistry, E- Agriculture Chemistry	CH:508: Chemistry of Biomolecules
----	Skill Enhancement Courses (SEC) CH:510 (A): Introduction of Medicinal Chemistry OR CH:510 (B): Polymer Chemistry
----	CH:511(A): Environmental Chemistry OR CH:511(B): Cheminformatics
Sem-IV (T.Y.B.Sc.)	Sem-VI (T.Y.B.Sc.)
Core courses	Discipline Specific Elective Courses (DSEC)
CH-341: Physical Chemistry	CH: 601: Physical Chemistry-II
CH-342: Inorganic Chemistry	CH: 604: Inorganic Chemistry-II
CH-343: Organic Chemistry	CH: 607: Organic Chemistry-II
CH-344: Analytical Chemistry	CH-602: Physical Chemistry -III
CH-345: Industrial Chemistry	CH: 605: Inorganic Chemistry-III
CH-346: Optional course (Any one) A- Nuclear Chemistry, B- Polymer Chemistry C- Intro. To Biochemistry, D- Env. And Green Chemistry, E- Dairy Chemistry	CH: 608: Organic Chemistry-III
	Skill Enhancement Courses (SEC) CH-610 (A): Chemistry of Soils and Agrochemicals OR CH-610 (B): Introduction of Forensic Chemistry
	CH-611 (A): Analytical Chemistry-II OR CH-611 (B): Chemistry of Cosmetics and Perfumes
CH-347: Physical Chemistry Practical	CH 503 and 603: Physical Chemistry Practical-I and II
CH-348: Inorganic Chemistry Practical	CH 506 and 606: Inorganic Chemistry Practical I and II
CH-349: Organic Chemistry Practical	CH 509 and 609: Organic Chemistry Practical-I and II

The Detailed Semester and Course Wise Syllabus as follows:

SEMESTER-V

DSEC-I: CH-501: Physical Chemistry- I [Credit -2, 36 L]

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Quantum Chemistry	10
2	Investigation of Molecular structure	16
3	Photochemistry	10
Total		36

1. Quantum Chemistry

[10 L]

Introduction, de Broglie hypothesis, The Heisenberg's uncertainty principle, quantisation of energy, Operators, Schrodinger wave equation, well behaved function, Particle in a one-, two and three-dimensional box (no derivation), Physical interpretation of the ψ and ψ^2 , sketching of wave function and probability densities for 1D box, degeneracy, applications to conjugated systems, zero-point energy and quantum tunnelling, Numerical

Expected learning Outcome:

After successfully completion, students will be able to:

1. Know historical of development of quantum mechanics in chemistry.
2. Understand and explain the differences between classical and quantum mechanics.
3. Understand the idea of wave function
4. Understanding of De Broglie hypothesis and the uncertainty principle
5. Understanding the operators: Position, momentum and energy
6. Solving Schrodinger equation for 1D, 2D and 3D model
7. Physical interpretation of the ψ and ψ^2 and sketching the wave function
8. Applications to conjugated systems, zero-point energy and quantum tunnelling, Numerical Problems

Reference books:

- 1) Principles of Physical Chemistry by Puri, Sharma, Pathania,; (Page No: 21-110)
- 2) Essential of Physical Chemistry, Bahl and Tuli (S. Chand).; (Page No: 50-58)

2. Investigation of Molecular structure

[16 L]

Introduction: Molar refraction and molecular structure, Dipole moment and molecular structure, electromagnetic spectrum, energy of molecules, Types of molecular spectra.

Microwave Spectroscopy: Introduction, Classification of molecules on the basis of moment of Inertia, Rotational spectra of rigid diatomic molecules, relative intensities of spectral lines, effect of isotopic substitution on the rotational spectra, Determination of bond length and moment of inertia from rotational spectra, Problems

Infrared Spectroscopy: Introduction, Simple Harmonic oscillator, Modes of vibration, force constant, Vibrational spectrum of a diatomic molecule: Vibrational Energy expression, Allowed vibrational energies, zero-point energy, Selection rule, Vibrational energy level diagram with transitions, spectrum depiction, Vibration-rotation Spectra: Born-Oppenheimer approximation, Energy expression for vibrational rotor, Selection rules, Vibrational-rotational energy level diagram with transitions, Nature of vibrational spectra, P, Q and R branches of lines of the IR spectra, Problems

Raman Spectroscopy: Introduction, Classical and Quantum theory of Raman effect, Rayleigh, Stokes and anti-stokes lines, Pure rotational Raman spectra of linear diatomic molecules

Expected learning Outcome: After studying this chapter, the student will be able to:

1. Understand the term additive and constitutive properties.
2. Understand the term specific volume, molar volume and molar refraction.
3. Understand the meaning of electrical polarization of molecule, induced and orientation polarization.
4. Dipole moment and its experimental determination by temperature variation method.
5. Electromagnetic spectrum, Nature of wave and its characteristics such as wavelength, wave number, frequency and velocity, Energy level diagram,
6. Classification of molecules on the basis of moment of Inertia,
7. Rotational spectra of rigid diatomic molecules, selection rules, nature of spectral lines.
8. Simple Harmonic oscillator model, Born-Oppenheimer approximation. Vibrational spectra of diatomic molecules selection rules, nature of spectral lines.
9. Explain the difference between Rayleigh, Stokes and anti-Stokes lines in a Raman spectrum.
10. Justify the difference in intensity between Stokes and anti-Stokes lines.
11. Draw the Stokes and anti-Stokes lines in a Raman spectrum
12. Raman spectra: Concept of polarizability,
13. Pure rotational Raman spectra of diatomic molecules, Energy Expression, Selection rule, Rotational energy level diagram, Rotational Raman spectrum and Problems

Reference books:

1. Fundamentals of molecular spectroscopy by C.N. Banwell and E. M. McCash.

(Page No: 33-59, 60-75, 111-119)

2. Physical Chemistry, Singh, N.B., et al. Volume 2, New Age International Ltd, 2000.

(Page No: 413-455)

3. Photochemistry

[10 L]

Introduction, Difference between thermal and photochemical processes, Laws of photochemistry: i) Grothus - Draper law ii) Stark-Einstein law, Quantum yield, Reasons for high and low quantum yield., Factors affecting Quantum yield, Experimental method for the determination of quantum yield, types of photochemical reactions - photosynthesis, photolysis, photocatalysis, photosensitization, Jablonski diagram depicting various processes occurring in the excited state: Qualitative description of fluorescence and phosphorescence, Chemiluminescence, Problems

Expected learning Outcome:

After studying this chapter, the student will be able to know and understand:

1. Difference between thermal and photochemical processes.
2. photochemical laws: Grothus - Draper law, Stark-Einstein law,
3. Quantum yield and reasons for high and low quantum yield,
4. factors affecting the quantum yield,
5. Experimental method for the determination of quantum yield
6. Photochemical reactions: photosynthesis, photolysis, photocatalysis, photosensitization
7. Various photochemical phenomena like fluorescence and phosphorescence, Chemiluminescence,
8. Problems

Reference books:

1. Essential of Physical Chemistry, Bahl and Tuli (S. Chand).; (Page No: 1154-1178)
2. Principles of Physical Chemistry by Puri, Sharma, Pathania,; (Page No: 1112-1135)
3. Physical Chemistry, Singh, N.B., et al. Volume 2, New Age International Ltd, 2000.
(Page No: 262-2810)

Additional Reference Books:

1. Physical Chemistry by G. M. Barrow, International student Edition, Mc Graw Hill.
2. University General Chemistry by C.N.R. Rao, Macmillan.
3. Physical Chemistry by, R. A. Alberty, Wiley Eastern Ltd.
4. The Elements of Physical Chemistry by P. W. Atkins, Oxford.
5. Principles of Physical Chemistry by S. H. Maron, C. H. Prutton, 4th Edition.
6. Quantum Chemistry by Donald A McQuarrie, Viva Student Edition

7. Quantum Chemistry by I. Levine.
8. Quantum Chemistry by R.K. Prasad

DSEC-I: CH-502: Analytical Chemistry- I**[Credit -2, 36 L]**

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Gravimetry	09
2	Inorganic Qualitative Analysis	07
3	Thermal methods of analysis	06
4	Parameters of instrumental analysis	04
5	UV-Visible spectroscopy	10
Total		36

1. Gravimetry**(9 L)**

Introduction to gravimetric analysis; Precipitation methods; The colloidal state; Supersaturation and precipitate formation; The purity of the precipitate: Co-precipitation; ; Conditions of precipitation; Precipitation from homogeneous solution; Washing the precipitate; Ignition of the precipitate: quantitative separations based upon precipitation methods: Fractional precipitation; Organic precipitants (8-hydroxyquinoline, DMG, Cupferron, Nitron, and Benzoin-alfa oxime, Anthanilic acid), Gravimetric Calculations—How Much Analyte is there (Ref-3)

Applications of Gravimetry: Determination of Al(III) by 8-hydroxyquoline, Determination of calcium as oxalate; Determination of potassium as potassium tetraphenylborate, Determination of phosphate as ammonium molybdophosphate, Numericals,

Key Reference-1: 417-428, 433-444, 446, 451, 464, 485; [Supplementary Ref-2: Pp-342 to 362]

2. Inorganic Qualitative Analysis**(7 L)**

Basic principle, common ion effect, solubility, solubility product, preparation of original solution, classification of basic radicals in groups, separation of basic radicals, removal of interfering anions (phosphate and borate), detection of acid radicals. Ref-6

3. Thermal methods of analysis**(6 L)**

General discussion, Thermogravimetry, Experimental factors affecting TG analysis, Instruments for thermogravimetry, Applications: Thermogravimetric analysis of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, Differential Thermal Analysis: Introduction, instrumentation for DTA and DSC, experimental and instrumental factors, applications: DTA of copper sulphate pentahydrate, Purity of

pharmaceutical by DSC, Key Reference-2: 503-522, [Supplementary reference, Ref-4: 884-890, Ref-1: 428-433]

3. Parameters of instrumental analysis (4 L)

Techniques, Methods, Procedures, and Protocols, Selecting an Analytical Method, Accuracy, Precision, Sensitivity, Selectivity, Robustness and Ruggedness, Scale of Operation, equipment, Time, and Cost, Making the Final Choice, Developing the Procedure, Calibration and Standardization, Sampling, Validation, Protocols, Key Reference -5: 35-48

4. UV-Visible spectroscopy (10 L)

Introduction, Theory of spectrophotometry and colorimetry-Beer's law, Application of Beer's Law, Spectrophotometry: Wavelength selection by prism and diffraction grating, Radiation source, cells, data presentation, single-beam spectrophotometer, Double-beam spectrophotometers, Choice solvent, general procedure for colorimetric estimation, simultaneous analysis, Applications: Estimation of metal ions from aqueous solution: Boron in steel, Chromium in steel with diphenyl carbazide reagent, ammonia in water, Chloride, Primary amine, Determination of phenol, spectrophotometric titration (example Cu(II) with EDTA), Determination of pKa value of indicator, Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method., Numericals Key Reference-2: 658-717 and Ref-1: 645-725

References:

- Ref-1: Vogel's textbook of Inorganic Quantitative Analysis, Jeffery, Basset, Mendham Doney, 5th Ed, Longman Scientific Technical, USA (copublished with John Wiley Sons)
Ref-2: Vogel's textbook of Inorganic Quantitative Analysis, Mendham, Doney Barnes, 6th Ed, Pearson education
Ref-3: Analytical Chemistry by G. D. Christian, et al , Wiley, 6th Ed.
Ref-4: Principles of Instrumental Analysis: Holler, Skoog, Crouch 6th Ed. Thomson Publication
Ref-5: Modern Analytical Chemistry, David Harvey, Mc-Graw Hill Higher education
Ref-6: Vogel's Qualitative Inorganic Analysis, G. Svehla, Pearson, 7th Ed.

Course outcome: After completion of the course student should be able to

1. Define basic terms in gravimetry, spectrophotometry, qualitative analysis and parameters in instrumental analysis. Such as: Gravimetry, precipitation, solubility product, ionic product, common ion effect, precipitating agent, washing of ppt., drying and ignition of ppt., linearity range, detection limit, precision, accuracy, Sensitivity, Selectivity, Robustness and Ruggedness, electromagnetic radiations, spectrophotometry, Beers law, absorbance, transmittance, molar absorptivity, monochromator, wavelength of maximum absorbance,

metal ligand ration, qualitative analysis, group reagent, dry tests, wet test, confirmatory test, precipitation, thermogravimetry, thermogram, percent wt. loss, differential thermal analysis, etc.

2. Identify important parameters in analytical processes or estimations. Example: minimum analyte concentration in particular method, reagent concentration in particular analysis (gravimetry, spectrophotometry, thermogravimetry), reagent for particular analysis, reaction condition to convert analyte into measurable form, drying and ignition temperature for ppt in gravimetry, heating rate thermogravimetry, wavelength in spectrophotometry, group reagent, removal borate and phosphate in qualitative analysis, etc.
3. Explain different principles involved in the gravimetry, spectrophotometry, parameters in instrumental analysis, qualitative analysis.
4. Perform quantitative calculations depending upon equations student has studied in the theory. Furthermore, student should able to solve problems on the basis of theory.
5. Discuss / Describe procedure for different types analyses included in the syllabus.
6. Select particular method of analysis if analyte sample is given to him.
7. Differentiate / distinguish / Compare among the different analytical terms, process and analytical methods.
8. Demonstrate theoretical principles with help of practical.
9. Design analytical procedure for given sample.
10. Apply whatever theoretical principles he has studied in theory during practical session in laboratory.

DSEC-I: CH-503: Physical Chemistry Practical - I**[Credit -2, 73 L]**

Total 12 experiments to be completed.

1. Refractometry: (any two)

- 1) To determine the specific refractivity's of the given liquids A and B and their mixture and hence determine the percentage composition their mixture C.
- 2) To determine the molecular refractivity of the given liquids A, B, C and D.
- 3) To determine the molar refraction of homologues methyl, ethyl and propyl alcohol and show the constancy contribution to the molar refraction by -CH₂ group.
- 4) Determine the refractive index of a series of salt solutions and determine the concentration of a salt of unknown solution

2. Spectrophotometry and Colorimetry (any three)

- 1) To titrate Cu²⁺ ions with EDTA photometrically.
- 2) To determine the indicator constant of methyl red indicator

- 3) To estimate of Fe^{3+} ions by thiocyanate method.
- 4) Cobalt by using R-nitroso salt method.
- 5) To determine the order of reaction for the oxidation of alcohol by potassium dichromate and potassium permanganate in acidic medium calorimetrically.
- 6) Simultaneous determination of Cu^{2+} and Ni^{2+} ions by colorimetry/spectrophotometry method

3. Conductometry (any four)

- 1) Titration of a mixture of weak acid and strong acid with strong alkali.
- 2) To determine the velocity constant of hydrolysis of ethyl acetate by NaOH solution by conduct metric method.
- 3) To determine the normality of citric acid in given fruit by titrating it against standard NaOH solution by conductometric method.
- 4) To determine λ_{∞} of strong electrolyte (NaCl or KCl) and to verify Onsager equation.
- 5) To estimate the amount of lead present in given solution of lead nitrate by conductometric titration with sodium sulphate.
- 6) To determine the relative strength of monochloro acetic acid and acetic acid conductometrically

4. Viscosity: (any one)

1. To determine the molecular weight of a high polymer by using solutions of different concentrations.
2. Determine the radius of glycerol molecule from viscosity measurement.

5. Photofluometry

1. Analysis of Riboflavin from vitamin supplementary capsules / syrup / tablet sample by Photofluometry

6. Table work

1. Analysis of the given vibration-rotation spectrum of $\text{HCl}(\text{g})$

DSEC-II: CH-504: Inorganic Chemistry - I**[Credit -2, 36 L]**

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Molecular Orbital Theory of Coordination Compounds	08
2	Inorganic Reaction Mechanism	06
3	Chemistry of transition elements	06
4	Chemistry of f-block elements	08
5	Metals, Semiconductors and Superconductors	08
Total		36

1. Molecular Orbital Theory of Coordination Compounds**(8L)**

Electro-neutrality principle, multiple bonding ($d\pi-p\pi$ and $d\pi-d\pi$), Nephelauxetic effect and Nephelauxetic series (Recapulation from VBT and CFT), Need and introduction of MOT, Assumptions, MO treatment to octahedral complexes with sigma bonding, Formation of MO's from metal orbitals and Composite Ligand Orbitals (CLO), MO correlation diagram for octahedral complexes with sigma bonding, effect of π bonding on MO correlation diagram, Charge transfer spectra, Advantages of MOT over VBT and CFT.

Aims and objective/Learning Outcomes: A student should know:

- Explain electroneutrality principle and different types of pi bonding.
- Able to explain Nephelauxetic effect towards covalent bonding.
- Explain MOT of Octahedral complexes with sigma bonding.
- Able to explain Charge Transfer Spectra.
- Able to compare the different approaches to bonding in Coordination compounds.

References:

- Concise Inorganic Chemistry by J.D. Lee - 4th Edition pp226-231
- Physical Inorganic Chemistry A Coordination Chemistry Approach S. F. A. Kettle Springer-Verlag Berlin Heidelberg GmbH, 1996 pp 95-120
- Theoretical Inorganic Chemistry by Day and Selvin (Relevant Pages)

2. Inorganic Reaction Mechanism**(6L)**

Basic concepts of stability and lability, stability constants, Factors affecting lability, chelate effect. Classification of inorganic reactions, ligand substitution reactions: Intimate and stoichiometric mechanism of ligand substitution. Substitution Reactions in Four Coordinated

square planar complexes: Trans effect and Trans effect series, applications of trans effect, stereochemistry of substitution.

[**Further reading:** Student should also read about the relation between kinetics and mechanism.

Reaction mechanisms in complexes with C.N.4, 5 and 6]

Aims and objective: A student should know:

- i. To understand about inert and labile complexes and stability of complexes in aqueous solutions
- ii. Classification of reactions of coordination compounds
- iii. The basic mechanisms of ligand substitution reactions.
- iv. Substitution reactions of square planer complexes.
- v. Tran's effect and applications of Trans effect
- vi. Stereochemistry of mechanism
- vii. Gain the knowledge of inorganic reaction mechanisms available in the literature to solve chemical problems.

References:

1. Inorganic Chemistry – Principles of Structure and Reactivity, J. E. Huheey, E. A. Keiter & R. L. Keiter, 4th Edn. Harper Collins College Publ. New York, Chapt.13, p.537-576, (1993).
2. Martin L. Tobe and John Burgess, Inorganic Reaction Mechanisms, Addison Wesley Longman Inc., 1999.
3. Inorganic Chemistry – D.F. Shriver, P.W. Atkins, C.H. Lamgford – Oxoford, 5th Edn., 1994, pp507-517.
4. Inorganic Chemistry - Messler and Tarr - Pearson Publishers pages 412-420, 434-440

3. Chemistry of Transition elements

[6L]

Position in periodic table, electronic configuration, trends in properties w.r.t.(a) size of atoms and ions (b) reactivity (c) catalytic activity (d) oxidation state (e) complex formation ability (f) colour (g) magnetic properties (h) non-stoichiometry (i) density, melting & boiling points. [Ref.-1]

Aims and objective: A student should know:

1. To know position of d-block elements in periodic table.
2. To know the general electronic configuration & electronic configuration of elements.
3. To know trends in periodic properties of these elements w.r.t. size of atom and ions, reactivity, catalytic activity, oxidation state, complex formation ability, color, magnetic properties, non-stoichiometry, density, melting point, boiling point.

References:

1. Concise Inorganic Chemistry by J.D. Lee - 5th edition. Pages 859-863, 865-866,

4. Chemistry of f-block elements**[8L]**

Introduction of f-block elements- on the basis of electronic configurations, occurrence and reactivity, F-block elements as Lanthanide and Actinide series

I. Lanthanides:

Position in periodic table, Name and electronic configuration of lanthanides, Oxidation States, atomic and ionic radii, Lanthanide contraction, its causes and consequences on chemistry of Lanthanides and post lanthanide elements, Occurrence and separation: Bulk separation, Individual separation by modern methods *viz.*, Ion exchange and solvent extraction method, applications of lanthanides. [Reference-1]

II. Actinides:

Position in periodic table, names and their electronic configurations. IUPAC nomenclature system for super heavy elements, Oxidation States, Occurrence and general methods of preparation of transuranic elements *viz.*, Neutron Bombardment, Accelerated projectile bombardment and Heavy ion bombardment. Nuclear Fuels-Nuclear fission and fusion fuels, comparison between Lanthanides and Actinides. [Reference-1]

Aims and objective: A student should know:

1. The meaning of term f-block elements, Inner transition elements, lanthanides, actinides.
2. Electronic configuration of lanthanides and actinides.
3. Oxidation states of lanthanides and actinides and common oxidation states.
4. Separation lanthanides by modern methods.
5. Lanthanide contraction and effects of lanthanide contraction on post-lanthanides.
6. Use of lanthanide elements in different industries.
7. Transuranic elements.
8. Preparation methods of transuranic elements.
9. Nuclear fuels and their applications.
10. Why transuranic elements are called as the synthetic elements?
11. IUPAC nomenclature for super heavy elements with atomic no. 100 onwards.

References:

1. Concise Inorganic Chemistry by J.D. Lee - 5th Edn. 874 – 875, 879-886, 891-893, 898-900.

5. Metals, Semiconductors and Superconductors**[8L]**

Introduction, Metallic bonding, Band theory in metals with respect to Na along with n (E) and N(E) diagrams, Electrical conductivity of metals (Na, Mg, Al), Valence electrons and conductivity of metals, Effect of temperature and impurity on electrical conductivity of metals,

Semiconductors, types of Semiconductors: I. Intrinsic II. Extrinsic, effect of temperature and impurity on semiconductivity, n & p type semiconductors ZnO and NiO, Superconductivity: Discovery, property, models, structure and superconductivity, low and high temperature superconductors, applications of superconductors.

Aims and Objectives: A student should be able –

1. The meaning of metal & semiconductor.
2. The difference between metal, semiconductor and insulator.
3. Metallic bond on the basis of band theory.
4. The energy band and energy curve.
5. Draw $n(E)$ & $N(E)$ curves.
6. Explain the electrical conductivity of metals with respect to valence electrons.
7. Explain the effect of temperature and impurity on conductivity of metals and semiconductors.
8. Intrinsic and extrinsic semiconductor.
9. The term valance band and conduction band.
10. n and p type of semiconductors.
11. Non-stoichiometry and semi conductivity.
12. Insulators on the basis of band theory.
13. The difference between Na, Mg, and Al in terms of valence electrons and conductivity.
14. Meaning of super conductors and their structure. o. Discovery and applications of superconductors.

References:

1. Solid State Chemistry: An Introduction, Lesley E. Smart, Elaine A. Moore, 3rd Edn. Relevant pages from Chapter 10, pp394-411
2. Solid State Chemistry and its Applications, Anthony R. West, Second Edition, Wiley 2014, PP 359-391
3. Chemistry by Raymond Chang - 5th edition (Related Pages)
4. New Guide to Modern Valence Theory by G.I. Brown - 3rd edition Pages 209-221

DSEC-II: CH-505: Industrial Chemistry - I**[Credit -2, 36 L]**

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Modern Approach to Chemical Industry	06
2	Manufacture of Basic Chemicals	07
3	Sugar and Fermentation Industry	07
4	Soap and Detergents Industry	08
5	Dyes and Pigments	08
Total		36

1. Modern Approach to Chemical Industry**(6 L)**

Introduction, basic requirements of chemical industries, chemical production, unit process and unit operations, Quality control and quality assurance, process control, research and development, human resource, safety measures, classification of chemical reactions, batch and continuous process, Conversion, selectivity and yield, copy-right act, patent act, trademarks.

Ref. No.-7, Relent pages, Ref. - 10: [www.wikipedia.org/wiki/copyright_act_of1976/patent act/trademark](http://www.wikipedia.org/wiki/copyright_act_of1976/patent_act/trademark)

Aims and Learning objectives: The students are expected to learn;

- i. Importance of chemical industry,
- ii. Meaning of the terms involved,
- iii. Comparison between batch and continuous process,
- iv. Knowledge of various industrial aspects

2 Manufacture of Basic Chemicals**(7 L)**

- a) Ammonia: Manufacture of ammonia by modified Haber-Bosch process, Physico-chemical principles involved and uses of ammonia.
- b) Nitric acid: Manufacture of nitric acid by Ostwald's process, Physico-chemical principles involved and uses of nitric acid.
- c) Sulphuric acid: Manufacture of sulphuric acid by contact process, Physico-chemical principles involved and uses of sulphuric acid.

Reference No.-1: Page No. 731 to 761, 809 to 844, Reference-3: 1128-1175, 1253-1263

Aims and Learning objectives: The students are expected to learn

- i. Concept of basic chemicals,
- ii. Their uses and manufacturing process.
- iii. They should also know the physico-chemical principals involved in manufacturing process

3. Sugar and Fermentation Industry**(7 L)**

- a. Sugar:** Introduction, manufacture of cane sugar, extraction of juice, purification of juice, sulfitation and carbonation, evaporation, crystallization, separations of crystals, drying refining, grades, recovery of sugar from molasses, by-product of sugar industry,

Reference No.-1: Page No.1208- 1218

- b. Fermentation Industry:** Introduction, importance, conditions favorable for fermentation, Characteristics of enzymes, short account of some fermentation processes, Alcohol beverages, Manufacture of beer, manufacture of spirit, manufacture of wines, manufacture of vinegar, manufacture of power alcohol, ethyl alcohol from molasses.

Reference No.-1: Page No. 1176-1184

Aims and Learning objectives: The students are expected to learn

Sugar Industry: The students are expected to learn

- i. Importance of sugar industry,
- ii. Manufacture of direct iii. Consumption (plantation white) sugar with flow diagram.
- iii. Cane juice extraction by various methods,
- iv. Clarification by processes like carbonation, vi. Sulphitation, vii. Phosphatation, etc.
- v. Concentration of juice by using multiple effect evaporator system,
- vi. Crystallization of sucrose by using vacuum pan.

Fermentation Industry- The students are expected to learn

- i. Importance,
- ii. Basic requirement of fermentation process,
- iii. Manufacturing of ethyl alcohol by using molasses and fruit juice.

4. Soap and detergents**(8 L)**

(a) Soap: Soap and Fatty Acids: Introduction, Chemistry, Manufacturing Technology, Raw Materials, Functional Properties of Soap, Manufacturing Processes, Saponification Reactor, Cooling, Soap Separator, Soap Extraction, Centrifugation, Neutralization, Direct Neutralization, Carbonate Neutralization, Partial Neutralizing with Soda Ash, Carbon Dioxide Separation, Raw Material Dosing, Caustic Soda, Completion of Neutralizing with Caustic Soda, Neutralization Soap Viscosity,

Reference-5: 980-997, Reference-1: 1243 -1250

- (b) Detergents: Synthetic Detergents: Introduction, Characteristic Features of Surfactants, Raw Materials for Surfactant Production, intermediates for Surfactant Production, Anionic Surfactants, Non-ionic Surfactants, Amphoteric Surfactants, Cationic Surfactants, Detergent Additives, Production of Synthetic Detergents, and Washing action of soap and detergents.

Reference-5: 1006-1029, Reference-1: 252 – 1279

Aims and Learning objectives: The students are expected to learn

- i. Different types of soap products,
- ii. Chemistry of soap.
- iii. Raw materials required for soap manufacture
- iv. Meaning of the term's Surfactants, Types of surfactants
- v. Raw materials for detergents
- vi. Detergent builders, additives
- vi. Washing action of soap and detergents

5. Dyes and Pigments

(8 L)

(a) Dyes: Introduction, qualities of good dye, Colour constituents (Chromophore, auxochrome), classification of dyes according to their application, Synthesis and uses of following dyes: Nitroso dye-martius yellow, Azo dyes-Methyl orange and aniline yellow, Triphenylmethane dye-Crystal violet, Phthalein dye - Phenolphthalein, Xanthane-Fluorescein, Antha-quinnoe-Alizarin and Indigo dyes - Indigo.

Reference -1: pp 1545-1595

(b) Pigments: Introduction, classification and general properties of pigments.

Inorganic pigments:

- i) Zinc oxide pigments (Fundamentals and properties, Raw materials, Direct process (American process), Precipitation process)
- ii) Iron oxide pigments (Fundamentals and properties, Production of iron oxide pigment by precipitation process),

Reference-9: 80-87, 97 to 109.

Aims and Learning objectives: The students are expected to learn

Dyes - Students should know about

- i. Dyes: introduction,
- ii. Dye intermediates,
- iii. Structural features of a dye;
- iv. Classification of dyes,
- v. Synthesis, Structures, properties and applications of dyes

Pigments: Students should know about

- i. Introduction,
- ii. Classification and general properties of pigment
- iii. Production processes of zinc oxide and iron oxide

References:

1. Industrial Chemistry, B. K. Sharma, Goel publishing House, 18th Ed. (2014)
 2. Riegeal's Hand book of industrial chemistry, James A. kent. 9th Ed. CBS publishers
 3. Advanced Inorganic Chemistry, Satyaprakash, Tuli, Basu pages 458-463.
 4. Advanced Inorganic Chemistry, Satyaprakash, Tuli, Basu pages 830-849
 5. Handbook of Industrial Chemistry and Biotechnology, James A. Kent, Tilak V. Bommaraju, Scott D. Barnicki, Thirteenth Edition, Springer.
 6. Inorganic Pigments by Gerhard Pfaff, Publisher-De Gruyter, 1st Ed.
 7. Shreeve's chemical process industries 5th Edition, G.T. Austin, TATA McGraw-Hill Edition, chemical engineering series
 8. Industrial Chemistry, Part-II, R. K. Das, Kalyani Publisher, Second Ed.
 9. Inorganic Pigments by Gerhard Pfaff, Publisher-De Gruyter, 1st Ed.
- www.wikipedia.org/wiki/copyright_act_of1976 , www.wikipedia.org/wiki/patentact and www.wikipedia.org/wiki/trademark

Industrial visit:

Visit to any one of the Chemical / Pharmaceutical / Polymer / Research Institutes / Sugar Factories / waste water treatment plant, etc. is essential and a systematic report is to be submitted by the student to the Department of Chemistry.

DSEC-II: CH-506: Inorganic Chemistry Practical - I [Credit -2, 73 L]**Total 12 experiments to be completed.****A. Gravimetric estimations (Any 3)**

1. Gravimetric estimation of Fe as Fe₂O₃. Ref-1: 457
2. Gravimetric estimation of Ba as BaSO₄ using homogeneous precipitation method. Ref-1: 448
3. Gravimetric estimation of Nickel as Ni – DMG. Ref-1: 462
4. Analysis of sodium bicarbonate from mixture by thermal decomposition method. Ref.-6
5. Determination of water of crystallization by thermal decomposition. Reference-5
6. Analysis of Food/Pharmaceutical sample for ash and sulphated ash example-Aspirin, Ref. -2.

B. Inorganic preparations (Any 3) (Ref-7, 8, 9)

Preparation of inorganic complexes and spot tests for metal ions and ligands:

1. Preparation of hexamminenickel(II) chloride, [Ni (NH₃)₆]Cl₂.
2. Preparation of Potassium trioxalatoferrate(III), K₃[Fe(C₂O₄)₃].
3. Preparation of Manganese (III) acetylacetonate, [Mn(acac)₃].
4. Preparation of tris(glycinato)nickelate(II), [Ni(gly)₃]
5. Preparation of Potassium dioxalatocuprate(II), [Cu(C₂O₄)₂]²⁻.

C. Inorganic Qualitative Analysis (6 Expts.)

1. Inorganic Qualitative analysis (5 mixtures) [1 simple water soluble mixture, 2 mixtures containing borates and 2 mixtures containing phosphates]

(DST manual green chemistry monograph procedure must be followed strictly) Ref.-4

2. Limit test for iron, chloride and sulphate from pharmaceutical raw materials. Ref.-2; pp - 220

OR

2. Qualitative and confirmatory tests of inorganic toxicants of any four ions (Borate, copper, hypochlorite or nitrate or nitrite, Sb or Bi, Iodate, H_2O_2). Reference-3

References:

1: Vogel's textbook of Inorganic Quantitative Analysis, Jeffery, Basset, Mendham Deney, 5th Ed, Longman Scientific Technical, USA (copublished with John Wiley Sons)

2: Indian Pharmacopoeia, Vol-2; 2007

3: Basics of Analytical toxicology, World Health Organization

4: [Green Chem - \[PDF Document\] – FDOCUMENTS; \(https://fdocuments.in/document/green-chem.html\)](https://fdocuments.in/document/green-chem.html)

5: <https://www.studocu.com/ec/document/universidad-de-investigacion-de-tecnologia-experimental-yachay/fisica-matematica/otros/the-gravimetric-analysis-of-barium-chloride-hydrate/8364963/view>

6: https://effectiveness.lahc.edu/academic_affairs/sfcs/chemistry/Shared%20Documents/Decomposing%20Baking%20Soda.pdf

7: Experimental Inorganic Chemistry, Mounir A. Malati, Horwood Series in Chemical Science (Horwood Publishing, Chichester) 1999.

8: Experiments in Chemistry, D. V. Jahagirdar, Himalaya Publishing House

9: Journal of chemical education: Synthesis of cis- $Cu(gly)_2$ Trans- $Cu(gly)_2$ and cis-ni(gly) $_2H_2O$ and their characterization using thermal and spectroscopic technique – a Capstone laboratory experiment.

Structure of Practical Examination [35 Marks; Time: 3 hours]

Q1. Gravimetric estimation/Inorganic preparation/Inorganic Qualitative analysis....	30 M
Q2. Viva-Voce	05 M

DSEC-III: CH-507: Organic Chemistry - I**[Credit -2, 36 L]**

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Polynuclear and Heteronuclear Aromatic Compounds	08
2	Active Methylene Compounds	05
3	Rearrangement Reactions	12
4	Elimination reactions	11
Total		36

1. Polynuclear and Heteronuclear Aromatic Compounds [08 L]

Introduction, Classification of aromatic compounds, Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Naphthalene, Anthracene, Furan, Pyrrole, Thiophene, and Pyridine. Ref.1: Pages 759 – 779. Ref.3: Pages 952 – 962. 2.

2. Active Methylene Compounds [05 L]

Definition, Preparation of Ethylacetoacetate and Synthetic uses of ethylacetoacetate Preparation of Diethyl malonate and Synthetic uses of diethyl malonate, (preparation of non-heteromolecules having upto 6 carbon). Ref.1: Pages 864 – 875. Ref.3: Pages 859 – 874. Ref.6: Pp 206 – 213.

3. Rearrangement Reactions [12 L]

Introduction, Types of rearrangement, Types of reactive intermediate involved in different rearrangements, Rearrangement – Beckmann, Baeyer-Villiger, Favorskii, Curtius, Lossen, Schmidt and Pinacol-Pinacolone with mechanism. Electrocyclic Rearrangements- Claisen, Cope and Mc-Lafferty rearrangements with mechanism. Ref.4: Pages 618-656. Ref.7: Pages 89-94, 105-107, 112-114, 122-125, 158-161. Ref.10: Pages 130-132.

4. Elimination reactions [11 L]

Introduction; Types of eliminations-1,1; 1,2 elimination, Mechanism with evidences of E1 and E2, E1cB reactions, stereochemistry of E1 and E2 elimination, Orientations and reactivity in E1 and E2 elimination- Hoffmann and Saytzeff's orientation, Factors affecting the reactivity- effect of structure, attacking base and leaving groups. Ref.1: Pages 305-326. Ref. 3: Pages 260-265. Ref.4: Pages 472-496. Ref.6: Pages 188-194.

References

- 1) R.T. Morrison & R.N. Boyd: Organic Chemistry, 7th edition, Prentice Hall.
- 2) Organic Chemistry: Clayden, Greeves, Wothers, Warren, Oxford Press.
- 3) Organic Chemistry: Graham Solomans
- 4) E. S. Gould: Mechanism and Structure in Organic Chemistry

- 5) Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman
- 6) I.L. Finar: Organic Chemistry (Vol. I & II), E.L.B.S.
- 7) S. N. Sanyal: Reactions, Rearrangements and Reagents
- 8) Eliel: Stereochemistry of Organic Compounds, Tata Mc Graw Hill, 1989
- 9) D. Nasipuri: Stereochemistry of Organic Compounds- Principles and Applications, New Age International Publishers, 3rd edition.
- 10) Jagdamba Singh, Jaya Singh: Photochemistry and Pericyclic reactions.3rd edition

Learning Outcomes

Chapter 1 Polynuclear and Heteronuclear Aromatic Compounds: After studying the polynuclear and heteronuclear aromatic compounds, students will able to

1. Define and classify polynuclear and hetreonuclear aromatic hydrocarbons.
2. Write the structure, synthesis of polynuclear and hetreonuclear aromatic hydrocarbons.
3. Understand the reactions and mechanisms
4. Explain the reactivity of polynuclear and hetreonuclear aromatic hydrocarbons.
5. Describe the synthesis of chemical reactions of polynuclear and hetreonuclear aromatic Hydrocarbons.

Chapter 2 Active Methylene Compounds : Students should be able to understand

1. Meaning of active methylene group
2. Reactivity of methylene group,
3. Synthetic applications ethyl acetoacetate and malonic ester
4. To predict product with panning or supply the reagent/s for these reactions

Chapter 3 Molecular Rearrangements Students will study

1. What is rearrangement reaction?
2. Different types of intermediate in rearrangement reactions?
3. To write the mechanism of some named rearrangement reactions and their applications 4.

Electrocyclic rearrangement with their mechanisms Chapter

Chapter 4 Elimination Reactions: Students should be familiar with

1. 1,1 and 1,2 elimination
2. E1, E2 and E1cB mechanism with evidences of these reactions 4
3. Understand stereochemistry by using models and learn reactivity of geometrical isomers
4. Orientation and reactivity in E1 and E2 elimination
5. Hoffmann and Saytzeff's Orientation
6. Effect of factors on the rate elimination reactions

DSEC-III: CH-508: Chemistry of Biomolecules**[Credit -2, 36 L]**

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Introduction to molecular logic of life	03
2	Carbohydrates	07
3	Lipids	06
4	Amino acids and Proteins	08
5	Enzymes	06
6	Hormones	06
Total		36

1. Introduction to molecular logic of life.**(3L)**

Unicellular and multicellular organisms, prokaryotes and eukaryotes. List of cell organelles and its functions. Molecules that constitute the organisation of cell and its organelles. types of bonds in biomolecules

2. Carbohydrates**(7L)**

Introduction, classification of carbohydrates, their structures and biological significance. Concept of anomers, epimers, reducing and non-reducing sugars, mutarotation, inversion. Reactions of glucose with acid, base, phenyl hydrazine, oxidizing agents, reducing agents and its significance, Glycosidic bonds.

3. Lipids**(6L)**

Introduction, classification of lipids, their structures and biological significance. Reactions of Lipids-Saponification Hydrolysis, emulsification, oxidation. Concept of saponification number, acid number, iodine number and their significance. Rancidity. Types of Lipoproteins and their significance. Blood group substances.

4. Amino acids and Proteins**(8L)**

Amino acids: classification of amino acids. Concept of ampholytes, isoelectric pH, zwitter ions, titration curve of glycine. Reactions of amino acid with Ninhydrin, Sanger's, Dansyl chloride, Dabsyl chloride and Edmann's reagents and their significance. Peptide bond and its features.

Proteins: Classification based on function, nutrition and composition. Structural organization of proteins- primary, secondary, tertiary and quaternary structures.

5. Enzymes**(6L)**

Classification of enzymes. Features of active site. ES complex formation, Enzyme specificity, Factors affecting enzyme activity. Basics of Enzyme kinetics. MM and LB equation and

Significance of K_m . Types of Enzyme inhibitions. Concept of Conjugated enzymes- Holoenzyme, Apoenzyme, prosthetic groups. Coenzymes of vitamins. Industrial applications of enzymes.

6. Hormones

(6L)

Introduction to endocrine glands and their hormones. Biochemical nature of hormones, Mechanism of action of lipophilic and hydrophilic hormones.

References

1. Lehninger's Principles of Biochemistry, by Nelson and Cox Macmillan Publisher 4th Edn.
2. Biochemistry by U. Satyanarayana
3. Harper's Illustrated Biochemistry, 26th Edition
4. Biophysical techniques by Upadhyay and Nath, 3rd revised edition.
5. Organic Chemistry, Morrison, R. T. & Boyd, R. N.
6. Organic Chemistry (Volume 1) Finar, I. L.
7. Organic Chemistry (Volume 2) Finar, I. L.

Learning Outcome:

1. **Introduction to molecular logic of life.** The student will understanding of Cell types, Difference between a bacterial cell, Plant cell and animal cell. Biological composition and organization of cell membrane, structure and function of various cell organelles of plant and animal cell. Concepts of biomolecules, Bonds that link monomeric units to form macromolecules
2. **Carbohydrates:** The student will understand the types of carbohydrates and their biochemical significance in living organisms, structure of carbohydrates and reactions of carbohydrates with Glucose as example. Properties of carbohydrates.
3. **Lipids:** The student needs to know the types of lipids with examples, structure of lipids, properties of lipids
4. **Amino acids and proteins:** The student will understand the structure and types of amino acids. Reactions of amino acids. Properties of amino acids. Peptide bond formation. Types of proteins. Structural features in proteins. Effect of pH on structure of amino acid, Determination of N and C terminus of peptide chain.
5. **Enzymes:** The student know the classes of enzymes with subclasses and examples. Enzyme specificity, Equations of enzyme kinetics K_m and its significance, features of various types of enzyme inhibitions, industrial applications of enzymes.

6. **Hormones:** Basic concepts of Endocrinology. Types of Endocrine glands and their hormones. Biochemical nature of hormones. Mechanism of action of lipophilic and hydrophilic hormones.

DSEC-III: CH-509: Organic Chemistry Practical-I [Credit -2, 73 L]**Total 12 Experiments to be performed****A) Separation of Binary Mixtures and Qualitative Analysis (Any Six)**

a) Solid-Solid (3 Mixtures) b) Solid-Liquid (2 Mixtures) c) Liquid-Liquid (1 Mixture) At least one mixture from each of the following should be given-Acid-Base, Acid- Phenol, AcidNeutral, Phenol-Base, Phenol-Neutral, Base-Neutral and Neutral- Neutral. (Solid-solid mixtures must be insoluble in water)

B) Preparations**a) Green Chemistry Preparations (Any Two)**

1. Preparation of dibenzalpropanone from benzaldehyde and acetone using $\text{LiOH}\cdot\text{H}_2\text{O}/\text{NaOH}$
2. Nitration of phenol or substituted phenols using CaNO_3 .
3. Bromination of acetamide using ferric ammonium nitrate and KBr in aqueous medium.

b) Organic Preparations (Any Two)

1. Preparation of 1, 4- dihydropyrimidinone from ethyl acetoacetate, benzaldehyde and urea using oxalic acid as catalyst.
2. Preparation p-Iodonitrobenzene from p-Nitroaniline by Sandmeyer Reaction
3. Preparation P-chloro benzoic acid and p-chloro benzyl alcohol from p-chloro benzaldehyde.

C) Preparations of Organic Derivative (Any Two)

1. Amide derivative of Carboxylic acid
2. Glucosazone derivative of Glucose
3. Paracetamol from p-Aminophenol

Imp. Note: At the time of practical examination candidate should perform complete analysis of one binary mixture OR One preparation and one preparation of organic derivative.

- To develop skills required in chemistry such as the appropriate handling of apparatus and chemicals.
- The student will learn the laboratory skills needed to design, safely conduct and interpret chemical research.
- To expose the students to an extent of experimental techniques using modern instrumentation.
- The student will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Learning Outcomes:**A) Separation of Binary Mixtures and Qualitative Analysis The students will be able to**

1. Perform the quantitative chemical analysis of binary mixture, explain principles behind it.
2. Separate, purify and analyse binary water insoluble mixture.
3. Separate, purify and analyse binary water-soluble mixture.
4. Understand the techniques involving drying and recrystallization by various method.
5. Familiarize the test involving identification of special elements.
6. Learn the confirmatory test for various functional groups.

B) Preparations The students will be able to

1. Systematic working skill in laboratory will be imparted in student.
2. Learn the basic principles of green and sustainable chemistry.
3. Synthesis of various organic compounds through greener approach.
4. Do and understand stoichiometric calculations and relate them to green process metrics.
5. Learn alternative solvent media and energy sources for chemical processes.
6. Learn the preparations of derivative various functional groups aspects of electrical experiments.
7. Understand the techniques involving drying and recrystallization by various method
8. Expertise the various techniques of preparation and analysis of organic substances
9. Understand principle of Thin Layer Chromatographic techniques.
10. Understand the purification technique used in organic chemistry.

SEC-I: CH-510: Skills Enhancing Course-I**[Credit -2, 36 L]****Choose one out of the two options, A and B.****CH-510 (A) : Introduction to Medicinal Chemistry**

Chapter No.	Title	Number of Lectures
1	An Introduction to Drugs, their Action and Immunobiologicals	08
2	Bio-physicochemical Properties in Drug Action and Design	08
3	Drugs for Infectious Diseases	12
4	Drugs for Non -infectious Diseases	08
Total		36

1. An Introduction to Drugs, their Action and Immunobiologicals (8L)

A. Introduction, Need of new drugs, Historical background of drug discovery and design, Sources of drugs, Classification of drugs, Introduction to drug action

(Ref.1 Pages 37-53, Ref.2 Pages 4-11, Ref.4 Pages 4-9)

B. Immunobiologicals: Vaccines: Introduction, Methods of vaccine production: Inactivated pathogens, Live/Attenuated Pathogens and Cellular Antigen from a pathogen, SARS-CoV-19

(Ref.3 Pages 165-168, Ref.9, Ref.10)

2. Bio-physicochemical Properties in Drug Action and Design (8L)

Introduction, Acidity/Basicity, Solubility, Ionization, Hydrophobic and hydrophilic properties, Lipinski Rule, **Terminology in Medicinal Chemistry:** Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics, metabolites, antimetabolites and therapeutic index. Importance of stereochemistry in drug action (Example: Ibuprofen), Concept of rational drug design: Structure activity relationship, Drug-receptor understanding

(Ref.1 Pages 57-75, 95-96 Ref.2 Pages 189-274, 384-392, Ref.4 Pages 29-61)

3. Drugs for Infectious Diseases (12L)

Introduction, Structures, Mode of Action and Applications:

A. Antimicrobial Agents: Classification on i) Type of action: Bacteriostatic and Bactericidal ii) Source (Natural, Synthetic and Semisynthetic) iii) Spectrum of activity: Narrow and Broad Spectrum iv) Chemical structure: β -lactams (Penicillin), Macrolides (Azithromycin), Sulphonamides (Sulfadiazine), and Tetracyclins (Chlortetracycline)

B. Anti-fungal and anti-viral agents: Example: Amphotericin-B, Acyclovir

(Ref.1 Pages 131-157, Ref.2 Pages 413-472, Ref.3 Pages 258-308, Ref.4 Pages 191-228)

4. Drugs for Non-infectious diseases (8L)

Introduction, Structures, Mode of Action, and Applications:

A. i) Anti-inflammatory and Analgesic Agents: Example: Aspirin, Paracetamol, and Ibuprofen, **ii) Psychoactive Agents:** Sedatives and Hypnotics: Example: Benzodiazepines,

B. Metallodrugs as Chemotherapeutic Agents: Examples: Aluminium based antacids, Salvarsan, Cis Platin, and Transition Metal Complexes

(Ref.3 Pp 443-457, 509-515, 637-647, 776-792, Ref. 5, Ref.6, Ref.7, Ref. 8 Pp.69-70, 481-491)

References:

1. Fundamentals of Medicinal Chemistry by Gareth Thomas, University of Portsmouth, UK.
2. An Introduction to Medicinal Chemistry, Patrick, G. Oxford. University Press (Vth Edition).
3. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical, Charles Owens Wilson, John H. Block, Ole Gisvold, John Marlowe Beale.
4. Foye's Principles of Medicinal Chemistry by David A. Williams, Thomas L. Lemke, William O. Foye (VIIth Edition), Kluwer publication.

5. Medicinal chemistry, fourth edition, Ashutosh Kar (2007).
6. Metallo drugs in Medicinal Inorganic Chemistry Katja Dralle Mjos and Chris Orvig, Chem. Rev. 2014, 114, 4540-4563, <http://dx.doi.org/10.1021/cr400460s>
7. Metallo drugs are unique: opportunities and challenges of discovery and development, E. J. Anthony et.al. Chem. Sci., 2020, 11, 12888, <http://dx.doi.org/10.1039/d0sc04082g>.
8. Metallo-therapeutic Drugs And Metal-Based Diagnostic Agents by Marcel Gielen and Edward R.T. Tiekink
9. Research and Development on Therapeutic Agents and Vaccines for COVID-19 and Related Human Coronavirus Diseases, Cynthia Liu et al., ACS Cent. Sci. 2020, 6, 315–331, <http://dx.doi.org/10.1021/acscentsci.0c00272>
10. A comprehensive overview of vaccines developed for pandemic viral pathogens over the past two decades including those in clinical trials for the current novel SARS-CoV-2, Kannan Damodharan et al., RSC Adv., 2021, 11, 20006–20035, <http://dx.doi.org/10.1039/d0ra09668g>

Learning Outcomes:

Upon completion of the course the student shall be able to understand,

1. The basics of medicinal chemistry, biophysical properties, overview of basic concepts of traditional systems of medicine.
2. Over view of the overall process of drug discovery, and the role played by medicinal chemistry in this process.
3. Biological activity parameters and importance of stereochemistry of drugs and receptors.
4. Knowledge of mechanism of action of drugs belonging to the classes of infectious and non-infectious diseases.
5. Enhancement of practical skills in synthesis, purification and analysis.

Additional Study Material: NPTEL Video lecture on Medicinal Chemistry:

1. <https://youtu.be/UHEXXGiegd0> ;
2. https://youtu.be/rVN_HybZ-Vk
3. <https://youtu.be/-fCXLW-jF2o>
4. <https://youtu.be/n5C-peu54Wk>
5. <https://youtu.be/0wx4hep1low>
6. <https://youtu.be/9IWrrNuUzP4A>
7. <https://youtu.be/84-q3SAVEQk>

CH-510 (B) : Polymer Chemistry

Chapter No	Topic	Number of lectures
1	Introduction and history of polymeric materials	6
2	Polymerization Chemistry	12
3	Molecular weight of Polymers	6
4	Important Polymers	12
Total		36

1. Introduction and history of polymeric materials: (6 L)

Brief history, Basic terms- monomer, polymer, polymerisation, degree of polymerisation, functionality. Different schemes of classification of polymers, polymer nomenclature, molecular forces and chemical bonding in polymers, glass transition temperature of polymer.

Ref. 1: Pages 1-20, 150

Ref. 2: Pages 1-16

Ref. 5, 7 & 8 Relevant Pages

2. Polymerization Chemistry (12 L)

Classification of polymerization processes, mechanism of- step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations. Polymerization techniques-bulk, solution, suspension, emulsion and interfacial condensation.

Ref. 1: Pages 20-58, 71-79

Ref. 2: Pages 25-32, 49-56, 82-86, 88-94, 126-132

Ref. 3 & 4 Relevant Pages

3. Molecular weight of Polymers (6 L)

Average molecular weight of polymer, Number average molecular weight (M_n), Weight average molecular weight (M_w), Number average molecular weight by end group analysis, Viscosity average molecular weight by viscometric method, Molecular weight distribution and its significance, polydispersity index.

Ref. 1: Pages 86-98, 402-409

Ref. 2 & 4: Relevant Pages

4. Important Polymers: (12 L)

Brief introduction to preparation, structure, properties and application of the following polymers: polyethylene, polystyrene, polyvinyl chloride, polyvinyl alcohol, polymethyl methacrylate, polytetrafluoroethylene, polyamides, polyesters, phenol formaldehyde resins (Bakelite, Novolac), silicone polymers, polyisoprene, conducting Polymers.

Ref. 1: Pages 215-255

Ref. 3, 4 & 6 Relevant Pages

Course Outcome: The students are expected to learn the following aspects of Polymer Chemistry:

- 1) History of polymers.
- 2) Difference between simple compounds and polymer.
- 3) Names of polymers.
- 4) Various ways of nomenclature.
- 5) Difference between natural, synthetic, organic and inorganic polymers.
- 6) Terms-Monomer, Polymer, Polymerization, Degree of polymerization, Functionality, Number average, Weight average molecular weight.
- 7) Mechanisms of polymerization.
- 8) Polymerization techniques.
- 9) Uses & properties of polymers.
- 10) Role of polymer industry in the economy.
- 11) Advantages of polymers.

Reference Books:

1. Polymer Science by V.R. Gowarikar, N.V. Vishvanathan, Jaydev Shreedhar New Age International Ltd. Publisher 1996. (Reprint 2012)
2. Textbook of Polymer Science by Fred Billmeyer, 3rd Edn. A Wiley-Interscience Publication John Wiley & Sons New York 1984. (Reprint 2008)
3. Introductory Polymer Chemistry by G.S. Misra New Age International (P) Ltd. Publisher 1996.
4. Polymer Chemistry by Charles E. Carraher (Jr.), 6th Edn, (First Indian Print 2005), New York- Basel.
5. Principle of Polymer Science by P. Bahadur, N.V. Sastry, 2nd Edn, Narosa Publishing House.
6. Polymer Chemistry by Ayodhya Singh, 2008, Published by Campus Book International, New Delhi.
7. Organic Polymer Chemistry by Jagdamba Singh, R.C. Dubey, 4th Edn, 2012.
8. Principles of Polymerisation by George Odian 3rd Edn. John Wiley & Sons New York.

SEC-II: CH-511: Skills Enhancing Course-II**[Credit -2, 36 L]****Choose one out of the two options, A and B.****CH-511 (A) : Environmental Chemistry**

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Concepts and Scope of Environmental Chemistry	06
2	Hydrosphere and Water Pollution	10
3	Analytical Techniques in water Analysis	10
4	Water pollution and treatment methods	10
Total		36

1: Concepts and Scope of Environmental Chemistry (06L)

Introduction, Environmental Pollution and Classification, Units of concentration, Segments of Environment, Biogeochemical cycles of C, N, P, S and O system

Reference: 1, 2, 3

Aims and objectives: -Students should know:

- i. Importance and conservation of environment.
- ii. Importance of biogeochemical cycles

2: Hydrosphere and Water Pollution (10L)

Water resources, Hydrological Cycle: stages of hydrological cycle and chemical composition of water bodies, Microbially mediated aquatic reactions, Classification of water pollutants

Organic and Inorganic pollutants, Sewage and Domestic waste, Sediments, Detergents, Pesticides, Eutrophication, Sampling and monitoring water quality parameters: pH, D.O. (Winkler Method), COD, TOC, Total hardness, free chlorine.

Reference: 1 Page no -47-62,

Aims and Objectives:- Students should know:

- i. Water resources
- ii. Hydrological Cycle
- iii. Organic and inorganic pollutants
- iv. Water quality parameters

3. Analytical Techniques in water Analysis (10 L)

Water quality parameters and standards, domestic water quality parameters, surface water, sampling, preservation, Monitoring techniques and methodology (pH, conductance, DO, ammonia, nitrate and nitrite, Cl, F, CN, Sulfide, sulphate, phosphate, total hardness, boron, metals and metalloids- As, Cd,

Cr, Cu, Fe, Pb, Mn, Hg (Exclude polarographic and AAS methods), COD, BOD, TOC, phenols, pesticides, surfactants, tannin and lignins, E. Coli, Case studies of water pollution.

Ref-1: 225-278

4. Water pollution and treatment methods (10 L)

Water pollutants, Eutrophication, Waste water treatment (domestic waste water, aerobic treatment, anaerobic treatment, upflow aerobic sludge bed, industrial waste water treatment, drinking water supplies, Trace elements in water, chemical speciation (Cu, Pb, Hg, As, Se, Cr)

Ref-1: 167-225

Reference-1: Environmental Chemistry – A. K. De, Third Edition (Wiley)

Additional References:

1. Environmental Chemistry – A. K. De, 5th Edition (New age international publishers)
2. Environmental Chemistry – A. K. Bhagi and C. R. Chatwal (Himalaya Publishing House)
3. Environmental Chemistry – H. Kaur 2nd Edition 2007, Pragati Prakashan, Meerut, India
4. Environmental Chemistry – J. W. Moore and E. A. Moore (Academic Press, New York)
5. Basic Concepts of Analytical Chemistry: S. M. Khopkar, Wiley Eastern (1995)

CH-511 (B) : Cheminformatics

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Introduction to Cheminformatics	02
2	Representation of Molecules and Chemical Reactions	10
3	Searching Chemical Structures	06
4	Applications of Cheminformatics	18
Total		36

1. Introduction to Cheminformatics [02L]

- 1.1. History and progression of cheminformatics
- 1.2. Significance of cheminformatics
- 1.3. Prospects of cheminformatics and Molecular Modelling

Learning Outcomes:

1. Students should understand the significance of cheminformatics in the modern practices of chemical science
2. Students should learn the necessity of cheminformatics in chemical science

Ref. 2. (Page no. 4-11 and relevant pages)

2. Representation of Molecules and Chemical Reactions: [10L]

- 2.1. Nomenclature

- 2.2. Different types of notations
- 2.3. Canonical representation of chemical structure, SMILES notation
- 2.4. 2D representation of chemical structure; Graph Theory, Connection tables and linear notations, Matrix representations
- 2.5. 3D chemical structure representation and molecular structure file formats; Molfiles, Sdfiles and Pdbfiles
- 2.6. 3D molecular structure visualization
- 2.7. Chemical Libraries (Pubchem, ChEMBL, DrugBank and Zinc) and online Available cheminformatics toolkits
- 2.8. Molecular properties calculations; electronic effects, Reaction classification

Learning Outcomes:

1. Students should learn the basic concepts about these representation methods.
2. Students should understand the significance of different representation methods for their specific applications.
3. Students should be able to identify these representation methods with understanding.
4. Students should be able to read these representation methods for basic examples.

Ref. 1. (Page no. 1-74, 183-201 and relevant pages)

Ref. 2. (Page no. 15-51, 92-96, 169-197 and relevant pages)

3. Searching Chemical Structures:**[06L]**

- 3.1. Basic ideas about the Full structure search, Sub-structure search
- 3.2. Basics of similarity and diversity search; Tanimoto, Dice, Cosine coefficient and Euclidean distance
- 3.3. Basics of three dimensional search methods
- 3.4. Basics of computation of physical and chemical data and structure descriptors.

Learning Outcomes:

1. Students should learn the basic concepts of referencing
2. Students should understand the significance of structural data in the process of referencing
3. Students should be able to correlate the necessity of input methods and the expected outcomes for the set of chemicals
4. Students should be able to understand data interpretation using these methods for basic or representative molecules.

Ref. 1. (Page no. 141-158 and relevant pages)

Ref. 2. (Page no. 291-313, 320-431 and relevant pages)

Ref. 3. (Page no. 39-50, 317-371 and relevant pages)

4: Applications of Cheminformatics:

[18 L]

4.1. Prediction of Properties of Compounds: Linear Free Energy Relations; Quantitative Structure-Property Relations; Descriptor Analysis; Model Building; Modeling Toxicity

4.2. Predictive Methods for Organic Spectral Data Simulation: Spectra prediction methods and tools, open source and propriety tools, spectra viewer programs, Structure-Spectra correlations

4.3. Introduction to computer aided drug design: Computer Assisted Synthesis Design; Target Identification and Validation; Lead Finding and Optimization; Combinatorial library design, Virtual screening, Molecular docking and Molecular Dynamics simulation. Pharmacophore modeling; Ligand-Based and Structure Based virtual screening, Drug likeness properties, Protein Ligand Interaction Profile (PLIP) analysis and its application in drug discovery process

4.4. Machine Learning Methods in Cheminformatics

4.5. Introduction to Cheminformatics Softwares: Basic operational principle and applications of MarvinSketch, Discovery Studio, Gaussian, GOLD, Schrodinger, Expert protein Analysis System (Expasy) online server

Learning Outcomes:

1. Students should learn the basic idea about how to apply cheminformatics tool for variety of applications.
2. Students should understand the significance of database for the specific purpose of application.
3. Students should able to correlate the content of data with the possible applications for the set of chemicals.
4. Students should get aware with the principle and the basic operational methods of well-practiced software used in the data interpretation in cheminformatics.
5. Students should learn the basic concepts of Machine Learning and Artificial intelligence

Ref. 1. (Page no. 75-97 and relevant pages)

Ref. 2. (Page no. 487-542, 567-616 and relevant pages)

Ref. 3. (Page no. 10-15, 93-129, 133-192, 375-406 and relevant pages)

Reference Books:

1. Andrew R. Leach and Valerie, J. Gillette (2007) An introduction to Chemoinformatics. Springer: The Netherlands.
2. Gasteiger, J. and Engel, T. (2003) Chemoinformatics: A text-book. Wiley-VCH.
3. Muthukumarasamy Karthikeyan and Renu Vyas (2014) Practical Chemoinformatics, Springer

Semester-VI

DSEC-IV: CH-601 : Physical Chemistry-II

[Credit -2, 36 L]

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Electrochemical Cells	16
2	Crystal structure	10
3	Nuclear Chemistry	10
Total		36

1. Electrochemical Cells**[16 L]**

Electrochemical cells, reversible and irreversible cells with examples, The e.m.f. of electrochemical cell and its measurement, The Weston standard cell, Reference electrodes: The primary reference electrode and Secondary reference electrodes, The Nernst equation for E.M.F. of a cell. Types of reversible electrodes, the sign convention for electrode potentials, Thermodynamics of reversible cells and reversible electrodes, E.M.F. and equilibrium constant of cell reaction, Electrochemical series, Types of concentration cells, liquid junction potential, salt bridge, Applications of emf measurements: 1. Determination of pH of a solution by using hydrogen electrode, quinhydrone electrode and glass electrodes 2. Potentiometric titrations: i) Acid-base titrations, (ii) Redox titrations. (iii) Precipitation titration, Batteries: Primary and Secondary batteries, applications for Secondary Batteries, Fuel Cells: Types of fuel cells, advantages, disadvantages of fuels cells, comparison of battery Vs fuel cell

Expected learning Outcomes:

After studying this chapter, the student will be able to know and understand:

1. Electrochemical cells: Explanation of Daniell cell, Conventions to represent electrochemical cells
2. Thermodynamic conditions of reversible cell, Explanations of reversible and irreversible electrochemical cell with suitable example,
3. EMF of electrochemical cell and its measurement.
4. The Weston standard cell
5. The primary reference electrode: The standard hydrogen electrode (SHE) with reference to diagram, Construction, representation, working and limitation,
6. Secondary reference electrodes: (a) The calomel electrode, (b) The glass electrode (c) The silver-silver chloride electrode. Understanding of these electrodes with reference to diagram, representation, Construction, working

7. Nernst Equation for theoretical determination of EMF
8. Types of Reversible electrodes: Metal-metal ion electrodes, Amalgam electrodes, Gas electrodes, Metal-metal insoluble salt electrodes, Oxidation-reduction electrodes with respect to examples, diagram, representation, construction, working (electrode reactions) and electrode potential.
9. Sign convention for electrode potentials and Electrochemical series
10. Standard electrode potentials,
11. Types of concentration cells: Concentration cells without and with transference
Concentration cells with liquid junction potential
12. Liquid junction potential and salt bridge
13. Applications of emf measurements: 1. Determination of pH of a solution by using hydrogen electrode, quinhydrone electrode and glass electrodes 2. Potentiometric titrations: i) Acid-base titrations, (ii) Redox titrations and (iii) Precipitation
14. Primary Batteries: Dry Cells, alkaline batteries with respect to construction, diagram and working
15. Secondary Batteries: Nickel-cadmium, Lithium-ion batteries, the lead acid battery with respect to construction, diagram and working
16. Applications for Secondary Batteries
17. Fuel Cells: Types of fuel cells, advantages, disadvantages of these fuels cells, comparison of battery Vs fuel cell
18. Problems

Reference books:

1. Essential of Physical Chemistry, Bahl and Tuli (S. Chand)., (Page No: 1154-1178)
2. Principles of Physical Chemistry by Puri, Sharma, Pathania, (Page No: 835-880)
3. Physical Chemistry, Singh, N.B., et al. Volume 2, New Age International Ltd, 2000, (Page No: 320-412)
- 4) Modern Electrochemistry Second Edition by John O'M Bockris, Molecular Green Technology College Station, Texas and Amulya K. N. Reddy, President International Energy Initiative Bangalore, India, (Page No: 1789-1888)

2. Crystal structure**[10 L]**

Types of Solids: Isotropy and Anisotropy, Laws of crystallography: Law of constancy of interfacial angles, Law of rational indices, Law of crystal symmetry, Weiss indices and Miller indices, Crystal Structure: Parameters of the Unit Cells, Cubic Unit Cells: Three Types of Cubic Unit Cells, Calculation of Mass of the Unit Cell, Methods of Crystal structure analysis: The

Laue method and Braggs method: Derivation of Bragg's equation, Determination of crystal structure of NaCl by Bragg's method, X ray analysis of NaCl crystal system, Calculation of d and λ for a crystal system, Numerical.

Expected learning Outcomes:

After studying this topic students are expected to know and understand:

1. Distinguish between crystalline and amorphous solids / anisotropic and isotropic solids.
2. Explain the term crystallography and laws of crystallography.
3. Weiss and Millers Indices, determination of Miller Indices
4. Bravais lattices, space groups, seven crystal systems and fourteen Bravais lattices;
5. Cubic lattice and types of cubic lattice
6. Distance between the planes for 100, 110 and 111 for cubic lattice
7. Methods of Crystal structure analysis: The Laue method and Braggs method: Derivation of Bragg's equation,
8. Determination of crystal structure of NaCl by Bragg's method,
9. X ray analysis of NaCl crystal system and Calculation of d and λ for a crystal system,
10. Problems

Reference books:

1. Essential of Physical Chemistry, Bahl and Tuli (S. Chand), (Pp: 491-507, 518-528)
2. Principles of Physical Chemistry by Puri, Sharma, Pathania, (Page No: 1165-1180)

3. Nuclear Chemistry**[10L]**

Radioactivity, Types of Radiations, Properties of Radiations, Detection and Measurement of Radioactivity: Cloud chamber, Ionization Chamber, Geiger-Muller Counter, Scintillation Counter and Film Badges, Nuclear structure, Classification of nuclides, Types of Radioactive Decay, The Group Displacement Law, Kinetics of Radioactive Decay, Half-life, average life, Energy released in nuclear reaction, Mass Defect, Nuclear Binding Energy, Some applications of radio-isotopes as tracers: Chemical investigation – Esterification, Friedel -Craft reaction, Structural determination – Phosphorus pentachloride, Age determination – use of tritium and C^{14} dating, Problems

Expected learning Outcomes:

After studying this topic students are expected to know

1. Radioactivity
2. Types and properties of radiations: alpha, beta and gamma
3. Detection and Measurement of Radioactivity: Cloud chamber, Ionization Chamber, Geiger-Muller Counter, Scintillation Counter, Film Badges

4. Types of radioactive decay: α -Decay, β -Decay and γ -Decay
5. The Group Displacement Law, Radioactive Disintegration Series
6. Kinetics of Radioactive Decay, Half-life, average life and units of radioactivity
7. Energy released in nuclear reaction: Einstein's equation, Mass Defect, Nuclear Binding Energy,
8. Application of radioisotopes as a tracer: Chemical investigation- Esterification, Friedel - Craft reaction and structure determination w.r.t PCl_5 , Age determination use of tritium and C^{14} dating.
9. Solve the problems based on this topic

Reference books:

1. Elements of Nuclear Chemistry by H.J. Arnikar
2. Essential of Physical Chemistry, Bahl and Tuli (S. Chand),. (Page No: 117-145)

Additional Reference Books:

- 1) Physical Chemistry by G. M. Barrow, International student Edition, Mc Graw Hill.
- 2) University General Chemistry by C.N.R. Rao, Macmillan.
- 3) Physical Chemistry by, R. A. Alberty, Wiley Eastern Ltd.
- 4) The Elements of Physical Chemistry by P. W. Atkins, Oxford.
- 5) Principles of Physical Chemistry by S. H. Maron, C. H. Prutton, 4thE dition.
- 6) Principles of Physical Chemistry by Puri, Sharma, Pathania,
- 7) Chemical applications of radioisotopes by H.J.M. Brown
- 8) Source book of Atomic energy by S. Glasstone and D. Van .
- 9) Modern Electrochemistry Second Edition by John O'M Bockris

Molecular Green Technology College Station, Texas and Amulya K. N. Reddy President International Energy Initiative Bangalore, India, Kluwer Academic Publishers New York, Boston, Dordrecht, London, Moscow

DSEC-IV: CH-602 : Physical Chemistry-III**[Credit -2, 36 L]**

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Colligative properties of dilute solutions	09
2	Kinetics of Reactions in the Solid State	09
3	Electronic structure and macroscopic properties	08
4	Polymers	10
Total		36

1) Colligative properties of dilute solutions (09L)

Introduction, Solution, electrolytes and nonelectrolytes, Meaning of term colligative property, relative lowering of vapour pressure of solvent in solution, elevation of B.P. of solvent in solution, Landsberger's method, freezing point depression, Beckmann's method, Osmosis and Osmotic pressure, Berkeley and Hartley method, application of colligative properties to determine molecular weight of nonelectrolyte, abnormal molecular weight, Relation between Vant Hoff's factor and degree of dissociation of electrolyte by colligative property, Numerical.

Expected learning Outcomes:

After studying this topic students are expected to know

1. Meaning of the terms-Solution, electrolytes, nonelectrolytes and colligative properties,
2. Lowering of vapour pressure of solvent in solution,
3. Elevation of B.P. of solvent in solution, Landsberger's method,
4. freezing point depression, Beckmann's method Osmosis and Osmotic pressure, Berkeley and Hartley method,
5. Application of colligative properties to determine molecular weight of nonelectrolyte, abnormal molecular weight,
6. Relation between Vant Hoff's factor and degree of dissociation of electrolyte by colligative property,
7. Problems.

Reference books:

- 3) Principles of Physical Chemistry by Puri, Sharma, Pathania, (Page No: 778 - 800)
- 4) Essential of Physical Chemistry, Bahl and Tuli (S. Chand). (Page No: 614 - 684)

2) Kinetics of Reactions in the Solid State: (09L)

Some General Considerations, Factors affecting reactions in Solids, Rate Laws for Reactions in Solids, The Parabolic Rate Law, The First-Order Rate Law, The Contracting Sphere Rate Law, The Contracting Area Rate Law, The Prout-Tompkins Equation, Rate Laws Based on Nucleation, Applying Rate Laws, Results of Some Kinetic Studies, The Deaquation-Anation of $[\text{Co}(\text{NH}_3)_5\text{H}_2\text{O}]\text{Cl}_3$, Two Reacting Solids

Expected learning Outcomes:

1. Factors affecting on solid state reactions,
2. Rate laws for reactions in solid state
3. Applying rate laws for solid state reactions
4. Results of kinetics studies

Reference books:

- 1) Principles of James E House, Second Edn, (Page nos: 229 to 262)
- 2) Principles of Physical Chemistry by Puri, Sharma, Pathania,
- 3) Essential of Physical Chemistry, Bahl and Tuli (S. Chand).

3) Electronic structure and macroscopic properties**(08L)**

Cohesive energy in ionic crystals, electronic structure of solids, conductors and insulators, Ionic crystals, semiconductors, cohesive energy in metals.

Reference books:

1. Castellan, G.W. Physical Chemistry Third edition (1993) , Addison –Wesley Publishing Co. (Page Numbers 709-719)

Expected learning Outcomes:

1. Cohesive Energy of ionic crystals based on coulomb's law and Born Haber Cycle
2. Correspondence between energy levels in the atom and energy bands in solid
3. Band structure in solids – Na , Ca and diamond
4. Conductors and insulators – Its correlation with Extent of energy in energy bands
5. phenomena of photoconductivity
6. Semiconductors – Role of impurity in transformation of insulator into semiconductor
7. Temperature dependant conductivity semiconductors
8. Cohesive Energy in metals
9. Numericals based on cohesive energy

4) Polymers**(10L)**

Introduction to Polymer Chemistry, Brief History, Polymer definition, Preparation, Classification, Structures, Chemical bonding & Molecular forces in Polymers. Ref. 1: Pages 1-14, Ref. 2: Pp. 1-16

Molecular weights of polymers: Average Molecular weight, Number Average & Weight Average Molecular weight, Molecular weight & degree of polymerisation, Practical significance of polymer molecular weights, b) Molecular weight determination by End Group Analysis & Viscosity method and c) Problems based on Number Average & Weight Average Molecular weight Ref. 1: Pages 86-89, 92, 96-98, 402-409

References

Polymer Science by V.R. Gowarikar, N.V. Vishvanathan, Jaydev Shreedhar New Age International Ltd. Publisher 1996.(Reprint 2012)

Textbook of Polymer Science by Fred Billmeyer, 3rd Edn. A Wiley-Interscience Publication John Wiley & Sons New York 1984. (Reprint 2008)

Expected learning Outcomes:

After studying this topic students are expected to know

- 1) History of polymers.
- 2) Classification of polymers
- 3) Chemical bonding & Molecular forces in Polymer
- 4) Molecular weight of polymers
- 5) Practical significance of polymer molecular weights
- 6) Molecular weight determination

Reference books:

- 1) Essential of Physical Chemistry, Bahl and Tuli (S. Chand). (Page No: 1 - 35)
- 2) Principles of Physical Chemistry by Puri, Sharma, Pathania, (Page No: 9-23)

Other Reference Books:

1. Atkins' Physical Chemistry by Peter Atkins Professor of Chemistry, University of Oxford, and Fellow of Lincoln College, Oxford Julio de Paula Professor and Dean of the College of Arts and Sciences Lewis and Clark College, Portland, Oregon
2. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).
4. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).

DSEC-IV: CH-603 : Physical Chemistry Practical-II [Credit -2, 73 L]**Total 12 Experiments to be performed.****1. Potentiometry (any five)**

- 1) To determine the PKa value of given monobasic weak acid by potentiometric titration.
- 2) To determine the formal redox potential of $\text{Fe}_2^+/\text{Fe}_3^+$ system potentiometrically.
- 3) To determine the amount of NaCl in the given solution by potentiometric titration against silver nitrate.
- 4) To determine the solubility product and solubility of AgCl potentiometrically using chemical cell.
- 5) Estimate the amount of Cl⁻, Br⁻ and I⁻ in given unknown halide mixture by titrating it against standard AgNO₃ solution (mixture of any two ions).
- 6) To prepare standard 0.2 M Na₂HPO₄ and 0.1 M Citric acid solution, hence prepare four different buffer solutions using them. Determine the pH value of these and unknown solution.

- 7) To determine the composition of Zinc ferrocyanide complex potentiometrically
- 8) To determine the standard electrode potentials of Cu and Ag electrodes and to determine the EMF of a concentration cell.

2. pH metry (any three)

- 1) To determine the degree of hydrolysis of aniline hydrochloride.
- 2) To determine the dissociation constant of oxalic acid by pH-metric titration with strong base.
- 3) Determination of Pka of given weak acid by pH metry titration with strong base
- 4) To determine the acid and base dissociation constant of an amino acid and hence the isoelectric point of an acid.
- 5) pH metric titration of strong acid against strong base by pH measurement and hence determine the concentration and strength of strong acid.

3. Radioactivity (any one)

- 1) To determine plateau voltage of the given G M counter.
- 2) To determine the resolving time of GM counter.
- 3) To determine Emax of beta particle

4. Colligative properties (any one)

1. To determine the molecular weight of solute by depression in freezing point method
2. To study the association of Benzoic acid in benzene by Beckmann Method
3. Determine the molecular weight of given electrolyte and non-electrolyte by Landsberger's method and to study the abnormal molecular weight of electrolyte

5. Turbidometry: (any one)

1. Determination of SO_4^{2-} and Cl^- by turbidimetric method (turbidimetric titration or calibration curve method)
2. To determine the molecular weight of a given polymer by turbidometry

6. Table work

1. Analysis of crystal structure from X-ray diffraction spectra of any two compounds (Calculation d, lattice constant, crystal volume and density, and assigning planes to peaks using JCPDS data)

Reference Books:

1. Practical physical chemistry, A. Findlay, T.A. Kitchner (Longmans, Green and Co.)
2. Experiments in Physical Chemistry, J.M. Wilson, K.J. Newcombe, A.r. Denko. R.M.W. Richett (Pergamon Press)
3. Senior Practical Physical Chemistry, B.D. Khosla and V.S. Garg (R. Chand and Co.,

Delhi.).

4. Experimental Physical Chemistry by D. P. Shoemaker, Mc. Growhill, 7th Edition, 2003.
5. Physical chemistry by Wien (2001)
6. Advance Physical Chemistry Experiment, Gurtu and Gurtu, Pragati Publication (Meerut),
7. Experiments in Chemistry, D. V. Jahagirdar, Himalaya Publishing House
8. Practical physical Chemistry, B. Vishwanathan and P. S. Raghwan, Viva Books
9. Vogel-qualitative-inorganic-analysis-5th-edition-1979
10. Vogel, A.I. A Textbook of Quantitative Inorganic Analysis, ELBS.
11. Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.*; W.H. Freeman & Co.: New York (2003).

DSEC-V: CH-604 : Inorganic Chemistry -II**[Credit -2, 36 L]**

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Organometallic Chemistry	08
2	Homogeneous and Heterogeneous catalysis	10
3	Bioinorganic Chemistry	08
4	Inorganic Polymers	05
5	Inorganic solids/ionic liquids of technological importance	05
Total		36

1. Organometallic Chemistry**[8L]**

Definition of Organometallic compounds and Organometallic chemistry, CO as a π -acid donor ligand, binary metal carbonyls, classification of metal carbonyls, synthesis of metal carbonyls; (a) Direct reaction (b) Reductive carbonylation (c) Photolysis and thermolysis. Hapticity, Molecular and electronic structures of binary metal carbonyls, Electron count in complexes (18 electron rule). Applications of organometallic compounds in industrial catalysis (list of examples). Chemistry of ferrocene; Introduction, synthesis and physical properties of ferrocene. Reactions of ferrocene such as Friedel-Craft Acylation, Friedel-Craft Alkylation, Mannich reaction, Nitration and Halogenation.

[Further Reading: Student should also read about the interaction of different organic ligands with metals and their possible bonding.]

Aim and Objectives: Students should be able:

- i. To understand M-C bond and to define organometallic compounds
- ii. To define organometallic chemistry
- iii. To understand the multiple bonding due to CO ligand.
- iv. To know methods of synthesis of binary metal carbonyls.
- v. To understand the structure and bonding using valence electron count (18 ele. rule)
- vi. To understand the catalytic properties of binary metal carbonyls.
- vii. To understand the uses of organometallic compounds in the homogenous catalysis.
- viii. Chemistry of ferrocene

References:

1. Inorganic Chemistry – D.F. Shriver, P.W. Atkins, C.H. Lamford – Oxford, 5th Edn., 1994, pp 534-542,553-564.
2. Concise Inorganic Chemistry by J. D. Lee (Relevant pages)
3. General Chemistry by Raymond Chang(Relevant pages)

4. Basic Organometallic Chemistry: Concepts, Syntheses and Applications of Transition Metals (CRC), B. D. Gupta and Anil J. Elias, Universities Press; 2nd Edition, 2013.

2. Homogeneous and Heterogeneous catalysis

[10L]

Introduction to Catalysis, basic principles, activity and selectivity in catalysis, Types of catalysis, homogeneous vs. heterogeneous catalysis, importance of catalysis in the synthesis of high value chemicals.

Homogeneous catalysis: catalytic cycles for following reactions: a) Hydrogenation of olefins using Wilkinson complex, b) Hydroformylation of olefins using Cobalt and Rhodium complexes, c) Carbonylation reaction: methanol to acetic acid process i.e. Monsanto processes and d) C-C coupling reactions: Heck reaction. [References 1 to 3]

Heterogeneous catalysis: History of the development of industrial heterogeneous catalysis, Classification of heterogeneous catalysts, supported metal catalyst, Role of support, Promoters and Poisons. Catalytic processes viz., a) Hydrogenation of olefins using Raney Nickel catalyst, b) Zeolites in catalysis: Catalytic cracking, c) Biodiesel synthesis using Heteropolyacids (HPAs) d) Automotive Exhaust catalysts: The catalytic converters. [Reference 5 to 6]

[Further reading: Student should also read about advanced development in the field of homogeneous and heterogeneous Catalysis.]

Aims and objectives: A student should be able to:

- i. Understand the phenomenon of catalysis, its basic principles and terminologies.
- ii. Define and differentiate homogeneous and heterogeneous catalysis.
- iii. Give examples and brief account of homogeneous catalysts.
- iv. Understand the essential properties of homogeneous catalysts-Give the catalytic reactions for Wilkinson's Catalysis, hydroformylation reaction, Monsanto acetic acid synthesis, Heck reaction
- v. Understand the principle of heterogeneous catalyst and development in it.
- vi. Give examples of heterogeneous catalysts.
- vii. Understand the classification and essential properties of heterogeneous catalysts.
- viii. Give the brief account of Hydrogenation of olefins, Zeolites in catalysis, biodiesel synthesis, Automotive Exhaust catalysts
- ix. Understand the catalytic reactions used in industries around.

References:

1. Homogeneous Catalysis: The Applications and Chemistry of Catalysis by Soluble Transition Metal Complexes, G.W. Parshall and S.D. Ittel, Wiley, New York 1992.

2. Inorganic Chemistry D.F. Shriver and P.W. Atkins, 5th Edn, Oxford University Press, 2010, Chapter 26 pp690-721.
3. Homogeneous Catalysis: Mechanisms and Industrial Applications, S. Bhaduri and D. Mukesh, Wiley, New York, 2000.pp 13-23, 55-61,85-102, 161-163
4. Catalysis: Concepts and Green Applications: Gadi Rothenberg, Wiley-VCH; First edition, 2015 Relevant pages.
5. Heterogeneous catalysis in industrial practice, Chaerls N. Shatterfield, second edition, Krieger Publishing Company, Florida USA pp 1-16, 87-112, 203-205, 222-224.
6. Heterogeneous catalysis by B. Vishwanathan and D. K. Chakrabarty , New Age International Private Limited, 2007 (Relevant pages)

3. Bioinorganic Chemistry

[8 L]

I. Introduction, Role of metals in bioinorganic chemistry, Classification as enzymatic and non-enzymatic metals, enzymatic redox metals such as Cu (SOD) and enzymatic non-redox metals such as Zn (Hydrolase). Role of metal ions in non-enzymatic processes-Na, K, Ca, Mg (one example of each and brief discussion). Role of metals in enzymatic processes-Transition metals-Catalase, peroxidase and nitrogenase (Redox active). II. Metalloproteins-Iron proteins-Introduction of Fe-S proteins, Electron transfer proteins (Fe-S, Fe₂S₂, Fe₃S₄, Fe₄S₄). Transport protein (transferrin) and Storage protein (ferritin) III. Bioinorganic Chemistry of Fe: Hemoglobin and myoglobin, its structure and functions and IV. Bioinorganic Chemistry of Co: Vitamin-B₁₂, its structure and function.

[Further Reading: Student should also read about the role of other metals and advanced development in the field of Bioinorganic Chemistry.]

Aims and objective- A student should:

- i. Identify the biological role of inorganic ions & compounds.
- ii. Know the abundance of elements in living system and earth crust.
- iii. Give the classification of metals as enzymatic and non-enzymatic.
- iv. Understand the role of metals in non-enzymatic processes.
- v. Know the metalloproteins of iron.
- vi. Explain the functions of hemoglobin and myoglobin in O₂ transport and storage.
- vii. Understand the toxicity of CN⁻ and CO binding to Hb.
- viii. Draw the structure of Vit.B₁₂ and give its metabolism.

References:

1. Concise Inorganic Chemistry by J.D. Lee - 5th edition, Pages 353, 775, 779, 796-797.
2. Inorganic Chemistry,-D.F. Shiver & P.W. Atkins- C.H. Longford ELBS- 2nd Ed,782-806.

- Principles of Bioinorganic Chemistry by S. J. Lippard and J. M. Berg, Panima Publishing Corporation, 1st Edn., Pages 1-13, 24, 285-290.

4. Inorganic Polymers

[5L]

Introduction, Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicates, silicones, siloxanes, borazines, and phosphazenes.

Aims and objective: A student should be able to:

- know thy types of Inorganic polymers
- comparison with organic polymers
- synthesis, structural aspects of Inorganic polymers
- understand the polymers of Si, B, Si and P
- Inorganic polymers and their use.

References:

- Inorganic polymer chemistry, Pimpalpure, Jain, Soni, Sahai, Pragati edition 2012, pages 1-7, 110-129, 179-186, 207-217
- N. H. Ray, Inorganic Polymers, Academic Press (1978).
- Inorganic Polymers, Second Edition James E. Mark Harry R. Allcock Robert West Oxford University Press, 2nd Edition, 2005.

5. Inorganic solids/ionic liquids of technological importance

[5L]

Inorganic solids, Preparation of inorganic solids: Conventional heat and beat methods, Co-precipitation method, Sol-gel method and Hydro-thermal method. Introduction to Solid electrolytes, inorganic liquid crystals and their examples. Ionic liquids, synthesis and application of imidazolium and phosphonium based ionic liquids.

Further reading: student should also read about the advanced smart materials and green aspects of ionic liquids.

Aims and objective: A student should know:

- Understand Preparation of inorganic solids by various methods,
- Inorganic liquid crystals
- Ionic liquids, their preparations, and their significance w.r.t green chemistry.
- Technological importance of ionic liquids,

Reference

- Rodger, G.E. *Inorganic and Solid State Chemistry*, Cengage Learning, 2002.
- Ionic Liquids: Industrial Applications for Green Chemistry, Robin D. Rogers, Kenneth R. Seddon, American Chemical Society, Washington, DC, USA. pp1-13, 30-41

DSEC-V: CH-605: Inorganic Chemistry -III**[Credit -2, 36 L]**

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Acid–Base and Donor–Acceptor Chemistry	08
2	Ionic Solids	10
3	Chemistry of Zeolites	08
4	Introduction to Nanochemistry	05
5	Chemical Toxicology	05
Total		36

1. Acid–Base and Donor–Acceptor Chemistry**[8 L]**

Acid–Base Models as Organizing Concepts, Arrhenius Concept, Brønsted–Lowry Concept, solvent system concept, Lux Flood concept, Lewis Concept, Frontier Orbitals and Acid–Base Reactions, Hard and soft acids and bases, theory of hard and soft acids bases, Acid and base strength (proton affinity, acidity and basicity of binary hydrogen compounds, inductive effects, steric effect, strength of oxy acids, acidity of cations in aqueous solutions, non-aqueous solvents and acid and base strengths, super acids).

Aims and objectives: A student should:

1. Student will learn the concept of acid base and their theories.
2. They will also come to know different properties of acids and bases.
3. Strength of various types acids.
4. How acid and base strengths get affected in non-aqueous solvents.

Reference: Inorganic chemistry, Gary L Messler and Donald A Tar, Third Ed, Pearson publisher, pages: 67-178, 183 – 208.

2. Ionic Solids**[10L]**

Crystalline and amorphous solids, crystal structures simple cubic, body centered cubic and face centered cubic, Properties of ionic solids, packing arrangements of anions in an ionic solids, Voids in crystal structure- tetrahedral and octahedral, Ionic radius, Palings univalent and crystal radii, Conversion of univalent radii to crystal radii, problems based on conversion of radii, Radius ratio effect, Lattice energy, Born-Lande equation, Born Haber cycle and its applications, Schottky and Frenkel defect.

A student should:

1. Know the nature of solids.
2. Know the crystal structures of solids.

3. Draw the simple cubic, BCC and FCC structures.
4. Identify the C.N. of an ion in ionic solid.
5. Identify the type of void.
6. Know the effect of radius ratio in determining the crystal structure.
7. Be able to define Pauling's univalent radius and crystal radius.
8. Be able to solve simple problems based on Pauling's univalent radii and crystal radii.
9. Know how to draw Born-Haber cycle.
10. Be able to solve simple problems based on Born- Haber cycle.
11. Know the defects in Ionic solids.
12. Be able to differentiate between the defects.

Reference Books:

Ref. 1- Concise Inorganic Chemistry by J.D. Lee - 5th edition. Pages 32-61

Ref .2- Concept and Model of Inorganic Chemistry by Douglas–Mc Daniels - 3rd edition Pp 102-127.

Ref. 3 -New Guide to Modern Valence Theory by G.I. Brown - 3rd edition Pages 55-62

3. Chemistry of Zeolites**[8L]**

1. Historical Background, Natural and artificial Zeolites,
2. Zeolite Framework Types: Classification, Nomenclature, Database of Zeolite Structures, Channels, Building Units, Natural Tiles, Framework Density, Coordination Sequences
3. Zeolite Structures: Framework Composition, Extra-framework Species, Stacking Faults and Disorder
4. Synthesis of Zeolites: Introduction, Basic Zeolite Synthesis, Mineralizing Agents, Effects of water concentration, Gel preparation and crystallization, Structure Directing Agents (SDA)
5. Applications 1. Zeolites as Heterogeneous Catalysts: Critical Properties for Catalysis, Catalytic Applications, Zeolites for Fine Chemistry: Acylation and Alkylation Aromatic Hydrocarbons, 2. Zeolites for Adsorption and Separations

A student should:

1. Different Zeolite Framework Types and their classification
2. Zeolite synthesis and their structure
3. Application of zeolites

Reference:

1. Zeolites in Catalysis Properties and Applications Edited by Jiri Cejka, Russell E. Morris, Petr Nachtigall, The Royal Society of Chemistry 2017 pp 1-5, 19-25, 37-50, 73-79, 87, 412-414, 418

2. Chemistry of Zeolites and Related Porous Materials: Synthesis and Structure, Ruren Xu, Wenqin Pang, Jihong Yu, Qisheng Huo, Jiesheng Chen, John Wiley & Sons (Asia) Pvt. Ltd, 2007

4. Introduction to Nanochemistry

[5L]

Synthesis and Stabilization of Nanoparticles by Chemical Reduction, Reactions in Micelles, Emulsions, and Dendrimers. Photochemical and Radiation Chemical Reduction, Cryochemical Synthesis, Physical Methods. Particles of Various Shapes and Films, Properties and Application of Nanoparticles in Science and Technology (in brief), Applications of CNTs

Reference:

1. Nanochemistry, G.B.Sergeev, Elsevier, 2006, pp 7-36, 175-83,199-201
2. The Chemistry of Nanomaterials C. N. R. Rao, A. Muller, A. K. Cheetham (Eds.) WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 2004. (Relevant pages)

A student should:

1. Various methods of nanoparticle synthesis
2. Stabilization of Nanoparticles in solution
3. Properties and Application of Nanoparticles
4. Know about carbon nanotube and its application

5. Chemical Toxicology

[5L]

Toxic chemicals in the environment, Impact of toxic chemistry on enzymes. Biochemical effect of Arsenic, Cadmium, Lead and Mercury. Biological methylation.

A student should be able -

- i) To know toxic chemical in the environment.
- ii) To know the impact of toxic chemicals on enzyme.
- iii) To know the biochemical effect of Arsenic, Cd, Pb, Hg.
- iv) To explain biological methylation.

Reference:

- i) Fundamental Chemistry by A. K. De (3rd Ed.)
- ii) Environmental chemistry by A.K.De Publisher- Wiley Eastern Limited New Age International Limited Page No. 75-100.

DSEC-V: CH-606: Inorganic Chemistry Practical-II

[Credit -2, 73 L]

Total 12 Experiments to be performed.

A. Volumetric Estimations (Any 3)

1. Analysis of Phosphate (PO_4^{3-}) from Fertilizer. (Ref-1)
2. Analysis of Iodine from Iodized salt.(Ref-2)

3. Strength of medicinal H_2O_2 . (Ref-1)
4. Analysis of Calcium from milk powder. (Ref-1)
5. Analysis of Cu from Cu-Fungicide. (Ref-1)

B. Flame Photometry (Any 3) (Ref-1)

1. Estimation of Na by flame photometry by calibration curve method.
2. Estimation of Na by flame photometry by regression method.
3. Estimation of K by flame photometry by calibration curve method.
4. Estimation of K by flame photometry by regression method.

C. Column Chromatography (any 1) (Ref-1)

1. Purification of water using cation/anion exchange resin and analysis by qualitative analysis /conductometry.

D. Nanomaterial synthesis (Any 1) (Ref-3, 4)

1. Synthesis of Silver nanoparticles.
2. Synthesis of ZnO nanoparticles.

E. Verification of periodic trends using solubility of alkaline earth metal hydroxides $Ca(OH)_2$, $Mg(OH)_2$, $Cr(OH)_2$, $Ba(OH)_2$. (Ref-1)**F. Synthesis of amine complexes of Ni(II) and its ligand exchange reaction (bidentate ligands like acac, DMG, Glycine) by substitution method.**

OR

Determination of the Metal to ligand ratio (M : L) in complexes. (Ref-5)

G. Solvent free microwave assisted one pot synthesis of phthalocynin copper (II) complex.

OR

Fenton reaction: Degradation of H_2O_2 using Fe catalyst. (Ref-6)

H. Table work: Band gap calculation for the nanomaterial TiO_2 / SnO_2 / ZnO from its electronic spectra (UV-Visible). (Ref-3, 4)**References:**

- 1: Vogel's textbook of Inorganic Quantitative Analysis, Jeffery, Basset, Mendham Deney, 5th Ed, Longman Scientific Technical, USA (copublished with John Wiley Sons)
- 2: General Chemistry Experiment – Anil J Elias (University press).
- 3: Nanotechnology: Principles and Practices by Dr.Sulbha Kulkarni. Third Edition, Springer
- 4: A laboratory course in nanoscience and nanotechnology, Dr. Gerrad Eddy Jai Poinem, CRC press
- 5: Experimental Inorganic Chemistry, Mounir A. Malati, Horwood Series in Chemical Science (Horword Publishing, Chichester) 1999.

6: Environmental Chemistry Microscale Laboratory Experiments, Jorge G.Ibanez Margarita
Hernandez-Esparza Carmen Doria-Serrano Arturo Fregoso-Infante, Springer

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Structure of Practical Examination [35 Marks; Time: 3 hours]

Q1. Expt. A/ B/ C/ D/ E/ F/ G/ H**30 M**

Q2. Viva-Voce**05 M**
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DSEC-VI: CH-607: Organic Chemistry-II**[Credit -2, 36 L]**

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Introduction to Spectroscopy	03
2	Ultra Violet and Visible Spectroscopy	06
3	Infra-Red Spectroscopy	08
4	Nuclear Magnetic Resonance Spectroscopy (PMR)	10
5	Combined problems based on U.V., I.R. and PMR spectroscopy	05
6	Stereochemistry of Disubstituted Cyclohexane and Decalin	04
Total		36

1: Introduction to Spectroscopy**[03 L]**

Introduction, meaning of spectroscopy, Types of spectroscopy, nature of electromagnetic radiation and regions of electromagnetic spectrum, Terms used in spectroscopy; wavelength, amplitude, frequency, wavenumber, energy and their relations and conversions Ref 2: Page Nos. 43-55 Chapter

2: Ultra Violet and Visible Spectroscopy**[06 L]**

Introduction, Electromagnetic radiations, electronic transitions, λ_{\max} & ϵ_{\max} , chromophore, auxochrome, bathochromic and hypsochromic shifts, Application of visible, ultraviolet spectroscopy in organic molecules. Application of electronic spectroscopy and Woodward rules for calculating λ_{\max} of conjugated dienes and α , β – unsaturated compounds. Ref 1: Page Nos.367-398

3: Infra-Red Spectroscopy**[08 L]**

Introduction, Infrared radiation and types of molecular vibrations, functional group and fingerprint region. Infra-red spectroscopy in organic molecules, IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on $>C=O$ stretching absorptions). Ref 1: Page Nos 26-93

4: Nuclear Magnetic Resonance Spectroscopy (PMR)**[10 L]**

Introduction, Principles, Magnetic and nonmagnetic nuclei, nuclear resonance, chemical shift, shielding, & deshielding effect. Measurement of chemical shift, TMS as reference and its advantages, peak area, integration, spin-spin coupling, coupling constants, J-value, problems

based on NMR. Ref 1: Page Nos.108-175 and 225-366 Chapter 5: Combined Problems Based on U.V., I.R. and PMR Spectroscopy. [05 L] Ref 1: Page Nos. 501 to 567

5: Combined problems based on U.V., I.R. and PMR spectroscopy. [05 L]

Ref 1: Page Nos. 501 to 567

6: Stereochemistry of Disubstituted Cyclohexane and Decalin [04 L]

Recapitulation, Geometrical and optical isomerism of 1,3- dimethyl and 1,4-dimethyl cyclohexane with their stability and energy calculations. Conformations of decalin and their stability.

Ref.19: Pages 94, 213 - 216, 250. Ref.20: Pages 243 – 250, 289-292.

References:

1. Pavia D.L.; Lampman G.M. Kriz G. S.; Vyvyan J.R. Spectroscopy, First Indian Reprint 2008 : Brooks/Cole CENGAGE Learning.
2. Silverstein and Basallar: Spectroscopic Identification of Organic Compounds.
3. M. Parikh :Absorption Spectroscopy Organic Compounds (John Wiley)
4. P. S. Kalsi : Spectroscopy of organic compounds (New Age)
5. J. R. Dyer: Application of absorption spectroscopy of organic compounds.
6. V. M. Parikh:Application spectroscopy of Organic molecules. (Mehata)
7. D.W. Williams and Flemming: Spectroscopic methods of Organic compound.
8. Jackman and Stermineil: Application of NMR spectroscopy
9. J. D. Roberts:Nuclear magnetic resonance (J. Wiley)
10. Jaffe and Orchin: Theory and application of U. V.
11. K. Benjamin: Mass spectroscopy
12. Budsikiewicy et al.: Mass spectroscopy.
13. Beynon J H et al: The mass spectra of organic molecules.
14. W. Kemp: Organic spectroscopy ELBS
15. Atherben; Electron spin resonance
16. Das and Jame: Mass Spectroscopy.
17. Eliel: Stereochemistry of Organic Compounds, Tata Mc Graw Hill, 1989
18. D. Nasipuri: Stereochemistry of Organic Compounds- Principles and Applications, New Age International Publishers, 3rd edition.

Learning Outcomes

Chapter 1 to 5: Organic Spectroscopic Methods in Structure Determination. (Chapter 1-5)

Students will learn the interaction of radiations with matter. They will understand different regions of electromagnetic radiations. They will know different wave parameters.

1. Students will learn the principle of mass spectroscopy, its instrumentation and nature of mass spectrum.
2. Students will understand the principle of UV spectroscopy and the nature of UV spectrum. They will learn types of electronic excitations.
3. Students will be able to calculate maximum wavelength for any conjugated system. And from the value of λ -max they will be able to find out the extent of conjugation in the compound.
4. Students will understand the principle of IR spectroscopy, types of vibrations and the nature of IR spectrum.
5. From the IR spectrum, they will be able to find out IR frequencies of different functional groups. And thus, they will be able to find functional groups present in the compound.
6. Students will understand the principle of NMR spectroscopy and will understand various terms used in NMR spectroscopy. They will learn measurement of chemical shift and coupling constants.
7. Students will be able to interpret the NMR data and they will be able to use it for determination of structure of organic compounds.
8. Students will be able to determine the structure of simple organic compounds on the basis of spectral data such as λ max values, IR frequencies, chemical shift (δ values).

Chapter 6: Students should be able to learn

1. The use of models to draw different types of disubstituted cyclohexanes in chair form
2. The geometrical isomerism in disubstituted cyclohexanes
3. The stability, energy calculations and optical activity of these conformers
4. The use models and to draw different types of conformational isomers of decalin in chair form
5. To know the stability of geometrical isomers of decalin

DSEC-VI: CH-608: Organic Chemistry-III

[Credit -2, 36 L]

Synthetic Organic Chemistry

Chapter No	Chapter	No of Lectures
1	Retrosynthetic Analysis and Applications	06
2	Organic Reaction Mechanism and Synthetic Applications	12
3	Reagents in Organic Synthesis	10
4	Natural Products	08

1. Retrosynthetic Analysis and Applications

[06 L]

Introduction, Different terms used – Disconnection, Synthons, Synthetic equivalence, FGI, TM. One group disconnection, Retrosynthesis and Synthesis of target molecules: Acetophenone, Crotonaldehyde, Cyclohexene, Benzylbenzoate, and Benzyl diethyl malonate.

Ref 1: Page Nos. 1-34 Ref. 2: Page Nos. 694-722

2. Organic Reaction Mechanism and Synthetic Applications [12 L]

1. Chemistry of reactive intermediates (carbocations, carbanions, free radicals, carbenes, nitrenes, benzyne etc...);
2. Wolff rearrangement (Step up),
3. Hofmann rearrangement (Step down),
4. Simmons-Smith reaction,
5. Michael reaction,
6. Wittig reaction and McMurry reaction,
7. Diels-Alder reaction,
8. Functional group interconversions and structural problems using chemical reactions.

Ref 2 Page Nos. 1021-1022, 1009-1018, 500, 237-238, 982-983, 877-893

3. Reagents in Organic Synthesis [10 L]

Reagents- Preparation and Applications of following reagents.

Reducing Reagents: *Ref 2 Pages Nos. 226, 828, 131-132, 26, 39, 537*

Lithium aluminium hydride LiAlH_4 , NaBH_4 , DIBAL-H, $\text{Li}(\text{tBuO})_3\text{AlH}$ & Raney Nickel.

Oxidizing Reagents: *Ref. 2 Page Nos. 545, 1123-1126, 919, 764*

1. DMSO either with DCC or Ac_2O , Dess Martin reagent, Osmium tetroxide, Selenium dioxide (SeO_2), DDQ.

4. Natural Products [08 L]

Ref 2: Page Nos. 1413-1447

Terpenoids: Introduction, Isolation, Classification. Citral- structure determination using chemical and spectral methods, Synthesis of Citral by Barbier and Bouveault Synthesis.

Alkaloids: Introduction, extraction, Purification, Some examples of alkaloids and their natural resources. Ephedrine- structure determination using chemical methods. Synthesis of Ephedrine by Nagai.

Reference:

1. Designing Organic Synthesis by Stuart Warren 1983.
 2. Organic Chemistry by Clayden, Greeves, Warren and Wothers. Second edition.
 3. Organic Chemistry by I. L. Finar Vol. II Edn. V.
 4. Organic Chemistry by Morrison and Boyd. VI Edn.
- A Guidebook to Reaction Mechanism by Peter Sykes VI Edn.

DSEC-VI: CH-609: Organic Chemistry Practical-II**[Credit -2, 73 L]****Total 12 Experiments to be performed****A) Interpretation of IR and NMR spectra (2 Experiments of each type)**

1. Determination of functional group of organic compound from given IR spectra.

2. Determination of structure of organic compound from given NMR spectra.

(Ethyl alcohol, Cis-2-butene, Trans-2-butene, Benzoic acid, Propanaldehyde, Ethyl methyl ether, 1 Butyne, Ethyl acetate, Propyl Cyanide, Salicylic Acid, Nitro phenols, Isopropyl benzene, Propanamine, Benzamide, n-Pentane, 2-chloro butane, Acetophenone)

B) Organic Estimations (Any Three)

1. Estimation of glucose

2. Estimation of glycine

3. Saponification value of oil

4. Estimation of Alkali content in Antacid using HCl.

C) Organic Extractions (Any Three)

1. Caffeine from tea leaves

2. Eugenol from cloves

3. Lycopene from tomato peels

4. Cinnamic acid from cinnamon

5. Trimyristin from nutmeg

D) Column chromatography

1. Separation of mixture of aldehyde and carboxylic acid by column chromatography

2. Separation of mixture of O-nitrophenol and P-nitrophenol by column chromatography

Learning Outcomes:**A) Interpretations of IR and PMR Spectra The students will be able to**

1. Explain “fingerprint region” of an infrared spectrum can used in the identification of an unknown compound.

2. Identify the functional group or groups present in a compound.

3. Identify the broad regions of the infrared spectrum in which occur absorptions caused by N–H, C–H, and O–H, C=C and C≡N, C=O, C=N, and C=C.

4. Understand use NMR spectra to determine the structures of compounds.

5. Interpret integration of NMR spectra

6. Calculate coupling constants from ^1H NMR spectra.

7. Interpret elemental analysis technique

B) Organic Estimations The students will be able to

1. Practical knowledge of handling chemicals.
2. Achieve the practical skills required to estimations of glucose and glycine.
3. Achieve the practical skills required to Saponification value of oil.
4. Determine the molecular weight of given tribasic acids.

C) Organic Extractions The students will be able to

1. Apply the principles of extraction
2. Understand the equipment for extraction.
3. Gain practical hands-on experience of modern Extraction.
4. Develop basic design of extractor
5. Describe the extraction separation process.

D) Column chromatography The students will be able to

1. Defines the basic parameters in chromatography
2. Explain the processes of a chromatography analysis
3. Describes the types and materials of column.
4. Explains the types of mobile phase and elution.
5. Realize the selection of appropriate mobile phase, column and detector

SEC-III: CH-610: Skill Enhancing Course-III

[Credit -2, 36 L]

Choose one out of the two options, A and B.

CH-610 (A) : Chemistry of Soil and Agrochemicals

Chapter No	Name of the Topic	Number of lectures
1	Soil Chemistry	6
2	Problematic Soil and Soil testing	6
3	Laboratory Methods of Soil Analysis	12
4	Fertilizers and Manures	6
5	Protection of Plants	6
Total Lectures		36

1. Soil Chemistry

(6 L)

- 1.1 Role of agricultural chemistry
- 1.2 Introduction to soil chemistry, definitions of soil, Soil components- Mineral component, organic matter or humus, soil atmosphere, soil water, soil microorganism.
- 1.3 Physical properties of soil- Soil texture, soil structure, soil colour, soil temperature, soil density, porosity of soil.

1.4 Surface soil and sub-soil, Functions of soil.

1.5 Chemical properties of soil - Soil reactions, importance of soil reaction, factors controlling soil reactions,

1.6 Buffer action, buffering capacity, importance of buffer reaction in agriculture, ion exchange and importance of ion exchange.

Ref 1- Pages 8-12, 92-94, 98-113, 116-146

Ref 3 - Pages 28-50

Ref 12 - Pages 211-224, 228-234

Ref 17 - Pages 49-56, 295-308, 357-370

2. Problematic Soil and Soil testing (06 L)

2.1 Introduction to problematic soils.

2.2 Acid soils- formation of acid soil, effect of soil acidity on plant, reclamation of acidic soil, application of lime in improving the acidity of soil, lime requirements.

2.3 Alkali Soil- formation of alkali soil, reclamation of alkali soil.

2.4 Classification of alkali soil- saline soil, alkali soil, saline alkali soil, non-saline alkali soil.

2.5 Soil testing - Introduction, different methods of soil fertility evaluation.

2.6 Objectives of soil testing.

Ref 1- Pages 345-370

Ref 3 - 301-312

Ref 4 – Pages 135-147, 150-159

Ref 12 - Pages 237-246, 337-353

3. Laboratory Methods of Soil Analysis (12 L)

3.1 Collection of soil Samples from field.

3.2 Soil sample preparation for analysis of various parameters.

3.3 Digestion and Extraction Procedures for soil.

3.4 Project/ Hands on training of Analysis of various parameters of soil and writing project on it.

(Note: Students can perform minimum six experiments out of eight in the laboratory with the help of teacher and write report on it and submit to subject teacher. It is considered for internal marks of this course).

1. Determination of pH of soil
2. Determination of EC and TDS of soil
3. Determination of soil organic matter of soil.
4. Determination of available nitrogen in soil.
5. Determination of available phosphorus from soil.

6. Determination of calcium and magnesium from soil by EDTA method.
7. Determination of sodium and potassium by flame photometry method.
8. Determination of carbonate and bicarbonates from soil.
9. Calculate the RSC, SAR, SSP, Salinity of soil. Interpretation of soil data and recommendations for soil use.

Ref 23 pages 11-160

Ref 25 pages 17-104

4. Fertilizers and Manures

(06 L)

Fertilizers

- 4.1 Introduction, Classification of nitrogenous fertilizers, reaction of ammonium sulphate, urea as a fertilizer in soil.
- 4.2 Nano fertilizers- Nano-Fertilizers for Sustainable Crop Production, Nano urea- preparation, forms and application of nano urea.
- 4.3 Phosphatic fertilizers- Classification of phosphatic fertilizers, reactions of superphosphate as a fertilizer in soil.
- 4.4 Potassic fertilizers - Classification of potassic fertilizers, reactions of potash fertilizer in soil.
- 4.5 Complex fertilizers- Characteristics, advantages and disadvantages,
- 4.6 Mixed fertilizers - Characteristics, advantages and disadvantages.
- 4.7 Time and mode of applications of fertilizers in the solid and liquid form to plants.
- 4.8 Factors affecting efficiency of fertilizers.

Manures

- 4.9 Introduction, Definition and classification of manures.
- 4.10 Effect of bulky organic manures on soil.
- 4.11 Farm yard manures (FYM), improved methods of handling FYM- Trench method for FYM, Factors affecting the composition of FYM, losses during the handling and storage of FYM, Gobar gas-compost plant - construction and advantages.
- 4.12 Biofertilizers - Definition, classification, role & advantages.
- 4.13 Vermicompost - Preparation, effect of vermicompost on soil fertility.

Ref 2- Pages 205-213,

Ref 3- Pages 90-112, 137-149

Ref 5 Pages Relevant pages

Ref 12 – Pages 263- 275, 280-290,

Ref 18 – URL: Attached in reference.

Ref 19 - URL: Attached in reference.

Ref 20 URL: Attached in reference.

5. Protection of Plants

(06 L)

5.1 Classification of pesticides.

5.2 Insecticide- Definition, Classification on the basis of mode of action and chemical properties.

5.2.1 Inorganic insecticides - plants or animal origin insecticides- nicotine, pyrethrum, rotenone.

5.2.2 Synthetic organic insecticides – a) Organochlorine insecticides - DDT, BHC, Aldrin and dieldrin. b) Organophosphorus insecticides – Parathion, Malathion, c) Carbamate insecticides – Carbaryl, Baygon.

5.3 Fungicide – Definition and Classification of fungicides.

5.3.1 Inorganic fungicide- Copper fungicides a) Bordeaux mixture, b) Copper oxychloride.

5.3.2 Organic fungicides- Dithiocarbamate, Quinone fungicides, Heterocyclic fungicides.

5.3.3 Synthetic fungicides.

5.4 Herbicides- Definition, Classification on the basis of mode of action- Selective and non-selective herbicides, classification based on their effect on weeds- contact, systemic herbicides. Classification on the basis of their chemical structures.

5.5 Nano pesticides: Its Scope and Utility in Pest Management

Ref 6 - Relevant Pages

Ref 13 – Pages 80-177,

Ref 14 – Pages 73-110,

Ref 15 – Chapter 3 Pages 1-45

Ref 16 Pages 2-16,

Ref 19 URL: Attached in reference.

Ref 21 URL: Attached in reference.

Learning Objectives:

- 1) Know the different components and properties of soil.
- 2) Know classification of soil on the basis of pH.
- 3) Identify the problematic soil and recommend method for their reclamation.
- 4) Know the different plant nutrients required for plants and their functions.
- 5) Know the role of various fertilizers and manures required for plant growth.
- 6) Know the various methods and their techniques in analysis of soil.
- 7) Know importance of manures as compared to chemical fertilizers.

- 8) Know various techniques to protect the plants.
- 9) Have the knowledge of various pesticides, insecticides, fungicides and herbicides.

Course Outcomes:

After studying this course, student is expected to

- 1) Understood various components of soil and soil properties and their impact on plant growth.
- 2) Understood the classification of the soil.
- 3) Explores the problems and potentials of soil and decide the most appropriate treatment for land use.
- 4) Understood the Reclamation and management of soil physical and chemical constraints.
- 5) Useful in making decisions on nutrient dose, choice of fertilizers and method of application etc. practiced in crop production.
- 6) Got experience on advanced analytical and instrumentation methods in the estimation of soil.
- 7) Understood various Nutrient management concepts and Nutrient use efficiencies of major and micronutrients and enhancement techniques.
- 8) Proper understanding of chemistry of pesticides will be inculcated among the students.
- 9) Imparts knowledge on different pesticides, their nature and, mode of action and their fate in soil so as to monitor their effect on the environment.

Reference Books

1. A text book of soil science (Revise Edition) J. A. Daji. Revised by J. R. Kadam, N. D. Patil, Media promoters and publishers, Mumbai, 1996.
2. Text book of soil science, T. D. Biswas, S. K. Mukherjee, 2nd ed. Tata McGraw Hill Publishing company, New Delhi, 2017.
3. Introduction to Agronomy and soil, water management, V. G. Vaidya, K. R. Sahashtrabuddhe, (Continental Prakashan).
4. Principals of soil science, M. M. Rai, 4th ed. Million complex of India, Bombay, 1977.
5. Manures and fertilizers (12th ed.), K. S. Yawalkar, J. P. Agarwal and Bokde, Agri-horticulture publishing house, Nagpur, 2016.
6. Chemistry of insecticides and fungicides, U.S. Sreeramula (2nd ed.), oxford and IBH Publishing company, New Delhi.
7. Fundamentals of soil sciences, Henry D. Foth, 8th ed. John Wiley and Sons, 1990. Book Soft copy URL: <https://1lib.in/book/634160/343570>

8. Soil, Plant, Water and fertilizer analysis, P. K. Gupta, 2nd ed. Agrobios Publication, Jodhpur, India. Book Soft copy URL:
https://content.kopykitab.com/ebooks/2016/06/7111/sample/sample_7111.pdf
9. Handbook of Biofertilizers and biopesticides, A. M. Deshmukh, R. M. Khobragade and P. D. Dixit, Oxford Book Company, Jaipur, India 2007. Book Soft copy URL:
<https://1lib.in/book/961124/8ecdcd>
10. Essential Plant Nutrients uptake use efficiency and Management, M. Naem, Abid A. Ansari, Sarvajeet Singh Gill Editor, Springer International Publishing AG, 2017. Book Soft copy URL: <https://1lib.in/book/3376008/16ba17>
11. The Use of Nutrients in crop plants, N.K. Fageria, CRC Press, Taylor and Francis Group, LLC, 2009. Book Soft copy URL: <https://1lib.in/book/550595/3a2232>
12. Agronomic Handbook – Management of crops, soils and their fertility, J. Benton Jones, Jr. CRC Press LLC, Washington D.C. 2003. Book Soft copy URL:
<https://1lib.in/book/946311/37a879>
13. The chemistry of Organophosphorus Pesticide, Christa Fest, Karl-Julius Schmidt, 2nd revised ed., Springer, Verlag Berlin Heidelberg, New York, 1982. Book Soft copy URL:
<https://1lib.in/book/2137868/423f0a>
14. Chemical Pesticide - Mode of action and Toxicology, Jorgen Stenersen, CRC Press, 2004. Book Soft copy URL: <https://1lib.in/book/550607/97f6b8>
15. Agrochemical and Pesticide safety Handbook, Michel F. Waxman, CRC Press, 1998. Book Soft Copy URL: <https://1lib.in/book/2061906/6282cc>
16. Basic Guide to Pesticides: Their Characteristics and Hazards, Shirley A. Briggs, Rachel Carson Council, First Edition, CRC Press, Taylor and Francis Group, 2017. Book Soft copy URL: <https://1lib.in/book/3580723/94db6c>
17. Principles of Soil Chemistry, Kim H. tan, 4th ed. revised and expanded, Marcel Dekker AG, New York, 1998. Book Soft copy URL: <https://1lib.in/book/2572952/f500e1>
18. Nano fertilizers, Nano Urea- URL: <https://www.iffco.in/>
19. Nano fertilizers & Nano Pesticides, URL:
<https://www.sciencedirect.com/science/article/pii/S0570178320300440> ,
<https://www.sciencedirect.com/science/article/pii/B9780128200926000124>
20. Biofertilizers, URL: <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/biofertilizers> , https://agritech.tnau.ac.in/ta/org_farm/orgfarm_biofertilizers.html,
<https://en.wikipedia.org/wiki/Biofertilizer>
21. Nano Pesticides, URL: <https://link.springer.com/article/10.1007/s10311-016-0600-4>

22. A Practical Course in Agricultural Chemistry, D. W. Gilchrist Shirlaw and J. E. Nichols, First ed. Pergamon Press Ltd. Headington Hill Hall Oxford4 & 5 Fitzroy Square, London. 1967. Book Soft copy URL: <https://1lib.in/book/2275633/04aec0>
23. Laboratory Guide for Conducting Soil Tests and Plant Analysis, J. Benton Jones Jr. CRC Press, 2001. Book Soft copy URL: <https://1lib.in/book/665386/63e6f0>
24. Agricultural Chemistry, First Edition, R. P. Dhok, Amazon Digital Services, LLP-KDP E Book, US. 2021. Book Soft copy URL: <https://drive.google.com/file/d/1gnvIAzdN0aaZtKbX6TY9UZ2PC7M3ANN9/view?usp=sharing>
25. Methods in Agricultural Chemical Analysis: A Practical Handbook: N.T. Faithfull, CABI Publishing, 2002, Book Soft copy URL: <https://1lib.in/book/917802/0b4a71>

CH-610 (B) Introduction to Forensic Chemistry

Chapter No	Name of the Topic	Number of lectures
1	History of Development of Forensic Science in India	10
2	Introduction to Narcotics Drugs and Psychotropic Substances	10
3	Analysis of Narcotics Drugs and Psychotropic Substances	16
Total Lectures		36

1. History of Development of Forensic Science in India

[10 L]

Functions of forensic science. Historical aspects of forensic science. Definitions and concepts in forensic science. Scope of forensic science. Need of forensic science. Basic principles of forensic science. Frye case and Daubert standard. Work nature of forensic science. Qualifications of forensic scientists. Duties & Code of conduct for forensic scientists.

Learning Objectives: After studying this paper the students will know –

- The significance of forensic science to human society.
- The fundamental principles and functions of forensic science.
- The work nature in a forensic science laboratory.
- Encourage academic students towards the noble career

Suggested Readings

- B.B. Nanda and R.K. Tiwari, *Forensic Science in India: A Vision for the Twenty First Century*, Select Publishers, New Delhi (2001).

2. M.K. Bhasin and S. Nath, *Role of Forensic Science in the New Millennium*, University of Delhi, Delhi (2002).
3. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005). Page No : 1-13, 243-260, 667-678
4. W.G. Eckert and R.K. Wright in *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (ED.), CRC Press, Boca Raton (1997). Page No: 11-78
5. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).Page No 5-29
6. W.J. Tilstone, M.L. Hastrup and C. Hald, *Fisher's Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013) Page No : 26-149
7. Directorate of Forensic Science services (DFSS) <http://dfs.nic.in/index.html>

2. Introduction to Narcotics Drugs and Psychotropic Substances [10 L]

Definition of narcotics drugs and psychotropic substances. Broad classification – Narcotics, stimulants, depressants and hallucinogens. General characteristics and common example of each classification. Natural, synthetic and semi-synthetic narcotics drugs and psychotropic substances. Designer drugs. Tolerance, addiction and withdrawal symptoms of narcotics, drugs and psychotropic substances. Introduction to NDPS Act-1985 and awareness about Punishment for Offences.

3. Analysis of Narcotics Drugs and Psychotropic Substances [16 L]

Crime scene search for narcotic drugs and psychotropic substances – searching a suspect, searching a dwelling, searching a vehicle. Clandestine drug laboratories. Collection and preservation of drug evidence. Testing of narcotics drugs and psychotropic substances. Isolation techniques for purifying narcotics drugs and psychotropic substances – thin layer chromatography, gas-liquid chromatography and high performance liquid chromatography. Presumptive and screening tests for narcotics drugs and psychotropic substances. Microcrystalline testing of Drug Abuse and Illicit Trafficking. Analysis of narcotics drugs and psychotropic substances in urine, and antemortem blood & in postmortem blood. Dope tests.

Learning Objectives: After studying this paper the students will know –

- a. The forensic identification of illicit liquors.
- b. The classification and characteristics of the narcotics, drugs and psychotropic substances.
- c. The menace of designer drugs.
- d. The methods of identifying of narcotics, drugs and psychotropic substance

Suggested Readings

1. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004). Page No 10-26
2. S.B. Karch, *The Pathology of Drug Abuse*, CRC Press, Boca Raton (1996). Page No: 429-638

3. A. Poklis, Forensic toxicology in, *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).Page No : 116-141
4. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, *Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013). Page No 323-337
5. THE NARCOTIC DRUGS AND PSYCHOTROPIC SUBSTANCES, ACT, 1985
<https://legislative.gov.in/sites/default/files/A1985-61.pdf>
6. THE NARCOTIC DRUGS SUBSTANCES AND PSYCHOTROPIC RULES, 1985
https://dor.gov.in/sites/default/files/Narcotic-Drugs-and-Psychotropic-Substances-Rules-1985_0.pdf
6. National Policy on NDPS Govt. of India
<https://dor.gov.in/narcoticdrugspychotropic/national-policy-ndps>
- 7.National Policy on NDPS & Punishment for Offences
<https://dor.gov.in/narcoticdrugspychotropic/punishment-offences>
8. J.W. Robinson, *Undergraduate Instrumental Analysis*, 5th Edition, Marcel Dekker, Inc., New York (1995). Page No : 721-797
9. Analytical Techniques in Forensic Science Rosalind Wolstenholme, Sue Jickells, Shari Forbes, edition first edition 2021 John Wiley & Sons Ltd Page No; 51-68
10. FORENSIC ANALYTICAL TECHNIQUES Barbara Stuart University of Technology, Sydney, Australia, first edition 2013 John Wiley & Sons, Ltd. 143-166

SEC-IV: CH-610: Skill Enhancing Course-IV**[Credit -2, 36 L]****Choose one out of the two options, A and B.****CH-611(A): Analytical Chemistry-II**

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Solvent extraction	08
2	Instrumental Methods of Chromatographic Analysis	04
3	High Performance Liquid Chromatography	06
4	Gas Chromatography	06
5	Atomic Absorption Spectroscopy	08
6	Flame Emission Spectroscopy	04
Total		36

1. Solvent extraction**(8 L)**

Introduction to solvent extraction, organic phase, Partition the theory of extraction (distribution coefficient, Distribution ratio, solute remaining unextracted, Separation coefficient), Factors favoring solvent extraction, Quantitative treatment to solvent extraction equilibrium, Ion association complexes, synergic extraction, some extraction reagent specifically used for inorganic ions (Acetylacetone, 8-Hydroxyquinoline, Diphenylthiocarbazone, Sodium diethyldithiocarbamate, Ammonium pyrrolidine dithiocarbamate), some practical aspects, Applications: determination of copper as the diethyldithiocarbamate complex, Determination of Fe(III) with 8-hydroxyquinoline, determination of nickel by synergistic extraction. Solid phase extraction (Ref-3) Numericals; **Key Reference-2:** 242- 253, [Supplementary Ref-3: 579-593]

2. Instrumental Methods of Chromatographic Analysis (4 L)

Principles of Chromatographic Separations, classification, Theory of Column Efficiency in Chromatography, (theoretical plate, rate theory of chromatography - the Van Deemter equation, efficiency and particle size in HPLC, retention factor efficiency and resolution,

Key Reference -4: 603-617, Supplementary reference-3: 547-556.

3. High Performance Liquid Chromatography (6 L)

Introduction, Types of liquid chromatography (liquid-solid, liquid-liquid, bonded phases), Choice of mode of separation, Equipment for HPLC: mobile phase, sample injection and column design (mobile phase, optimization of mobile phase, gradient elution, solvent delivery and sample injection, sample injection system, the column (effect of column length and column diameter), Choosing the Detector, Ultraviolet detector, Luminescence detector, RI detector, electrochemical detector, Column efficiency, HPLC chromatogram and its characteristics (retention time, peak height, peak area), method of quantitative analysis by HPLC, Example: determination of aspirin, phenacetin and caffeine in a mixture, numerical, **Key Reference -2:** 289-315, [Supplementary reference - Ref-3: 649 – 724, Ref-6: 1-325 -relevant part]

4. Gas Chromatography (6 L)

Introduction, Apparatus: A supply of carrier gas from a high-pressure cylinder, Sample injection system and derivatization, the column (Packed columns, Open tubular columns), the detector (properties, hot wire detector or TCD, FID, ECD), Quantitative analysis by GC (Area normalization method and internal standard addition method), Elemental analysis, numerical

Key Reference-2: 317- 337, [Supplementary reference - 7: 1-209 (relevant part)]

5. Atomic Absorption Spectroscopy (8 L)

Introduction, Elementary theory, Instrumentation, flames, the nebulizer-burner system, non-flame techniques, (graphite furnace, cold vapour technique), resonance line sources, monochromator, detectors, interferences, chemical interferences, background correction

methods, Atomic absorption spectrophotometers, Experimental preliminaries (calibration curve methods, standard addition method) Preparation of sample (wet ashing, fusion, Dry ashing, microwave dissolution, concentration procedures), Detection limits, Estimation of Ca and Mg in water.

Key Ref-2: 612 – 643

6. Flame Emission Spectroscopy

(4 L)

Introduction, emission spectra, flame emission spectroscopy, flame photometers. Evaluation methods, calibration curve procedure, the standard addition technique, Applications: determination of alkali metals by flame photometry, determination of trace elements in contaminated soil by AAS. Numerical,

Key Reference-2: 645-649, 655-656

References:

Ref-1: Vogel's textbook of Inorganic Quantitative Analysis, Jeffery, Basset, Mendham Deney, 5th Ed, Longman Scientific Technical, USA (copublished with John Wiley Sons)

Ref-2: Vogel's textbook of Inorganic Quantitative Analysis, Mendham, Deney Barnes, 6th Ed, Pearson education

Ref-3: Analytical Chemistry by G. D. Christian, et al, Wiley, 6th Ed.

Ref-4: Principles of Instrumental Analysis: Holler, Skoog, Crouch 6th Ed. Thomson Publication

Ref-5: Modern Analytical Chemistry, David Harvey, Mc-Graw Hill Higher education

Ref-6: High performance Liquid Chromatography, (Analytical Chemistry through open learning series) Second Ed, Sandie Lindsay, Wiley

Ref-7: Gas Chromatography, (Analytical Chemistry through open learning series) 2nd Ed, [Ian A. Fowles](#), Wiley

Course outcome: After completion of the course student should able to

1. Define basic terms in solvent extraction, basics of chromatography, HPLC, GC, and AAS and AES. Some important terms are: solvent extraction, aqueous and organic phase, distribution ratio and coefficient, solute remain unextracted, percent extraction, ion association complex, theoretical plate, HETP, retention time, selectivity, resolution, stationary phase, normal and reverse phase, ion exchange, column efficiency, carrier gas, split and spitless injection, packed column, tubular column, atomic absorption and emission spectroscopy, electronic excitation in atoms, nebulization, atomization, reduction of metal ions in flame, absorbance by atoms in flame, flame atomizers, furnace atomizers, interference in AES and FES, HCL, hydride generator, etc.

- Identify important parameters in analytical processes or estimations. Example: minimum analyte concentration in particular method, reagent concentration for particular analysis, reagent for particular analysis, reaction condition to convert analyte into measurable form, wavelength selection in HPLC with spectrophotometric and fluorometric detector, solvent or carrier gas in HPLC and GC, choice method for the sample preparation in atomic spectroscopic methods, choice of filter and HCL in atomic spectroscopic methods, etc.
- Explain different principles involved in the analyses using solvent extraction, basics of instrumental chromatography, HPLC, GC, and atomic spectroscopic techniques.
- Perform quantitative calculations depending upon equations students has studied in the theory. Furthermore, student should able to solve problems on the basis of theory.
- Discuss / Describe procedure for different types analyses included in the syllabus.
- Select particular method of analysis if analyte sample is given to him.
- Differentiate / distinguish / compare among the different analytical terms, process and analytical methods.
- Demonstrate / explain theoretical principles with help of practical.
- Design analytical procedure for given sample.
- Apply whatever theoretical principles he has studied in theory during practical in laboratory.

CH-611 (B): Chemistry of Cosmetics and Perfumes

Chapter No.	Title of Topic/Chapter	No. of lecture
1	Chemical composition, preparation and uses of some cosmetics	12
2	Chemistry of Perfumes and fragrances	12
3	Rules and regulations for cosmetic industry	12
Total		36

1. Chemical composition, preparation and uses of some cosmetics [12 L]

A general study including chemical composition, preparation and uses of the following:

Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), Eye make-up (Mascara, Eyeshadow, Eyeliner, Eyebrow pencil), Antiperspirants, (Ref. 1 – all relevant pages, Ref. 2 Pp. 149 - 177, 187 to 199, 233 to 255, 263, 291 to 310, 323 to 346, 406 to 422, 437 to 452, 457 to 490, 519 to 522)

2. Chemistry of Perfumes and fragrances [12 L]

History of perfume, classification sources of fragrance, Development and role of natural products in cosmetics, Extraction of Essential oils and their importance and uses in cosmetic industries with reference to Chemistry of - Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, 2-

phenyl ethyl alcohol, Jasmone, Civetone, Muscone. (**Ref. 3** Pages 3 to 67 and relevant pages from 68 to 360)

3. Rules and regulations for cosmetic industry

[12 L]

Understanding of regulations of Central Drugs Standard Control Organization, India Cosmetic Regulation, Steps for process of cosmetic registration in India (**Ref. 4, 5, 6**)

4. Projects: (students can choose any one of the following projects and submit a project report at the end of semester for evaluation)

1. Preparation of talcum powder. (**Ref.2** Pages 263)
2. Preparation of shampoo. (**Ref.2** Pages 323 to 346)
3. Preparation of enamels. (**Ref.2** Pages 495 to 522)
4. Preparation of hair remover. (**Ref.2** Pages 425 to 434)
5. Preparation of face cream. (**Ref.2** Pages 149 to 177)
6. Preparation of nail polish and nail polish remover. (**Ref.2** Pages 505 to 522)
7. Preparation of Emulsified and solid fragrances. (**Ref.2** Pages 575 to 583)
8. Isolation of Simple Floral fragrances and Alcoholic fragrances solution. (**Ref.2** Pp 569 to 573)

Reference Books:

1. Cosmetic Formulation: Principles and Practice - Heather A.E. Benson, Michael S. Roberts, Vania Rodrigues Leite-Silva, Kenneth Walters
2. COSMETICS Formulation, Manufacturing & Quality Control, Fourth Edition - P. P. Sharma, M pharm
3. Perfumes, Cosmetics and soaps, ninth edition, – W. A. Poucher.
4. <https://cdsco.gov.in/opencms/opencms/en/Cosmetics/cosmetics>
5. <https://cosmetic.chemlinked.com/cosmepedia/india-cosmetic-regulation>
6. <https://morulaa.com/cdsco/process-cosmetics-registration-india>

Additional References :

1. E. Stocchi: *Industrial Chemistry*, Vol -I, Ellis Horwood Ltd. UK.
2. Sharma, B.K. & Gaur, H. *Industrial Chemistry*, Goel Publishing House, Meerut (1996).
3. Indian medical plants: by Kirtikar & Basu
4. Naturals and Cosmetics – by Dr. Satish Sakharwade
5. Manufacture of Perfumes, Cosmetics & Detergents – Giriraj Prasad
6. Perfumes: History & Chemistry Vol-I- Dr. D. D. Wasule
7. Cosmetics: Science & Technology – Sagarin.
8. Essential oils Vol. I by Gunther.
9. Perfume flowers & essential oil industries by S.B. Srivastva.

CBCS: 2020-2021 T. Y. B. Sc.Mathematics



Savitribai Phule Pune University

(Formerly University of Pune)

**Three Year B.Sc. Degree Program in Mathematics
(Faculty of Science and Technology)**

T.Y.B.Sc. (Mathematics)

Choice Based Credit System Syllabus

(With effect from June 2021)

To be implemented from Academic Year 2021-2022

Title of the Course: B. Sc. (Mathematics)**Preamble:**

University of Pune has decided to change the syllabi of various faculties from June, 2019. Taking into consideration the rapid changes in science and technology and new approaches in different areas of mathematics and related subjects, Board of Studies in Mathematics with concern of the teachers of Mathematics from different colleges affiliated to University of Pune has prepared the syllabus of T.Y.B.Sc. Mathematics. To develop the syllabus the U.G.C. Model curriculum is followed.

Programme Specific Outcome (PSO)

- i) Give the students a sufficient knowledge of fundamental principles, methods and a clear perception of innumerable power of mathematical ideas and tools and know how to use them by modeling, solving and interpreting.
- ii) To equip the students sufficiently in both analytical and computational skills in Mathematical Sciences.
- iii) To develop a competitive attitude for building a strong academic - industrial collaboration, with focus on continuous learning skills.
- iv) Enhancing students overall development and to equip them with mathematical modeling abilities, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
- v) Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.
- vi) Enabling students to Gauge the hypothesis, theories, techniques and proofs provisionally.

Programme Outcome:(PO)

A graduate of this program are expected to:

- i) Gain sound knowledge on fundamental principles and concepts of Mathematics and computing with their applications related to Industrial, Engineering, Biological and Ecological problems.
- ii) Exhibit in depth the analytical and critical thinking to identify, formulate and solve real world problems of science and engineering.
- iii) Get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning.
- iv) A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical Sciences.
- v) Apply their skills and knowledge, that is, translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
- vi) Be capable of undertaking suitable experiments/research methods while solving the real-life problem and would arrive at valid conclusions based on appropriate interpretations of data and experimental results.

- vii) Develop written and oral communications skills in order to effectively communicate design, analysis and research results.
- viii) Demonstrate appropriate inter-personal skills to function effectively as an individual, as a member or as a leader of a team and in a multi-disciplinary setting.
- ix) Acquire competent positions in industry and academia as well.

Eligibility:

S.Y.B.Sc. (with Mathematics) or T.Y.B.Sc. Computer Science as per University rules.

Medium of Instruction: English

Structure of the Course:

Semester –V		Semester-VI	
DSE-1A	MT 351: Metric Spaces	DSE-4A	MT 361: Complex Analysis
DSE-1 B	MT 352: Real Analysis-I	DSE-4 B	MT 362: Real Analysis-II
DSE-2 A	MT 353: Group Theory	DSE-5 A	MT 363: Ring Theory
DSE-2 B	MT 354: Ordinary Differential Equations	DSE-5 B	MT 364: Partial Differential Equations
Select any one out of three		Select any one out of three	
DSE-3A	MT 355(A): Operations Research MT 355(B): Differential Geometry MT 355(C): C- Programming	DSE-6A	MT 365(A): Optimization Techniques MT 365(B): Calculus of Variation and Classical Mechanics MT 365(C): Financial Mathematics
Select any one out of three		Select any one out of three	
DSE-3B	MT 356(A): Machine Learning-I MT 356(B): Number Theory MT 356(C): Laplace Transform and Fourier Series	DSE-6B	MT 366(A): Machine Learning-II MT 366(B): Computational Geometry MT 366(C): Lebesgue Integration
Practical Lab		Practical Lab	
DSE-1	MT 357: Practical Course Lab-1 (on Metric Space and Real Analysis-I)	DSE-4	MT 367: Practical Course Lab-1 (on Complex Analysis and Real Analysis-II)
DSE-2	MT 358: Practical Course Lab-II (on Group Theory and Ordinary Differential equations)	DSE-5	MT 368: Practical Course Lab-II (on Ring Theory and Partial Differential Equations)
DSE-3	MT 359: Practical Course Lab-III (on DSE-3A and DSE-3B)	DSE-6	MT 369: Practical Course Lab-III (on DSE-6A and DSE-6B)
SEC-I	MT -3510: Programming in Python-I	SEC-III	MT 3610: Programming in Python-II
SEC-II	MT-3511: LaTeX for Scientific Writing	SEC-IV	MT 3611: Mathematics into LaTeX

Note.

- i) Papers MT-351 to MT-354 are compulsory, a student can opt one paper from MT-355(A) to MT-355 (C) and opt one paper from MT-356(A) to MT-356 (C) in fifth semester.
- ii) Papers MT-361 to MT-364 are compulsory, a student can opt one paper from MT-365(A) to MT-365 (C) and opt one paper from MT-366(A) to MT-366 (C) in sixth semester.
- iii) For MT-351 to MT-359 and MT-361 to MT-369 each course is of 50 marks (35 marks external examination and 15 marks internal examination).
- iv) For SEC: MT-3510, MT-3511, MT-3610 and MT-3611 each course is of 50 marks (15 marks internal evaluation: assignments/ tutorial/seminar/test and 35 marks external theory and practical examination).

Examination:

A) Pattern of examination: **Semester wise.**

B) Standard of passing: 20 Marks out of 50 marks for each paper. (But for passing a student should obtain minimum 14 marks out of 35 in the external University examination and should obtain minimum 06 marks out of 15 in the internal examination). For Skill enhancement courses a student should obtain minimum 06 marks out of 15 in internal examination and theory/practical external examination 14 marks out of 35 in the external University examination.

C) Pattern of question papers: For MT-351 to MT-354 and MT-361 to MT-364.

Q.1. Attempt any 05 out of 07 questions each of 01 marks. [05 Marks]

Q.2. Attempt any 02 out of 04 questions each of 05 marks. [10 Marks].

Q.3. Attempt any 02 out of 04 questions each of 05 marks. [10 Marks].

Q.4. Attempt any 02 out of 04 questions each of 10 marks. [10 Marks].

D) External Students: **Not allowed.**

E) Verification / Revaluation: **Allowed for Theory papers only.**

F) Qualifications for Teacher: **M.Sc. Mathematics (with NET /SET as per UGC existing rules).**

Equivalence of Previous syllabus along with new syllabus:

New Course	Old Course	New Course	Old Course
Semester-V	Semester-III	Semester-VI	Semester-IV
MT-351: Metric Spaces	MT 331 : Metric Spaces	MT 361: Complex Analysis	MT 341: Complex Analysis
MT-352: Real Analysis-I	MT 332: Real Analysis-I	MT 362 : Real Analysis-II	MT 342: Real Analysis-II

MT 353:Group Theory	MT 334 : Group Theory	MT 363 : Ring Theory	MT 344: Ring Theory
MT 354 : Ordinary Differential Equations	MT 335 : Ordinary Differential Equations	MT 364 : Partial Differential Equations	MT 345: Partial Differential Equations
MT 355 (A): Operations Research	MT 337 A. Operations Research	MT 365 (A): Optimization Techniques	MT 347 A : Optimization Techniques
MT 355 (B): Differential Geometry	MT 337 D: Lattice Theory	MT 365 (B): Calculus of Variation and Classical Mechanics	MT 347 B : Differential Geometry
MT 355 (C): C-Programming	MT 337 B. Dynamical System	MT 365(C): Financial Mathematics	MT 347 E: Lebesgue Integration
MT 356 (A): Machine Learning-I	MT 347D. Graph theory	MT 366 (A): Machine Learning-II	MT 347 C: C-Programming-II
MT 356 (B): Number Theory	MT 337 F. Number Theory	MT 366 (B): Computational Geometry	MT 347F : Computational Geometry
MT 356 (C): Laplace Transform and Fourier Series	MT 337 C. C- Programming I	MT 366(C): Lebesgue Integration	MT 337 E. Financial Mathematics
MT 357: Practical CourseLab-I: Metric Spaces and Real Analysis-I	MT 333 : Problem Course on MT 331 and MT 332	MT 367: Practical CourseLab-I: Complex Analysis and Real Analysis-II	MT 343 : Problem Course on MT 341 and MT 342
MT 358: Practical CourseLab-II: Group Theory and Ordinary Differential Equations	MT 336 : Problem Course on MT 334 and MT 334	MT 368: Practical CourseLab-II: Ring Theory and Partial Differential Equations	MT 346 : Problem Course on MT 344 and MT 345
MT 359: Practical Course Lab-III: DSE-3A and DSE-3B	MT 338: Practical based on papers selected from 337 A to 337 F	MT 369:Practical CourseLab-III: DSE-6A and DSE-6B	MT 348: Practical based on papers selected from 347 A to 347 F
MT 3510: Programming in Python-I		MT 3610: Programming in Python -II	
MT 3511: LaTeX for Scientific Writing		MT 3611: Mathematics IntoLatex	

Details of Syllabus:

Semester-V

DSE-1A: MT 351: Metric Spaces (2 credits)

Course Objectives: The course aims at providing the basic knowledge pertaining to metric spaces such as neighborhood, interior, closure, open and closed balls, continuity, completeness, compactness and connectedness etc.

Course Learning Outcomes: The course will enable the students to:

- i) understand the introductory concepts of metric spaces;
- ii) correlate these concepts to their counter parts in modern analysis by studying examples;
- iii) learn to analyze mappings between spaces.
- iv) attain background for advanced courses in real analysis, functional analysis, and topology.
- v) appreciate the abstractness of the concepts such as open balls, closed balls, compactness, connectedness etc. beyond their geometrical imaginations.

Course Contents:

Unit 1: Basic Notions [09 Lectures]

- 1.1 Definition and examples
- 1.2 Open Balls and Open Sets

Unit 2: Convergence [09 Lectures]

- 2.1 Convergent Sequences
- 2.2 Limit and Cluster points
- 2.3 Cauchy Sequences and Completeness
- 2.4 Bounded Sets
- 2.5 Dense Sets
- 2.6 Boundary of a set

Unit 3: Continuity [08 Lectures]

- 3.1 Continuous Functions
- 3.2 Equivalent Definitions of Continuity
- 3.3 Topological Property
- 3.4 Uniform Continuity
- 3.5 Limit of a Function
- 3.6 Open and closed maps

Unit 4: Compactness and Connectedness [10 Lectures]

- 4.1 Compact Spaces and their Properties
- 4.2 Connected Spaces

Text Book:

1. **Topology of Metric Spaces, S. Kumaresan, Narosa Publishing House (2nd edition), 2011.**

Unit 1: Chapter-1: Sec. 1.1; 1.1.14(only Statement) (Except- 1.1.9 to 1.1.12, 1.1.15 to 1.1.27, 1.1.33 to 1.1.37), Sec. 1.2; 1.2.40(only Statement), 1.2.42 (only Statement) (Except - 1.2.9 to 1.2.17, 1.2.41, 1.2.49 to 1.2.55, 1.2.57 to 1.2.60, 1.2.65, 1.2.66, 1.2.70 to 1.2.73, 1.2.76, 1.2.77, 1.2.87, 1.2.88, 1.2.107).

Unit 2: Chapter -2: Sec. 2.1 (Except 2.1.7, 2.1.8, 2.1.11 to 2.1.13, 2.1.15 to 2.1.19),
 Sec. 2.2; 2.2.7 (on metric space), 2.2.19(on metric space) (Except- 2.2.11, 2.2.21,
 2.2.31), Sec. 2.3; 2.3.12(only statement) (Except - 2.3.4, 2.3.19, 2.3.20), Sec. 2.4
 (Except 2.4.8 to 2.4.13, 2.4.16), Sec. 2.5 (Except 2.5.3, 2.5.4, 2.5.15), Sec. 2.7.

Unit 3: Chapter – 3: Sec. 3.1 (Except 3.1.9, 3.1.10, 3.1.12, 3.1.14, 3.1.21to 3.1.24),
 Sec. 3.2; 3.2.35 (only statement), 3.2.53 (only statement), (Except- 3.2.3, 3.2.4,
 3.2.6, 3.2.8, 3.2.12 to 3.2.15, 3.2.19, 3.2.29, 3.2.37 to 3.2.43, 3.2.51, 3.2.52),
 Sec. 3.3 (Except 3.3.5, 3.3.6, 3.3.10), Sec. 3.4 (Except 3.4.4, 3.4.5, 3.4.12 to
 3.4.14, 3.4.16), Sec. 3.5, Sec. 3.6.

Unit 4: Chapter -4: Sec. 4.1; 4.1.15(only statement) (Except - 4.1.27 to 4.1.31, 4.1.35,
 4.1.36), Sec. 4.2 (Except- 4.2.2, 4.2.6, 4.2.9, 4.2.12 to 4.2.14), Sec. 4.3;
 4.3.1(only statement) (Except 4.3.16, 4.3.25, 4.3.26, 4.3.27).
 Chapter -5: Sec. 5.1; 5.1.6(on metric space), 5.1.7(only statement)
 (Except - 5.1.12, 5.1.15 to 5.1.17, 5.1.23, 5.1.24, 5.1.27, 5.1.33, 5.1.34, 5.1.36,5.1.48).

Reference Books:

1. Metric Spaces, Q.H. Ansari: Narosa Publishing House, New Delhi, Chapters 1 – 5.
2. Metric Spaces, SatishShirali, H. Vasudeva, Springer.
3. First Course in Metric Spaces, B. K. Tyagi, Cambridge University Press
4. M. O. Searcoid: Metric spaces, Springer, 2007.
5. Metric Spaces, E.T.Copson, University Press, Cambridge, 2nd edition, Mumbai, 1978.

DSE-1B: MT: 352 Real Analysis-I (2 credits)

Course Objectives: The course will provide students with a thorough understanding of real lines and distinguishing concepts in order to prove convergence and divergence of real number sequences and series. These principles have a wide variety of real-world applications.

Course Learning Outcomes: This course will enable the students to:

- i) learn the basic facts in logic and set theory
- ii) learn to define sequence in terms of functions from \mathbb{N} to a subset of \mathbb{R} and to understand several properties of the real line.
- iii) recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- iv) use the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

Course Contents:

Unit 1: Logic and Set Theory

[10 Lectures]

1.1 Introduction

1.2 "And" and "Or"

1.3 "Not" and "If-Then"

1.4 Contrapositive, Converse, and Iff

1.5 Quantifiers

1.6 Set Theory and Venn Diagrams

1.7 Relations and Functions

1.8 Countable and Uncountable Sets

Unit 2: Sequences of Real Numbers

[07 Lectures]

2.1 Definition of sequence and subsequence

2.2. Limit of a sequence

2.3 Convergent sequences

2.4 Divergent sequences

2.5 Bounded sequences

2.6 Monotone sequences

Unit 3: Operations on convergent sequences and Limit Superior, Limit Inferior

[07 Lectures]

3.1 Operations on convergent sequences

3.2 Operations on divergent sequences

3.3 Limit superior and limit inferior

3.4 Cauchy sequences

Unit 4: Series of Real Numbers

[12 Lectures]

4.1 Convergence and divergence

4.2 Series with nonnegative terms

4.3 Alternating series

4.4 Conditional convergence and absolute convergence

4.5 Rearrangements of series

4.6 Tests for absolute convergence

4.7 Series whose terms form a non-increasing sequence

4.8 The class l^2 .

Text Books: -

1. **Real Analysis and Foundations, Second Edition, Steven G. Krantz, Chapman and Hall/CRC.**

Unit 1: Chapt. 1- Sec.: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8

2. **Methods of Real Analysis, Second Edition, Richard R. Goldberg, John Wiley & Sons, Inc.**

Unit 2: Chapt.-2: Sec.: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6,

Unit3: Chapt.-2 Sec.: 2.7, 2.8, 2.9, 2.10,

Unit 4: Capt.- 3: Sec.: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.10

Reference Books: -

1. Real Analysis, N.L. Carothers, Cambridge University Press

2. Introduction to Real Analysis, Third edition, Robert, G. Bartle, Donald Sherbert, John Wiley and Sons.

3. A Basic Course in Real Analysis, Ajit Kumar and S.Kumaresan ,CRC Press, Second Indian, , CRC Press (Chapman and Hall)
4. A course of Mathematical Analysis, Revised edition, Shantinarayan and Mittal - S. Chand and Co. (2002).
5. Mathematical Analysis, third Edition, S.C. Malik and Savita Arora - New Age International Publications.

DSE-2A: MT-353: Group Theory(2 credits)

Course Objectives: The course objective is to introduce students to the fundamental theory of groups and their homomorphisms. Symmetric groups and symmetries in groups, Lagrange's theorem are also studied in depth.

Course Learning Outcomes: The course will enable the students to:

- i) recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc;
- ii) analyze consequences of Lagrange's theorem
- iii) learn about structure preserving maps between groups and their consequences.
- iv) explain the significance of the notion of cosets, normal subgroups, and factor groups.

Course Contents:

Unit 1. Groups [06 lectures]

- 1.1 Binary Operation
- 1.2 Isomorphic Binary Structures
- 1.3 Groups

Unit 2. Subgroups [06 lectures]

- 2.1 Subgroups
- 2.2 Cyclic Groups

Unit 3. Permutations[12 lectures]

- 3.1 Groups of Permutations
- 3.2 Orbits
- 3.3 Cycles
- 3.4 Alternating Groups
- 3.5 Cosets and the Theorem of Lagrange
- 3.6 Direct Products

Unit 4. Homomorphisms and Factor Group [12 lectures]

- 4.1 Homomorphisms
- 4.2 Factor Groups
- 4.3 Factor Group Computations and Simple Groups

Text book:

1. **John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson.**
Sections: 2,3,4,5,6,8,9,10, 11(only Direct Product), 13,14,15.

Reference Books:

1. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra, Second Ed., Foundation Books, New Delhi, 1995.

2. I. N. Herstein, Topics in Algebra, John Wiley and Sons.
3. N.S. Gopalakrishnan, University Algebra, Second Edition, New Age International, New Delhi, 1986.
4. Joseph. A. Gallian, Contemporary Abstract Algebra,(4th Edition), Narosa Publishing House.

DSE-2B: MT-354- Ordinary Differential Equations (2 credits)

Course Objectives: The main objectives of this course are to introduce the students to the exciting world of differential equations, system of differential equations and their applications.

Course Learning Outcomes: The course will enable the students to:

- i) understand the genesis of ordinary differential equations.
- ii) learn various techniques of getting exact solutions of solvable first order differential equations and linear differential equations of higher order.
- iii) grasp the concept of a general solution of a linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations.

Course Contents:

Unit 1. Linear Differential Equations with constant coefficients **[12 lectures]**

1.1 Constant coefficient homogeneous equations

1.2 Characteristic equations

1.2.1 distinct real roots

1.2.2 repeated roots

1.2.3 complex roots

1.3 Particular solution

1.4 Initial value problem

1.5 The operator $\frac{1}{f(D)}$ and its evaluation for the functions $x^m, e^{ax}, e^{ax}v, xv$ and the operator

$\frac{1}{D^2+a^2}$ acting on $\sin ax$ and $\cos ax$ with proofs.

Unit 2. Non -Homogeneous Linear Equations **[08 lectures]**

2.1 Principle of superposition

2.2 Method of undetermined coefficients

2.3 Method of reduction of order

2.4 Method of variation of parameters.

Unit 3. Series Solutions of Linear Second Order Equations **[06 lectures]**

3.1 Review the properties of power series

3.2 Series solution near an ordinary point

3.3 Regular singular points

3.4 Euler equations

Unit 4. System of Equations **[10 lectures]**

4.1 Introduction to system of differential equations

4.2 Linear systems: basic theory of homogeneous linear systems, constant coefficient

4.3 Homogeneous systems.

Text Books:

1. **William F Trench , Elementary Differential Equations with Boundary Value Problems , E book (Free download)**

Unit 1 : Chapter 5: Sections 2 to 3 . Unit 2 : Chapter 5: Sections 4 to 7 .

Unit 3: Chapter 7: sections 1 to 4. Unit 4 : Chapter 10 : sections 1 to 6.

2. **Frank Ayres JR, Theory and Problems on Differential Equations, Schaum's outline Series, SI (metric) edition.** Unit 1 Chapter 16 Short methods

Reference Books:

1. M. D. Raisinghania , Ordinary and Partial Differential Equations , S. Chand and Company LTD 2009.
2. Elementary Differential Equations seventh edition by Earl D. Rainville and Philip E Bedient.
3. George F. Simmons and Stevan G. Krantz , Differential Equations, Tata McGraw-Hill.
4. W. R. Derrick and S. I. Grossman, A First Course in Differential Equations with Applications . CBS Publishers and Distributors , Delhi 110032, Third Edition.
5. Daniel Murray, Introductory Course in Differential Equations, Orient Longman.

DSE-3A: MT 355(A): Operations Research (2 credits)

Course Objectives: This course develops the ideas underlying the Simplex method for Linear programming problem, as an important branch of operations research. The course covers Linear programming with applications to Transportation and Assignment problem. Such problems arise in manufacturing resource planning and financial sectors.

Course Learning Outcomes: This course will enable the students to learn:

- i) Analyze and solve linear programming models of real-life situations.
- ii) The graphical solution of LPP with only two variables, and illustrate the concept of convex set and extreme points. The theory of the simplex method is developed.
- iii) The relationships between the primal and dual problems and their solutions with applications to transportation, assignment and two-person zero-sum game problem.

Course Contents:

Unit 1. Modeling with Linear Programming [08 Lectures]

- 1.1 Two variable LP Model
- 1.2 Solution of LP Model by Graphical Method
- 1.3 Selected LP Model Applications
- 1.4 Graphical Sensitivity analysis.

Unit 2. The Simplex Method and Duality [12 Lectures]

- 2.1 LP Model in equation form
- 2.2 Transition from graphical to algebraic solutions
- 2.3 The Simplex method.
- 2.4 Definition of the dual problem
- 2.5 Primal dual relationship
- 2.6 Economic interpretation of Duality.

Unit 3. Transportation Model [10 Lectures]

- 3.1 Definition of the Transportation model
- 3.2 The Transportation algorithm.

Unit 4. The Assignment Model [06 Lectures]

- 4.1 The Hungarian method
- 4.2 Simplex explanation of the Hungarian method.

Text Book:

1. Hamdy A. Taha, **Operation Research (Eighth Edition, 2009)**, Prentice Hall of India Pvt. Ltd, New Delhi.

Unit 1: Chapter-2: 2.1,2.2,2.3(2.3.4, 2.3.5, 2.3.6).

Unit 2:Chapter-3: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6 (3.6.1), Chapter-4: 4.2, 4.3

Unit 3:Chapter -5: 5.1,5.3 (5.3.1, 5.3.2, 5.3.3), **Unit 4:Chapter-5:** 5.4(5.4.1, 5.4.2).

Reference Books:

1. Frederick S. Hillier, Gerald J. Lieberman, Introduction to Operation Research (Eighth Edition) Tata McGrawHill.
2. J K Sharma, Operations Research (Theory and Applications,second edition, 2006), Macmillan IndiaLtd.
3. Hira and Gupta, Operation Research.

DSE-3A: MT-355(B): Differential Geometry (2 credits)

Course Objectives: This course enables the students to understand differential geometry of curves, their fundamental properties like torsion, curvature etc. along with their different forms. Also, to make understand different forms of curves and surfaces, along with their diverse properties through the use of differential calculus.

Course Learning Outcomes: The course will enable the students to:

- i) Gain an understanding to solve problems with the use of differential geometry to diverse situations in mathematical contexts.
- ii) Develop different properties associated with curves and surfaces.
- iii) Demonstrate a depth of understanding in advanced mathematical topics in relation to geometry of curves and surfaces Learn to analyze mappings between spaces.
- iv) Apply the theory of differential geometry to specific research problems in mathematics or other fields.

Course Contents:

Unit 1: Curves in the plane and in space [04 Lecture]

- 1.1 What is a curve?
- 1.2 Arc-length
- 1.3 Reparameterization
- 1.4 Level Curves vs. Parameterized Curves

Unit 2 : How much does a curve? [06 Lecture]

- 2.1 Curvature
- 2.2 Plane Curves
- 2.3 Space Curves

Unit 3 : Global Properties of curves [06 Lecture]

- 3.1 Simple Closed Curves
- 3.2 The Isoperimetric Inequality
- 3.3 The Four Vertex Theorem

Unit 4 : Surfaces in three dimensions [06 Lecture]

- 4.1 What is a Surface?
- 4.2 Smooth Surfaces
- 4.3 Tangents, Normal and Orientability

- 4.4 Examples of surfaces
- 4.5 Quadratic Surfaces
- 4.6 Triply orthogonal Systems
- 4.7 Applications of the Inverse Function Theorem

Unit 5 : The first fundamental form **[07 Lecture]**

- 5.1 Lengths of Curves on Surfaces
- 5.2 Isometries of Surfaces
- 5.3 Conformal Mappings of Surfaces
- 5.4 Surface Area
- 5.5 Equiareal Maps and Theorem of Archimedes

Unit 6 : Curvature of surfaces **[07 Lecture]**

- 6.1 The Second Fundamental Theorem
- 6.2 The Curvature of Curves on a Surface
- 6.3 The Normal and Principal Curvatures
- 6.4 Geometric Interpretation of Principal Curvatures.

Text book:

1. Andrew Pressley: Elementary Differential Geometry, Springer International Edition, Indian Reprint 2004.

- Unit 1: Chapter 1: Section 1.1 to 1.4, Unit 2: Chapter 2: Section 2.1 to 2.3,
- Unit 3: Chapter 3: Section 3.1 to 3.3, Unit 4: Chapter 4: Section 4.1 to 4.7,
- Unit 5: Chapter 5: Section 5.1 to 5.5, Unit 6: Chapter 6: Section 6.1 to 4.4.

Reference Books:

1. John A. Thorpe, Differential Geometry, Springer International Edition, Indian Reprint 2004.
2. M. DoCarmo, Differential geometry of Curves and surfaces, Prentice Hall, 1976.

DSE-3A: MT 355(C): C-Programming (2 credits)

Course Objectives: The course is designed to provide complete knowledge of **C-language**. Students will be able to develop logics which will help them to create **programs**, applications in **C**. Also, by **learning** the basic **programming** constructs they can easily switch over to any other **language** in future.

Course Learning Outcomes: After the completion of this course, the students will be able to develop applications.

Course Contents:

Unit 1. Fundamentals of C – programming: **[06 Lectures]**

- 1.1 Introduction to C, The character set. Identifier and keywords. Data types, Constants.
- 1.2 Variables and arrays.
- 1.3 Declarations. Expressions., Statements, Symbolic constants, Operators and Expressions.

Unit 2. Data Input and Output: **[06 Lectures]**

- 2.1 Preliminaries. Single character input- the getchar() function.
- 2.2 Single character output-the putchar() function.
- 2.3 Entering input data- the scanf() function.
- 2.4 Writing output data- the printf function.
- 2.5 The gets and puts functions.

Unit 3. Preparing, running a complete C Program and Control Statements: [10 Lectures]

3.1 Preliminaries. The while statement. The do-while statement.

3.2 The for statement, Nested loops. The if-else statement. The switch statement.

3.3. The break statement. The continue statement. The comma operator. The goto statement.

Unit 4. Functions and Arrays: [14 Lectures]

4.1 Introduction to a function. Defining a function. Accessing a function.

4.2 Passing arguments to a function. Function prototypes, Recursion, Defining an array.

4.3 Processing an array. Passing arrays to functions. Multidimensional arrays. Arrays and strings.

Text Book:

1. Programming with C. By Byron S. Gottfried. Schaum's Outline series.

Unit-1: Chapters: 1, 2, 3, Unit-2: Chapter: 4, Unit-3: Chapters: 5, 6.

Unit-4: Chapters: 7, 9.

Reference Books:

1. The C Programming Language. By Brian W. Kernighan, Dennis M. Ritchie, 2nd Edition.
2. Spirit of C: An Introduction to Modern Programming. By Henry Mullish and Herbert L. Cooper, Jaico Publishers.

DSE-3B: MT-356(A): Machine Learning-I (2 credits)

Course Objectives:

Students will try to learn:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To become familiar with **introduction to NumPy Array and Matrices**.
3. To become familiar with discover and visualize data to gain insights.
4. To become familiar with Fine-tuning the model - Grid Search, Randomized Search.
5. To develop the ability to write database applications in Python.

Course Learning Outcomes:

Upon successful completion of this course the student will be able to:

1. Gain knowledge about basic concepts of Machine Learning.
2. Identify machine learning techniques suitable for a given problem.
3. Solve the problems using various machine learning techniques.

Course Contents:

Unit 1: Introduction to Machine Learning

[08 Lectures]

1.1 What & why behind machine learning

1.2 Types of Machine Learning - Supervised vs Unsupervised

1.3 Model Based Training

1.4 Main challenges of Machine Learning

1.5. Testing and Validating

Unit 2: Introduction to Python

[08 Lectures]

2.1 The Way Of The Program

2.2 Variables, Expressions and Statements

- 2.3 Functions
- 2.4 Conditionals and Recursion
- 2.5 Strings
- 2.6 Lists

Unit 3: Understanding ML related Python Packages

[10 Lectures]

- 3.1 Numpy Basics: Arrays and Vectorized Computation
 - 1. The NumPyndarray: A Multidimensional Array Object
 - 2. Universal Functions: Fast Element-wise Array Functions
 - 3. Data Processing Using Arrays
 - 4. Linear Algebra
- 3.2 Getting Started with Pandas
 - 1. Introduction to pandas Data Structures
 - 2. Essential Functionality
 - 3. Summarizing and Computing Descriptive Statistics
 - 4. Handling Missing Data
 - 5. Hierarchical Indexing
- 3.3 Plotting and Visualization
 - 1. A Brief matplotlib API Primer
 - 2. Plotting Functions in Pandas
 - 3. Plotting Maps: Visualizing Haiti Earthquake Crisis Data

Unit 4: End to End Machine Learning Project

[10 Lectures]

- 4.1 Get the data
- 4.2 Discover & Visualize the data to gain insights
- 4.3 Preparing the data for machine learning - Cleaning, Handling categorical values, Feature scaling
- 4.5 Select and Train a model - Training and Evaluating on the Training Set
- 4.4 Fine-tuning the model - Grid Search, Randomized Search

Text Books:-

1. **Hands-on Machine Learning with Scikit-Learn, Keras and Tensorflow–AurelienHeron, Sections: 1, 2**
2. **Python for Data Analysis by Wes McKinney (O’ Reilly publication)Chapter -4:4.1, 4.2, 4.3, 4.5, Chapter -5: 5.1, 5.2, 5.3, 5.4, 5.5, Chapter-8:8.1, 8.2, 8.3**
3. **Allen Downey, Think Python, How to Think Like a Computer Scientist, Green Tea Press Needham, Massachusetts, 2015, Sections - 1, 2, 3, 5, 8, 10**

Reference Book:-

1. Introduction to Machine Learning With Python - Andreas C. Muller & Sarah Guide
2. Head first Python by Paul Barry (O Reilly publication)
3. Jason Brownlee - Basics of Linear Algebra for Machine Learning, 2018
4. M. P. Deisenroth, A. A. Faisal, C. S. Ong - Mathematics for Machine Learning, Cambridge University Press, 2019
5. DipanjanSarkar, Raghav Bali, Tushar Sharma - Practical Machine Learning with Python, 2018.
6. **Extra Reference Resources -**
[geeksforgeeks.org/machine-learning](https://www.geeksforgeeks.org/machine-learning)
<https://towardsdatascience.com/search?q=machine%20learningwww.kaggle.com>

DSE-3B: MT-356(B): Number Theory (2 credits)

Course Objectives: There are difficult open problems in number theory that are understandable at the undergraduate level; this course is designed to develop a micro aptitude for understanding the aesthetic aspect of mathematical instructions and to prepare young minds to ponder such problems. Another goal is to familiarise students with basic number theoretic techniques that can be used in data protection.

Course Learning Outcomes: This course will enable the students to learn:

- i) some of the open problems related to prime numbers.
- ii) about number theoretic functions and modular arithmetic.
- iii) the Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues, and quadratic non-residues.

Course Contents:

Unit 1. Divisibility	[06 Lectures]
1.1 Introduction	
1.2 Divisibility	
1.3 Prime	
Unit 2. Congruences	[08 Lectures]
2.1 Congruences	
2.2 Solution of Congruences	
2.3 The Chinese Remainder Theorem	
Unit 3. Greatest integer function	[08 Lectures]
3.1 Greatest integer function	
3.2 Arithmetic functions	
3.3 The Mobius Inversion formula	
Unit 4. Quadratic Reciprocity	[08 Lectures]
4.1 Quadratic residues	
4.2 Quadratic reciprocity	
4.3 The Jacobi Symbol	
Unit 5. Diophantine Equations	[06 Lectures]
5.1 Diophantine equations $ax + by = c$	
5.2 Pythagorean triplets.	

Text Book:

1. **I. Niven, H. Zuckerman and H.L. Montgomery, An Introduction to Theory of Numbers, 5th Edition, John Wiley and Sons.**

Unit 1 : Chapter 1 Section 1.1- 1.3, Unit 2 : Chapter 2 Section 2.1- 2.3,

Unit 3 : Chapter 3 Section 3.1- 3.3, Unit 4 : Chapter 4 Section 4.1 -4.3,

Unit 5 : Chapter 5 Section 5.1 and 5.3

Reference Book:

1. David M. Burton, Elementary Number Theory (Second Ed.), Universal Book Stall, New Delhi, 1991.

DSE-3B: MT-356 (C): Laplace Transform and Fourier Series (2 credits)

Course Objectives: The main objective of this course is to determine properties of Laplace Transform and Fourier series which may be solved by application of special functions.

Course Learning Outcomes: This course will enable the students to learn:

- i) Students will be able to know the use of Laplace transform in system modeling, digital signal processing, process control.
- ii) Solve an initial value problem for an nth order ordinary differential equation using the Laplace transform.
- iii) Find the Fourier series representation of a function of one variable

Course Contents:

Unit 1: The Laplace Transform

[10Lectures]

- 1.1 Definition, Laplace Transform of some elementary functions.
- 1.2 Sufficient condition for existence of Laplace Transform
- 1.3 Some important properties of Laplace Transform.
- 1.4 Methods of finding Laplace Transform: Direct Method, Series Method
- 1.5 Evaluation of Integration
- 1.6 Some Special Functions

Unit2: The Inverse Laplace Transform

[10Lectures]

- 2.1 Definition, Some inverse Laplace Transform.
- 2.2 Some important properties of Inverse Laplace Transform.
- 2.3 Methods of finding inverse Laplace Transforms: Partial Fraction Method and Series Method.
- 2.4 The Heaviside's Expansion formula.
- 2.5 Beta function, Evaluation of Integration.

Unit3: Applications to Differential Equations

[10Lectures]

- 3.1 Ordinary Differential Equations with constant coefficients.
- 3.2 Ordinary Differential Equations with variable coefficients.
- 3.3 Simultaneous Ordinary Differential Equations.

Unit 4: Fourier series

[06Lectures]

- 4.1 Even and Odd functions, Its properties.
- 4.2 Fourier series and its Examples.

Text Book:

1. **Schaum's Outline Series-Theory and Problems of Laplace Transform by Murray R. Spiegel.**

Unit1:Chapter-1, Unit2:Chapter-2, Unit3:Chapter-3 (Excluding Applications to Mechanics, Electrical circuits, Beam and PDE).

2. **Richard R. Goldberg, Methods of Real Analysis, Oxford and IBH Publishing Co.Pvt.Ltd.(1970).**

Unit4: Chapter-12(only12.1)

ReferenceBooks:

1. Phil Dyke, An Introduction to Laplace Transforms and Fourier Series, Second Edition, Indian Reprint 2014.
2. Joel L. Schiff, The Laplace Transforms- Theory and Applications, Springer Verlag New York 1999.
3. Lokenath Debnath and Dambaru Bhatta, Integral Transforms and Their Applications, Third Edition, CRC Press.

DSE-1: MT 357: Practical Course Lab-I (Metric Spaces and Real Analysis-I)(2 credits)

Section-I: Metric Spaces Practical

Practical 1: Definition and examples of Metric Spaces (Unit-1; 1.1)

Practical 2: Open and Closed sets in metric spaces (Unit-1; 1.2)

Practical 3: Convergences (Unit 2)

Practical 4: Continuity (Unit 3)

Practical 5: Compactness (Unit 4)

Practical 6: Connectedness (Unit 4)

Section-II: Real Analysis-I Practical

Practical 1: Logic, Set Theory, Functions and Cardinality (Unit-1)

Practical 2: Convergent and Divergent Sequences of Real Numbers (Unit-2)

Practical 3: Monotone Sequences and Algebra of Convergent Sequences (Unit-2)

Practical 4: Limit Superior, Inferior and Cauchy Sequences (Unit-3)

Practical 5: Series of Real Numbers, Alternating Series and Conditional/Absolute Convergence (Unit-4)

Practical 6: Convergent and Divergent Series of Real Numbers (Unit-4)

DSE-2: MT 358: Practical Course Lab-II (Group Theory and Ordinary Differential Equations)(2 credits)

Section-I: Group Theory Practical

Practical 1: Isomorphic Binary Structures and Groups (Unit-1)

Practical 2: Subgroups and Cyclic Groups (Unit-2)

Practical 3: Groups of Permutations, Orbits and Cycles (Unit-3)

Practical 4: Alternating Groups, Cosets and the Theorem of Lagrange (Unit-3)

Practical 5: Direct Products and Homomorphisms (Unit-4)

Practical 6: Factor Groups, Factor Group Computations and Simple Groups (Unit-4)

Section-II: Ordinary Differential Equations Practical

Practical 1: Linear differential equations with constant coefficients (Unit 1.1 to 1.4)

Practical 2: Inverse differential operators (Short methods) (Unit 1.5)

Practical 3: Non homogeneous linear equations Part I (Unit 2.1 to 2.2)

Practical 4: Non homogeneous linear equations Part II (Unit 2.3 to 2.4)

Practical 5: Series solution of linear second order equations (Unit 3)

Practical 6: System of equations (Unit 4).

DSE-3: MT 359: Practical Course Lab-III (Based on DSE-3A and DSE-3B)(2 credits)

Section-I: Operations Research/ Differential Geometry/C-Programming

Section-I (A): Operations Research Practical

Practical 1: Modeling with Linear Programming (Unit-1)

Practical 2: The Simplex Method-I (Unit-2)

Practical 3: The Simplex Method-II (Unit-2)

Practical 4: Duality (Unit-2)

Practical 5: Transportation Model (Unit-3)

Practical 6: The Assignment Model (Unit-4)

OR

Section-I (B): Differential Geometry Practical

Practical 1: Curves in the plane and in space (Unit 1)

Practical 2: How much does a curve? (Unit 2)

Practical 3: Global Properties of curves (Unit 3)

Practical 4: Surfaces in three dimensions (Unit 4)

Practical 5: The first fundamental form (Unit 5)

Practical 6: Curvature of surfaces (Unit 6)

OR

Section-I(C): C- Programming Practical

Practical-1: Operators and expressions-I (Unit 1)

Practical-2: Operators and expressions-II (Unit 2)

Practical-3: Control statements-I (Unit 3)

Practical-4: Control statements-II (Unit 3)

Practical-5: Arrays (Unit 4)

Practical-6: Functions (Unit 4)

Section-II: Machine Learning-I/ Number Theory/Laplace Transform and Fourier Series

Section-II(A): Machine Learning-I Practical

Practical 1: Introduction to Python, Python Data Types-I (Unit 2)

Practical 2: Python Data Types- II (Unit 2)
Practical 3: Control statements in Python-I (Unit 2)
Practical 4: Control statements in Python-II (Unit 2)
Practical 5: Python collection type - List (Unit 2)
Practical 6: Data handling with Panda - 1 (Unit 3)
Practical 7: Data handling with Panda - 2 (Unit 3)
Practical 8: Data visualization with Matplotlib (Unit 3)
Practical 9: Introduction to scikit-learn (Unit 3)
Practical 10: End to end model implementation - 1 (Unit 4)
Practical 11: End to end model implementation - 2 (Unit 4)
Practical 12: End to end model implementation - 3 (Unit 4)

OR

Section-II(B): Number Theory Practical

Practical 1: Divisibility and GCD – I (Unit 1)
Practical 2: Divisibility and GCD – II (Unit 1)
Practical 3: Congruences (Unit 2)
Practical 4: Quadratic Reciprocity (Unit 3)
Practical 5: Number Theoretic Functions (Unit 4)
Practical 6: Linear Diophantine Equations, Pythagorean Triplets (Unit 5)

OR

Section-II(C): Laplace Transforms and Fourier Series Practical

Practical 1: The Laplace Transform (Unit 1: 1.1, 1.2, 1.3, 1.4)
Practical 2: Special Functions (Unit 1: 1.5, 1.6)
Practical 3: The Inverse Laplace Transform-I (Unit 2: 2.1, 2.2, 2.3, 2.4)
Practical 4: The Inverse Laplace Transform-II (Unit 2: 2.4, 2.5)
Practical 5: Applications to Differential Equations (Unit 3)
Practical 6: Fourier Series (Unit 4)

SEC-I: MT -3510: Programming in Python–I (2 credits)

Course Objectives:

1. To understand why **Python** is a useful scripting language for developers.
2. To learn how to use lists, tuples, and dictionaries in **Python** programs.

3. To learn and understand python looping, control statements and string manipulations.
4. To acquire programming skills in core Python.

Course Learning Outcomes: At the end of the course:

1. The student will be able to explain basic principles of Python programming language.
2. The student will implement object oriented concepts.

Course Contents:

Unit 1: Introduction to Python

[06 Lectures]

- 1.1 Installation of Python
- 1.2 Values and types: int, float and str,
- 1.3 The Print Function: Print basics
- 1.4 Variables: assignment statements, printing variable values, types of variables.
- 1.5 Mathematical Operators, operands and precedence: +, -, /, *, **, % PEMDAS (Rules of precedence)
- 1.6 String operations: + : Concatenation, * : Repetition
- 1.7 Boolean operator:
 - 1.7.1 Comparison operators: ==, !=, >, =, <=
 - 1.7.2 Logical operators: and, or, not
- 1.8 Mathematical functions from math, cmath modules, random module
- 1.9 Keyboard input: input() statement
- 1.10 Calculus: Differentiation, Integration, Limit and Series

Unit 2: String, list, tuple

[06 Lectures]

- 2.1 Strings:
 - 2.1.1 Length (Len function)
 - 2.1.2 String traversal: Using while statement, Using for statement
 - 2.1.3 String slice
 - 2.1.4 Comparison operators (>, <, ==)
- 2.2 Lists:
 - 2.2.1 List operations
 - 2.2.2 Use of range function
 - 2.2.3 Accessing list elements
 - 2.2.4 List membership and for loop
 - 2.2.5 List operations
 - 2.2.6 Updating list: addition, removal or updating of elements of a list
- 2.3 Tuples:
 - 2.3.1 Defining a tuple,
 - 2.3.2 Index operator,
 - 2.3.3 Slice operator,
 - 2.3.4 Tuple assignment,
 - 2.3.5 Tuple as a return value

Unit 3: Iterations and Conditional statements

[10 Lectures]

- 3.1 Conditional and alternative statements, Chained and Nested Conditionals: if, if-else, if-elif-else, nested if, nested if-else
- 3.2 Looping statements such as while, for etc, Tables using while.
- 3.3 Functions:

- 3.3.1 Calling functions: type, id
- 3.3.2 Type conversion: int, float, str
- 3.3.3 Composition of functions, Returning values from functions
- 3.3.4 User defined functions, Parameters and arguments

Unit 4: Linear Algebra

[04 Lectures]

- 4.1 Matrix construct, eye(n), zeros(n,m) matrices
- 4.2 Addition, Subtraction, Multiplication of matrices, powers and invers of a matrix.
- 4.3 Accessing Rows and Columns, Deleting and Inserting Rows and Columns
- 4.4 Determinant, reduced row echelon form, nullspace, column space, Rank
- 4.5 Solving systems of linear equations (Gauss Elimination Method, Gauss Jordan Method, LU- decomposition Method)
- 4.6 Eigenvalues, Eigenvectors, and Diagonalization

Unit 5: Numerical methods in Python

[06 Lectures]

- 5.1 Roots of Equations
- 5.2 Newton-Raphson Method
- 5.3 False Position (RegulaFalsi) Method
- 5.4 Numerical Integration:
 - 5.4.1 Trapezoidal Rule,
 - 5.4.2 Simpson's 1/3rd Rule,
 - 5.4.3 Simpson's 3/8th Rule

Unit 6: 2D and 3D Graphs

[04 Lectures]

- 6.1 Installation of numpy, matplotlib packages
- 6.2 Graphs plotting of functions
- 6.3 Different formats of graphs, PyDotPlus (Scalable Vector Graphics), PyGraphviz.
Decorate Graphs with Plot Styles and Types: Markers and line styles, Control colors, Specifying styles in multiline plots, Control linestyle, Control marker styles.
Polar charts: Navigation Toolbar with polar plots, Control radial and angular grids.
- 6.4 Three-dimensional Points and Lines
- 6.5 Three-dimensional Contour Plots, Wireframes and Surface Plots.

Practicals:

Practical 1: Introduction to Python, Python Data Types-I (Unit 1)

Practical 2: Python Data Types- II (Unit 2)

Practical 3: Control statements in Python-I (Unit 3- 3.1, 3.2)

Practical 4: Control statements in Python-II (Unit 3- 3.3)

Practical 5: Application: Matrices (Unit 4 – 4.1-4.3)

Practical 6: Application: Determinants, system of Linear Equations (Unit 4- 4.4, 4.5)

Practical 7: Application: System of equations (Unit 4- 4.5)

Practical 8: Application: Eigenvalues, Eigenvectors (Unit 4 – 4.6)

Practical 9: Application: Eigenvalues, Eigenvectors (Unit 4 – 4.6)

Practical 10: Application: Roots of equations (Unit 5 – 5.1)

Practical 11: Application: Numerical integration (Unit 5 – 5.2, 5.3,5.4)

Practical 12: Graph Plotting (Unit 6)

Text Books:-

1. Allen Downey, Think Python, How to Think Like a Computer Scientist, Green Tea Press Needham, Massachusetts, 2015,
Unit1-1: Chapter-1:1.1-1.5, Chapter-2: 2.1-2.6, Chapter-3: 3.1-3.6, Chapter-5: 5.1-5.3
Unit1-2: Chapter-8: 8.1-1.5, Chapter-10: 10.12, Chapter-12: 12.1.- 12.6
Unit-3: Chapter 5:5.4 -5.7, Chapter 7: 7.1-7-7.5
2. Robert Johansson, Introduction to Scientific Computing in Python, 2016
Unit-1: 6.5-6.8
Unit- 4: Chapter-4: 4.6 (4.6.1 - 4.6.6), Chapter-6: 6.9-6.10, Unit-5: Chapter-4: 4.8,
Unit-6: Chapter-5
3. Hans-Petter Halvorsen, Python for Scientific engineering, 2020 Unit-5: Chapter-31

Reference Books:-

1. Lambert K. A., Fundamentals of Python - First Programs, Cengage Learning India, 2015.
2. Guzdial, M. J., Introduction to Computing and Programming in Python, Pearson India.
3. Perkovic, L., Introduction to Computing Using Python, 2/e, John Wiley, 2015. Zelle, J., Python Programming: An Introduction to Computer Science, Franklin, Beedle and Associates Inc.
4. Sandro Tosi, Matplotlib for Python Developers, Packt Publishing Ltd. (2009) BIRMINGHAM – MUMBAI. (Use for 2D and 3D plots and also use Lambert K. A book).
5. Python: Notes for Professionals, Goalkicker.com, Free Programming books.

SEC-II: MT-3511: LaTeX for Scientific Writing (2 credits)

Course Objectives: The purpose of this course is

- i) To provide an understanding of the basic mechanisms of LaTeX, using plain text as a vehicle
- ii) To acquaint students with the latest typesetting skills, which shall enable them to prepare high quality typesetting.

Course Learning Outcomes: After studying this course the student will be able to:

- i) Write a simple LaTeX input document based on the article class.
- ii) Turn the input document into pdf with the pdflatex program.
- iii) Format Words, Lines, and Paragraphs.
- iv) Understand how to present data using tables.

Course Contents:

Unit 1. Introduction to LaTeX

[06 Lectures]

- 1.1 Definition and application of LaTeX
- 1.2 Preparation and Compilation of LaTeX input file
- 1.3 LaTeX Syntax
- 1.4 Keyboard Characters in LaTeX

Unit 2. Formatting Words, Lines, and Paragraphs

[09 Lectures]

- 2.1 Text and Math Mode Fonts.
- 2.2 Emphasized and Colored Fonts

- 2.3 Sectional Units
- 2.4 Labeling and Referring Numbered Items
- 2.5 Texts Alignment and Quoted text
- 2.6 New Lines and Paragraphs
- 2.7 Creating and Filling Blank Space
- 2.8 Producing Dashes Within Texts

Unit 3. Listing and Tabbing Texts [09 Lectures]

- 3.1 Listing Texts
- 3.2 Tabbing Texts Through the tabbing Environment

Unit 4. Table Preparation [12 Lectures]

- 4.1 Table Through the tabular Environment
- 4.2 Table Through the tabularx Environment
- 4.3 Vertical Positioning of Tables
- 4.4 Sideways (Rotated) Texts in Tables
- 4.5 Adjusting Column Width in Tables
- 4.6 Additional Provisions for Customizing Columns of Tables
- 4.7 Merging Rows and Columns of Tables.

Practicals:

Practical 1: Introduction to LaTeX (Unit-1; 1.1, 1.2)

Practical 2: Syntax and Keyboard Characters in LaTeX (Unit-1; 1.3, 1.4)

Practical 3: Fonts in LaTeX (Unit -2; 2.1, 2.2)

Practical 4: Sections, Labelling and Text Alignment in LaTeX (Unit-2; 2.3, 2.4, 2.5)

Practical 5: New Lines, Paragraphs, Blank Space and Dashes in LaTeX (Unit-2; 2.6-2.8)

Practical 6: Listing Texts -I (Unit-3; 3.1[Chapter 6, 6.1.1, 6.1.2])

Practical 7: Listing Texts -II (Unit-3; 3.1[Chapter 6, 6.1.3, 6.1.4, 6.1.5])

Practical 8: Tabbing Texts (Unit-3; 3.2)

Practical 9: Table Through the tabular Environment (Unit-4; 4.1)

Practical 10: Table Through the tabularx Environment (Unit-4; 4.2)

Practical 11: Positioning and Texts in Tables (Unit-4; 4.3, 4.4)

Practical 12: Customizing Tables in LaTeX (Unit-4; 4.5, 4.6, 4.7)

Text Book:

1. **LaTeX in 24 Hours, A Practical Guide for Scientific Writing, Dilip Datta, Springer International Publishing AG, 2017.**

Unit 1: Chapter 1; 1.1 to 1.6, Unit 2: Chapter 2; 2.1 to 2.4, Chapter 3; 3.1 to 3.7

Unit 3: Chapter 6; 6.1, 6.2, Unit 4: Chapter 7; 7.1 to 7.7

Reference Books:

1. LaTeX, A Document Preparation System, User's Guide and Reference Manual, Leslie Lamport, Addison-Wesley Publishing Company, Inc., 1994.
2. LaTeX Beginner's Guide, Stefan Kottwitz, Packt Publishing Ltd, 2011.

3. LaTeX and Friends, M.R.C. van Dongen, Springer-Verlag Berlin Heidelberg ,2012.

Semester-VI

DSE-4A: MT - 361: Complex Analysis (2 Credits)

Course Objectives: This course aims to introduce the basic ideas of analysis for complex functions in complex variables with visualization through relevant Practicals. Particular emphasis has been laid on Cauchy's theorems, series expansions and calculation of residues.

Course Learning Outcomes: The completion of the course will enable the students to:

- i) Understand the significance of differentiability of complex functions leading to the understanding of Cauchy-Riemann equations.
- ii) Evaluate the contour integrals and understand the role of Cauchy-Goursat theorem and the Cauchy integral formula.
- iii) Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.
- iv) Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.

Course Contents:

Unit 1: Analytic functions **[09 Lectures]**

- 1.1 Functions of a Complex Variables
- 1.2 Limits, Theorems on limits (Without Proof), Limits involving the point at infinity, Continuity, Derivatives, Differentiation formulas (Without Proof)
- 1.3 Cauchy- Riemann Equations, Sufficient Conditions for differentiability (Only Statement and Examples)
- 1.4 Polar coordinates, Analytic functions, Harmonic functions.

Unit 2: Elementary Functions **[07 Lectures]**

- 2.1 The Exponential functions
- 2.2 The Logarithmic function, Branches and derivatives of logarithms, Some identities involving logarithms
- 2.3 Complex exponents, Trigonometric functions.

Unit 3. Integrals **[11 Lectures]**

- 3.1 Derivatives of functions, Definite integrals of functions
- 3.2 Contours, Contour integral, Examples
- 3.3 Upper bounds for Moduli of contour integrals, Anti-derivatives (Only Examples)
- 3.4 Cauchy-Goursat Theorem (without proof), Simply and multiply Connected domains. Cauchy integral formula, Derivatives of analytic functions. Liouville's Theorem and Fundamental Theorem of Algebra (Without Proof).

Unit 4. Series **[04 Lectures]**

- 4.1 Convergence of sequences and series (Theorems without proof)
- 4.2 Taylor's series (without proof), Laurent series (without proof), examples only.

Unit 5. Residues and Poles **[05 Lectures]**

- 5.1 Isolated singular points, Residues
- 5.2 Cauchy residue theorem (Without Proof), residue at infinity, types of isolated singular points, residues at poles
- 5.3 Zeros of analytic functions, zeros and poles.

Text Book:

1. **J.W. Brown and R.V. Churchill, Complex Variables and Applications, International Student Edition, 2009. (Eighth Edition).**

Unit -1: Chapter 1: Sec.11, 12, 15 to 26. Unit-2: Chapter 3: Sec.29 to 34.

Unit -3: Chapter 4: Sec. 37 to 44, 46 and 48 to 53.

Unit -4: Chapter 5: Sec. 55 to 60 and 62. Unit – 5: Chapter 6: Sec.68 to 76.

Reference Books:

1. S. Ponnusamy, Complex Analysis, Second Edition (Narosa).
2. S. Lang, Complex Analysis, (Springer Verlag).
3. A.R. Shastri, An Introduction to Complex Analysis, (MacMillan).
4. L.V.Ahlfors, Complex Analysis, 3rd edition, McGraw Hill, 2000.
5. H.A.Priestley, Introduction to Complex Analysis, 2nd edition (Indian), Oxford, 2006.

DSE-4B: MT: 362 Real Analysis-II(2 Credits)

Course Objectives: To comprehend bounded function integration on a closed and bounded interval, as well as its extension to situations where either the integration interval is infinite or the integrand has infinite limits at a finite number of points on the integration interval. The sequence and series of real-valued functions.

Course Learning Outcomes: The course will enable the students to learn about:

- i) some of the families and properties of Riemann integrable functions, and the applications of the fundamental theorems of integration.
- ii) beta and gamma functions and their properties.
- iii) recognize the difference between pointwise and uniform convergence of a sequence of functions.
- iv) illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability.

Course Contents:**Unit 1: Riemann Integration** [12 Lectures]

- 1.1 Sets of Measure zero
- 1.2 Definition of the Riemann Integral
- 1.3 Existence of the Riemann Integral
- 1.4 Properties of the Riemann Integral
- 1.5 Fundamental Theorems of Calculus

Unit 2: Improper Integrals [10 Lectures]

- 2.1 Improper Integrals on Closed and Bounded Intervals
- 2.2 Tests for Convergence of Positive Integrands
- 2.3 Improper Integrals on Unbounded Intervals and Tests for their Convergence
- 2.4 Tests for Convergence of the Integral of Product

Unit 3: Sequences of Functions [07 Lectures]

- 3.1 Pointwise convergence of sequences of functions
- 3.2 Uniform convergence of sequences of functions
- 3.3 Consequences of uniform convergence

Unit 4: Series of Functions [07 Lectures]

- 4.1 Convergence and uniform convergence of series of functions
- 4.2 Integration and differentiation of series of functions

Text Books:

1. **Methods of Real Analysis, Second Edition, Richard R. Goldberg, John Wiley and Sons, Inc.**
Unit -1:Sec.: 7.1,7.2,7.3,7.4,7.8, Unit -3: Sec.: 9.1, 9.2, 9.3, Unit-4: Sec.9.4, 9.5
2. **Introduction to Real Analysis, Eighth Edition, S.K. Mapa, Sarat Book House**
Unit-2: Sections: 12.1, 12.2, 12.3, 12.4,12.5, 12.6, 12.7, 12.8, 12.9, 12.10

Reference Books:

1. Real Analysis, N.L. Carothers, Cambridge University Press
2. Introduction to Real Analysis, Third edition, Robert, G. Bartle, Donald Sherbert, John Wiley and Sons.
3. A Basic Course in Real Analysis, Ajit Kumar and S.Kumaresan,CRC Press, Second Indian, CRC Press (Chapman and Hall)
4. A course of Mathematical Analysis, Revised edition, Shanti Narayan and Mittal - S.Chand and Co.(2002).
5. Mathematical Analysis, third Editions'. Malik and Savita Arora - New Age International Publications

DSE-5A: MT: 363 Ring Theory (2 Credits)

Course Objectives: The objective of this course is to introduce the fundamental theory of rings and their corresponding homomorphisms. The basic concepts of ring of polynomials and irreducibility tests for polynomials over ring of integers.

Course Learning Outcomes: The course will enable the students to learn about:

- i) The fundamental concept of Rings, Fields, subrings, integral domains and the corresponding morphisms.
- ii) Learn in detail about polynomial rings, fundamental properties of finite field extensions, and classification of finite fields.
- iii) Appreciate the significance of unique factorization in rings and integral domains.

Course Contents:**Unit 1: Rings and Fields** **[08 lectures]**

- 1.1 Ring, Subring, Fields.
- 1.2 Divisors of zero, Integral Domain, The Characteristics of a Ring.
- 1.3 The Field of Quotients of an Integral Domain.

Unit 2: Rings of Polynomials & Factorization **[08 lectures]**

- 2.1 Polynomials in an indeterminate,
- 2.2 The Evaluation Homomorphism Zeros.
- 2.3 Factorization of a Polynomial over a Field: The Division Algorithm in $F[x]$
- 2.4 Irreducible Polynomials, Uniqueness of Factorization in $F[x]$.

Unit 3: Ideals and Factor Rings **[08 lectures]**

- 3.1 Homomorphism, Properties of Homomorphism
- 3.2 Ideals, Factor Ring, Fundamental Homomorphism Theorem.
- 3.3 Maximal Ideal, Prime Ideal, Ideal Structure in $F[x]$.

Unit 4: Factorization **[12 Lectures]**

- 4.1 Unique Factorization Domain, Principal Ideal Domain, Gauss Lemma, $D[x]$ is a UFD.
- 4.2 Euclidean Norm, Euclidean Domain, Euclidean Algorithm (Without Proof).
- 4.3 Gaussian Integers, Multiplicative Norm.

Text Book:**1. John B. Fraleigh, A First Course In Abstract Algebra, 7th Edition, Pearson.**

Unit 1: Section 18, 19, 21. Unit 2: Section 22 and 23.

Unit 3: Section 26 and 27. Unit 4: Section 45, 46 and 47 (except theorem 47.10).

Reference Books:

1. Josheph A. Gallian, Contemporary Abstract Algebra, 7th Edition, Narosa Publishing House.
2. David S. Dummit and Richard M. Foote, Abstract Algebra, 3rd Edition, Jonh Wiley and Sons, Inc.
3. I.N. Herstein, Abstract Algebra, 3rd Edition, Prentice Hall of India.
4. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra, 2nd Edition, Cambridge University Press.

DSE-5B: MT 364: Partial Differential Equations (2 credits)

Course Objectives: The main goals of this course are to teach students how to form, solve, and apply partial differential equations to solve physical problems. Also, to introduce first and second order partial differential equations and their classifications and methods of finding solutions of these partial differential equations.

Course Learning Outcomes: The course will enable the students to:

- i) formulate, classify and transform partial differential equations into canonical form.
- ii) solve linear partial differential equations using various methods and apply these methods in solving some physical problems.
- iii) solve Laplace equations using various analytical methods demonstrate uniqueness of solutions of certain kinds of these equations.

Course Contents:**Unit 1: Introduction to Ordinary and Partial Differential Equations [10 Lectures]**

- 1.1 Surfaces and Curves in Three Dimensions
- 1.2 Simultaneous Differential Equations of the First Order and the First Degree in Three Variables.
- 1.3 Methods of solution of $dx/P = dy/Q = dz/R$
- 1.4 Pfaffian Differential Forms and Equations.
- 1.5 Solution of Pfaffian Differential Equations in Three Variables

Unit 2: Partial Differential Equations [08 Lectures]

- 2.1 Introduction to Partial Differential Equations
- 2.2 Origin of first order Partial Differential Equations
- 2.3 Linear Equations of First order equations
- 2.4 Integral surfaces passing through given curve

Unit 3: Second Order Partial Differential Equations [10 lectures]

- 3.1 The Origin of Second Order Partial Differential Equations.
- 3.2 Linear Partial Differential Equations with constant coefficients.
- 3.3 Methods of solving Linear Partial Differential Equations
 - 3.3.1. Solution of reducible equations
 - 3.3.2. Solution of irreducible equations with constant coefficients

3.3.3. Rules of finding complementary functions

3.3.4. Rule of finding particular integrals

Unit 4 :Classification of Partial Differential Equations [08 lectures]

4.1 Classification of second order partial differential equations, canonical forms

4.2 Solution of Laplace equations by separation variables methods

4.3 Solution of periodic differential equations by separation variables method

4.4 Solution of wave equation by separation variables method.

Text Books:

1. **Ian Sneddon, Element of Partial Differential Equations, McGraw-Hill Book Company, McGraw-Hill Book Company.**

Unit-1: Chapter-1 : 1,2,3,5 , Unit-2: Chapter-2 :1,2,4,5, Unit-3:Chapter-3: 1,4,5

2. **J.N. Sharma, Kehar Singh, Partial Differential equations for Engineers and Scientists, second Edition, Narasa Publications.**

Unit-4: Chapter No.3: 3.3, Chapter No.4: 4.3 ,Chapter No.5: 5.5

Reference Books:

1. T. Amaranath, An Elementary Course in Partial Differential Equations, Narosa Publishing, House 2nd Edition, 2003 (Reprint, 2006).
2. K. Sankara Rao, Introduction to Partial Differential Equations, Third Edition, PHI.

DSE-6A: MT365 (A): Optimization Techniques(2 Credits)

Course Objectives: This course enables the students to get an idea about the

- i) Network and basic components, Determination of critical path: Critical Path Method (CPM),Project Evaluation and Review Techniques(PERT).Time-cost optimization Algorithm.
- ii) Problem of Sequencing, Processing n Jobs through Two Machines, Processing n Jobs through 3 Machines and Processing n Jobs through k Machines.

Course Learning Outcomes: The course will enable the students to:

- i) understand fundamentals of Network Analysis using CPM and PERT.
- ii) solve a sequencing Problem for various jobs and machines.

Course Contents:

Unit 1: Network Models [10 Lectures]

1.1 CPM and PERT, Network representation, Critical Path Computations

1.2 Construction of the time schedule, PERT networks.

Unit 2: Game Theory [08 Lectures]

2.1 Game theory, Some basic terminologies

2.2 Optimal solution of two person zero sum game

2.3 Solution of mixed strategy games (Graphical solution of gamesonly).

Unit 3: Replacement and Maintenance Models [08 Lectures]

3.1 Introduction, Types of failure

3.2 Replacement of items whose efficiencydeteriorates with time.

Unit 4: Sequencing Problems [05 Lectures]

4.1 Introduction, Notation, terminology and assumptions

4.2 processing n jobs throughtwo machines, processing n jobs through three machines.

Unit 5: Classical Optimization Theory**[05 Lectures]**

- 5.1 Unconstrained problems, Necessary and sufficient conditions
- 5.2 Newton Raphson method, Constrained problems, Equality constraints (Lagrangian Method Only).

Text Books:

1. **Hamdy A. Taha, Operation Research (Eighth Edition, 2009), PrenticeHall of India Pvt. Ltd, New Delhi.**
Unit-11: Ch.6: 6.5 (6.5.1 to 6.5.3 & 6.5.5), Unit-2: Ch.13: 13.4(13.4.1,13.4.2,13.4.3), Unit-4:Ch.18: 18.1(18.1.1, 18.1.2), 18.2 (18.2.1).
2. **J K Sharma, Operations Research (Theory and Applications, second edition, 2006), Macmilan India Ltd.**
Unit-5: Ch.17: 17.1,17.2, 17.3, Ch.20: 20.1, 20.2, 20.3, 20.4.

Reference Books:

1. Frederick S. Hillier, Gerald J. Lieberman, Introduction to Operation Research (Eighth Edition) Tata McGraw Hill.
2. Hira and Gupta, Operation Research

DSE-6A: MT 365(B): Calculus of Variation and Classical Mechanics (2 credits)

Course Objectives: Using mathematical methods, the course seeks to comprehend various definitions of physical quantities and their effects on various bodies. It stresses the acquisition of knowledge in order to apply mathematics to the real world.

Course Learning Outcomes: The course will enable the students to:

- i) understand problems, methods and techniques of calculus of variations.
- ii) understand necessary conditions for the equilibrium of particles acted upon by various forces and learn the principle of virtual work for a system of coplanar forces acting on a rigid body.
- iii) deal with the kinematics and kinetics of the rectilinear and planar motions of a particle including the constrained oscillatory motions of particles.
- iv) determine the center of gravity of some materialistic systems and discuss the equilibrium of a uniform cable hanging freely under its own weight.

Course Contents:**Unit 1: Variational Problems with Fixed Boundaries****[06 Lectures]**

- 1.1 Necessary condition of extremum of functionals
- 1.2 Euler equation
- 1.3 Euler-Poisson equation
- 1.4 Euler-ostrogradsky equation
- 1.5 Euler equation in parametric form
- 1.6 Isoperimetric problems
- 1.7 Principle of reciprocity

Unit 2: Variational Problems with Moving Boundaries**[06 Lectures]**

- 2.1 Moving boundaries in explicit form
- 2.2 Moving boundaries in implicit form
- 2.3 One sided variation
- 2.4 Functional in parametric form

Unit 3: Sufficient Conditions of Extremum**[03 Lectures]**

- 3.1 Higher order variations
- 3.2 Sufficient condition for extremum
- 3.3 Jacobi equation and Jacobi equation

Unit 4: Mechanics of a Particle and System of Particles**[06 Lectures]**

- 4.1 Conservation principles (laws)
- 4.2 Conservation of linear momentum
- 4.3 Conservation of angular momentum
- 4.4 Conservation of energy, Constrained motion, constraints, degrees of freedom
- 4.5 Generalized co-ordinates
- 4.6 Limitations of Newton's laws

Unit 5: Variational Principle and Lagrangian Formulation**[15 Lectures]**

- 5.1 Hamilton's variational principle
- 5.2 Deduction of Lagrange's equations of motion from Hamilton's principle
- 5.3 Deduction of Lagrange's equations by D'Alembert's Principle
- 5.4 Lagrangian for charged particle in an electromagnetic field, gyroscopic forces, nonconservative forces.
- 5.5 Deduction of Hamilton's principle from D'Alembert's Principle
- 5.6 Deduction of Newton's second law of motion from Hamilton's principle
- 5.7 Deduction of Lagrange's equations of motion using variational principle for non-conservative systems
- 5.8 Applications of Lagrange's equations of motion
- 5.9 Non-holonomic systems
- 5.10 Conservation theorems
- 5.11 Worked Examples

Text Books:

1. Classical Mechanics by SL Gupta, V. Kumar and H.V. Sharma PragatiPrakashan.
Unit-4: Chapter 1: 1.1 to 1.6, Unit-5: Chapter-2: 2.1 to 2.12
2. An elementary course on variational problems in Calculus, Naveen Kumar Narosa Publishing House.
Unit-1: Chapter 1: 1.1 to 1.9, Unit-2: Chapter-2: 2.1 to 2.4, Unit-3: Chapter-3: 3.1 to 3.3.

Reference Books:

1. Classical Mechanics by Herbert Goldstein, Pearson Publication.
2. Introduction to classical Mechanics: with problems and solutions by David J. Morrin Cambridge University Press.
3. Mathematical Methods of Classical Mechanics by V.I. Arnold. Springer Publication.

DSE-6A: MT 365 (C): Financial Mathematics (2 credits)**Course Objectives:**

This course enables the students to understand the basic securities, organization of financial markets, the concept of interest rates, present and future value of cash flow.

Course Learning Outcomes: The course will enable the students to:

- i) describe and explain the fundamental features of a financial instruments.
- ii) demonstrate a clear understanding of financial research planning, methodology and implementation.
- iii) demonstrate understanding of basic concepts in linear algebra, relating to linear equations, matrices, and optimization.
- iv) demonstrate understanding of concepts relating to functions and annuities.

Course Contents:

Unit 1: Mathematical models in economics, recurrences, and the elements of finance

[08 Lectures]

- 1.1 Introduction, a model of the market, market equilibrium and excise tax.
- 1.2 The first-order recurrence, limits, special cases, continuous compounding of interest.
- 1.3 Interest and capital growth, income generation, the interval of compounding.

Unit 2: The Cobweb model, and Introduction to optimization

[10 Lectures]

- 2.1 Stability of market equilibrium, the general linear case and economic interpretation.
- 2.2 Marginal cost as a derivative, Profit maximization, critical points, optimization in an interval and infinite intervals.

Unit 3: The derivative in economics

[08 Lectures]

- 3.1 Elasticity of demand, profit maximization again.
- 3.2 Competition versus monopoly, the efficient small firm, startup and break-even points.

Unit 4: Linear equations and the input-output model

[10 Lectures]

- 4.1 Making money with matrices, a two-industry 'economy', arbitrage portfolios and state prices and IS-LM analysis.
- 4.2 An economy with many industries and the technology matrix.

Text Book:

1. **Martin Anthony and Norman Biggs, Mathematics for Economics and Finance Methods and Modeling, Cambridge University Press, Reprint 2012.**

Unit-1: Chapters-3: 3.2, 3.3, 3.4 and Chapter-4,

Unit-2: Chapter-5, Chapter-6: 6.3, Chapter-8

Unit-3: Chapter-9, Chapter-10,

Unit-4: Chapter-15:15.3, Chapter-16:16.1, Chapter-17:17.4, Chapter-18:18.5,

Chapter- 19.

Reference Books:

1. Edward T. Dowling, Mathematical Economics, Second Edition, Schaum's Outline Series, McGraw Hill International Edition.
2. AswathDamodaran, Corporate Finance- Theory and Practice, John Wiley and Sons, Inc.
3. Sheldon M. Ross, An Introduction to Mathematical Finance, Cambridge University Press.

DSE-6B: MT-366(A): Machine Learning-II (2 Credits)

Course Objectives:

The main goal of this course is to help students learn, understand, and practice machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications.

Course Learning Outcomes:

The students learning outcomes are designed to specify what the students will be able to perform after completion of the course: Ability to select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.

Course Contents:

Unit 1: Classification of MNIST dataset

[10 Lectures]

1.1 MNIST

1.2 Training a Binary Classifier

1.3 Performance Measures - Measuring accuracy using Cross Validation, Confusion Matrix, Precision and Recall

1.4 Multiclass Classification

1.5 Multilabel Classification

Unit 2: Linear Regression

[10 Lectures]

2.1 Linear Regression

1. The Normal Equation

2.2 Gradient Descent

1. Batch Gradient Descent

2. Stochastic Gradient Descent

3. Mini-batch Gradient Descent

2.3 Polynomial Regression

Unit 3: Logistic Regression

[06 Lectures]

3.1 Estimating Probabilities

3.2 Training and Cost Function

3.3 Decision Boundary

3.4 Softmax Regression

Unit 4: Other Supervised Algorithms

[10 Lectures]

4.1 K Nearest Neighbors

4.2 Decision Trees

4.3 Ensembles of Decision Trees - Random Forest

4.4 Support Vector Machines

Text Books:-

1. **Hands-on Machine Learning with Scikit-Learn, Keras and Tensorflow – Aurelien Geron. Chapter-3:** Sections: 3.1, 3.2, 3.3, 3.4, 3.6, Chapter-4: 4.1, 4.2, 4.3, 4.6
2. **Introduction to Machine Learning With Python - Andreas C. Muller & Sarah Guido,** Chapter-2: Sections: 2.2.2, 2.2.5, 2.2.6, 2.2.7

Reference Book:-

1. Introduction to Machine Learning With Python - Andreas C. Muller & Sarah Guide.
2. Head first Python by Paul Barry (O Reilly publication).
3. Jason Brownlee - Basics of Linear Algebra for Machine Learning, 2018.
4. M. P. Deisenroth, A. A. Faisal, C. S. Ong - Mathematics for Machine Learning, Cambridge University Press, 2019.

5. DipanjanSarkar, Raghav Bali, Tushar Sharma - Practical Machine Learning with Python, 2018.
6. Andrew Ng Playlist - https://www.youtube.com/playlist?list=PLLsT5z_DsK-h9vYZkQkYNWcIqHJRJLN (First 4 Lectures (till 4.6))
<https://towardsdatascience.com/search?q=machine%20learningwww.kaggle.com>
[geeksforgeeks.org/machine-learning](https://www.geeksforgeeks.org/machine-learning)

DSE-6B: MT- 366(B): Computational Geometry(2 credits)

Course Objectives: This course enables the students to gain detailed knowledge of the fundamental problems within computation geometry and general techniques for solving problems within computational geometry and practical experience with implementation issues involved in converting computation geometry algorithms into running programs.

Course Learning Outcomes: The course will enable the students to:

- v) construct algorithms for simple geometrical problems.
- vi) characterize invariance properties of Euclidean geometry by groups of transformations.
- vii) describe and construct basic geometric shapes and concepts by computational means.

Course Contents:

Unit 1: Two Dimensional Transformations

[12 Lectures]

- 1.1 Introduction.
- 1.2 Representation of points.
- 1.3 Transformations and matrices.
- 1.4 Transformation of – points, straight lines.
- 1.5 Midpoint Transformation.
- 1.6 Transformation of – parallel lines, intersecting lines.
- 1.7 Transformation: rotations, reflections, scaling.
- 1.8 Combined transformations.
- 1.9 Transformation of a unit square.
- 1.10 Solid body transformations.
- 1.11 Translations and homogeneous coordinates.
- 1.12 Rotation about an arbitrary point.
- 1.13 Reflection through an arbitrary line.
- 1.14 Projection – A Geometric Interpretation of Homogeneous Coordinates.
- 1.15 Overall Scaling.
- 1.16 Points at Infinity.

Unit 2: Three Dimensional Transformations

[08 Lectures]

- 2.1 Introduction.
- 2.2 Three dimensional – Scaling, shearing, rotation, reflection, translation.
- 2.3 Multiple transformations.
- 2.4 Rotation about – an axis parallel to coordinate axes, an arbitrary axis in space.
- 2.5 Reflection through an arbitrary plane.

Unit 3: Projection

[08 Lectures]

- 3.1 Orthographic projections.
- 3.2 Axonometric projections.

- 3.3 Oblique projections.
- 3.4 Perspective Transformations.

Unit 4: Plane and Space Curves **[08 Lectures]**

- 4.1 Introduction.
- 4.2 Curve representation.
- 4.3 Parametric curves.
- 4.4 Parametric representation of a circle.
- 4.5 Bezier Curves – Introduction, definition, properties (without proof), Curve fitting (up to $n = 3$), equation of the curve in matrix form (up to $n = 3$).

Text Book:

1. **D. F. Rogers, J. A. Adams, Mathematical Elements for Computer Graphics, Tata McGraw Hill, Second Edition.**

Unit 1: Chapter 2: Sec. 2.1 to 2.20, Unit 2: Chapter 3: Sec. 3.1 to 3.10.

Unit 3: Chapter 3: Sec. 3.12 to 3.15, Unit 4: Chapter 4: Sec. 4.1, 4.2, 4.4, 4.5,

Chapter 5: Sec. 5.1, 5.8.

Reference Books:

1. Computer Graphics with OpenGL, Donald Hearn, M. Pauline Baker, Warren Carithers, Pearson (4th Edition).
2. Schaum Series, Computer Graphics by Zhigang Xiang and Roy A. Plastock.

DSE-6B: MT-366(C): Lebesgue Integration (2 Credits)

Course Objectives: To develop skills and to acquire knowledge on basic concepts of Lebesgue Measure, The Lebesgue Integral, Measurable Functions, Convergence and completeness.

Course Learning Outcomes: The course will enable the students:

- i) To understand the concept of measure and properties of Lebesgue measure.
- ii) To study the properties of Lebesgue integral and compare it with Riemann integral.

Course Contents:

Unit 1. Measurable Sets: **[08 Lectures]**

- 1.4 Length of open sets and closed sets
- 1.5 Inner and outer measure
- 1.6 Measurable sets
- 1.7 Properties of measurable sets.

Unit 2. Measurable Functions: **[08 Lectures]**

- 1.4 Definition of measurable functions and other criteria for measurability equivalent
- 1.5 Sums, Products, and limits of a measurable functions
- 1.6 Sequences of a measurable function

Unit 3. The Lebesgue integral for bounded function **[10 Lectures]**

- 3.1 Measurable partition, lower sum, upper sum,
- 3.2 Lebesgue integral for bounded measurable function
- 3.3 Properties of Lebesgue integrals for bounded measurable functions

Unit 4. The Lebesgue integral for unbounded function **[10 lectures]**

- 4.1 The Lebesgue integral for non-negative valued function
- 4.2 The Lebesgue integral for real valued function
- 4.3 Properties of Lebesgue integrals for unbounded functions
- 4.4 Some fundamental theorems

Text-Book:

1. **Richard R. Goldberg, Methods of Real Analysis, Oxford and IBH Publishing Co. Pvt. Ltd. (1970).**

Unit 1: Chapter 11: Sec 11.1 to 11.3. (Theorem No. 11.1B and 11.1C Statements only).

Unit 2: Chapter 11: Sec 11.4. Unit 3: Chapter 11: Sec 11.5 to 11.4.

Unit 4: Chapter 11: Sec. 11.5 to 11.8 (Theorem 11.8 D statement only)

Reference Books:

1. Tom M. Apostol, Mathematical Analysis, Second Edition, Narosa Publishing House.
2. D. Somasundaram and B. Choudhari, A first course in Mathematical Analysis, Narosa Publishing House.
3. R.G. Bartle and D.R. Scherbert, Introduction to real analysis Fourth Edition, Wiley India Edition.
4. Inder K. Rana, An Introduction to Measure and Integration Second Edition, Narosa Publishing House.
5. G. de Barra, Measure Theory and Integration, New Age International (P) Limited, Publishers.

MT 367: Practical Course Lab-I (Complex Analysis and Real Analysis-II) (2 Credits)**Section-I: Complex Analysis Practical**

Practical No. 1: Analytic Functions (Unit 1)

Practical No. 2: Elementary Functions (Unit 2)

Practical No. 3: Integrals - I (Unit 3 upto and including Anti-derivatives)

Practical No. 4: Integrals – II (Unit 3 from Cauchy-Goursat's Theorem onwards)

Practical No. 5: Series (Unit 4)

Practical No. 6: Residues and Poles (Unit 5)

Section-II: Real Analysis-II Practical

Practical 1: Definition and Existence of Riemann Integral (Unit 1)

Practical 2: Properties of Riemann Integrals and Applications (Unit 1)

Practical 3: Improper Integrals (Unit 2)

Practical 4: Pointwise Convergence of Sequences of Functions (Unit 3)

Practical 5: Uniform Convergence of Sequences of Functions (Unit 3)

Practical 6: Series of Functions: Convergence and Divergence (Unit 4)

MT 368: Practical Course Lab-II (Ring Theory and Partial Differential equations) (2 credits)

Section-I: Ring Theory Practical

Practical 1: Rings and Fields (Unit 1)

Practical 2: Rings of Polynomials (Unit 2)

Practical 3: Homomorphism and Factor Ring (Unit 3: 3.1)

Practical 4: Ideals in a Ring (Unit 3: 3.2)

Practical 5: Unique Factorization Domain (Unit 4: 4.1)

Practical 6: Euclidean Domain and Gaussian Integers (Unit 4: 4.2, 4.3)

Section-II: Partial Differential Equations Practical

Practical 1: Simultaneous Differential Equations of the First Order and the First Degree in Three Variables (Unit 1: 1.1, 1.2, 1.3)

Practical 2: Pfaffian Differential Equations and their Solution (Unit 1: 1.4, 1.5)

Practical 3: Solution of First order Partial Differential Equations (Unit 2: 2.1, 2.2, 2.3)

Practical 4: Linear Equations of First order equations and Integral surfaces passing through given curve (Unit 2: 2.3, 2.4)

Practical 5: Solution of Second order Partial Differential Equations (Unit 3)

Practical 6: Canonical Forms and Solution of Second order Partial Differential Equations by Separation Variables Method (Unit 4)

MT 369: Practical Course Lab-III (Based on DSE-6A and DSE-6B) (2 credits)

Section-I: Optimization Techniques/Calculus of Variation and Classical Mechanics/Financial Mathematics

Section-I(A): Optimization Techniques Practical

Practical 1: Network Models (Unit 1)

Practical 2: Game Theory (Unit 2)

Practical 3: Network Models and Game Theory (Unit 1, Unit 2)

Practical 4: Replacement Theory (Unit 3)

Practical 5: Sequencing (Unit 4)

Practical 6: Classical Optimization Theory (Unit 5)

OR

Section-I(B): Calculus of variation and classical Mechanics Practical

Practical 1: Applications of Euler -Lagrange's equation (Unit 1)

Practical 2: Isoperimetric Problems and Variational Problems with Moving Boundaries (Unit 1 and Unit 2)

Practical 3: Degrees of freedom and Generalized coordinates (Unit 3)

Practical 4: Problems on Conservation laws (Unit 4)

Practical 5: Lagrangian Formulation and worked examples-I (Unit 5)

Practical 6: Lagrangian Formulation and worked examples-II (Unit 5)

OR

Section-I (C): Financial Mathematics Practical

Practical 1: Mathematical Models in Economics (Unit 1)

Practical 2: Recurrences and the elements of finances (Unit 1)

Practical 3: The Cobweb model (Unit 2)

Practical 4: Introduction to Optimization (Unit 2)

Practical 5: The derivative in Economics (Unit 3)

Practical 6: Linear Equations and the Input Output Model (Unit 4)

Section-II(A): Machine Learning-II Practical

Practical 1: Revision of python and scikit learn (Unit 1)

Practical 2: MNIST classification with python - 1 (Unit 1)

Practical 3: MNIST classification with python - 1 (Unit 1)

Practical 4: Linear Regression Implementation - 1 (Unit 2)

Practical 5: Linear Regression Implementation - 2 (Unit 2)

Practical 6: LogisticRegressionImplementation 1 (Unit 3)

Practical 7: LogisticRegressionImplementation 2 (Unit 3)

Practical 8: Dealingwith Data (Unit 4)

Practical 9: KNN Implementation (Unit 4)

Practical 10: Decision Tree Implementation 4 (Unit 4)

Practical 11: Random Forest Implementation 4 (Unit 4)

Practical 12: Support Vector Machine Implementation 4 (Unit 4)

OR

Section-II (B): Computational Geometry Practical

Practical 1: Two Dimensional Transformation-I (Unit 1)

Practical 2: Two Dimensional Transformation-II (Unit 1)

Practical 3: Two and three Dimensional Transformation-I (Unit 1, Unit 2)

Practical 4: Three Dimensional Transformation-II (Unit 2)

Practical 5: Projection (Unit 3)

Practical 6: Plane and Space Curve (Unit 4)

OR

Section-II(C): Lebesgue Integration Practical

Practical 1: Length of Open and closed sets (Unit 1:1.1, 1.2)

Practical 2: Measurable Sets (Unit 1: 1.2, 1.3)

Practical 3: Measurable functions (Unit 2)

Practical 4: Lebesgue Integral - I (Unit 3: 3.1, 3.2, 3.3)

Practical 5: Lebesgue Integral - II (Unit 3: 3.3, 3.4)

Practical 6: Fourier Series (Unit 4: 4.1, 4.2)

SEC-III: MT-3610: Programming in Python –II(2 Credits)

Course Objectives:

1. To acquire Object Oriented Skills in Python.
2. To develop the skill of designing Graphical user Interfaces in Python.
3. To learn and understand Python programming basics and paradigm.
4. To learn the concepts of visualization of data and database connectivity.
5. To develop the ability to write database applications in Python.

Course Learning Outcomes:

Upon successful completion of this course the student will be able to:

1. Demonstrate the use of Python in Mathematics such as operations research and computational Geometry etc.
2. Study graphics and design and implement a program to solve a real world problem.
3. The students will implement the concepts of data with python and database connectivity.

Course Contents:

Unit 1: Graphics

[06 Lectures]

- 1.1 Turtle Graphics: Overview of Turtle Graphics , Turtle Operations, Object Instantiation and the turtle graphics Module.
- 1.2 Drawing Two-Dimensional Shapes
- 1.3 Taking a Random Walk
- 1.4 Colors and the RGB System
- 1.5 Drawing with Random Colors
- 1.6 Using the str Function with Objects.

Unit 2: Data Visualization with Python

[04 Lectures]

- 2.1 Seaborn
- 2.2 Matplotlib
- 2.3 Plotly
- 2.4 MayaVI

Unit 3: Dictionary and Sorting, Minimum and Maximum: [08 Lectures]

- 3.1 Introduction to Dictionary , Avoiding Key Error Exceptions, Iterating Over a Dictionary,
- 3.2 Dictionary with default values, Merging dictionaries, Accessing keys and values, Accessing values of a dictionary, Creating dictionary, Creating an ordered dictionary, Unpacking dictionaries using the ** operator.
- 3.3 Sorting, Minimum and Maximum: Special case: dictionaries, Using the key argument, Default Argument to max, min, Getting a sorted sequence, Extracting N largest or N smallest items from an iterable, Getting the minimum or maximum of several values, Minimum and Maximum of a sequence.

Unit 4: Computational Geometry [10 Lectures]

- 4.1 Points: The distance between two points, Lists of Points - the PointList class, Integer point lists, Ordered Point sets, Extreme Points of a PointList, Random sets of Points not in general position.
- 4.2 Points: Displaying Points and other geometrical objects, Lines, rays, and line segments, The geometry of line segments, Displaying lines, rays and line segments.
- 4.3 Polygon: Representing polygons in Python, Triangles, Signed area of a triangle, Triangles and the relationships of points to lines, is Collinear, is Left, is Left On, is Right, is Right On, Between
- 4.4 Two dimensional rotation and reflection
- 4.5 Three dimensional rotation and reflection
- 4.6 Generation of Bezier curve with given control points

Unit 5: Study of Operational Research in Python [08 Lectures]

- 5.1 Linear Programming in Python
- 5.2 Introduction to Simplex Method in Python

Practicals:

Practical 1: Turtle Graphics (Unit 1)

Practical 2: Data Visualization (Unit 2)

Practical 3: Dictionary and Sorting, Minimum and Maximum (Unit 3)

Practical 4: Application to Computational Geometry-I (Unit 4)

Practical 5: Application to Computational Geometry-II (Unit 4)

Practical 6: Application to Computational Geometry-II (Unit 4)

Practical 7: Study of Graphical aspects of Two dimensional transformation matrix using Matplotlib (Unit 4)

Practical 8: Study of Graphical aspects of Three dimensional transformation matrix using Matplotlib (Unit 4)

Practical 9: Study of Graphical aspects of Three dimensional transformation matrix using Matplotlib and Study of effect of concatenation of Two dimensional and Three dimensional transformations (Unit 4)

Practical 10: Generation of Bezier curve using given control points (Unit 4)

Practical 11: Study of Operational Research in Python (Unit 5-5.1)

Practical 12: Study of Operational Research in Python (Unit 5-5.2)

Text Books:

1. **Kenneth A. Lambert, Fundamentals of Python:From First Programs to DataStructure, Martin Osborne, 2010, Course Technology, Cengage Learning.**
Unit-1: Chapter-7: Sec-7.1.1 to 7.1.8
2. **Python: Notes for Professionals, Goalkicker.com, Free Programming books.**
Unit-2: Chapter-108, Unit-3: Chapter-19 Section:19.1 to 19.10 and Chapter-72:Section:72.1 to 72.8
3. **Jim Arlow, Interactive Computational Geometry in Python.**
Unit-4: Chapter-1: Sec.-1 to 7, Chapter-2: Sec.-1 to 2, Chapter-3: Sec.-1, 3 to 11, Chapter-4: Sec.-1 to 3, :Chapter-5: Sec.-3 to 7.
4. **Operations Research: Unit-5: <https://pypi.org/project/PuLP/>**

Reference Books:

1. Guzdial, M. J., Introduction to Computing and Programming in Python, Pearson India.
2. Perkovic, L., Introduction to Computing Using Python, 2/e, John Wiley, 2015.
3. Zelle, J., Python Programming: An Introduction to Computer Science, Franklin,Beedle and Associates Inc.
4. Jim Arlow, Interactive Computational Geometry in Python.
5. Robert Johansson, Introduction to Scientific Computing in Python.
6. Jason Brownlee, Basics of Linear Algebra for Machine Learning, Discover the Mathematical Language of Data in Python.
7. JaanKiusalaas, Numerical Methods in Engineering with Python, Cambridge University Press, (2005).

SEC-IV: MT-3611: Mathematics into LaTeX(2 Credits)

Course Objectives: The purpose of this course is to acquaint students with typesetting basic Mathematics in LaTeX.

Course Learning Outcomes: After studying this course the student will be able to:

- i) typeset mathematical formulas, use nested list, tabular and array environments.
- ii) import figures and pictures that are stored in external files.

Course Contents:

Unit 1. Figure Insertion

[06 Lectures]

- 1.1 Commands and Environment for Inserting Figures
- 1.2 Inserting a Simple Figure
- 1.3 Side-by-Side Figures
- 1.4 Sub-numbering a Group of Figures
- 1.5 Figures in Tables

Unit 2. Equation Writing -I

[12 Lectures]

- 2.1 Basic Mathematical Notations and Delimiters.
- 2.2 Mathematical Operators
- 2.3 Mathematical Expressions in Text-Mode

- 2.4 Simple Equations
- 2.5 Array of Equations
- 2.6 Left Aligning an Equation
- 2.7 Sub-numbering a Set of Equations

Unit 3. Equation Writing -II

[12 Lectures]

- 3.1 Texts and Blank Space in Math-Mode
- 3.2 Conditional Expression
- 3.3 Evaluation of Functional Values
- 3.4 Splitting an Equation into Multiple Lines
- 3.5 Vector and Matrix
- 3.6 Overlining and Underlining
- 3.7 Stacking Terms
- 3.8 Side-by-Side Equations

Unit 4. User-Defined Macros

[06 Lectures]

- 4.1 Defining New Commands
- 4.2 Defining New Environments

Practicals:

Practical 1: Commands and Environment for Inserting Figures (Unit 1: 1.1, 1.2)

Practical 2: More about Figure Insertion (Unit-1; 1.3, 1.4, 1.5)

Practical 3: Mathematical Notations, Operators and Expression in LaTeX (Unit 2: 2.1- 2.3)

Practical 4: Simple Equations (Unit-2: 2.4)

Practical 5: Array of Equations (Unit-2: 2.5)

Practical 6: Alignment and numbering a Set of Equations (Unit-2: 2.6, 2.7)

Practical 7: Texts, Blank Space and Conditional Expression in Math mode (Unit-3: 3.1, 3.2)

Practical 8: Evaluation of Functional Values and Splitting an Equation (Unit-3: 3.3, 3.4)

Practical 9: Vector and Matrix (Unit-3; 3.5)

Practical 10: More about equation writing in LaTeX (Unit-3: 3.6, 3.7, 3.8)

Practical 11: New Commands in LaTeX (Unit-4: 4.1)

Practical 12: New Environments in LaTeX (Unit-4: 4.2)

Text Book:

1. **LaTeX in 24 Hours, A Practical Guide for Scientific Writing, Dilip Datta, Springer International Publishing AG 2017.**

Unit 1: Chapter 9; 9.1 to 9.4, 9.8, Unit 2: Chapter 11; 11.1 to 11.7

Unit 3: Chapter 12; 12.1 to 12.8 , Unit 4: Chapter 13; 13.1, 13.3 (13.3.1, 13.3.2, 13.3.3)

Reference Books:

1. LaTeX, A Document Preparation System, User's Guide and Reference Manual, Leslie Lamport, Addison-Wesley Publishing Company, Inc., 1994.
2. LaTeX Beginner's Guide, Stefan Kottwitz, Packt Publishing Ltd, 2011.
3. LATEX and Friends, M.R.C. van Dongen, Springer-Verlag Berlin Heidelberg ,2012.
4. Math into LaTeX, George Gratzer, Springer Science Business Media New York, 1996.

Modalities For Conducting The Practical and The Practical Examination:

1. There will be one 4 hours and 20 minutes (260 minutes) practical session for each batch of 15 students per week for each practical course.
2. The College will conduct the Practical Examination at least 15 days before the commencement of the Main Theory Examination. The University practical examination will consist of written examination of 30 marks and oral examination of 05 marks.
3. There will be external examiner; the practical exam will be of the duration of 3hours. The teacher will set a question paper at the time of paper setting meeting conducted by SavitribaiPhule Pune University, Pune based on respective papers I and II given in **Practical Lab-I, Practical Lab-II and Practical Lab-III**,and the pattern is as follows
 - Q1. Any 3 out of 5 each question of 5 marks on paper – I (from Practical Lab-I, Practical Lab-II and Practical Lab-III).
 - Q2. Any 3 out of 5 each question of 5 marks on paper – II(from Practical Lab-I, Practical Lab-II and Practical Lab-III).
4. **SEC:MT -3510, MT -3511, MT -3610, MT -3611 University practical writtenexaminationof 30 marks, oral examination 05 marks and internal examination of 15 marks.**
5. **The courses MT-356(A): Machine Learning-I, MT-366(A): Machine Learning-II, MT -3510: Programming in Python -I, MT -3610: Programming in Python –II, MT-3511: LaTeX for Scientific Writing and MT 3611: Mathematics into LaTeX**will teach in Computer Laboratory with live sessions for better understanding of students.
6. Each student will maintain a journal to be provided by the college.The internal 15 marks will be given on the basis of journal prepared by student and the cumulative performance of student at practical.**Methods of assessment for Internal exams:** Seminars, Viva-voce, Projects, Surveys, Field visits, Tutorials, Assignment, Group Discussion.
7. It is recommended that concept may be illustrated using computer software (Python, Maxima etc.) and graphing calculators wherever possible.
8. Study tours may be arranged at places having important mathematical institutes or historical places.
9. **Special Instruction:**
 - a) There should be well equipped mathematics practical laboratory of size 20x20 sq. fts containing at least 20 computers because there are six papers based on Software's (like **Machine Learning-I & II, Programming in Python –I & II, LaTeX Software for Scientific Writing and Mathematics into LaTeX**).
 - b) Examiners should set separate question papers, solutions and scheme of marking for each batch and claim the remuneration as per University rule.
 - c) Before starting each practical necessary introduction, basic definitions, intuitive inspiring ideas and prerequisites must be discussed.

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Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Physics (Faculty of Science & Technology)

T.Y.B.Sc. (Physics)

Choice Based Credit System

To be implemented from Academic Year 2021-2022

Salient Features of Revised Syllabi in Physics

As far as possible to promote:

1) Physics Education through Master Texts:

It helps in understanding the theoretical and mathematical development of the subject and to create interest in the subject.

2) Physics Education through Experimentation:

It helps in general to improve scientific attitude. So emphasis is given on the development of experimental skills, data analysis, calculations, and also on the limitations of the experimental method and data and, results obtained.

3) Physics Education through Problem Solving: It helps in understanding the concepts of physics. It underline the strength of equations, formulae, graphs, mathematical tools to tackle the problems. So accordingly, we have introduced compulsory problem part in the question paper.

4) Physics Education through History and Philosophy:

It helps in understanding the conceptual development of the subject and thereby increase the interest in the subject. A topic on this is introduced in the Physics Course.

5) Physics Education through Awareness of Misconceptions:

It improves the scientific awareness among the students. A discussion on different subjects are encouraged.

6) Physics Education through Proto-research:

It creates interest in the subject and improves technological aspect. Accordingly, mini projects, hands-on activities, projects, models and demonstrations etc. is included in the syllabi.

7) Physics Education through Qualitative Overview:

It creates interest in the subject to continue to work in the field of science in general and physics in particular. Accordingly future directions and frontiers of the subject are included in the syllabi.

8) Structure of Question paper:

Existing structure shall continue.

9) ATKT Rules:

Existing rules shall apply.

10) Structure of the Course:

Semester	Course Type	Course Code	Course Name	Credit	
V	Discipline Specific Elective Course	PHY-351	Mathematical Methods in Physics-II	2	
		PHY-352	Electrodynamics	2	
		PHY-353	Classical Mechanics	2	
		PHY-354	Atomic and Molecular Physics	2	
		PHY-355	Computational Physics	2	
		PHY-356: Elective-I (Select any One)			2
		PHY-356(A)	Astronomy and Astrophysics-I		
		PHY-356(B)	Elements of Materials Science		
		PHY-356(C)	Biophysics		
		PHY-356(D)	Renewable Energy Sources-I		
		PHY-356(E)	Applied Optics		
		PHY-356(F)	C# programming		
		PHY-356(G)	Acoustics-I		
		PHY-357	Physics Laboratory-3A	2	
	PHY-358	Physics Laboratory-3B	2		
	PHY-359	Project-I	2		
	Skill Enhancement Course	PHY-3510: Skill Enhancement Course-I (Select any One)			2
		PHY-3510(H)	Python Programming		
		PHY-3510(I)	Energy studies		
PHY-3510(J)		Introduction to Arduino			
PHY-3510(K)		Sensors and Transducer			
PHY- 3511: Skill Enhancement Course-II (Select any One)			2		
PHY-3511(L)		Physics Workshop Skill			
PHY-3511(M)		Biomedical Instrumentation			
PHY-3511(N)		Non-destructive Testing Techniques			
PHY- 3511(O)		Acoustics Applications			
VI	Discipline Specific Elective Course	PHY-361	Solid State Physics	2	
		PHY-362	Quantum Mechanics	2	
		PHY-363	Thermodynamics and Statistical Physics	2	
		PHY-364	Nuclear Physics	2	
		PHY-365	(A) Electronics-II OR	2	

		(B) Advanced Electronics		
		PHY-366: Elective-II (Select any One)		
		PHY-366(P) Medical Electronics	2	
		PHY-366(Q) Physics of Nanomaterials		
		PHY-366(R) Microcontrollers		
		PHY-366(S) Lasers		
		PHY-366(T) Astronomy and Astrophysics-II		
		PHY-366(U) Renewable Energy Sources-II		
		PHY-366(V) Acoustics-II		
		PHY-367 Physics Laboratory-4A		2
		PHY-368 Physics Laboratory-4B	2	
		PHY-369 Project-II	2	
	Skill Enhancement Course	PHY-3610: Skill Enhancement Course-III (Select any One)		
		PHY-3610(W) Scientific Data Analysis using Python	2	
		PHY-3610(X) Solar PV System: Installation, Repairing and Maintenance		
		PHY-3610(Y) Applications of Internet of things (IOT)		
		PHY-3610(Z) Calibration Techniques		
			PHY- 3611: Skill Enhancement Course-IV (Select any One)	
		PHY- 3611(AA) Microcontrollers	2	
		PHY- 3611(AB) Instrumentation for Agriculture		
		PHY- 3611(AC) Radiation Physics		
		PHY- 3611(AD) Photography		

Semester-V

T.Y.B.Sc. (Physics) (Sem-V)
PHY-351: Mathematical Methods in Physics-II

Lectures: 36

(Credits-02)

1: Curvilinear Co-ordinates

(10L)

Review of Cartesian, spherical and cylindrical co-ordinate, transformation equation, General Curvilinear co-ordinate system: Co-ordinate surface, co-ordinate lines, length, surfaces and volume elements in curvilinear co-ordinate system.

Orthogonal curvilinear co-ordinate system, expressions for gradient, divergence, Laplacian, and curl, special case for gradient, divergence and curl in Cartesian, spherical polar and cylindrical co-ordinate system, Problems.

2: The Special Theory of Relativity

(10L)

Introduction, Newtonian relativity, Galilean transformation equation, Michelson-Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Kinematic effects of Lorentz transformation, Length contraction, Proper time, Problems.

3: Partial Differential Equations

(8L)

Introduction to Partial differential equations (PDE), General methods for solving second order PDE, Method of separation of variables in Cartesian, Spherical polar and cylindrical co-ordinate system (two dimensional Laplace's equation, one dimensional Wave equation), Singular points ($x = x_0$), Solution of differential equation-Statement of Fuch's theorem, Frobenius method of series solution.

4: Special Functions

(8L)

Introduction, generating function for Legendre Polynomials: $P_n(x)$, Properties of Legendre Polynomials, Generating function for Hermite Polynomials: $H_n(x)$, Properties of Hermite Polynomials, Bessel function of first kind: $J_n(x)$, Properties of Bessel function of first kind, Problems.

Reference books:

1. Mathematical methods for physicists, Arfken and Weber, Academic press Newyork, 7th Edition.
2. Mathematical physics, Rajput, Pragati prakashan-1997.
3. Mathematical methods in the physical sciences – Marry L. Boas, John Willy & Sons publication, 3rd Edition-2005.
4. Introduction to special relativity, Robert Resnick, John Wiley & Sons, Inc.-1968.
5. Mathematical physics, B. D. Gupta, Vikas publishing house Pvt. Ltd., 4th edition-2010.
6. Mathematical physics, H. K. Dass, Dr. Rama Varma, S. Chand & Company Pvt. Ltd., 7th Edition-2014
7. The Special Theory of Relativity: A Mathematical Approach-Farook Rahaman, Springer Publication -2014.

T.Y.B.Sc. (Physics) (Sem-V)
PHY-352: Electrodynamics

Lectures: 36

(Credits-02)

1: Electrostatics

(12 L)

- a. Revision of Coulomb's law, Gauss law, Electric field, Electrostatic Potential.
- b. Potential energy of system of charges.
- c. Statement of Poisson's and Laplace's equation, Boundary Value problems in electrostatics- Solution of Laplace equation in Cartesian system, Boundary conditions.
- d. Polarization **P**, Electric displacement **D**, Electric susceptibility and dielectric constant, bound volume and surface charge densities.
- e. Electric field at an exterior and interior point of dielectric.

2: Magnetostatics

(12 L)

- a. Concepts of magnetic induction, magnetic flux and magnetic field.
- b. Magnetic induction due to straight current carrying conductor, magnetization of matter, relationship between **B**, **H** and **M**.
- c. Boundary conditions at the interface of two magnetic media (Normal and tangential components).
- d. Biot-Savart's law, Ampere's force law, Magnetic force between two current carrying loops, Ampere's circuital law.
- e. Equation of continuity, Magnetic vector potential **A**, Magnetic susceptibility and permeability.

3: Electrodynamics

(12 L)

- a. Concept of electromagnetic induction, Faradays law of induction, Lenz's law, displacement current, generalization of Amperes' law.
- b. Maxwell's equations (Differential and Integral form) and their physical significance.
- c. Polarization, reflection & refraction of electromagnetic waves through media.
- d. Wave equation and plane waves in free space.
- e. Poynting theorem & Poynting vector.

Reference Books:

1. Introduction to Electrodynamics; D. J. Griffith; Cambridge India; Fourth edition (2020)
2. Classical Electrodynamics; J. D. Jackson; Wiley; Third edition (2007)
3. Introduction to Electrodynamics; A. Z. Capri, Panat P. V.; Alpha science international ltd; Illustrated edition(2002)
4. Foundations of electromagnetic theory; Reitz, Milford and Christy; Pearson education India; Fourth edition (2010)
5. Electrodynamics; Gupta, Kumar, Singh; Pragati Prakashan; Ninteenth edition (2011)
6. Electromagnetic field and waves; Paul-Lorrain, D. R. Corson; W.H. Freeman & co. Ltd; Second edition (1970)
7. Electricity and magnetism; Murugesan; S. Chand; (2020)
8. Electromagnetic theory and electrodynamics; Satya Prakash; Kedar Nath Ram Nath; (2020)

T.Y.B.Sc. (Physics) (Sem-V)
PHY-353: Classical Mechanics

Lectures: 36

(Credits-02)

1: Motion of Particles

(8L)

- a. Charged Particles: Motion of a charged particle in constant electric, magnetic and electromagnetic field,
- b. System of particles: Concept of Centre of mass, Conservation of linear momentum, angular momentum, energy of system of particles.(statements only)
- c. Problems

2: Central force Field

(8L)

- a. Central force Field: Definition and Properties of central force field. Reduction of two body problem to an equivalent one body problem
- b. Motion in central force field,
- c. Kepler's laws of planetary motion and their proof
- d. Artificial satellite and its orbit
- e. Problems.

3: Scattering of particles

(10L)

- a. Elastic and inelastic scattering: Definition and properties,
- b. Elastic scattering - Laboratory and center of mass system.
- c. Scattering: Scattering angles in laboratory and center of mass system.
- d. Differential cross-section, impact Parameter, total cross-section in brief.
- e. Problems

4: Langrangian and Hamiltonian formulation

(10L)

- a. Limitations of Newton's Law of Motion,
- b. Constraints and Their Classification, Example of Constrains, degrees of freedom, generalized coordinate, configuration space,
- c. Principle of Virtual work done,
- d. D'Alemberts Principle of virtual work,
- e. Langrangian equation from D'Alembert's principle, cyclic coordinates,
- f. Phase space, Hamiltonian's equations
- g. Problems

Reference books:

1. **Classical Mechanics**, J.C. Upadhyaya, Himalaya publishing Houses, 2nd Edition of 2005.
2. **Introduction to Classical Mechanics**, R. G. Takawale, P. S. Puranik, Tata McGraw Hill publishing Company Ltd., New Delhi.
3. **Classical Mechanics**, NC Rana and PS Joag, Tata McGraw Hill Education Private Limited, New Delhi, 1991.
4. **Classical Mechanics** by P.V.Panat.
5. **Classical Mechanics**, Herbert Goldstein, Narosa Publishing House.

T.Y.B.Sc. (Physics) (Sem-V)
PHY-354: Atomic and Molecular Physics

Lectures: 36

(Credits-02)

1: Atomic structure

(6 L)

1. Revision of various atomic models
2. Vector atom model (Concepts of space quantization and electron spin)
3. Pauli Exclusion Principle and electron configuration, Quantum states, Spectral notations of quantum states.
4. Problems

2: One and Two Valence electron systems

(12 L)

1. Spin-Orbit Interaction (Single valence electron atom), Energy levels of Na-atom, Selection rules, Spectra of sodium atom, Sodium doublet.
2. Spectral terms of two electron atoms, terms for equivalent electrons, LS and JJ-coupling schemes.
3. Singlet-Triplet separations for interaction energy of LS coupling, Lande's interval rule, Spectra of Helium atom.
4. Problems

3: Zeeman Effect

(4 L)

1. Zeeman Effect
2. Experimental arrangement
3. Normal and anomalous Zeeman Effect
4. Stark effect (Qualitative discussion)
5. Applications of Zeeman effects
6. Problems

4: Molecular spectroscopy

(8 L)

1. Introduction of molecular spectra and its types
2. Rotational energy levels, Rotational spectra of rigid diatomic molecule
3. Vibrational energy levels
4. Rotational and Vibrational spectra
5. Electronic spectra of molecules
6. Applications of UV-Vis spectroscopy
7. Problems

5: Raman spectroscopy

(6 L)

1. History of Raman effect, Molecular polarizability
2. Classical theory and Quantum theory of Raman Effect
3. Characteristics Raman Lines and Applications of Raman spectroscopy
4. Problems

Reference books:

- 1) R. Murugesan, Er. K. Sivaprasath, Modern Physics, S. Chand, 2014, Revised edition
- 2) Robert Eiseberg, Robert Resnik, Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Wiley, 2016, 2nd edition
- 3) G. Aruldas, Molecular structure and Spectroscopy, PHI, 2015, 2nd edition
- 4) Colin Banwell, Elaine McCash, Fundamentals of Molecular Spectroscopy, TMH, 4th ed
- 5) Arthur Baiser, Concepts of Modern Physics, McGraw Hill International, 4th edition
- 6) White H. E, Introduction to Atomic spectra, McGraw Hill International

T.Y.B.Sc. (Physics) (Sem-V)
PHY-355: Computational Physics

Lectures: 36

(Credits-02)

1: Concepts of Programming and Introduction to C-programming: (14 L)

- a) Definition and Properties of algorithms, Algorithm development, Flow charts- symbols and simple flowcharts.
- b) Introduction and Structure of C-program, 'C' Character set, key words, Constants and variables, Variable names, Data types, qualifiers and their declarations, Symbolic Constants.
- c) Input/output functions: scanf(), printf(), getchar(), putchar(), gets(), puts().
- d) Operators and Expressions: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Conditional Operator.
- e) Control statements: if, if else, while, do while, for loop, nested control structures (nested if, nested loops), break, continue, switch- case statement, goto statement.
- f) Use of Library functions: e.g. mathematical, trigonometric, graphics.

2: Arrays, Pointers and user defined function in C-Language (8 L)

- a) Arrays: 1-D, 2-D: Arranging numbers in descending and ascending order, Sum of matrices, multiplication of matrices.
- b) Concept of pointers with suitable illustrative examples.
- c) User defined functions: Definitions and declaration of function, function prototype, passing arguments (Call by value, Call by reference). Simple illustrative examples.

3: Graphics in C-Language: (3 L)

Concepts of graphics in C, Some simple graphic commands- Point, Line, Circle, Arc, Ellipse, Bar with suitable illustrative examples.

4: Computational Physics: (11 L)

Numerical Methods to solve the Physics Problems

- a) **Iterative methods:** Bisection method and Newton-Raphson Method– Algorithm, Flowchart and writing C- program for finding the roots of the equation, problems
- b) **Integration:** Trapezoidal rule, Simpson's $1/3^{\text{rd}}$ rule – Algorithm, Flowchart and C-program, problems

Reference Books:

1. Programming in C- (Schaum's series), Gottfreid, TMH
2. Programming in C- Balgurusami, Prentice Hall publications
3. Let us C- Yashwant Kanetkar, BPB publications
4. Programming with C- K.R. Venugopal, S. R. Prasad, TMH.
5. Introductory methods of numerical analysis-S. Sastry, Prentice Hall
6. Computer oriented numerical methods – V. Rajaraman.

PHY-356: Elective-I

T.Y.B.Sc. (Physics) (Sem-V)
PHY-356 Elective-I (A): Astronomy and Astrophysics-I

Lectures: 36

(Credits-02)

1: Fundamentals of Astronomy: (10 L)

Introduction: Components of the Universe; Stars, Planets, Asteroids, Meteors, Comets, Galaxies.

Solar System: Age, Origin Basic measurements: Planetary orbits, distances, physical size, mass, density, temperature, rotation period determination, Co-ordinate system, Celestial hemisphere,

2: Astronomical Instruments: (8 L)

Optical telescopes, mounts, light gathering power, magnification, Resolution. Spectroscopes, CCD camera, photometer, filters Radio telescopes, Interferometry (only introduction)

3: Star Systems and basic observations: (10 L)

Stars life cycle, Stellar processes (Nuclear). Neutron stars, black holes, Chandrasekhar limit.

Spectral classification of stars, O, B, A, F, G, K, M. Star Systems: Binaries / Cepheids / RR Lyrae,

Observation of Sun: Eclipses, Moon, planets, meteor showers, transits, occultations.

4: Galaxies, Dark Matter and Dark Energy (8 L)

A) Galaxies, types, their formation, Hubble's tuning fork diagram, Open and Globular clusters, Dark Matter / Energy (evidence for both), Cosmology: Theories: BBT, Steady State, Oscillating Universe Theory.

B) **Observational Astronomy:** Concept of time, Magnitudes: apparent and absolute, introduction to Constellations, Star dial.

Reference books:

1. Astronomy structure of the Universe. A.E. Roy and D. Clarke, Adam Hilger Pub.
2. Source Book of Space Sciences, Samuel Galsstone; D.Van Nostrand Co. Inc
3. Astrophysics - Stars and Galaxies, K.D. Abhyankar, Tata McGraw Hill Pub.
4. Textbook of Astronomy and Astrophysics with elements of cosmology, V.B. Bhatia, Narosa Pub.
5. Structure of the Universe, J.V. Narlikar
6. Astrophysics, Baidyanath Basu.
7. Astrophysical Techniques, third Edition, C. R. Kitchin
8. Fundamentals of Astronomy, Michael Seed
9. Telescopes and techniques, C. R. Kitchin (Springer)

List of experiments: (Any 2)

1. Study of Binocular, refracting and reflecting telescopes and their mounts.
2. To determine the diameter of the Moon.
3. Measurement of Solar Constant.
4. Observation of emission, continuous and absorption spectra. (Mercury, sodium or iodine spectra could be obtained.)
5. Study of Construction and working of CCD.
6. Study of Solar Eclipse and Lunar Eclipse.

T.Y.B.Sc. (Physics) (Sem-V)
PHY-356 Elective-I (B): Elements of Material Science

Lectures: 36

(Credits-02)

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- 1: Defects in Solids** **(7 L)**
1. Material Properties – Mechanical, Electrical, and thermal
 2. Impurities in solids.
 3. Solid solutions in metals.
 4. Rules of solid solubility.
 5. Imperfection in crystals.
 6. Defects in solids point, line, surface, and volume.
 7. Atomic diffusions definition, mechanism, Fick's laws.
- 2: Single Phase Metals** **(6 L)**
1. Single phase alloys
 2. Deformation
 3. Elastic Deformation and Plastic Deformation
 4. Mechanism of plastic Deformation by slip
 5. Critical resolved shear stress (CRSS)
 6. Plastic deformation in poly crystalline materials
- 3: Ceramic Materials** **(10 L)**
1. Ceramic Phases, Classification of ceramic materials
 2. Ceramic crystals (AX)
 3. Mechanical behavior of ceramics
 4. Electromagnetic behavior of ceramics –
 - a) Electric properties dielectrics, semiconductors, piezoelectric
 - b) Magnetic Properties Magnetic Ceramics, hard and soft ferrites
- 4: Phase Diagrams** **(9 L)**
1. Basic terms System, Surrounding, Component, Coordinates, Phase, Equilibrium.
 2. Phase Diagram definition, importance, and objective
 3. Lever rule
 4. Gibb's phase rule
 5. Phase diagram of a) Sugar water b) NaCl water
 6. Types of phase diagrams with construction
 - a) Type I Lens type CuNi phase diagram
 - b) Type II Only introduction
 - c) Type III Eutectic type PbSn phase diagram
 7. Isothermal cuts
- 5: Introduction to smart materials** **(4 L)**
1. Definition of smart materials
 2. Types and structure of smart materials,
 3. Properties of smart materials
 4. Applications of smart materials.

Reference books :

1. Elements of Materials Science and Engineering I. H. Vanvlach (4th Edition)
2. Materials Science and Engineering - V. Raghavan

List of experiments : (Any 2)

1. To determine the dipole moment of a given liquid
2. To determine magnetic susceptibility of FeCl_3
3. To determine the specific heat of graphite
4. Determination of the yield point and the breaking point of an elastic material
5. Ionic conductivity of NaCl/ NaI
6. Grain size and grain boundary measurement using optical microscope.

T.Y.B.Sc. (Physics) (Sem-V)
PHY-356 Elective-I (C): Biophysics

Lectures: 36

(Credits-02)

1: Introduction of Biophysics

(13L)

- 1.1 History of Biophysics, Concept of Biophysics and Physical properties applied to biology- Surface tension, Viscosity, adsorption, diffusion, osmosis, Definition for Biostatistics and Biometry
- 1.2 Cell: Animal and plant cell, types of cell, Functional aspects of cell membrane, cytoplasm, nucleus, mitochondria and chloroplast
- 1.3 Protein structure (Primary and Secondary), amino acid structure, Genetic code- symmetry, DNA structure
- 1.4 Photosynthesis process:- electron transport, Gibbs's free energy, Redox couple, Redox potential, Oxidation and reduction, Examples of redox potential in biological system.

2: Bio-potentials

(9L)

- 2.1 Bioelectric signals: structure of neuron, resting potential, action Potential, Nernst equation
- 2.2 Bioelectrodes- Half-cell potential, polarizable and non-polarizable electrodes, Microelectrode- metal and glass electrodes
- 2.2 Study of Cardiovascular system, Compound action potential of human body-ECG (Electrocardiography), Electrodes for ECG

3: Bio-instruments

(6L)

- 3.1 Basic principle, Construction and working of colorimeter, spectrophotometer, PH meter and Centrifuge measurement.
- 3.2 Electron Microscope: SEM, TEM.

4: Radiation Biophysics

(8L)

- 4.1 Definition, Units of Radioactivity and radiation doses, Types of radiation (Ionizing and non- ionizing), radioimmunoassays.
- 4.2 Applications: PET (Positron Emission Tomography), NMR (Nuclear Magnetic Resonance), MRI (Magnetic Resonance Imaging Techniques), Ultrasonography, CT (Computed Tomography) Scan.

Reference books:

1. Introduction to Biophysics - by P. Narayanan. New Age P.
2. Medical Instrumentation - by Khandpur, TMH
3. Laboratory Manuals of Biophysics Instruments - by P.B. Vidyasagar
4. Biophysics -by Vatsala Piramal, Dominant Publisher and Distributors, New Delhi-110002
5. Textbook of Biophysics - by R.N. Roy
6. Photosynthesis - by Hall and Rao.
7. Introduction to Biomedical Equipment Technology (Fourth Edition) by-Joseph J.Carr
8. Text Book of Bio-medical Electronics-by S.S. Agrawal

List of Experiments : (Any 2)

1. Recording and analysis of ECG signals
2. Verification of Beer's and Lambert's Law
3. Absorption spectrum of Blood/Chlorophyll.
4. pH value of Amino acids.
5. Bimolecular model building using standard kits.
6. Separation of components of Milk/Chlorophyll using centrifuge machine.

T.Y.B.Sc. (Physics) (Sem-V)
PHY-356 Elective-I (D): Renewable Energy Sources-I

Lectures: 36

(Credits-02)

1: An Introduction to Energy Sources: (10L)

1. Energy: Definition, Classifications of energy sources
2. Conventional and non-conventional energy sources.
3. Sun: The source of energy (Structure, Characteristics and Composition)
4. Solar Constant
5. Electromagnetic Energy Spectrum.
6. Solar radiations outside earth atmosphere.
7. Solar radiation at the earth surface.
8. Problems.

Ref.1- page no. 1 to 11 and 15 to 37

Ref.3- 3.1, 3.2, 3.3, 3.4, 3.5

2: Photothermal Applications: (10L)

1. Photothermal devices: Solar Insolation, Selective Coating, Glass Cover, Heat Conductor and Heat Insulation.
2. Solar water heating systems: Types, construction and working of Liquid Flat Plate Collector (FPC) and Evacuated Tube Collector (ETC)
3. Energy Balance Equation (without thermal Analysis).
4. Concentrating collectors: Flat plate collector with plane reflector, Cylindrical parabolic, Compound parabolic, Collector with fixed circular concentrators and moving receiver, paraboloid concentrator.
5. Comparative study between flat plate collector and solar concentrators.
6. Solar distillation, Solar dryer, Solar cooker (box type)

Ref. 1: 3.3, 3.3(A), 3.5, 3.7, 3.8, 5.2, 5.8, 5.11.

Ref. 2: 2.2.6

3: Photovoltaic systems: (10L)

1. Introduction to Photovoltaic effect and Photovoltaic Conversion.
2. Basic photovoltaic system for power generation
3. Basics of Solar Cell, PV modules, Arrays,
4. Solar Cell: I-V characteristics, Power output and conversion efficiency.
5. Factors affecting on photovoltaic efficiency. (Change in amount of input light, solar cell area, Change in angle, Change in operating Temperature etc.)
6. Types of solar cells: p-n junction solar cell, p-i-n diode solar cell, cadmium sulphide solar cell, Gallium arsenide solar cell, Indium phosphide solar cell, nano-crystalline solar cell.
7. Application of solar photovoltaic systems.

Ref.3 -15.1, 15.3, 15.4, 15.5, 15.7, 15.8, 15.10.

Ref.8 – 3.6.1, 3.6.2, 3.6.3, 3.6.4, 3.6.5

4: Energy Storage:

(06L)

1. Importance and Needs of Energy storage in Conventional and Nonconventional Energy Systems.
2. Various forms of Energy Storage
3. Electrical Energy: Super capacitors
4. Electrochemical Energy: Battery
5. Chemical Energy: Hydrogen Production and storage

Ref.4 - Ref.5 - Ref.6 - Ref.7 -

Reference books:

1. Non-conventional Energy sources, G. D. RAI (4th edition), Khanna Publishers, Delhi.
2. Solar Energy, S.P. Sukhatme (second edition), Tata Mc. Graw Hill Ltd, New Delhi.
3. Solar Energy Utilizations, G. D. RAI (5th edition), Khanna Publishers, Delhi.
4. Energy Storage: Fundamentals, Materials and Applications, by Huggins R. A., Springer
5. Chemical and Electrochemical Energy System by R. Narayan and B. Viswanathan, University Press.
6. Battery Systems Engineering by C. D. Rahn and C. Wang, Wiley Pub.
7. Electrochemical Energy Storage for Renewable sources and grid balancing by P. T. Moseley and J. Garche, Elsevier Science.
8. Solar Photovoltaic Technology and Systems by C S Solanki

List of Experiments: (Any 2)

1. To calculate the thermal efficiency of liquid flat plate collector.
2. To study the box type solar cooker.
3. To determine an instantaneous thermal efficiency of parabolic collector.
4. To calculate an efficiency and fill factor of PN junction solar cell.
5. To study I-V characteristic of various types of solar cells.

T.Y.B.Sc. (Physics) (Sem-V)
PHY-356 Elective-I (E): Applied Optics

Lectures: 36

(Credits-02)

1: Fermat's Principle and Matrix Methods in Paraxial Optics: (9L)

- 1.1 Introduction to Fermat's Principle and its Applications.
- 1.2 Laws of Reflection and Refraction from Fermat's Principle.
- 1.3 Ray paths in an Inhomogeneous Medium.
- 1.4 Introduction to Matrix methods in Paraxial Optics.
- 1.5 The matrix method, Unit planes and Nodal planes.
- 1.6 A System of two thin lenses.
- 1.7 Problems.

2: Multiple-Beam Interferometry and Diffraction: (9L)

- 2.1 Introduction to Multiple-Beam Interferometry.
- 2.2 Michelson Interferometer
- 2.3 The Fabry-Perot Etalon.
- 2.4 The Fabry-Perot Interferometer.
- 2.5 Introduction and revision of diffraction.
- 2.6 Two slit and N-Slit Fraunhofer diffraction pattern.
- 2.7 Fresnel half period zones, the zone plate and Fresnel Diffraction.
- 2.8 Problems.

3: Polarization and Holography: (9L)

- 3.1 Introduction and Revision of Polarization.
- 3.2 Malus law, Double refraction,
- 3.3 Phase retarded plate, Quarter wave plate and half wave plate
- 3.4 Optical activity and Polarimeter
- 3.5 Introduction and Theory of Holography.
- 3.6 Importance of coherence and Principle of holography.
- 3.7 Characteristics, recording and reconstruction of Holography
- 3.8 Applications of Holography.
- 3.9 Problems.

4: Fibre Optics: (9L)

- 4.1 Introduction to Fibre Optics.
- 4.2 The Optical Fibre: Principle and Structure.
- 4.3 Fibre Optics: Numerical aperture and Acceptance angle, Pulse dispersion and Calculation of pulse dispersion.
- 4.4 Types of Optical Fibres: Concept of Mode, Multimode and Single mode fibre.
- 4.5 Attenuation in optical fibers, single mode and multimode fibers.
- 4.6 Fibre Optic communication system: Fiber optical telecommunication system.
- 4.7 Advantages of Fibre Optics.
- 4.8 Applications of Fibre Optics.
- 4.9 Problems.

Reference Books:

- (1) Ghatak Ajoy, Optics 3rd Edition, The McGraw Hill companies.
- (2) N. Subrahmanyam, A textbook of Optics, S. Chand publications.
- (3) Optical Fiber and Fiber Optic communication System, S.K Sarkar S. Chand.
- (4) Practical Optics, Naftaly Menn, Academic press (2004)
- (5) M. Born and E. Wolf, Principles of Optics, Cambridge University Press
- (6) F. A. Jenkins, H.E White, Fundamental of Optics, McGraw companies

List of Experiments : (Any 2)

- (1) Determination of the numerical aperture of the given optical fibre.
- (2) Determination of the optical power loss in attenuators.
- (3) Fabry Perot Etalon
- (4) To study the nature of polarization of laser light using photo cell and quarter wave plate.
- (5) To determine the Brewster's angle for glass using a polarized monochromatic light source.

T.Y.B.Sc. (Physics) (Sem-V)
PHY-356 Elective-I (F): C# Programming

Lectures: 36

(Credits-02)

1: MS.NET Framework Introduction (8L)

• The .NET Framework - an Overview • Framework Components • Framework Versions • Types of Applications which can be developed using MS.NET • MS.NET Base Class Library • MS.NET Namespaces • The Common Language Runtime (CLR), Common Type System (CTS) • Common Language Specification (CLS) . Installing Required Software – SQL Server and Management studio

2: C # Language Syntax (8L)

• Datatypes • Global, Stack and Heap Memory • Common Type System • Reference Type and Value Type • Datatypes and Variables Declaration • Implicit and Explicit Casting • Checked and Unchecked Blocks – Overflow Checks • Casting between other datatypes • Boxing and Unboxing • Enum and Constant • Operators • Control Statements • Working with Arrays • Working with Methods • Pass by value and by reference and out parameters • Writing, testing and execution of program to understand general syntax and functions available in C#.

3: Database Programming Using ADO.NET (8L)

• Prerequisite - Knowledge of SQL Queries • Introduction and Evolution of ADO.NET • Understanding the Role of Managed Provider and ADO.NET Objects • connecting to Database and Connection Pooling • Performing Insert, Update and Delete Operations • Fetching Data from database - Executing Select Statements • How to implement Login facility with database

4: Interactive methods (6L)

Preparing flowchart, algorithm for interactive methods, Bisection Methods, Newton Rapson Method, Numerical integration by Trapezoidal rule, Simpson 1/3rd rule.

5: Hands on training: (6L)

Hands on training to execute numerical problems for interactive methods, Bisection Methods, Newton Rapson Method, Numerical integration by Trapezoidal rule, Simpson 1/3rd rule.

Reference Books:

1. C# 8.0 Pocket Reference: Instant Help for C# 8.0 Programmers
2. Programming in C# by E Balagurusamy
3. Beginning C# Object-Oriented Programming (English, Paperback, Clark Dan)
4. Pro C# 9 with .NET 5: Foundational Principles and Practices in Programming by Troelsen, Andrew, Japikse, Philip

Web References:

1. <https://dotnet.microsoft.com/learn/csharp>
2. <https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/>
3. <https://www.pragimtech.com/courses/c-sharp-tutorial-for-beginners/>
4. https://www.tutorialspoint.com/csharp/csharp_tutorial.pdf

List of Experiments: (Any 2)

1. Write a program that converts 1 lower case letter ("a" - "z") to its corresponding upper case letter ("A" - "Z"). For example if the user enters "c" then the program will show "C" on the screen.
2. Write a program using a switch statement that takes one value from the user and asks about the type of conversion and then performs a conversion depending on the type of conversion. If user enters:
3. Write a program using conditional operators to determine whether a year entered through the keyboard is a leap year or not.
4. Write a program using a for loop that prints the following output (you need to find a pattern to print letters in this order): A B D H P
5. Write a program using a loop that prints the following output.
1 2 2 3 3 3 4 4 4 4 5 5 5 5 6 6 6 6 6 . . . nth iteration.

T.Y.B.Sc. (Physics) (Sem-V)
PHY-356 Elective-I (G): Acoustics-I

Lectures: 36

(Credits-02)

1: Fundamentals of Sound:

Velocity of sound in fluids; Acoustic standards and reference conditions; Decibel scales: Intensity level (IL), Sound pressure Level (SPL), Sound Power Level (PWL); Problem-solving; Sound fields: Near, far, reverberant, and free. (6L)

2: Speech, Hearing and Community Noise Criteria:

Voice mechanism, acoustic power output of speech; Mechanism of hearing, thresholds of the ear; Equivalent continuous sound pressure level (L_{Aeq}); Perceived noise level (L_{EPN}); Audiometry (6L)

3: Architectural Acoustics and Audio Rooms:

Reverberation time: Concept and measurement, problem-solving relating to reverberation time; Management of sound absorption: porous absorbers, effect of density, thickness, airspace, acoustic tiles, foam board insulation, carpet absorption; Anechoic chamber; Haas effect and delay; Room modes: concept and room mode calculation; Room acoustics: Sound Transmission Class (STC), high-loss acoustic frame walls, acoustic floor, and ceiling systems (10L)

4: Resonators, Filters and Active Noise Control:

Helmholtz resonator; Acoustic, electrical, and mechanical analogues; Expansion chamber muffler, Active noise control: Noise Cancellation, Pros and cons of headphones, earphones, earbuds (8L)

5: Bioacoustics and Music:

Animal sounds: Bird songs, whale sounds - FFT and Wavelet Analysis (introductory) with examples; Pitch and timbre; Characteristics of musical notes: Vibrato, Tremolo, Portamento; Musical Instruments Digital Interface (MIDI) (6L)

Reference Books:

1. Fundamentals of Acoustics, L.E. Kinsler and A. R. Frey, Wiley Eastern
2. Audio and Video Systems, R. G. Gupta, Tata McGraw Hill, 2010
3. Acoustics, W.W. Seto, Schaum's Outline Series, McGraw Hill, 1970
4. Handbook of Sound Engineers, G.M. Ballou, Academic Press
5. Basic Acoustics, D.E. Hall, Oxford University Press
6. Design for good Acoustics and Noise Control, J. E. Moore, Univ. Press
7. Acoustics of Ducts and Mufflers, M. L. Munjal, John Wiley & sons

List of Experiments (Any two):

1. Transmission loss of an expansion chamber muffler.
2. Reverberation time measurement using a storage oscilloscope.
3. Calculation of room modes for a typical room and verification using an online mode calculator
4. Sound mapping using localized SPL measurement.
5. FFT: Square wave, animal sound recording

T.Y.B.Sc. (Physics) (Sem-V)
PHY-357: Physics Laboratory-3A

Lectures: 36

(Credits-02)

(General Laboratory, Electromagnetism, Atomic and Molecular Physics, and Optics)

(Any Eight)

GROUP-I: GENERAL PHYSICS (any FOUR)

1. Kater's pendulum
2. Moment of Inertia by Bifilar suspension
3. Young's modulus by Koeing method
4. Surface tension of mercury by ripple method
5. Surface tension liquid by Fergusson method
6. Surface tension of mercury by Quincke's method
7. 'Y' by vibration of wooden scale
8. Young's modulus by Newton's rings
9. Determination of wavelength of light by Michelson's interferometer
10. Study of damped oscillations of physical pendulum and finding log decrement

GROUP-II: ELECTROMAGNETISM (any TWO)

1. Study of forced oscillations by electromagnetically driven simple pendulum
2. Self-Inductance by Anderson's bridge
3. Core losses in transformers
4. Electromagnetic pendulum
5. Self-Inductance by Maxwell's bridge

GROUP-III: ATOMIC AND MOLECULAR PHYSICS AND OPTICS (any TWO)

1. Determination of Rydberg's constant
2. Zeeman Effect
3. Llyod's mirror
4. Determination of Resolving Power of grating
5. Determination of wavelength by Constant deviation spectrometer

Additional Activities (Any ONE)

- Demonstrations: Any 2 demonstrations equivalent to 2 experiments
- Study tour with report equivalent to 2 experiments
- Mini project equivalent to 2 experiments
- Computer aided demonstrations (simulations or animations)
(Any 2 demonstrations equivalent to 2 experiments)

***Note:** Students have to perform **ten** experiments or **one** additional activities in addition to **eight** experiments mentioned above. Total laboratory work with additional activities should be equivalent to **ten** experiments.*

T.Y.B.Sc. (Physics) (Sem-V)
PHY-358: Physics Laboratory-3B

Lectures: 36

(Credits-02)

GROUP-I: EXPERIMENTS USING CRO/INSTRUMENTATION (any TWO)

1. Charging and discharging of capacitor and RC time constant
2. Measurement of g using simple pendulum
3. Velocity of sound
4. Radiation detection
5. IV Characteristics of diode
6. Measuring a value of a capacitor using CRO.
7. Temperature controller using AD590
8. Study of IC 7490 as mod 2, mod 5, mod 7 and mod 10 counter.

GROUP-II: C-PROGRAMMING (any TWO)

1. Factorial of a number by simple and recursive method.
2. To find out the first 100 prime numbers
3. Matrix multiplication
4. Position time data using kinematic equations
5. Finding pressure using Van-der-Waals' equation of state

GROUP-III: COMPUTATIONAL PHYSICS (NUMERICAL BASED) (any TWO)

1. Roots of an algebraic equation (Bisection)
2. Roots of polynomial (Newton Raphson)
3. Numerical Integration by Trapezoidal rule
4. Numerical Integration by Simpson's 1/3 rule

GROUP-IV: PRACTICAL FROM OPTIONAL COURSE (Any TWO)

Additional Activities (Any ONE)

- Demonstrations: Any 2 demonstrations equivalent to 2 experiments
- Study tour with report equivalent to 2 experiments
- Mini project equivalent to 2 experiments
- Computer aided demonstrations (simulations or animations)
(Any 2 demonstrations equivalent to 2 experiments)

***Note:** Students have to perform **ten** experiments or **one** additional activities in addition to **eight** experiments mentioned above. Total laboratory work with additional activities should be equivalent to **ten** experiments.*

T.Y.B.Sc. (Physics) (Sem-V)
PHY-359: Physics Project-I

Lectures: 36

(Credits-02)

Guidelines:

It is expected that,

1. The student does work equivalent to about ten (10) laboratory experiments throughout the semester in the third year.
2. One bears in mind that the project work is a practical course and it is intended to develop a set of skills pertaining to the laboratory work apart from the cognition of students. Therefore, the guides should not permit projects that involve no contribution on part of student.
3. The project must have a clear and strong link with the principles of basic physics and/or their applications.
4. The theme chosen should be such that it promotes better understanding of physics concepts and brings out the creativity in the students.
5. The evaluation of the project work must give due credit to the amount of the project work actually done by a student, skills shown by the student, understanding of the physics concepts involved and the final presentation at the time of viva voce.
6. It is also recommended that a teacher will look after Four (4) projects at one time.
7. Practical examination will be conducted semester wise.
8. The student can perform an Experimental/Theoretical/Computational Project in Physics or interdisciplinary areas under the supervision of one or more guides.
9. The student can learn the basics of the topic chosen for project, to learn how to do literature survey and set up the basic experimental/theoretical and computational techniques needed for the project.
10. The department encourage to students for projects both in experimental and theoretical areas of Physics in collaboration with other institutes and industry.

The Project work shall consist of the following Criteria.

1. Project work is mandatory for all the T. Y .B. Sc. students.
2. All the T. Y. B. Sc. students will be have to complete the Project work prescribed by the Board of Studies in Physics of Savitribai Phule Pune University during the Vth Semester.
3. The Project work shall consist of the following Criteria.
 - It is expected that students must finalize the Title of Project, Aim and objective, Significance, Literature survey, Materials required, Method and Application etc.
 - Introduction to foundations of Project Work.
 - Introduction of Project Research Methodology.
 - Study of Data Collection Methods.
 - Project Problem Writing and Presentation Skills.

Evaluation weightage:

- Project-I: Semester End University Examination : 35 Marks
- Internal Examination: 15 Marks

Skill Enhancement Courses

Skill Enhancement Courses (SEC)

a) Selection of Skill enhancement courses

There are two skill enhancement courses (SEC) in 5th semester (PHY-3510 and PHY-3511). For 5th semester, there are four options available. The college has to select any one from the given four options. It is advised that college should not offer elective and skill enhancement course of same theme.

b) Teaching Learning process for Skill Enhancement Courses

Skill base courses are intended to explore the applications of physics knowledge. Learning in skill enhancement courses is largely experience based. The skill enhancement courses may be categorized as knowledge skill or technical skill. For knowledge skill courses one can use the conventional method for teaching along with problem solving, assignments seminars etc. For acquiring the technical skill, the students will get adequate 'hands-on' experience. The teachers may use demonstrations and activity-based learning techniques. On field visits, study tour and mini projects will enrich the learning experience of the students.

c) Assessment methods for skill enhancement courses

Continuous evaluation will be the best method for assessment of skill enhancement courses.

One can use tools like assignments, mini projects or activities, problems, etc and grade the students according to their performance. The internal assessment should have 50 % weightage.

The University examination may be conducted for the remaining 50%.

The University examination question paper should have adequate proportion of objective and subjective question.

d) List of Skill Enhancement Courses:

Semester-V th	Semester-V th
PHY-3510	PHY-3511
PHY-3510(H): Python Programming	PHY-3511(L): Physics Workshop Skill
PHY-3510(I): Energy studies	PHY-3511(M): Biomedical Instrumentation
PHY-3510(J): Introduction to Arduino	PHY-3511(N): Non-destructive Testing Techniques
PHY-3510(K): Sensors and Transducer	PHY-3511(O): Acoustics Applications

T.Y.B.Sc. (Physics) (Sem-V)
PHY-3510 SEC (H): Python Programming

Lectures: 36

(Credits-02)

Pre-requisite	: Basic mathematics (XII-Science)
Version of python	: 3.4
Proposed IDE	: Spider, Py Charm or Jupyter

Python Programming:

Python is one of the top ten popular programming languages. Python is a general purpose and high level programming language. You can use Python for developing desktop GUI applications, websites and web applications. Also, Python, as a high level programming language, allows you to focus on core functionality of the application by taking care of common programming tasks. The simple syntax rules of the programming language further makes it easier for you to keep the code base readable and application maintainable. There are also a number of reasons why you should prefer Python to other programming languages.

Advantages of Python Programming

- i.) Readable and Maintainable Code
- ii.) Multiple Programming Paradigms
- iii.) Compatible with Major Platforms and Systems
- iv.) Robust Standard Library
- v.) Many Open Source Frameworks and Tools
- vi.) Simplify Complex Software Development
- vii.) Adopt Test Driven Development

Objectives:

- i.) To build foundation for understanding Python environment to enhance computational skills.
- ii.) Understand variables, input and output functions in python and To Apply computational skill in problem solving approach of Physics
- iii.) Get exposure to arithmetic, assignment, relational, logical and Boolean operators.
- iv.) Be familiar with Python modules and Libraries

Course outcomes:

After completion of this course student will be able

- i.) To write code for complex scientific computational requirement.
- ii.) Use Libraries like NumPy for numeric computation
- iii.) Use Library SciPy for scientific and technological calculations
- iv.) Use Library Matplotlib for plotting of graph and its visualization.
- v.) Develop own functions for Physics or mathematics.

Syllabus

a) Python Programming:

Unit No.	Topic	Lectures
1	Introduction to Python Programming Language: Introduction to Python Language, <ul style="list-style-type: none">• Strengths and Weaknesses,• IDLE, Dynamic Types,• Naming Conventions,• String Values,• String Operations,• String Slices,• String Operators,• Numeric Data Types,• Conversions,• Built In Functions	03
2	Data Collections and Language Component: <ul style="list-style-type: none">• Introduction,• Control Flow and Syntax,• Indenting,• The if Statement,• Relational Operators,• Logical,• Operators,• True or False,• Bit Wise Operators,• The while Loop, break and continue,• The for Loop, Lists,• Tuples,• Sets,• Dictionaries,• Sorting Dictionaries,• Copying Collections.	05
3	Functions and Modules : <ul style="list-style-type: none">• Introduction• Defining Your Own Functions Parameters• Function Keyword and Optional Parameters• Passing Collections to a Function• Variable Number of Arguments Scope• Functions Passing Functions to a Function• Mapping Functions in a Dictionary	05

	<ul style="list-style-type: none"> • Modules • Standard Modules – sys • Standard Modules – math • Standard Modules – time • The dir Function 	
5	Modules and packages in Python : <ul style="list-style-type: none"> • NumPy, SciPy • MathPlot etc 	05

a) **Demonstrations :**

Sr. No.	Practical Demonstration to Communicate Concepts and Application in Physics, Electronics, Statistics and Mathematics
1	Write python program to use basic math and string operations.
2	Write python program to find roots of quadratic equation, prime numbers etc
3	Write python program to store data in list and perform matrix operation
4	Write python program to do numerical methods
5	Write python program involving tuples, dictionaries in problems related to physics or mathematical concepts
6	Write python program to use random number generator as probability density to show expected value is 0.5 to explain quantum mechanical behaviour of particle in one dimensional well.
7	Write python program to use NumPy library for more complex arithmetic operations
8	Write python program to use complex numbers and complex algebra
9	Write python program to use bitwise operation
10	Write python program to plot graphs using matplotlib or similar library

Reference books:

- Python Programming: Using Problem Solving Approach. By Reema Thareja.
- Think Python By Allen Downey
- Problem Solving and Python Programming By Balguruswami McGraw Hill
- Let Us Python By Aditya Kanetkar
- Learning with Python By Allen Downey
- Data Analytics By Bharti Motwani

T.Y.B.Sc. (Physics) (Sem-V)
PHY-3510 SEC (I): Energy Studies

Lectures: 36

(Credits-02)

Course Objectives:

1. Students understand the comparative aspects, advantages and disadvantages of various sources of energy. They understand the facts and myths regarding the energy sources.
2. Students learn the basic principles involved and technologies developed in the uses of solar energy, biomass energy, wind energy, fuel cells.
3. Students understand the challenges and opportunities in conversion of energy from one form to another, generation of electricity and mechanical work using different energy sources.
4. Students get acquainted with challenges and recent trends in energy storage devices and they learn more about super-capacitors and batteries, electrical vehicles. They can imagine about future road maps in the fields of energy conversion and storage technologies.

Course Outcomes:

1. Students become capable of conducting energy audits and give consultancy in that field.
2. Students can design different types of solar heaters for small domestic as well as large scale community level applications.
3. Students acquire skills to implement solar P-V systems at domestic levels as well as for office premises and educational institutions. Students become able to start their own enterprise in net metering.
4. Students get ideas and hence become self-employed in the field of design , production, commissioning and implementation of bio-mass energy sources , bio-gas plants, gasifiers, wind mills, hybrid systems etc.
5. Students can go for research in the fields of super-capacitors, battery technologies, fuel cells and material synthesis for implementation of these technologies.
6. Students become successful entrepreneurs in the energy field.

Students strive to make the regions where they live and work self-sufficient in generating and fulfilling their own energy needs using different energy solutions.

Unit No.	Topic	Lectures
1	An Introduction to Energy Sources: Classification and comparison of energy sources (hydro, thermal, nuclear, solar, wind, biomass, and fossil fuels) considering environmental, safety, economy, production and distribution aspects. Facts and Myths about various sources of energy, thermal, nuclear sources of energy, Hybrid sources. Energy audit. Activity: 1. Energy audit of college campus/public campus/home/building 2. Comparison of energy sources. Visits to energy generation/distribution sites.	6
2	Solar thermal Applications: Sun as a source of energy, Solar Constant, Liquid flat plate collector, construction and working, Concentrating collectors, Solar drying, Solar water heating systems. Activity:	6

	<ol style="list-style-type: none"> 1. Study of solar water heaters 2. Study of large scale solar heaters for industrial/cooking/water heating applications. 3. Study of flat plate, parabolic solar concentrators 	
3	<p>Solar Photovoltaic systems Applications: Photovoltaic principle, Power output and conversion efficiency, Limitation to photovoltaic efficiency, Basic photovoltaic system for power Generation, Application of solar photovoltaic systems, Advantages and disadvantages of Solar PV Systems.–Configurations of Solar Photovoltaic Systems: Off-grid, Grid-Tied and Grid-Storage, Net metering and steps in installation of a rooftop solar PV System design. Activity: <ol style="list-style-type: none"> 1. Efficiency measurement of PV systems using I-V characteristics of Amorphous Si, Mono-crystalline Si, Polycrystalline Si in individual, series and parallel combinations. 2. Effect of intensity of incident light, incident angle and shading on Solar PV Module on Output power. 3. Study of design of solar lanterns, street lights using solar systems 4. Study of Installation and commissioning of roof top solar PV systems 5. Study of net metering systems </p>	8
5	<p>Biomass and wind energy: Bio-mass conversion technologies, Bio-gas generation, Working of biogas plant, Bio-gas from plant wastes, Methods for obtaining energy from biomass, Thermal gasification of biomass, Introduction to wind energy, Classification and description of wind machines, Wind energy, Wind data. Activity <ol style="list-style-type: none"> 1. Visit to bio gas plant 2. Visit to bio diesel plants 3. Study of modified bio mass plants 4. Design and implementation of domestic/small scale biogas plants. 5. Study of different types of gasifiers 6. Study of wind mill / visit to wind mill </p>	8
	<p>Energy storage devices and electrical Vehicles : Recent trends in batteries, super-capacitors, fuel cells. Applications of storage devices: Electrical Vehicles (EV), Converter, Inverter, Controls & Controllers in EV, Future Trends in Electric Cars. Activity <ol style="list-style-type: none"> 1. Preparation and testing of fuel cell on Laboratory scale 2. Preparation and testing of super capacitors on Laboratory scale 3. Preparation and testing of paper batteries and other types of batteries on Laboratory scale. 4. Design and implementation of battery-operated toys using green technology </p>	8

Reference books:

1. Non-conventional Energy sources- G. D. RAI (4th edition), Khanna Publishers, Delhi
2. Solar Energy - S. P. Sukhatme (Second Edition), Tata Mc Graw Hill Ltd., New Delhi.
3. Solar Energy Utilisation - G. D. RAI (5th edition), Khanna Publishers, Delhi.

4. Renewable Energy Technology: A practical guides of beginners, Chetan Singh Solanki, PHI Learning Private-Ltd., New Delhi.
5. Solar Photovoltaics: Fundamentals, Technologies and Applications, Chetan Singh Solanki, PHI Learning Private-Ltd., New Delhi

Note :

1. It is expected that students should undertake at least 1 activity from each unit and total 6 activities amounting to 18 lectures time.
2. Out of the total time allotted to each unit, half the time should be utilized for classroom teaching and remaining half for the activity.
3. Students should be encouraged to study this course by using Case–Study approach.

T.Y.B.Sc. (Physics) (Sem-V)
PHY-3510 SEC (J): Introduction to Arduino

Lectures: 36

(Credits-02)

Introduction:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino board designs use a variety of microcontrollers. Boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various circuits. It has USB that is used for loading programs. Microcontrollers can be programmed using C / Python programming languages. This course will focus on creative thinking and on hands-on project development using Arduino Boards.

Objectives:

- To create general awareness and interest in Arduino Boards.
- To provide knowledge of different Arduino boards and various sensors and actuators.
- The course enables student to understand the basics of interfacing with Arduino Boards.
- To familiarize students with Arduino as IDE, programming language & platform and to Program basic Arduino examples.
- To provide knowledge of different Smart System applications.
- Develop skills to design and implement various smart system application.

Course Outcomes: After successful completion of this course, student will be able to

- Students will be able to understand and use various Arduino Boards, and its various components, Input / Output Pins, Input / Output Devices.
- Understand general concepts of Programming Arduino Boards.
- Apply the knowledge gain to design applications using Arduino in different domains.
- To analyze and evaluate the performance of various Arduino based devices.
- Learn and understand about any new IDE, compiler, and MCU chip in Arduino compatible boards or similar types.

Instructions: This course consists of two parts

- Part I: Theory and Part II: Practical / Project.
- Out of which 1 Credit is for Theory and 1 credit is for Practical work.
- Part II has two sub parts:
- Part II(A) : Practical / Demonstration & Part II(B) : Project. The A or B parts are optional, students can opt any one for 1 credit

Part I: Theory

Unit	Topics	Lectures
I : Introduction to Microcontrollers	<ul style="list-style-type: none">• Introduction to Embedded Systems, Block Diagram, Single Board Computers (SBC) and System on Chip (SoC), Single Board Microcontroller (SBM), microprocessor vs microcontrollers, Basic system with microcontroller such as Arduino (SBM), Raspberry Pi (SoC) etc.	04

II : Introduction to Arduino and Arduino Programming	<ul style="list-style-type: none"> • Arduino Basics: What is Arduino, Advantages of Arduino, Arduino Types, Arduino Components, Arduino Uno Architecture • Arduino Hardware: Types of Arduino boards, Various components on Arduino Board, Various sensors and actuators: Overview of Sensors working, Analog and Digital Sensors 	06
III : Introduction to Programming for Arduino	<ul style="list-style-type: none"> • Arduino Software: Integrated Simulation Environment (IDE), Setup the IDE, Arduino Libraries, What is Sketch, Writing Arduino Sketches, Serial Monitor, <p>Introduction to programming: Functions, Variables & Basic Structure of Arduino (C++) Code, Basics Programs (Hello Word, Blinking of LED), Loading program through USB and Test performance of the System, Integration of Sensors and Actuators with Arduino</p>	08

Part II (A): Arduino Programming (Practical / Demonstration) : Any 6 [18 L]

Simple Practical using Arduino Uno Board (Software + Hardware): Choose any-3 Practical from group-1 and any-3 practical from group-2. (Total = 6 practical)

Sr No	List of Practical's
Group 1 : Any-3	
1	Demonstration of Arduino Uno Board, Its Various Components, Pins
2	Installation Arduino Software (IDE) on computer, Introduction to Sketch, Loading of Program from computer, Simple programs: Hello Word, Blinking of LED on Arduino board etc.
3	Interfacing external LED (ON & OFF); Fading of LED
4	Analog Read Serial: 1. Read a potentiometer, print its state out to the Arduino Serial Monitor. 2. Read an analog input and prints the voltage to the Serial Monitor.
5	Digital Read Serial: Interfacing a switch, Read a switch, print the state out to the Arduino Serial Monitor.
6	Digital: Interfacing push Button: Use a push button to control an LED or Buzzer
7	Digital : State Change Detection: Count the number of button pushes.
8	Analog In Out Serial: Read an analog input pin, map the result, and then use that data to dim or brighten an LED.
Group 2 : Any 3	
9	Knock: Detect knocks with a piezo element.
10	Interfacing of Ultrasonic Sensor, Detect objects with an ultrasonic range finder.
11	Interfacing of Proximity Sensor

12	Interfacing of Temperature & Humidity Sensor : To interface DHT11 sensor for recording temperature and humidity readings with Arduino.
13	Interfacing LCD display with Arduino
14	Interfacing of Relay Switch and Servo Motor with Arduino
15	Interfacing Bluetooth Module to Arduino
16	Interfacing of Motion (PIR Sensor) or Light Sensor using (LDR & LED) or Gas Sensor (MQ-2) with Arduino

OR

Part II (B): Arduino Programming (Practical / Demonstration)

Project : any-1 Simple Projects Using Arduino Uno Board

[18 L]

Sr No	List of Simple Projects
1	Line Following Robot with Arduino
2	Obstacle Avoiding Robot with Arduino
3	Weather Station using Arduino
4	Home Automation using Arduino
5	Android Based Air quality Monitor
6	Intelligent automatic irrigation system

References:

1. www.arduino.cc
2. <https://www.arduino.cc/en/Tutorial/BuiltInExamples>
3. <https://create.arduino.cc/projecthub>

Course Objectives:

- To make students familiar with the constructions and working principle of different types of sensors and transducers.
- To make students aware about the measuring instruments and the methods of measurement and the use of different transducers.

Course Outcomes: At the end of the course, a student will be able to:

- Use concepts in common methods for converting a physical parameter into an electrical quantity
- Classify and explain with examples of transducers, including those for measurement of temperature, strain, motion, position and light
- Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc
- Predict correctly the expected performance of various sensors
- Locate different type of sensors used in real life applications and paraphrase their importance
- Set up testing strategies to evaluate performance characteristics of different types of sensors and transducers and develop professional skills in acquiring and applying the knowledge outside the classroom through design of a real-life instrumentation system.

Syllabus:

[18 L]

1) **Mechanical and Electromechanical sensor:**

Definition, principle of sensing & transduction, classification. Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity. Strain gauge: Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature, adhesive, rosettes. LVDT: Construction, material, output input relationship, I/O curve, discussion.

2) **Capacitive sensors:**

Variable distance-parallel plate type, variable area- parallel plate, serrated plate/teeth type and cylindrical type, variable dielectric constant type, calculation of sensitivity. Stretched diaphragm type: microphone, response characteristics..

3) **Thermal sensors:**

Material expansion type: solid, liquid, gas & vapor Resistance change type: RTD materials, tip sensitive & stem sensitive type. Thermo emf sensor: types, thermoelectric power, general consideration, Junction semiconductor type IC and PTAT type.

4) **Magnetic sensors:** Sensor based on Villari effect for assessment of force, torque, proximity, Wiedemann effect for yoke coil sensors, Thomson effect, Hall effect, and Hall drive, performance characteristics. Radiation sensors: LDR.

Activity: Any-6

[18 L]

Based on chapter I

- 1) Linear displacement measurement using potentiometric sensor.

- 2) Displacement/pressure measurement using strain gauge sensor.
- 3) Linear displacement measurement using LVDT.

Based on chapter II

- 1) Capacitive type transducer measure small displacement/force varying plate area/distance of plate/dielectric constant.
- 2) Displacement/pressure measurement using microphone.
- 3) Liquid pressure measurement using pressure sensor

Based on chapter III

- 1) Measurement of temperature using RTD .
- 2) Measurement of temperature using Thermocouple transducer.
- 3) Silicon diode as temperature sensor

Based on chapter IV

- 1) Magnetic sensor/Hall effect/proximity sensor based measurement magnetic susceptibility magnetisation
- 2) LDR based measurement light intensity etc.

Reference books:

- 1) R Sensor & transducers, D. Patranabis, 2nd edition, PHI
- 2) Instrument transducers, H.K.P. Neubert, Oxford University press.
- 3) Measurement systems: application & design, E.A.Doebelin, Mc Graw Hill
- 4) Sensor & transducers, D. Patranabis, 2nd edition, PHI
- 5) Instrument transducers, H.K.P. Neubert, Oxford University press.
- 6) Measurement systems: application & design, E.A.Doebelin, Mc Graw Hill

T.Y.B.Sc. (Physics) (Sem-V)
PHY-3511 SEC (L): Physics Workshop Skill

Lectures: 36

(Credits-02)

Objectives:

This course is to get exposure with various aspects of instruments and their usage through hands-on mode.

Course outcomes:-

After completion of this course students will able to handle and test various instruments.

Syllabus:

Unit-1. Basic of Measurement:

4L

- Accuracy, precision, sensitivity, resolution, range etc.
- Errors in measurements and loading effects.
- Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter.

Multimeter:

- Block diagram and working of a digital multimeter.
- Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance.
- Specifications of a multimeter and their significance.

Unit-2. Electronic Voltmeter:

4L

- Principles of voltmeter, Construction (block diagram only).
- Specifications of an electronic Voltmeter and their significance.
- AC Milli Voltmeter: Type of AC Milli Voltmeters
- Block diagram ac Milli Voltmeter,
- Specifications and their significance.

Unit-3. Cathode Ray Oscilloscope:

5L

- Block diagram of basic CRO.
- Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only-no mathematical treatment),
- Brief discussion on screen phosphor, visual persistence & chemical composition.
- Time base operation, synchronization. Front panel controls.
- Specifications of a CRO and their significance.
- Use of CRO for the measurement of voltage (dc and ac frequency, time period.
- Special features of dual trace oscilloscope.
- Introduction to digital oscilloscope, Block diagram and principle and working.

Unit-4. Signal Generators and Analysis Instruments:

2L

- Block diagram, explanation and specifications of low frequency signal generators.
- Pulse generator, and function generator.

- Brief idea for testing, specifications. Distortion factor meter, wave analysis.

Unit-5. Impedance Bridges and Q-Meters:

3L

- Block diagram of bridge.
- Working principles of basic (balancing type) RLC bridge.
- Specifications of RLC bridge. Block diagram & working principles of a Q- Meter.
- Digital LCR bridges.

Activity: (Complete any activity of 18 L)

(18 L)

1. Use of Digital multimeter.(3L)
2. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance. (3L)
3. To observe the limitations of a multimeter for measuring high frequency voltage and currents. (3L)
4. Measurement of voltage, frequency, time period and phase angle using CRO. (3L)
5. Measurement of rise, fall and delay times using a CRO. (3L)
6. To measure Q of a coil and its dependence on frequency, using a Q- meter. (3L)
7. Measurement of distortion of a RF signal generator using distortion factor meter. (3L)
8. Measurement of R, L and C using a LCR bridge/ universal bridge. (3L)

Reference Books:

- 1) A text book in Electrical Technology - B L Theraja - S Chand and Co.
- 2) Performance and design of AC machines - M G Say ELBS Edn.
- 3) Digital Circuits and systems, Venugopal, 2011, Tata Mc Graw Hill. Logic circuit design, Shimon P. Vingron, 2012, Springer.
- 4) Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3, 2012, Tata Mc-Graw Hill
- 5) Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, Springer
Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

T.Y.B.Sc. (Physics) (Sem-V)
PHY-3511 SEC (M): Biomedical Instruments

Lectures: 36

(Credits-02)

Objectives

- Introduction to various bio-signals and their origin
- Understanding of electrode theory
- Use of transducers in biomedical instrumentation
- Patient safety while using biomedical instrumentation
- Instruments handling and analysis of the recorded data

Course Outcomes

- Students will acquire basic knowledge of biomedical instrumentation.
- Students can handle and operate different equipment's like ECG, Oxymeter, and Glucometer.
- Students will be able to record the different health parameters using it.
- Student will also able to analyze and interpret the recorded data.

Syllabus:

Unit-I: Physiological transducers

(7L)

- Introduction to physiological transducers
- Classification of Transducer
- Performance characteristic of transducer.
- Displacement, position and motion transducer.
- Pressure transducer for blood pressure measurement
- Transducer for Body temperature measurement
- Biosensors

Unit-II: Bioelectric signals and cardiovascular system:

(7L)

- Basics of signal measuring system
- Basic and essentials of biomedical instrumentation system.
- Heart and Cardiovascular system
- Resting and action potential, propagation of action potential, Passive and active conduction.
- Electro-conduction system of heart
- Blood Pressure measurement
- Heart Sounds, Phonocardiography
- Pulse oximetry

Unit-III: Electrocardiography:

(4L)

- Introduction and Principle
- Interpretation of Electrocardiogram
- Block diagram of electrocardiograph, ECG machine maintenance and trouble shooting
- The ECG leads
- Effect of artifacts on ECG recording

- Types of ECG recorders

Activities: (Any 6: 3 Lecture hours each)

(18L)

1. Study of ECG machine(Voltage gain , chart speed etc) and EEG placement of electrodes
2. ECG recording and analysis (Calculation of heart rate, measurement of peak amplitude and period of waves)
3. Study of analog sphygmomanometer and digital BP monitor – Measurement of SBP, DBP and pulse rate
4. Measurement of pulse parameter using pulse oxymetry /pulse measuring instrument
5. Use of biosensor (sugar level measurement / skin resistance).
6. To study Infrared sensor/ temperature gun and measuring values
7. Study of BMI/ body composition monitor and measurement of physiological parameters (BMI, % Body fat,
8. First aid for heart patient – study and practice
9. Study of Spirometer and practice for increasing lung capacity
10. Visit to established hospital

Reference Books:

1. Biomedical Instrumentation and Measurements (Second edition) - Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer Pearson education.
2. Handbook of Biomedical Instrumentation (Second Edition) - R. S. Khandpur (Tata McGraw Hill).
3. Biomedical Instrumentation and Measurement by Carr and Brown-Pearson.
4. Biomedical instruments and measurements (Second edition) - R. Ananda Natarajan Eastern economy edition
5. A textbook of Biomedical engineering edited - R.M. Kenedi, blackie (Glasgow & London)
6. Medical instrumentation: Application and design (Third edition)- John G. Webster, Willey India Education

Required Equipment with Probable cost:

1. Electro Cardiogram- ECG machine- analog- Rs. 30000/-
2. SPO₂ meter- Analog- Rs. 3000/-
3. Fat Meter- Digital- Rs. 4000/-
4. Sphygmomanometer – Digital and analog: Rs. 3000/- each
5. Glucometer- Digital: Rs.2000 each.

T.Y.B.Sc. (Physics) (Sem-V)
PHY-3511 SEC (N): Nondestructive Testing Techniques

Lectures: 36

(Credits-02)

Objective:

- To study and understand the various non-destructive testing (NDT) methods, and their industrial and scientific applications.

Outcomes:

- After completion of this course the students will be able to use NDT methods for defects and characterization of industrial components.

Unit No.	Topics	Lectures
I	Definition and objectives of NDT, introduction to materials testing, purpose of testing and properties of materials, classification of material testing, destructive testing and its examples only, Definition, Characteristics detected, principle, advantages, limitation and applications of various methods like Visual inspection, liquid penetrant testing, magnetic particle testing, thermography testing, eddy current testing, ultrasonic testing, acoustic emission testing, radiography testing,	6
II	What are the discontinuities, Types of discontinuities in materials? Processing the discontinuity, service induced discontinuity, factors for selection of NDT method in different cases of discontinuity, brief description of equipment used in visual testing method, Principles of liquid penetrant method, stages of liquid penetrant process, liquid penetrant process flow chart, chemical and solvent cleaning methods of surface preparation, how to apply and removal of excess penetrant?, application of developer, and observation of defects, penetrant, their types and properties, role of developer, their types, Magnetic particle testing method, procedure of Magnetic particle testing methods, portable magnetization equipment and stationary magnetization equipment, dry and wet particle inspection techniques and stages involved in it and its applications	6
III	Thermography testing, basics of infrared theory, range characteristics, wavelength, frequency, emission, convection, conduction, reflection, transmission, emissivity of infrared, basic principles of thermography testing, elements of infrared detection system, thermography testing active and passive approach, basics of eddy current testing, working principles of eddy current testing, stages in eddy current testing, factors influencing in eddy current testing, Ultrasonic testing and its methods (transmission and pulse echo method), Acoustic emission testing, factors influencing acoustic wave propagation and data acquisition, instrumentation of acoustic emission testing, Radiography testing, principle, various stages in testing, gamma ray radiography testing, SWSI and DWSI techniques in X ray testing, Fluoroscopy testing arrangement and working principle, Computed tomography in NDT	6

Activity: Any-6 demonstration activities from the followings (each activity will be equivalent to 3-hrs)

1. Video demonstration of any two NDT techniques
2. Study of different X ray photograph and MRI scan photographs in medicine
3. Study of NDT by acoustic method
4. Surface visual study of defects of various objects provided
5. Study of surface defects by liquid penetration method
6. Study of surface defects by liquid leak method
7. Study of surface defects by liquid spray method
8. Study of surface defects by using UV light and fluorescent liquid method
9. Visit to any industry and observing NDT method live (equivalent to two demonstrations)
10. Audio visual expert lecture of industrialist who is using NDT method for quality control.

Reference Books:

1. Non- destructive testing of materials, Dr V. Jaykumar, Dr. K. Elangovan, Lakshmi Publications, Tamilnadu, India.
2. Practical non-destructive testings, Baldev Raj, T. Jaykumar, M. Thavasimuthu, Narosa Publications
3. Basics of non-destructive testings, Lari and Kumar, S.K. Kataria& Sons publications
4. Non-destructive testing techniques, Ravi Prakash, New Age International Private Limited
5. Non-destructive test and evaluation of materials, J. Prasad, C.G.K. Nair, McGraw Hill Education

T.Y.B.Sc. (Physics) (Sem-V)
PHY-3511 SEC (O): Acoustics Applications

Lectures: 36

(Credits-02)

Objective:

To study and understand about sound physics, properties and their applications.

Outcomes:

After completion of this course the students will be able to use sound detection and characterization of sounds.

Syllabus:

Unit-1. Environmental Acoustics

(3 L)

- 1.1 Environmental Noise: sonic boom, aircraft flyover, foot-fall noise, slammed door
- 1.2 Weighted sound levels: Sound level meters, A-weighted & C-weighted sound level, Phon, Sone,
- 1.3 Noise rating: Community noise: Highway noise, Aircraft noise
- 1.4 Noise induced hearing loss: Chronic, Trauma.
- 1.5 Mufflers: Automobile, Silencers, Transmission loss,

Unit-2. Sound Reinforcement Systems

(5 L)

- 2.1 Microphones- Types, selection criteria, Professional grade, sensitivity, FM microphones
- 2.2 Loudspeakers- Direct Radiator type, Horn- Folded and Flared horn, Woofer, Squawker, Tweeter, Loudspeaker Cabinets- Enclosed cabinet, Open Cabinet, Bass Reflex Cabinet,
- 2.3 Amplifiers: Public Address systems, Gain and Bandwidth
- 2.4 Headphones- Noise cancellation features
- 2.5 Acoustic Delays
- 2.6 Synthesizers, Graphic equalizers, mixers
- 2.8 Basics of Audio Signal Processing
- 2.9 Monophonic and Stereophonic Systems

Unit-3. Musical Acoustics

(4 L)

- 3.1 Pitch, timbre, rhythm, intensity, loudness, consonance, dissonance, Bass, Treble, Harmonics and Overtones
- 3.2 Standing waves, interference, beats, harmony, melody
- 3.3 Octave: Musical Scales
- 3.4 Types of Musical Instruments: String - violin, guitar, Wind - Brass, Reed instruments, organ, Percussion - Drums, Tabla
- 3.5 MIDI - Musical Instruments Digital Interface
- 3.6 Audio file formats: MP 3 and MP 4 systems

Unit-4. Room Acoustics

(2 L)

- 4.1 Growth and decay of sound in live rooms
- 4.2 Sabine Equation, Reverberation time measurement methods
- 4.3 Room modes, Sound absorption materials
- 4.2 Speech Intelligibility: Articulation Test, Articulation Score

Unit-5. Acoustics in Medicine & Ultrasound

(2 L)

- 5.1 Audiometry and Hearing loss

5.2 Ultrasonography

5.3 Ultrasonic Transducers

5.4 Ultrasonic cleaning, Non Destructive Testing (NDT)

Unit-6. Underwater Acoustics

(2 L)

6.1 Speed of sound in sea water, Transmission loss

6.2 Sonar: Active and Passive Sonar

Activities: Any-6

[18L]

1. Frequency response of loudspeaker
2. Polar characteristics of a microphone
3. Study of Graphic Equalizer
4. Estimation and measurement of reverberation time
5. Expansion chamber mufflers Transmission Loss (TL)
6. Online calculators for Room Modes

Reference Books:

8. Fundamentals of Acoustics, L.E. Kinsler and A. R. Frey, Wiley Eastern
9. Audio and Video Systems, R. G. Gupta, Tata McGraw Hill, 2010
10. Acoustics, W.W. Seto, Schaum's Outline
11. Handbook of Sound Engineers, G.M. Ballou, Academic Press
12. Basic Acoustics, D.E. Hall, Oxford University Press
13. Design for good Acoustics and Noise Control, J.E. Moore, University Press

Semester-VI

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-361: Solid State Physics

Lectures: 36

(Credits-02)

1: The Crystalline Structures

(10 L)

Lattice, Basis, Translational Vectors, Primitive Unit Cell, Symmetry Operations, Different types of lattices: 2D and 3D (Bravais lattices) Miller indices, Inter Planer Distances, SC, BCC and FCC structures, Packing Fraction, Crystal structures NaCl, diamond, CsCl, ZnS, HCP, Concept of Reciprocal Lattice and its properties, Problems

2: X ray Diffraction and Experimental Methods

(9 L)

Bragg's Diffraction, Bragg's Law, Experimental X-ray diffraction Methods: The Laue Method, Bragg's Spectrometer, The Powder Crystal Method, Analysis of cubic structure by Powder Method, Ewald's Construction, Bragg's Diffraction condition in direct and reciprocal lattice, Problems

3: Free Electron and Band Theory of Metals

(9L)

Assumptions of Classical and Sommerfeld Free Electron model, Energy levels and Density of States (One and Three Dimensions), Nearly free electron model, Fermi energy, Fermi level, Hall Effect, Mobility, Hall Angle

Band Theory of Solids: Origin of energy gap, Energy bands in Solids, Distinction between metal, semiconductor and insulator, Problems

4: Magnetism

(8L)

Diamagnetism, Langevin theory of Diamagnetism, Paramagnetism, Langevin theory of Paramagnetism, Ferromagnetism, Antiferromagnetism, Ferromagnetic Domains, Hysteresis, Curie temperature, Neel temperature, **Superconductivity**, Problems

Reference books:

1. Solid State Physics S.O.Pillai, 6th Edition, New Age International (P) Ltd, Publisher, (2010).
2. Solid State Physics – Kakani S.L. and Hemrajani C, 4th Edition, S. Chand Publication (2005).
3. Fundamentals of Solid State Physics – B.S.Saxena, R.C.Gupta and P.N.Saxena, Pragati Prakashan, Meerut , Uttar Pradesh
4. Introduction to Solid State Physics- Charles Kittel, John Wiley and Sons, 7th Edition.
5. Solid State Physics- A.J.Dekker, Macmillan India Ltd, (1998).
6. Solid State Physics- R.K. Puri, V.K. Babbar, S. Chand Publication.
7. Elementary Solid State Physics Principles and Applications, M Ali Omar, Pearson Education, Inc. and Dorling Kindersley Publishing, Inc.(2006)
8. Problems and Solution in Solid State Physics-S.O. Pillai, New Age International (P) Ltd.
9. Solid State Physics, P.K. Palanisamy, Scitech Publications(India) Pvt Ltd, Chennai, 1st Edition (2004)
10. Solid State Physics: Essential Concepts, David W. Snoke, 2nd Edition, Cambridge University Press

1: Origin of Quantum Mechanics (08 L)

1. Historical Background: Black body radiation, photoelectric effects.
2. Matter waves - De Broglie hypothesis. Davisson and Germer experiment.
3. Wave particle duality
4. Concept of wave function, wave packet, phase velocity, group velocity and relation between them
5. Heisenberg's uncertainty principle with Electron diffraction experiment, different forms of uncertainty.
6. Different fields of applications of quantum mechanics
7. Problems

2: The Schrodinger equation (10 L)

1. Physical interpretation of wave function
2. Schrodinger time dependent equation.
3. Schrodinger time independent equation.(Steady state equation).
4. Requirements of wave function.
5. Probability current density, equation of continuity, and its physical significance.
6. An operator in Quantum mechanics, Eigen function and Eigen values.
7. Expectation value, Ehrenfest's theorem (Only statements)
8. Problems

3: Applications of Schrodinger Steady state equation (14 L)

1. Free particle.
2. Step potential.
3. Potential barrier. (Qualitative discussion). Barrier penetration and tunnelling effect.
4. Particle in infinitely deep potential well (one - dimension).
5. Schrodinger's equation in spherical polar co-ordinate system.
6. Rigid rotator (free axis).
7. Problems

4: Operators in Quantum Mechanics (4 L)

1. Hermitian operator.
2. Position, Momentum operator, angular momentum operator, and total energy operator (Hamiltonian).
3. Commutator brackets- Simultaneous Eigen functions.
4. Commutator Algebra
5. Commutator bracket using position, momentum and angular momentum operator
6. Concept of parity according to quantum mechanics, parity operator and its Eigen values.
7. Problems

Reference books:

1. Eisberg, Robert M., and Robert Resnick. *Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles*. Wiley, 1985. ISBN: 9780471873730.
2. Liboff, Richard L. *Introductory Quantum Mechanics*. Addison Wesley, 2002. ISBN: 9780805387148.
3. Griffiths, David J. *Introduction to Quantum Mechanics*. Upper Saddle River, Pearson Prentice Hall, 2005. ISBN: 9780131118928
4. Feynman, Richard P., Robert B. Leighton, and Matthew L. Sands. *The Feynman Lectures on Physics*. Addison Wesley, 1989. ISBN: 9780201500646.
5. P M Mathews and K Venkatesan, *A Textbook of Quantum Mechanics*, Tata McGraw Hill publication, ISBN : 9780070146174
6. N. Zettili, *Quantum Mechanics- Concepts and applications*, Wiley publication, ISBN: 978-0-470-02679-3
7. Ajoy Ghatak, S. Lokanathan, *Quantum Mechanics: Theory and Applications*, Springer Publication, ISBN 978-1-4020-2130-5
8. G Aruldas, *Quantum Mechanics*, Phi Learning Private Ltd., ISBN : 97881203363
9. Shankar, Ramamurti. *Principles of Quantum Mechanics*. Springer, 2008. ISBN: 9780306447907.
10. Gupta, Kumar & Sharma, *Quantum Mechanics*, Jai Prakash Nath Publications.

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-363: Thermodynamics and Statistical Physics

Lectures: 36

(Credits-02)

1: Transport phenomenon and Maxwell's relations: (9L)

Mean free path, Transport phenomenon, Viscosity, Thermal conductivity and diffusion.

Thermodynamic functions: Internal Energy, Enthalpy, Helmholtz function, Gibb's function,

Derivation of Maxwell Relations, Specific heat and latent heat equations, Joule Thomson effect (Throttling Process), Problems

2: Elementary Concepts of Statistics: (9L)

Probability, distribution functions, Random Walk and Binomial distribution, Simple random walk problem, Calculation of mean values, Probability distribution for large-scale N, Gaussian probability distributions, Problems

3: Statistical Distribution of System of Particles and Ensembles: (12L)

Specification of state of system, Statistical ensembles, Basic Postulates, Probability calculations, Behaviors of density of states, Thermal, Mechanical and general interactions

Micro canonical Ensemble (Isolated System), Canonical ensembles, simple application of canonical ensemble, Molecules in Ideal gas, Calculation of mean values in canonical ensemble.

Problems.

4: Introduction to Quantum Statistics: (6L)

Quantum distribution function, Maxwell-Boltzmann's statistics, Bose-Einstein Statistics, Fermi-Dirac Statistics, Comparison of the distributions. Problems.

Reference books:

- 1) Lokanathan, R.S. Gambhir, Statistical and Thermal physics
- 2) F. Reif, Fundamentals of statistical and thermal physics
- 3) A. Beiser, Perspectives of modern physics
- 4) B.B. Laud, Fundamental of Statistical Mechanics
- 5) R.B. Singh, A primer of Statistical Mechanics
- 6) Gupta, Kumar, Statistical Mechanics

1: Nuclear Structure, Properties and Radioactivity: (12 L)

Basic Concept of Nucleus:

- Composition, charge, size, density of nucleus(Revision)
- Nuclear Angular momentum,
- Nuclear magnetic dipole moment
- Electric quadrupole moment, Parity & symmetry,
- Mass defect and Binding energy, packing fraction,
- Classification of nuclei,
- Stability of nuclei (N Vs Z Curve) and problems.

Radioactivity:

- Radioactivity disintegration (concept of natural and artificial radioactivity, Properties of α , β , γ -rays, Laws of radioactive decay, half-life, mean life, Specific activity and its units (Revision)
- Successive disintegration and equilibriums and radioisotopes.
- Radiocarbon dating
- Application of radioactivity (Agricultural, Medical, Industrial, Archaeological).
- Problems

Ref.(1) Ch.(2,3), Ref.(3) Ch.(3, 6)

2: Particle Accelerator and Radiation Detectors: (06 L)

Particle Accelerators:

- Introduction and Classification
- Linear Accelerator (electron/proton LINAC)
- Cyclic Accelerator (Cyclotron)
- Particle Accelerators In India (Discussion only)

Ref.(1) Ch.(12)

Nuclear Detector:

- Classification of Nuclear Detectors
- Gas filled Detectors (G. M. counter)
- Solid state detectors (scintillation counter)
- Problems:

Ref.(2) Ch.(4), Ref.(3) Ch.(7, 15)

3: Nuclear forces and Nuclear Models: (09 L)

Nuclear Forces:

- Classification of Nuclear Forces
- Meson theory of nuclear forces,
- Properties Of nuclear forces, properties of deuteron system,

- Elementary particles,
- Quarks model for elementary particles
- Shell Model: Assumptions, Evidences, and Spin and Parity limitations.
- Liquid drop model: Assumptions
- Semi-empirical B.E. formula
- Problems:

Ref.(1) Ch.(9, 17, 18), Ref.(3) Ch.(18)

4: Nuclear Reactions and Reactor Theory:

(09 L)

Introduction to Nuclear reactions:

- Nuclear Reaction, Conservation laws (Revision)
- The Q-value equation, Exothermic and Endothermic reaction
- Compound nucleus
- Threshold energy
- Nuclear cross-section
- Nuclear fission , nuclear fusion stellar energy, chain reaction and critical mass,
- Nuclear reactor and its basic components, homogeneous and heterogeneous reactors, power reactor, fast breeders
- Nuclear Reactors In India (Discussion only)
- Problems.

Ref.(1) Ch.(14, 15), Ref.(3) Ch.(11, 13, 14)

Reference books:

1. Dr. S. N. Ghoshal, Nuclear Physics, Revised Edition, S. Chand Publication, 2014
2. D. C. Tayal, Nuclear Physics, Revised Enlarged Edition, Himalaya Publishing House.
3. K.S. Krane, Introductory Nuclear Physics, Wiley, India, 1988
4. B. L. Cohen, Concepts of Nuclear Physics, Tata McGraw Hill
5. I. Kaplan, Nuclear Physics, 2nd Edition, Narosa, New Delhi, 1989
6. S.B. Patel, Nuclear Physics: An Introduction, New Age International, 1991

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-365 (A): Electronics-II

Lectures: 36

(Credits-02)

1: Semiconductor Devices:

(9L)

- a. LED and Photodiode, Optocoupler. (Working Principles) Problems. Ref. 1.
- b. BJT: Transistor amplifier classifications - Class A, B, C and AB (working only), Differential amplifier (transistorized), Problems. Ref. 1.
- c. Field Effect Transistor: JFET (Introduction, classification, principle, working and IV characteristics) MOSFETs (DE-MOSFET and E only MOSFET). Problems. Ref. 1

2: Applications of Semiconductor Devices:

(9L)

- a. Three Pin Regulators: Block diagram of 3-pin IC regulator, study of IC-78XX, 79XX. Dual Power Supply using IC-78XX, 79XX. Ref. 1
- b. Switching Regulators (SMPS): Introduction, Block diagram, Advantages and Disadvantages. Ref. 4
- c. Modulation and Demodulation : Concept of Carrier Wave, Need of Modulation and Demodulation, Methods of Modulation like AM, FM, PM (Concepts Only),
- d. Concept of Modulation Index, Upper and Lower Side Band Frequencies in AM. Problems, Ref.3

3: Integrated Circuits:

(9L)

- a. Integrated Circuits: Introduction, Scale of Integration, Advantages and drawbacks of IC Ref.4
- b. OP-AMP Applications as Integrator, Differentiator, Comparator. Ref. 1
- c. Timer IC-555: Block diagram, Astable, monostable multivibrator (working and design). Problems, Ref. 1

4: Combinational and Sequential Circuits:

(9L)

- a. Combinational Circuits: Introduction to SOP and POS equation. Concept of Standard SOP and POS equation. Concept of K-map and their use in reduction of Boolean expressions, design of half adder, full adder, half subtract, Study of binary to gray and gray to binary code conversion. Problems. Ref. 2
- b. Sequential Circuits: RS flip flop using NAND/NOR, clocked RS, D, JK and T-flip flops. Application of flip flops in Sequential Circuits as Counters and Registers. Asynchronous and Synchronous Counters. (3-bit Counter), Shift Registers and their types of operation -SISO, SIPO, PISO, PIPO (Concepts only). Ref. 2

Reference books:

1. Malvino, Electronic Principles (6th Ed.), Tata McGraw Hill, New Delhi
2. R. P. Jain, Modern Digital Electronics (3rd Ed.), Tata McGraw Hill, New Delhi
3. B. L. Theraja, Basic Electronics - Solid State, S. Chand and Company, New Delhi
4. K. R. Botkar, Integrated Circuits, Khanna Publishers, Delhi

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-365 (B): Advanced Electronics

Lectures: 36

(Credits-02)

(Important Note: This course is designed for the student who has offered Electronics as one of the subjects at S.Y.B.Sc. level)

1: Sensors:

(9L)

Introduction to Sensors: Revision of temperature measurement and Pressure Measurement.

Motion sensors: Types of motions, Accelerometers' principles, Types of accelerometers, applications.

Optical sensors:

Photo detectors, Photo detector characteristics, photoconductive detectors, photo voltaic detectors, Photodiode detectors, photo emissive detectors.

Pyrometry: Thermal radiation, Broadband pyrometers, Narrowband pyrometers.

Optical sources: Conventional light sources, Laser light sources and principles.

Applications: Label inspection, Turbidity, Ranging.

2: Analog Signal Conditioning:

(11L)

Introduction to analog and digital signals: Analog Multiplexer and De-Multiplexer using Ic-4051, Ideal & Practical characteristics of Low Pass, High Pass, band pass and band reject filters. 2nd order active low pass and high pass filter using op-amp. Instrumentation amplifier using 3-OP-AMP, Application of Instrumentation Amplifier as thermocouple signal conditioning. Interpretation of integrator and differentiator as low pass and high pass filters respectively.

3: Digital signal conditioning:

(10L)

Digital Multiplexer and De-Multiplexer using NAND gate, Priority encoder using Ic-74148, Decoders: 2 to 4 decoder and 3 to 8 Decoder.

Signal Converters:

DAC: R-2R ladder type DAC, Binary weighted DAC.

ADC: Single slope ADC, Successive Approximation ADC, Flash ADC.

Data Acquisition System using 3-channels

4: Introduction to Process Control:

(6L)

Block diagram of Process control, Process control using ON-OFF controller, Op-amp and temperature sensor, Process control using Proportional Control Logic, Definition of Process LAG, and Problems.

Reference books:

1. C.D. Johnson, Process Control Instrumentation Technology, Pearson Education, 8th edition.
2. Krishna Kant, Computer Based Industrial Control, Eastern Economic Edition
3. Rangan, Mani, Sharma, Instrument of Device System
4. B. C. Nakra, K. K. Chaudhari, Instrument measurement and analysis

PHY-356: Elective-II

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-366 Elective-II (P): Medical Electronics

Lectures: 36

(Credits-02)

-
- 1: Introduction:** (9L)
- 1.1 Terminology of medical instrumentation,
 - 1.2 Physiological system of body
 - 1.3 Sources of bioelectric signals,
 - 1.4 Origin of bioelectric signals,
 - 1.5 Analysis of ECG pattern
 - 1.6 Nernst equation
 - 1.7 Various types of bioelectric signals,
 - 1.8 Basic medical instrumentation system,
- Problems
Ref: 1
- 2: Bio potential Electrodes and sensors:** (9L)
- 2.1 Electrode-electrolyte interface,
 - 2.2 Polarizable and non-polarizable electrodes,
 - 2.3 Electrodes for ECG, EEG, EMG,
 - 2.4 Resistive sensor
 - 2.5 Capacitive sensor
 - 2.6 Inductive sensor
 - 2.7 Piezoelectric sensor
 - 2.8 Temperature sensor
- Problems
Ref: 2
- 3: Amplifiers and Signal Processing:** (9L)
- 3.1 Introduction
 - 3.2 Basic amplifier requirements
 - 3.3 The Differential amplifier
 - 3.4 Common mode rejection
 - 3.5 Instrumentation amplifier
 - 3.6 Isolation amplifier
 - 3.7 Patient safety
 - 3.8 Cardiac monitor
- Problems
Ref: 2
- 4: Measurements of Pressure and Volume Flow of Blood:** (9L)
- 4.1 Direct measurements of blood pressure,
 - 4.2 Indirect measurements of BP.
 - 4.3 Heart sounds,

- 4.4 Phonocardiography,
 - 5.4 Ultrasonic blood flow meter
 - 5.5 Laser Doppler blood flow meter
- Ref: 1

Reference books :

1. Handbook of Biomedical Instrumentation, R.S. Khandpur
2. Medical Instrumentation application design, John G Webster, Houghon Mifflin Co.
3. Clinical Biophysics, P. Narayanan
4. Introduction to biomedical equipment technology J. Carr and John M. Brown
5. Introduction to Biomedical Electronics, Joseph DfuBovy, Mc Graw Hill.

List of Experiments: (Any Two)

1. Measurement of BP using Mercury sphygmomanometer and digital BP monitor
2. Study of ECG machine. Gain, chart speed arrangements and positioning electrodes
3. Recording of ECG and its analysis.
4. Absorbance using calorimeter/ Absorption spectra using Spectrophotometer.
5. Pulse oximetry. Measurement of SpO₂
6. Use of thermal scanner/Thermal gun
7. Study of glucometer as a sensor and measurement of BSL

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-366 Elective-II (Q): Physics of Nanomaterials

Lectures: 36

(Credits-02)

-
- 1: Introduction to nanomaterials:** (10 L)
- Introduction to Nano-sized materials and Structures
 - Significance of Nano-size
 - Properties of Nanomaterials: Mechanical, Electrical, Thermal and Optical properties
 - Classification of nanostructured materials
- 2: Methods for Synthesis of Nanomaterials:** (08 L)
- Bottom-up and Top-down approaches
 - Classification of Synthesis Techniques: Vapour phase and Liquid phase approach.
 - Synthesis Methods: Thermal Evaporation, Sputter deposition, Colloidal method, Sol-gel Method, Chemical Vapour deposition and Electrochemical Deposition.
- 3: Characterization techniques:** (08 L)
- Over view of structural characterization of nanomaterials by XRD
 - Microstructural characterization and elemental analysis of nanomaterials using Scanning electron microscopy (SEM) and Energy Dispersive Spectroscopy (EDS)
 - Structural characterization of nanomaterials using Transmission electron microscopy (TEM)
 - Optical characterization of nanomaterials using UV- visible spectroscopy
- 4: Special nanomaterials:** (04 L)
- Carbon nanotubes, their types and properties
 - Quantum dots and their properties
- 5: Applications:** (06L)
- Nanomaterials for application in Nano-electronics, Cosmetics, Medical, Biosensors Automobiles, Space, Sports, Cloth industry etc.
 - Nanomaterials for environmental pollution monitoring and reduction etc.
 - Nanomaterials for energy generation and storage

Reference books :

1. Nanotechnology: Principles and Practices by Sulbha Kulkarni, Capital Publishing Co. New Delhi.
2. Introduction to nanotechnology, by C. P. Poole Jr. and F. J. Ownes, Willey Publications.
3. Origin and development of nanotechnology by P. K. Sharma, Vista International publishing house.
4. Nanostructure and nanomaterials synthesis, Properties and applications, by G. Cao, Imperials College Press, London.
5. The chemistry of nanomaterials: Synthesis, properties and applications, C. N. R. Rao, A. Muller, A. K. Cheetham (Eds) Wiley VCH Verlag GmbH & Co, Weinheim, 2004.

List of experiments: (Any Two)

1. Synthesis of metallic nanoparticles by wet chemical method.
2. Synthesis of Metal Oxide Nanoparticle using different techniques.
3. Synthesis of silver nanoparticles from silver nitrate by colloidal solution method.
4. Study of optical absorption of nanoparticles.
5. Determination of crystallite size from X-ray diffraction spectra.

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-366 Elective-II (R): Microcontrollers

Lectures: 36

(Credits-02)

1: ARCHITECTURE OF 8051: [10L]

- 1.1 Comparison of Microprocessor and Microcontroller,
- 1.2 Intel 8051 Microcontroller: Block Diagram and Functions of each block, Pinout details, A and B CPU registers, Program status word (PSW) register, Program Counter, Data Pointer, Stack and Stack Pointer.
- 1.3 Memory Organization of 8051, Internal RAM, Register Banks, Special function registers, Internal ROM, I/O Ports and their functions, Oscillator and Clock.

2: 8051 ASSEMBLY LANGUAGE PROGRAMMING: [16L]

- 2.1 Introduction to 8051 Assembly programming, 8051 data types and assembler directives, Different Addressing modes, Concept of Unsigned and Signed numbers.
- 2.2 Instruction Set of 8051 microcontroller: Data Transfer instructions, Arithmetic Instructions, Logic and compare instructions, rotate instructions, Branch (Jump, Call RET) instructions.
- 2.3 Use of Instruction Set in Assembly Language Programming.

3: 8051 INTERRUPTS, TIMERS/COUNTERS AND SERIAL COMMUNICATION: [10L]

- 3.1 Interrupts and their vector structure, IE register, Interrupt priority in the 8051
- 3.2 Timers and Counters: Use of Basic Registers in Programming 8051 timers, Timer/ Counter Operation modes. Problems on Timer clock frequency and its Period.
- 3.3 Basics of Serial Data Communication, Types of Serial Data Communication, Concept of Baud Rate, RS 232 Standards, 8051 connection to RS 232, Functions of SBUF and SCON Registers.

Reference Books:

1. 8051 Microcontroller by Kenneth J. Ayala.
2. 8051 Microcontroller and Embedded Systems using Assembly and C by Mazidi and D Mac Kinlay, 2006 Pearson Education Low Price Edition.
3. 8051 Microcontroller – Hardware, Software and Applications by V Udayashankara, M S Mallikarjunaswamy, McGraw Hill Education (India) Pvt.Ltd, New Delhi.
4. Microprocessor and Microcontroller by R. Theagarajan, Sci Tech Publication, Chennai
5. Programming customizing the 8051 Microcontroller by Myke Predko, Tata McGraw Hill

List of Experiments : (Any Two)

Use Keil / Pinacle software for:

1. Addition of two 16 bit numbers
2. Multiplication of two 8 bit numbers.
3. Write a program to find largest/smallest number of N numbers in given block.
4. Memory block transfer from one location to another.
5. Find one's and two's complement of given number.
6. Subtraction two 8 bit numbers using two's complement method.

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-366 Elective-II (S): Lasers

Lectures: 36

(Credits-02)

-
- 1: Introduction to Lasers:** (8 L)
Brief history of Lasers, Interaction of radiation with matter, Energy levels, Population density, Boltzmann distribution, Stimulated Absorption, Spontaneous Emission and Stimulated Emission, Einstein's Coefficients, Einstein's relations.
Characteristics of Laser: Directionality, Mono-chromaticity, Coherence,
- 2: Laser Action:** (6 L)
Population inversion, Condition for light amplification, Gain coefficient, Active medium, metastable states.
Pumping schemes: three level and four level
- 3: Laser Oscillator:** (6 L)
Optical feedback, round trip gain, critical population inversion, Optical resonator, condition for steady state oscillations, cavity resonance frequencies.
- 4: Laser Output:** (3 L)
Line-shape broadening: Lifetime broadening, Collision broadening
- 5: Types of Lasers:** (7 L)
Solid State Lasers – Ruby Laser, Diode Laser, Gas Lasers – HeNe Laser, CO₂ Laser
- 6: Applications of Lasers:** (6 L)
Industrial: welding, cutting, drilling
Nuclear Science: laser isotope separation, laser fusion,
Medical: eye surgery

Reference books :

1. An introduction to Lasers - Theory and applications, M.N. Avadhanulu, S. Chand and Co. New Delhi
2. Experiments with He-Ne Laser by Sirohi
3. Optical fibre and Laser - Principle and applications, Anuradha De, New Age International Publishers,

List of Experiments: (Any Two)

1. Determination of wavelength of He-Ne Laser by transmission grating
2. Determination of Angle of prism (Pin and drawing paper)
3. Study of Lissajous figures using diode Laser and mirrors
4. Beam divergence of a Diode Laser.
5. Determination of the diameter of a thin wire using a laser.
6. Measurement of wavelength of Laser beam using Michelson Interferometer.
7. To study the interference of light using optical fibers
8. Measurement of the focal length of a given convex lens using a laser.

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-366 Elective-II (T): Astronomy and Astrophysics-II

Lectures: 36

(Credits-02)

-
- 1: Astronomical Scales:** (10 L)
Measurement of Astronomical Quantities, Astronomical Distances, Stellar Radii, Masses of Stars, Stellar Temperature, Measurement of Time, Sidereal Time, Apparent Solar Time, Mean Solar Time, Equation of Time, Astronomical Coordinate system (only introduction)
- 2: The Milky Way and Universe:** (8 L)
Basic Structure and Properties of the Milky Way, Active Galaxies, Quasars and Radio Galaxies, Hubble's law with equation, its significance, Concept of space time, fate of our universe, Multiverse (only introduction)
- 3: The Stellar Phenomenon:** (10 L)
Basic Composition of Interstellar Medium, Sun: Solar Cycle, Activity, Butterfly diagram, Photospheric phenomenon, Stars as distance estimators, Hydrostatic Equilibrium of a Star, Stellar models (only introduction).
- 4: Non-optical Astronomy:** (8 L)
Basic parameters of an antenna, various types of antennas. UV, IR, X-ray and Gamma ray Telescopes, Detectors for optical and infrared regions. Orbiting space based telescopes: HST, Chandra.

List of Reference Books:

1. Astronomy structure of the Universe, A. E. Roy and D. Clarke, Adam Hilger Pub.
2. Source Book of Space Sciences, Samuel Galsstone; D.Van Nostrand Co. Inc
3. Astrophysics - Stars and Galaxies, K.D. Abhyankar, Tata McGraw Hill Pub.
4. Textbook of Astronomy and Astrophysics with elements of cosmology, V.B. Bhatia, Narosa Pub.
5. Structure of the Universe, J.V. Narlikar
6. Astrophysics, Baidyanath Basu.
7. Astrophysical Techniques, third Edition, C. R. Kitchin
8. Fundamentals of Astronomy, Michael Seed
9. Telescopes and techniques, C. R. Kitchin (Springer)

List of experiments: (Any Two)

1. To determine the temperature of an artificial star.
2. To observe the Fraunhofer lines in sunlight and determine the elements present.
3. To obtain the solar image on the screen and trace out the existing sunspots.
4. To locate and observe the various stars, constellation, planets. (At least 2 observation of each)
5. To polar Align an astronomical telescope.
6. To study the solar limb darkening effect.

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-366 Elective-II (U): Renewable Energy Sources-II

Lectures: 36

(Credits-02)

1: Bioenergy and Biofuels:

(10L)

Bioenergy:

1. Introduction to Bioenergy
2. Basic Routs: Biochemical, Thermochemical, Transesterification
3. Biochemical- Biogas generation/methanation
4. Biogas plant: Floating gas holder and fixed dome type biogas plant, construction and working
5. Factors affecting on bio-digestion (list of factors).
6. Thermochemical: Pyrolysis, Gasification, Carbonization
7. Transesterification:
8. Comparative study of floating gas holder and fixed dome type biogas plant.
9. Working of downdraft gasifier.
10. Various methods to obtain energy from biomass.

Biofuel:

1. Introduction to Biofuels
2. Production of Biofuels (Jatropha and Sugar cane bagasse)

Ref 1: 7.1, 7.2, 7.2.1, 7.2.2, 7.4, 7.5, 7.6, 7.7, 7.8, 7.11, 7.23, 7.24.1

Ref 2: 10.3 (page no 374 to 380)

2: Wind Energy

(08L)

1. Introduction to wind energy.
2. Principles and components of wind energy conversion system.
3. Classification of wind machines: Horizontal axial machine and vertical axial machine.
4. Advantages and disadvantages of wind energy.
5. Wind data

Ref -1: 6.1, 6.2, 6.3, 6.5, 6.7, 6.8

3: Other Energy Sources:

(08L)

1. Introduction to tidal and geothermal energy.
2. Tidal energy: methods of utilization of tidal energy.
3. Advantages and disadvantages of tidal power generation.
4. Geothermal energy: Geothermal sources and energy conversion.
5. Advantages and disadvantages of geothermal energy.
6. Introduction to Thermocell

Ref -1 (9.3), pages from 510-532),

Ref -1 (8), pages from 443, 470-476, 477) Ref -1 (11), pages from 609-657)

4: Energy Management:

(10L)

1. Introduction to Energy Management (Definition, Principles etc)
2. Need of Energy Saving and Management
3. Different strategies of Energy Management
4. Role of Energy Managers and Auditors,

5. Energy Audit Measurements and Instruments, and Preparation of Energy Audit Report (in brief).
6. Case studies of Energy Audit & Management (e.g. Industries & Green Buildings, Boilers, Furnaces, Refrigeration and Air conditioning, Cogeneration, Waste Heat recovery, Electric motors, Pumping systems, Fans and blowers, Cooling Towers, Industrial/Commercial Lighting system, BEE Star rated equipment) any one.

Ref- 4 to 12 - Use any book for reference

Reference books:

1. Non-conventional Energy Sources, G. D. RAI (4th edition), Khanna Publishers, Delhi.
2. Solar Energy, S.P. Sukhatme (second edition), Tata Mc Graw Hill Ltd, New Delhi.
3. Solar Energy Utilisation, G. D. RAI (5th edition), Khanna Publishers, Delhi.
4. Energy Management: W.R.Murphy, G.Mckay (Butterworths).
5. Energy Management Principles: C.B.Smith (Pergamon Press).
6. Efficient Use of Energy: I.G.C.Dryden (Butterworth Scientific)
7. Energy Economics -A.V.Desai (Wiley Eastern)
8. Industrial Energy Conservation: D.A. Reay (Pergammon Press)
9. Energy Management Handbook – W.C. Turner (John Wiley and Sons, A Wiley Inter science publication)
10. Industrial Energy Management and Utilisation –L.C. Witte, P.S. Schmidt, D.R. Brown (Hemisphere Publication, Washington)
11. Hand book of Energy Audit by Sonal Desai (Publisher Tata McGraw Hill.)
12. Energy Management and Conservation Handbook, Frank Kreith and Yogi Goswami, (CRC Press)

List of Experiments: (Any Two)

1. Fuel value of wood/charcoal.
2. Study of sensible heat storage using liquid.
3. Selective and Non-selective coatings – Determination of Selectivity ratio.
4. To do energy audit of home/society/college/industry and prepare a detail audit report.
5. Study and analysis of home Electricity Bill
6. Study of Power consumption of conventional tube light vs LED fitting

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-366 Elective-II (V): Acoustics-II

Lectures: 36

(Credits-02)

1: Microphones:

Carbon, Moving Coil and Condenser microphones: construction, equivalent circuit, expression for sensitivity (no derivation), constant pressure frequency response and sensitivity related problem-solving (6L)

2: Loudspeakers:

Direct radiator loudspeaker: construction, equivalent circuit, expression for efficiency (no derivation), acoustic power radiated; problem-solving relating to efficiency and acoustic power; Woofer, tweeter and squawker; Bass-reflex cabinet; Horn Loudspeakers: types, wave equation, cut-off frequency, folded horns, problem-solving relating to exponential horns and cut-off frequency (8L)

3: Sound systems, Recording and Reproduction:

Amplifier power specifications for auditoria: Power required for various applications, expression for power calculation; problem-solving related to power; Audio file formats: Lossy compressed (MP3, WMA), uncompressed (WAV, AIFF, AU); Dynamic range; Volume compressors, expanders, and limiters; Graphic equalizer; Monophonic and Stereophonic sound reproducing systems; Dolby Noise Reduction, Dolby Atmos (12L)

4: Environmental Acoustics:

Community noise criteria: Highway noise, aircraft flyover noise, sonic boom; Weighted sound levels: A-weighted sound level, C-weighting, Phon, Sone, Noise induced hearing loss: Trauma and chronic Hearing aids (6L)

5: Ultrasound: Ultrasound Transducers, Medical Ultrasound, Ultrasonography, Distance Measurement, NDT (4L)

Reference Books:

1. Fundamentals of Acoustics, L.E. Kinsler and A. R. Frey, Wiley Eastern
2. Audio and Video Systems, R. G. Gupta, Tata McGraw Hill, 2010
3. Acoustics, W.W. Seto, Schaum's Outline Series, McGraw Hill 1970
4. Handbook of Sound Engineers, G.M. Ballou, Academic Press
5. Basic Acoustics, D.E. Hall, Oxford University Press
6. Design for good Acoustics and Noise Control, J.E. Moore, Univ. Press
7. Consumer Electronics, S. P. Bali
8. Modern Electronics, A. B. Gupta, Books and Allied (P) Ltd

List of experiments (Any two):

1. Polar response of a microphone
2. Speaker response of a direct radiator loudspeaker
3. Graphic equalizer
4. Acoustic power of direct radiator loudspeaker using hemispherical array
5. Distance measurement using ultrasound transducer

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-367: Physics Laboratory-4A

Lectures: 36

(Credits-02)

(General Physics, Thermodynamics and Statistical Physics, Nuclear Physics and Quantum Mechanics)

(Any Eight)

GROUP-I: GENERAL PHYSICS (any FOUR)

1. Surface Tension of Mercury by method of Ripples.
2. Viscosity of Liquid by rotating cylinder method.
3. Coefficient of sound absorption
4. 'Y' by Cornu's Method
5. Hall Effect: To measure the Hall coefficient
6. Energy gap of a semiconductor
7. Study of XRD spectrum of any material.
8. Resistivity by Four probe method
9. Platinum resistance thermometer

GROUP-II: THERMODYNAMICS AND STATISTICAL PHYSICS (any TWO)

1. Determination of pressure coefficient of air by constant volume thermometer.
2. Verification of Stefan's fourth power law by bulb filament
3. Thermal conductivity by Forbes Method.
4. Thermal conductivity of rubber tube.
5. Thermal diffusivity of Brass.
6. Thermal and Electrical conductivity of Cu.

GROUP-III: NUCLEAR PHYSICS AND QUANTUM MECHANICS (any TWO)

1. Characteristics of G.M. tube
2. Inverse square law (γ -rays)
3. e/m by Thomson method
4. Determination of Planck's constant
5. Study of Gaussian distribution by G. M. tube.

Additional Activities (Any ONE)

- Demonstrations: Any 2 demonstrations equivalent to 2 experiments
- Study tour with report equivalent to 2 experiments
- Mini project equivalent to 2 experiments
- Computer aided demonstrations (simulations or animations)
(Any 2 demonstrations equivalent to 2 experiments)

*Note: Students have to perform **ten** experiments or **one** additional activities in addition to **eight** experiments mentioned above. Total laboratory work with additional activities should be equivalent to **ten** experiments.*

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-368: Physics Laboratory-4B

Lectures: 36

(Credits-02)

(Electronics (Essential) or Advanced Electronics, acoustics and Lasers, Optional Courses)

(Any Eight)

GROUP-I: ELECTRONICS (ESSENTIAL) (any TWO)

(For the students not offering advance electronics in theory courses)

1. Characteristics of JFET
2. Design and built astable multivibrator using IC 555/IC 741
3. Half adder /Full adder
4. Integrator and differentiator using IC 741
5. IC 723 as regulated power supply

GROUP-I: ADVANCED ELECTRONICS (any TWO)

(For the students offering advance electronics in theory courses)

1. Instrumental amplifier using three op-amps
2. Temperature controller using PT 100 / thermocouple /thermistor temperature sensors
3. Object counter (two digit)
4. Schmitt trigger
5. Study of LVDT

GROUP-II: ACOUSTICS AND LASERS (any FOUR)

1. Frequency response of loudspeaker (twitter, woofer, mid-range)
2. Study of interference by Quinck's method
3. Use of Ultrasonic interferometer to measure velocity of sound in liquids
4. Transmission loss using expansion chamber muffler.
5. Study of diffraction using a transmission/reflection grating (metal ruler)
6. Study of the characteristics of a laser beam.
7. Determination of the diameter of a thin wire using a laser beam.
8. ' μ ' By total internal reflection of light

GROUP-III: PRACTICAL FROM OPTIONAL COURSE (Any-2)

Additional Activities (Any ONE)

- Demonstrations: Any 2 demonstrations equivalent to 2 experiments
- Study tour with report equivalent to 2 experiments
- Mini project equivalent to 2 experiments
- Computer aided demonstrations (simulations or animations)
(Any 2 demonstrations equivalent to 2 experiments)

*Note: Students have to perform **ten** experiments or **one** additional activities in addition to **eight** experiments mentioned above. Total laboratory work with additional activities should be equivalent to **ten** experiments.*

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-369: Physics Project-II

Lectures: 36

(Credits-02)

Guidelines:

It is expected that,

1. The student does work equivalent to about 10 laboratory experiments throughout the semesters in the third year.
2. One bears in mind that the project work is a practical course and it is intended to develop a set of skills pertaining to the laboratory work apart from the cognition of students. Therefore, the guides should not permit projects that involve no contribution on part of student.
3. The project must have a clear and strong link with the principles of basic physics and/or their applications.
4. The theme chosen should be such that it promotes better understanding of physics concepts and brings out the creativity in the students.
5. The evaluation of the project work must give due credit to the amount of the project work actually done by a student, skills shown by the student, understanding of the physics concepts involved and the presentation of the final report at the time of viva voce.
6. The viva voce should be conducted at the time of evaluation of project work at least for twenty minutes per student. Extra care must be taken in the evaluation of projects done in a pair or group. Delegation of the work done by individuals must be sought from the students in such cases.
7. Any ready-made material used in the report (such as downloaded pages from the web) must be clearly referred to and acknowledged.
8. It is also recommended that a teacher will look after 4 projects at one time.
9. Any non-adherence to this norm should attract a penalty by way of deduction in the marks awarded to a student. It is recommended that the College will provide consumables/contingencies for every project, to the tune of Rs. 750 /- each. (*If the students paid extra fee other than laboratory fee then college will provide financial assistance for the Project work.)

The Project work shall consist of the following Criteria.

- 1) Working model (Experimental or Concept based simulation/Demonstration Related to Physics).
- 2) Understanding of the project.
- 3) Experimental Details.
- 4) Data collection and Data Analysis.
- 5) Innovation.
- 6) Outcomes/Result.
- 7) Conclusion.

Note: At the time of project practical examination, the candidate must submit the certified project report by the project in-charge and HOD. A candidate will be allowed to appear for the Project practical examination only if the candidate submits a project completion report duly certified by the project in-charge and Head of the department.

The Project work shall include:

Models based / Demonstrated Applications / Review articles / Simulation on PC on any concept in Physics / Comparative & differentiative study / Improvement in the existing experiment (Design and fabrication concept) / Extension of any regular experiments / Attempt to make experiment open-ended / Thorough survey of existing active components / devices, ICs, methods, means, technologies, generations, applications etc. / any innovative projects using the concept of Physics / Interdisciplinary areas.

Evaluation weightage:

- Semester End University Examination : 35 Marks
- Internal Examination: 15 Marks

Skill Enhancement Courses

Skill Enhancement Courses (SEC)

a) Selection of Skill enhancement courses

There are two skill enhancement courses (SEC) in 6th semester (PHY-3610 and PHY-3611). For 6th semester, there are four options available. The college has to select any one from the given four options. It is advised that college should not offer elective and skill enhancement course of same theme.

b) Teaching Learning process for Skill Enhancement Courses

Skill base courses are intended to explore the applications of physics knowledge. Learning in skill enhancement courses is largely experience based. The skill enhancement courses may be categorized as knowledge skill or technical skill. For knowledge skill courses one can use the conventional method for teaching along with problem solving, assignments seminars etc. For acquiring the technical skill, the students will get adequate 'hands-on' experience. The teachers may use demonstrations and activity-based learning techniques. On field visits, study tour and mini projects will enrich the learning experience of the students.

c) Assessment methods for skill enhancement courses

Continuous evaluation will be the best method for assessment of skill enhancement courses.

One can use tools like assignments, mini projects or activities, problems, etc and grade the students according to their performance. The internal assessment should have 50 % weightage.

The University examination may be conducted for the remaining 50%.

The University examination question paper should have adequate proportion of objective and subjective question.

d) List of Skill Enhancement Courses:

Semester-VI th	Semester-VI th
PHY-3610	PHY-3611
PHY-3610(W): Scientific Data Analysis using Python	PHY-3611(AA): Microcontrollers
PHY-3610(X): Solar PV System: Installation, Repairing and Maintenance	PHY-3611(AB): Instrumentation for Agriculture
PHY-3610(Y): Applications of Internet of things (IOT)	PHY-3611(AC): Radiation Physics
PHY-3610(Z): Calibration Techniques	PHY-3611(AD): Photography

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-3610 SEC (W): Scientific Data Analysis using Python

Lectures: 36

(Credits-02)

Pre-requisite	: Basic knowledge of computer programming (Python/c)
Mode of internal Assessment	: A small project analysing scientific data for visualization
Data sets may include	: Pollution Data, Rain data, Astronomical data, any scientific data Related to Physics or science in general
Sources of Data sets	: MERI, Nashik, AIUCAA Pune, NASA or similar 1. Website for competition: https://www.kaggle.com/ 2. Google dataset: https://datasetsearch.research.google.com/ 3. Data for visualization and dataset resources: https://dev.to/aspittel/my-favorite-data-visualization-and-dataset-resources-35kp Other potentially useful searches: 1. https://bigdata-madesimple.com/70-amazing-and-free-data-sources-for-data-visualization/ 2. https://eduinpro.com/blog/data-sets-for-data-visualization-projects-datascience/

Learn how to analyse data using Python. This course will take you from the basics of Python to exploring many different types of data. You will learn how to prepare data for analysis, perform simple statistical analyses, create meaningful data visualizations, predict future trends from data, and more

Student will learn how to:

- Import data sets, access different elements of data frames.
- Understand the functions available in existing Python modules.
- Understand the utility of functions available in NumPy and Pandas library.
- Clean and prepare data for analysis
- Manipulate pandas Data Frame
- Understand awareness with different types of basic charts and functions in matplotlib library
- Get exposure to visualization techniques from seaborn library
- Build data pipelines

Data Analysis with Python is delivered through lecture, hands-on labs, and assignments. It includes following parts:

- Data Analysis libraries: will learn to use Pandas Data Frames, Numpy multi-dimensional arrays, and SciPy libraries to work with a various datasets. We will introduce you to pandas, an open-source library, and we will use it to load, manipulate, analyze, and visualize cool datasets. Then we will introduce you to another open-source library, scikit-learn, and we will use some of its machine learning algorithms to build smart models and make cool predictions.

Outcome of the course

- Know basic notions and definitions in data analysis.
- Know standard methods of data analysis and information retrieval.
- Be able to formulate the problem of knowledge extraction as combinations of data filtration, analysis and exploration methods.
- Be able to translate a real-world problem into mathematical terms.

Syllabus:

Unit No.	Topics	Lectures
I	Data Structures, modules and Importing Datasets Lists: Creating list, accessing list elements, functions for lists, programming with lists Tuples: Creating Tuples, accessing list elements, functions for Tuples, programming with Tuples Dictionary: Creating Dictionary, accessing list elements, functions for Dictionary, programming with Dictionary. In Built modules : Math module, random Module, Array module, string Module etc	6
II	Core libraries in Python NumPy Library for Arrays Pandas Library for Data Processing Basics of data frames, create, adding/ deleting of rows, columns to data frames Import of data, functions of data frames Data Normalization Sets, data extraction using relational, logical operators. Group by functionality, missing values	6
III	Summarizing the Data Frame and visualization Matplotlib Library for visualization: Pie chart, violin plot, scatter plot, histogram, bar chart, area plot. Seaborn Library for Visualization: Box plot, point plot, line plot, count plot, bar plot, strip plot, scatter plot and Regression Plot	6

Activity: Hands on data Analysis and Visualization with Pandas**[18L]**

Note: For Internal assessment students will either do 8 activities related to data analysis and visualization on particular dataset or will carry out small project on analysis or visualization using science (preferably physics) related dataset.

Reference Books:

- Python Programming: Using Problem Solving Approach- Reema Thareja.
- Let us Python - Aditya Kanetkar
- Learning with Python - Allen Downey
- Data Analytics - Bharti Motwani

T.Y.B.Sc. (Physics) (Sem-VI)

PHY-3610 SEC (X): Solar PV System: Installation, Repairing and Maintenance

Lectures: 36

(Credits-02)

Objectives:

1. In this skill oriented course, student will study basics of solar photovoltaic (PV) cells, modules, and system components.
2. Design and sizing of off-grid PV system for homes, apartments as well as commercial offices.
3. Understanding energy conversion from sunlight to electricity, and working with solar conversion equipment.
4. This Course will hands on experience needed to become self-employed.

Outcomes:

1. Learn basics of light conversion in electricity.
2. Hands on training will motivate to use Solar PV system.
3. Become entrepreneur / self-employed.
4. Analyzed of MSEB electricity bill and design and sizing of off-grid PV system
5. Participants will learn about solar PV module and batteries used in solar PV plant.

Syllabus:

Unit-1: Introduction

(6L)

The Sun, Earth, and Renewable Energy, Photovoltaic Effect, Working of Solar cell, Types of Solar cell, PV Modules and Arrays, Module Parameters, Sunshine and Shadow, tracking mechanism, Aligning the Array.

Unit-2: Solar Radiations and Measurement

(6L)

Introduction, Solar Constant, Solar Radiation at the Earth Surface, Need of Solar Radiation Measurement, Instruments For The Measurement of Solar Radiation, Pyrheliometer, Pyranometer, Sunshine Recorder, Sun Meter or Lux Meter

Unit-3: Basics Solar PV Systems

(6L)

Basics types of PV Systems On grid and off grid, DC to AC Conversion, Building-integrated Photovoltaics, Engineering and Architecture, Balancing of PV system. System Components, Batteries, Charge Controllers, Inverters, Hybrid Systems, System Sizing, Applications of off grid PV System.

Activity:

(18L)

1. Estimate the value of the Solar Constant.
2. Study of intensity variation on the performance of PV module.
3. Study of series and parallel combination of the PV modules.
4. Measurement of Solar radiation measurement using Sunmeter and Pyranometer.
5. Analysis of MSEB electricity bill.
6. Energy Farm/PV Plant visit report.

Reference books:

1. Solar Energy, S.P. Sukhatme (second edition), Tata Mc.Graw Hill Ltd, New Delhi.
2. Solar Energy Utilisation, G. D. RAI (5th edition), Khanna Publishers, Delhi.
3. Electricity from Sunlight, An Introduction to Photovoltaics, Paul A. Lynn, John Wiley & Sons, Ltd.
4. Solar Electricity, 2nd edition, T. Markvart, John Wiley & Sons, Ltd.
5. Solar Photovoltaic Basics, White Sean, Taylor & Francis Ltd.

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-3610 SEC (Y): Applications of Internet of Things (IOT)

Lectures: 36

(Credits-02)

Objectives:

- To introduce the terminology, technology and its applications
- To introduce the concept of M2M (machine to machine) with necessary protocols
- To introduce the C# Language which is used in many IoT devices
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of web based services on IoT devices

Learning Outcomes :

- a) IOT concepts
- b) IOT Standards
- c) Components of IOT System.
- d) Relevance of IOT for the future.
- e) IOT Applications.
- f) IOT for smart cities (Case study Smart city Barcelona)
- g) IOT in Indian Scenario
- h) Challenges in IOT implementation.

This subject does not have the intention of being a comprehensive course about the technologies involved in IOT. The focus will be more on the possibilities offered by the different technologies, and on the creative thinking techniques to find innovative applications of combinations of such technologies in real-life scenarios. Some presentations will also be scheduled in which people from industry will make presentations about selected topics related to the IoT. The Internet of Things (IoT) is a course about the new paradigm of objects interacting with people, with information systems, and with other objects. The course will focus on creative thinking and on hands-on project development. The duration of the course is 30 hours. Will be a mix of 75 minutes session and 2 hours session. Lab will be for 5 hours.

Future Scope:

It is a system of interrelated computing devices, digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. Internet of Things

What Internet of Things can do?

3. Medical Check-up Health Devices Operational Efficiency Medical Report Health Sector
4. Advanced Kitchen Automatic Parking Remote Home Control Security System Smart Home
5. Wi-Fi Connectivity Traffic Control Security System Advanced Parking System Smart City
6. Advanced Power Supply Manufacturing Bill Payment Planning Industrial Automation
7. Let's Take an Example of Internet of Things

● Renewal Energy Source. ● Automatic wearing suit. ● Next Gen way to fly. ● Speech Recognition. ● Perfect example of AI. ● Advanced GPS.

Syllabus:

Unit-1: Introduction to Internet of Things

[4L]

Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols,

Unit-2: IOT Concepts and introduction

[5L]

- i) Technologies that led to evolution of IOT
- ii) IOT and SCADA
- iii) IOT and M2M
- iv) IOT and Big Data
- v) Requirement of international standard (case study)
- vi) IOT standards in practice.
- vii) Operating platforms /systems

Unit-3: IOT Applications.

[4L]

- i) Lighting as a service (case study)
- ii) Intelligent Traffic systems (case study)
- iii) Smart Parking (case study)
- iv) Smart water management (case study)
- vi) IOT in Indian Scenario

Unit-4: Introduction to C#

[5L]

Language features, commands , functions of C#, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling.

Activity: Case Studies (Any two)

[18 L]

- i) Lighting as a service (case study)
- ii) Intelligent Traffic systems (case study)
- iii) Smart Parking (case study)
- iv) Smart water management (case study)
- v) IoT for smart cities (Case study Smart city Barcelona)

Reference books:

1. Internet of Things – A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
3. The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World Paperback – 26 March 2015 by Michael Miller.

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-3610 SEC (Z): Calibration Techniques

Lectures: 36

(Credits-02)

Objective:

- To make students familiar with the constructions and working principle of different types of Instruments
- To make students aware about the measuring instruments and Calibration of Instrument

Course Outcomes: At the end of the course, a student will be able to:

- Calibrate hydraulic, pneumatic and mechanical measuring and control equipment: setting, adjustment, validation or verification of mechanical, pneumatic, hydraulic, measuring and control instruments using reference standards in accordance with predetermined procedures.
- Calibrate electrical and electronic measuring and control equipment: setting, adjustment, validation or verification of electrical, electronic measuring and control instruments using reference standards in accordance with predetermined procedures.
- Carryout maintenance activities on instrumentation and control panel.

Syllabus:

Unit-1: Principles of Calibration

[4 L]

1. Introduction and Importance of Calibration
2. Traceability in Calibration
3. Calibration Uncertainty
4. Various Calibration Methods
5. Factors Affect Calibration
6. Instrument Classification and Instrument Identification

Unit-2: Pressure Calibration

[6L]

1. Introduction to pressure calibration
2. Pressure unit conversion standards
3. Types of Pressure Gauges
4. Calibration of Pressure Gauges
 - a. Accuracy
 - b. Pressure Media
 - c. Contamination
 - d. Height Difference
 - e. Leak test of Piping
 - f. Adiabatic Effect
 - g. Torque Force
 - h. Calibration Position
 - i. Generating Pressure
 - j. Pressurizing the Gauge
 - k. Reading the Pressure Value
 - l. Number of Calibration Points
 - m. Hysteresis (deviation of calibration points)
 - n. Number of Calibration cycles
5. Instruments required for calibration:
 - a. Pressure comparator
 - b. Master Gauge
6. Pressure Calibration with Example

Unit-3: Calibration of Electronic Instruments

[4L]

1. Identification of Components
2. Equipment required for calibration
3. Procedure of Calibration
 - a. Read operational Specifications
 - b. Sequence of events
 - c. Identification of common Faults
4. Electronic Calibration with Examples (Oscilloscopes, Multimeters, Function Generators, Signal Generators)

Unit-4: Temperature Calibration

[4L]

1. Temperature units and Conversions
2. Temperature Sensors
3. Calibration of temperature sensors
 - a. Handling temperature sensor
 - b. Preparations
 - c. Temperature sources
 - d. Reference Temperature Sensor
 - e. Immersion Depth
 - f. Stabilization
 - g. Temperature sensor handle
 - h. Calibrated temperature range
 - i. Calibration Points
 - j. Adjusting/trimming a temperature sensor
4. Examples:

Activity: Any-6

[18L]

Calibration of a dial thermometer

- 1) RTD calibration check
- 2) Temperature controller loop
- 3) Calibration of pressure Transmitters
- 4) Calibration of pressure switch
- 5) Level calibration Instrument
- 6) Liquid head measurement
- 7) Calibrating a differential pressure level transmitter
- 8) Calibration of top pan balance
- 9) Calibration of digital balance
- 10) Calibration of PH/Conductivity meter
- 11) Calibration of Volt meter
- 12) Calibration of Current meter
- 13) Calibration of Oscilloscopes
- 14) Calibration of Function Generators

Reference Books :

- 1) **Calibration:** A Technician's Guide - Mike Cable
- 2) Measurement and Control Basics -Thomas A. Hughes
- 3) Measurement and Control of Liquid Level - Chun H. Cho
- 4) A Practical Book On Calibration Of Analytical Instruments - Dr S Jain ,
- 5) Calibration Handbook of Measuring Instruments - Alessandro Brunelli

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-3611 SEC (AA): Microcontroller

Lectures: 36

(Credits-02)

Objective:

- To make students familiar with the constructions and working principle of microprocessor
- To make students aware about microprocessor

Outcome: After successful completion of this course students are supposed to develop their own applications/ mini/ tiny projects using microcontroller.

Syllabus:

Unit-1. ARCHITECTURE OF 8051:

[05]

Microprocessor and Microcontrollers a short comparison, Overview of the 8051 family, Block diagram of Microcontroller, Functions of each block, Pin details of 8051, A and B CPU registers, Flags and Program status word (PSW), Program Counter (PC) and Data Pointer register (DPTR), Internal RAM, Stack and Stack Pointer, Special function registers, Memory Organization of 8051, Internal ROM, I/O Ports, Oscillator and Clock

Unit-2. 8051 ASSEMBLY LANGUAGE PROGRAMMING:

[05]

Introduction to 8051 Assembly programming, Assembling and running an 8051 program, 8051 data types and directives, Jump, loop, and call instructions, 8051 I/O programming, Addressing modes, arithmetic and logical instructions and programs, Signed number concepts and arithmetic operations, Logic and compare instructions, Rotate instructions, BCD, ASCII, and other application programs.

Unit-3. Timers/ Counters and Interrupt programming:

[04]

Timers of 8051, TMOD and TCON registers, Programming timers 0 and 1 in 8051, counter programming, 8051 interrupts, Interrupt priority in the 8051, and Application programs using interrupts.

Unit-4. INTERFACING TECHNIQUES

[04]

Key/ keyboard (push button) interfacing, interfacing a LCD display, interfacing an ADC and LM35 temperature sensor.

Activity: any-3

[18L]

1. Use of Kiel/ Pinnacle/AVR (Atmel processor family) Studio/IDE (Integrated development environment) or any other suitable IDE.
2. Use of IDE/Software the students are supposed to run basic programs of their own. (Arithmetic, logical, Data manipulation, Data transfer/I-O Port related etc.)
3. Single key / Keyboard Interfacing.
4. ADC/DAC Interfacing.
5. Mini Project (Water level controller, Electronic Thermometer etc.)

Reference Books:

1. 8051 Microcontroller by Kenneth J. Ayala.
2. 8051 Microcontroller and Embedded Systems using Assembly and C - Mazidi, Mazidi and D MacKinlay, 2006 Pearson Education Low Price Edition.
3. Microprocessor and Microcontroller by R.

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-3611 SEC (AB): Instrumentation for Agriculture

Lectures: 36

(Credits-02)

Objectives:

After completion of this course students can

1. Get knowledge of sensors used in agriculture field
2. Learn continuous and batch process
3. Learn greenhouse automation schemes
4. Learn Instrumentation in Irrigation

Course Outcomes:

After completion of this course student will

1. Able to test soil and water parameters.
2. Able to develop their own juice extract plant.
3. Able to developed their own green house

Syllabus:

Unit-1: Introduction

[02L]

Necessity of instrumentation and control for agriculture, sensor requirement, remote sensing, bio sensors in agriculture.

Unit-2: Soil Properties & Sensing

[04L]

Properties of soil: fundamentals definitions and relationship, index properties of soil, permeability & seepage analysis, shear strength, Mohr's circle of stress, active & passive earth pressures, stability & slopes,

Sensors: introduction to sonic anemometers, hygrometers, fine wire thermocouples, open & close path gas analyzers

Unit-3: Instrumentation in Continuous & Batch process

[04L]

Flow diagram of sugar plant, sensors & instrumentation setup, Flow diagram of fermenter & control (batch process), flow diagram of dairy industry & instrumentation setup for it, Juice extraction control process & instrumentation setup.

Unit-4: Instrumentation in Irrigation

[04L]

Water distribution and management control, Auto drip and sprinkler irrigation system, upstream & downstream control concept, SCADA for DAM parameters & control.

Unit-5: Greenhouse Parameters & Instrumentation

[04L]

Greenhouse effect, Concept and construction of greenhouse, merits & demerits, ventilation, cooling & heating, wind speed, temperature & humidity, soil moisture, rain gauge, carbon dioxide enrichment measurement & control, Leaf area length *evapotranspiration*, temperature, wetness & respiration measurement & data logging, electromagnetic radiations photosynthesis.

Activity : any-6

[18L]

- 1) Measurement of water holding capacity of soil.
- 2) Measurement of soil texture.
- 3) Measurement of moisture contain in soil.
- 4) Micronutrients analysis of soil.
- 5) Measurement of physical properties of soil. (Color, odder, texture etc.)
- 6) Measurement of Chemical properties of soil (pH, chloride, Oxygen, Sulphur etc. contain in soil)
- 7) Measurement of Biological properties of soil (Fungi, Bacteria)
- 8) Air quality measurement.

- 9) Analysis of Residues in fruits.
- 10) Visit to green house.
- 11) Visit to Sugar industry/Juice extract plant/ dairy industry

Reference books:

1. Industrial instrumentation, “Patranabis”, TMH.
2. Instrumentation handbook-process control, “B.G. Liptak”, Chilton.
3. Process control and instrumentation technology, “C.D. Johnson”, PHI
4. Wills B.A., “ Mineral Processing Technology”, 4th Ed., Pergamon Press
5. Principle of Farm Machinery, R.A Kepner, Roy Bainer;: CBS Publication
6. Agricultural Engineering; Radhey Lal: Saroj Publication
7. Environmental Engineering, Peary. II. S. and others

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-3611 SEC (AC): Radiation Physics

Lectures: 36

(Credits-02)

Course Objectives:

1. Students should understand the mechanism of interaction of various types of radiations with matter.
2. Students should get acquainted with principles of Measurement radiation levels, design principles and actual implementation of variety of radiation detectors.
3. Students should learn about standards regarding safety levels laid down by National and International agencies, methods adapted to maintain safety standards in various places and methods of shielding.
4. Students should study the applications of radiations in various fields.

Course outcomes:

1. Students can use the knowledge in the applications of Radiation Physics in the fields like radio carbon dating, medical diagnostic tools.
2. Students acquire skill in operating different types of radiation detectors to detect and measure radiation levels in different places.
3. Students can work as advisers in maintenance of radiation safety standards and following of strict protocols at various places like Hospitals, Industry, and Laboratories etc.
4. Students become able to employ their skills to develop applications of radio activity in the fields like agriculture, industry, hospitals etc.

Syllabus:

Unit No.	Title and Contents	Lectures
I	Interaction of Radiation with Matter Interaction of different types of radiation with matter-Ionizing & Nonionizing radiations, excitation, ionization, radioactive losses-Energy loss by collision, range energy relation, Bethe-Bloch formula collision stopping power, radiation stopping power, Straggling.	3
II	Radiation Detectors Characteristic curve of Gas-filled detectors. Ionization chamber, Proportional counter, Gas filled detectors (G. M. counter), Characteristics of organic and inorganic scintillation detectors, Scintillator detector, Semiconductor detector.	3
III	Radiation units and Measurement of radiation exposure Units for radiation exposure- Roentgen, Becquerel, Gray, Sievert, RAD, REM, KERMA. Radiation exposure, Absorbed Dose, Equivalent Dose, Effective Dose, Ambient and directional equivalent dose, Relative biological effective dose, Quality factor, Personal dosimeters, Film badge dosimeters, Thermo luminescent dosimeter.	3
IV	Radiation Sources and Radiation Shielding Natural & Artificial radioactive sources, Alpha, Beta, Gamma Sources, Basic concept of radiation shielding, linear and mass absorption coefficient, stopping power, materials for shielding of gamma and neutron, shielding interaction cross section.	3

V	Radiation Protection: Time, Distance, Shielding, Radiation Protection and Safety rules as per the regulatory guidelines of the Government of India, Safety codes for handling radioactive sources. Monitoring of radiation levels around an open radioactive source, ICRP, NCRP, AERB recommended limit.	3
VI	Radiation Applications: Radioactive pharmaceuticals and labelled compounds. Radioactive nuclei used in diagnostic applications. Applications of gamma-rays in sterilization of medical instruments, medication items and preservation of food.	3

Activity: any-6

[18L]

1. Study the different types of radio isotopes and their applications in medical field.
2. Study use of isotopes in radiocarbon dating.
3. Study of working of G. M. Counter.
4. Study of G. M. Counter characteristics – Dead Time and End point energy.
5. Study of commercially available portable, handy radiation detectors.
6. Survey of various places to measure radiation levels
7. Visit to hospitals and other such locations for measuring radiation exposure.
8. Visit to industrial areas to measure radiation exposure levels
9. Study of various shielding materials and their stopping power.
10. Study of dependence of radiation stopping power of materials on physical properties of materials
11. Study of protocols followed by various units to follow safety measures
12. Visit to food industry using preservation techniques using nuclear radiations.
13. Visit to pharmacy industry producing radioactive compounds.
14. Visit to diagnostic centres which employ radiation sources

Reference books:

1. Nuclear and Radiation Physics in Medicine. Tony Key. World Scientific. 2014
2. Introduction to Radiological Physics and Radiation dosimetry. Frank H. Attix. Wiley. 1986
3. Medical Physics by Glasser O, Vol 1, 2, 3 Year Book Publisher Inc Chicago.
4. Radiation Protection and Health Science. Marilyn E. Noz. World Scientific. 2007.
5. Introduction to Radiation Protection. Grupen C. Springer. 2008.
6. Radiation Physics for Medical Physicists. Podgorsak Ervin B. Springer. 2005.
7. Techniques for Nuclear and Particle Physics experiments. Leo. W. R. Springer. 2005.

T.Y.B.Sc. (Physics) (Sem-VI)
PHY-3611 SEC (AD): Photography

Lectures: 36

(Credits-02)

Objectives:

- To create general awareness and interest in photography process.
- To make students familiar with the Photographic equipment and handling techniques.
- To help students to learn basic photographic and image processing skills.

Course Outcomes: After successful completion of this course, student will be able to

- Understand the basic principle, structure and handling techniques in digital photography.
- Students will be able to develop and apply photographic skills using digital photography tools including digital editing, saving, sizing, and posting of the images
- Student gets proficient at the technical aspect of photographing with a digital camera.
- Students can identify and apply appropriate business practices specific to the self-employed professional photographer

Syllabus:

Unit No.	Topics	Lectures
I	Introduction of Photography: Introduction: History & Development of photography, Principles, functions and structure of camera, Indoor and outdoor lighting techniques; Background selection; Flash and its features. Black & White v/s Digital camera (Limitation & advantages) Types of Camera: Pinhole camera, Box camera, SLR camera, Studio camera, Digital camera.	6
II	Camera Control and Exposure: Camera Controls: Need for camera controls. Apertures, Depth of field and depth of focus. Shutters (Ideal, leaf and focal plane shutter). Shutter speed (slow and fast). Auto focus, Manual focus and Image stabilization Camera lenses & Exposure: Normal, Wide angle, Telephoto and Zoom range, Incident and reflected light, Exposure triangle, Exposure and equivalent exposures, Brief idea of exposure meter (TTL and Flash meter).	6
III	Colour Theory & Digital Camera: Colour Theory: Classification and use of colours in photography, Construction of colour enlarger, Colour Head, sources of light and filters used in a colour enlarger Digital Camera: Types of Digital Camera and its features, Memory Chip card, Creative shots, Settings in the Digital Camera - Handling methods; White balance, Maintenance of camera. Digital camera sensors and its types.	6

Sr No	List of Practical's
1	To study the effect of aperture on depth of field
2	To study and recognize the use of slow and fast shutter speed
3	To study the effect of Exposure for different colour temperatures
4	To identify and determine the focal length of the different types of lenses
5	To study the Image Mixing, Image Cutting and Text Building Effect
6	To study Blurr Effect and Transformation Tools
7	To understand the effect of clip mask, photo filter and stamping Tool
8	To study the effect of natural light, tungsten light and fluorescent light on Photograph.
9	Lighting for still life (Earthen ware, Metal ware, Glass ware, Fruits, Crockery, Jewelry, Flowers, Food etc.)
10	Indoor shooting using three point lighting set up
11	Image processing 1: (Light room techniques 1): Brightness, saturation etc
12	Image processing 2: (Light room techniques 2): Exporting, contact sheet, print
13	Nature photography
14	Wild life photography
15	Night photography
16	Event Photography
17	News photography and preparing a photo story
18	Cover page design for a magazine

Reference books:

1. Basic Photography- M.J. Langford, Focal Press.
2. The basic book of Photography – Fifth edition – by Tom Gri
3. Beginner's guide to photographic lighting: Techniques studio or on Location-Dom Marr
4. Photography its principles & practice: A manual of the photography – Carroll.
5. Photography for the 21st century by Katic Millar
6. Advanced Photography (Vol.-I & Vol.-II) - M.J. Langford, Focal Press.
7. Applied Photographic Optics- Sidney F. Ray; Focal Press
8. The Practical Guide to Photographic Lighting, John Tarrant, Focal Press



Savitribai Phule Pune University
(Formerly University of Pune)

Three Year B. Sc. Degree Program in Zoology
(Faculty of Science & Technology)

T. Y. B. Sc. Zoology

Choice Based Credit System Syllabus

To be implemented from
Academic Year 2021 - 2022

Preamble:

Zoology is one of the major subjects of Basic Sciences and deals with all aspects of animal biology. It includes an interesting range of highly diverse topics. A zoology student needs to gain understanding of many areas of the subject to keep pace with advancements in Life Sciences.

This under-graduate degree program has been designed by the Board of Studies in Zoology of Savitribai Phule Pune University with a substantial component of what is needed from a zoologist as a skilled career and what zoologists needs to pursue for post-graduation and further academic studies. It follows the guidelines laid down by the University Grants Commission, New Delhi. This newly designed curriculum is a perfect blend of the classical aspects in Zoology with the advanced and more specialized areas.

This degree offers Discipline Specific Core Courses [CC] in Animal Systematics, Animal Ecology, Animal Cell biology, Applied Zoology, Pest Management, Histology, Biological Chemistry, Genetics, Developmental Biology, Parasitology, Medical & Forensic Zoology, Animal Physiology, Molecular Biology, Entomology, Techniques in Biology and Evolutionary Biology.

In addition to the Core Courses, Ability Enhancement Compulsory Courses [AECC] have been added in the second year i.e. Semester III and Semester IV of the undergraduate course. In the third year i.e. Semester V and Semester VI, Discipline specific Elective Courses [DSEC] and Skill Enhancement Courses [SEC] have been offered. The students, therefore, have an opportunity to take courses in Environment Awareness, Language & communication, English / Marathi, Aquarium Management, Poultry Management and Environmental Impact Assessment. In Semester VI the students also have a course dedicated to Project work.

The syllabus has been framed in such a way that the student gains each year, a broader perspective of the subject as he progresses towards completion of the degree program. Field visits, Educational visits and the Project work have been included for the student to experience the applications of the theory learnt in the classroom.

After completion of the program, it is expected that students will understand and appreciate: animal diversity, few applications of Zoology, the structure, functions and life processes at cellular, tissue, organ and system level, significance of evolution, and basic concepts of human health. The students would also gain an insight into laboratory and field work through the practical course, field work and the project.

While presenting this new syllabus to the teachers and students of T. Y. B. Sc. Zoology, I am extremely happy to state that efforts have been made to seek inputs of all the stake holders to make it more relevant.

The new course will be effective from the academic year 2021- 2022 and will follow the Choice Based Credit System in a Semester mode. It has been primed keeping in view the distinctive requirements of B. Sc. Zoology students. The contents have been drawn-up to accommodate the widening prospects of the discipline of Life Sciences. They reflect the changing pre requisites of the students. This graduate program has been introduced with 132 credits for the subject group while 08 credits to earn from any of the 08 groups offering a range of curricular, co-curricular and extracurricular activities. This pattern has been specially aimed towards the overall development of the students.

The calculation of credits and CGPA will be as per the guidelines of the University. The B. Sc. Zoology program provides an appropriate blend of classical and applied aspects of the subject. This newly designed curriculum will allow students to acquire the skill in handling scientific instruments planning and performing in the laboratory and exercising critical judgement, independent thinking and problem solving skills. The Syllabus has been revised with the following aims -

- To foster curiosity in the students for Zoology,
- To create awareness amongst students for the basic and applied areas of Zoology,
- To orient students about the importance of abiotic and biotic factors of environment and their conservation,
- To provide an insight to the aspects of animal diversity,
- To inculcate good laboratory practices in students and to train them about proper handling of lab instruments.

Board of Studies in Zoology
Savitribai Phule Pune University

1. Course Structure:**Course Structure with Credit Distribution of the Undergraduate Science Program in Zoology**

Course	Course Code and Name of the Course		Credits
F. Y. B. Sc.	SEMESTER I	SEMESTER II	
CC	ZO-111 Animal Diversity I	ZO-121 Animal Diversity II	2+2
CC	ZO-112 Animal Ecology	ZO-122 Cell Biology	2+2
CC	ZO-113 Zoology Practical Paper	ZO-123 Zoology Practical Paper	1.5+1.5
S. Y. B. Sc.	SEMESTER III	SEMESTER IV	
CC	ZO-231 Animal Diversity III	ZO-241 Animal Diversity IV	2+2
CC	ZO-232 Applied Zoology I	ZO-242 Applied Zoology II	2+2
CC	ZO-233 Zoology Practical Paper	ZO-243 Zoology Practical Paper	2+2
AECC	EVS 231-Environment Awareness	EVA 241-Environment Awareness	2+2
AECC	LA 231-English / Marathi	LA 241- English / Marathi	2+2
T. Y. B. Sc.	SEMESTER V	SEMESTER VI	
DSEC	ZO-351 - Pest Management	ZO-361 - Medical & Forensic Zoology	2+2
DSEC	ZO-352 - Histology	ZO-362 - Animal Physiology	2+2
DSEC	ZO-353 - Biological Chemistry	ZO-363 - Molecular Biology	2+2
DSEC	ZO-354 - Genetics	ZO-364 - Entomology	2+2
DSEC	ZO-355 - Developmental Biology	ZO-365 - Techniques in Biology	2+2
DSEC	ZO-356 - Parasitology	ZO-366 - Evolutionary Biology	2+2
DSEC	ZO-357 - Zoology Practical Paper 1	ZO-367 - Zoology Practical Paper 1	2+2
DSEC	ZO-358 - Zoology Practical Paper 2	ZO-368 - Zoology Practical Paper 2	2+2
DSEC	ZO-359 - Zoology Practical Paper 3	ZO-369 - Zoology Practical Paper 3	2+2
SEC	ZO-3510 - Aquarium Management	ZO-3610 - Environmental Impact Assessment	2+2
SEC	ZO-3511 - Poultry Management	ZO-3611 - Project	2+2

2. Detailed Syllabus of T. Y. B. Sc.

Following is the syllabus of each course along with the course outcomes:

SR.NO.	SEMESTER	COURSE NUMBER AND NAME	CREDITS
1	V	ZO 351 - Pest Management	2
2	V	ZO 352 - Histology	2
3	V	ZO 353 - Biological chemistry	2
4	V	ZO 354 - Genetics	2
5	V	ZO 355 - Developmental Biology	2
6	V	ZO 356 - Parasitology	2
7	V	ZO 357 - Zoology Practical Paper 1	2
8	V	ZO 358 - Zoology Practical Paper 2	2
9	V	ZO 359 - Zoology Practical Paper 3	2
10	V	ZO 3510 - Aquarium Management	2
11	V	ZO 3511 - Poultry Management	2
12	VI	ZO 361 - Medical & Forensic Zoology	2
13	VI	ZO 362 - Animal Physiology	2
14	VI	ZO 363 - Molecular Biology	2
15	VI	ZO 364 - Entomology	2
16	VI	ZO 365 - Techniques in Biology	2
17	VI	ZO 366 - Evolutionary Biology	2
18	VI	ZO 367 - Zoology Practical Paper 1	2
19	VI	ZO 368 - Zoology Practical Paper 2	2
20	VI	ZO 369 - Zoology Practical Paper 3	2
21	VI	ZO 3610 - Environmental Impact Assessment	2
22	VI	ZO 3611 - Project	2

SEMESTER - V**Course Title: Pest Management****Course Code: ZO 351****Credits - 02****ZO 351 - Pest Management****Course Objectives:**

After you complete your study of this unit, you should be able to:

- Explain why identification of the pest is the first step in developing an effective pest control strategy.
- Explain the differences between continuous pests, sporadic pests, and potential pests.
- Explain what is meant by prevention, suppression, and eradication of pests.
- Describe "thresholds" and why they are an important consideration in developing a pest control strategy.
- Describe "monitoring" as it relates to pest control and explain why it is important to pest control strategy.

Course Outcomes:

1. Define pest management.
2. Describe the economic, ecological, and sociological benefits of IPM.
3. Distinguish positive and negative impacts of pesticide use.
4. Understand problems resulting from misuse, overuse, and abuse of chemical pesticides.
5. Define and describe pesticide resistance and how it develops.
6. Identify ecological and biological characteristics important in development of pest populations.
7. Identify 10 tactics commonly used in IPM and be able to distinguish them.
8. Understand society's role in IPM decisions.
9. Describe different groups of pests and compare them to weeds and plant pathogens.
10. Analyse and compare management tactics to determine the best approach to reducing pest populations, weeds, and disease presence.
11. Locate appropriate, scientifically valid sources of information on specific tactics to manage insect pests, weeds, and diseases.
12. Know and how to develop an IPM program.

Title & Contents**Number of lectures****1. Pest:****2 L**

- 1.1. Definition.
- 1.2. Types of pests.
- 1.3. Types of damages caused by the pest.

2. Pest management using Regulatory control:**4 L**

- 2.1. Quarantine.
- 2.2. Eradication.

- 2.3. Control districts.
2.4. "Crop-free" periods.
- 3. Pest management using Cultural control: 4 L**
- 3.1. Sanitation.
3.2. Tillage.
3.3. Crop rotation.
3.4. Cropping systems.
- 4. Pest management using Biological control: 4 L**
- 4.1. Ecological considerations.
4.2. Biological control of insects.
4.3. Biological control of plant disease.
4.4. Biological control of weeds.
- 5. Biotechnology approaches in pest management: 4 L**
- 5.1. Introduction.
5.2. Recent advance in use of fungi and viruses.
5.3. Methodology in Biotechnology.
5.4. Somaclonal variability.
5.5. Concept of Genetic engineering and Transgenic plants.
- 6. Integrated pest management (IPM): 5 L**
- 6.1. Principles and its components.
6.2. Advantages and disadvantages.
6.3. Biological control -
Predators, Parasitoids, Entomopathogens, Weed killers and their mass production.
- 7. Insecticides: 4 L**
- 7.1. Classification of insecticides based on mode of entry.
7.2. Action and chemical nature.
7.3. Insecticides formulations and their uses.
7.4. Safe handling of insecticides.
- 8. Insecticide residue: 3 L**
- 8.1. Methods of residue detection – Organochlorine, Organophosphates, Synthetic Pyrethroids, Systemic.
8.2. Problems in fruits, vegetables, medicinal plants.
8.3. Maximum permissible residue limits (MRLs).

Reference Books -

1. Handbook of Pest Management in Agriculture by Pimentel.
2. Principles of Insect Pest Management by Dhaliewal and Arora.
3. Agricultural Pest of India & South East Asia by A. Satwal.
4. Pathological Problems of Economics Crop Plants & their Management by Paul Khurana, S. M., 1998.

5. Integrated Diseases Management and Plant Health by Gupta V. K. & Sharma R. C.
6. Diseases of Millets by Ramkrishnan T. S., I. C. A. R. Publ. New Delhi.
7. Fungal diseases of Rice in India by Padmanabhan S. Y., I. C. A. R. Publ., New Delhi.
8. Analysis of Pesticides Residues by H. A. Moye (JW)
9. Advance in Pest Control Research by R. L. Methcalf (JW)
10. Chemistry of pesticides by K. H. Buchel (JW).
11. Progress in Pesticides Biochemistry and Toxicology Vol. I, II & III by D. H. Hutson and T. R. Robert.
12. Evaluation of Pesticides in Ground Water by W. Y. Garnett, R. C. Honeycatt and others.
13. Chemistry of Pesticides by Edward
14. Insecticide Biochemistry and Physiology by C. F. Wilkinson.

Course Title: Histology

Course Code: ZO 352

Credits: 02

ZO 352 - Histology

Objectives –

1. To understand the histological aspects of mammalian organs.
2. To study the important features of different types of tissues in organ system.
3. To understand the classification of various types of basic tissues.
4. To study structure & functions of various tissues in organ system.
5. To understand histological structure of various glands and its functions.

Learning Outcomes for the course –

1. The students will be able to understand, classify and identify the different types of tissue.
2. The students will understand the complexity of various tissues in an organ.
3. The students will be able to learn structure & functions of various tissues.
4. The students will understand the various diseases related to organs.
5. The student will be able to know the role of glands in mammals.

Title & Contents

Number of lectures

1. Introduction:

Definition and Scope of Histology.

1 L

2. Definitions and Review of Types of Tissues:

2.1 Epithelial tissue.

2.2 Connective tissue.

2.3 Nervous tissue.

2.4 Muscular tissue.

3 L

3. Histological study of following mammalian organs:

3.1 Skin (V. S.).

3.2 Tooth (V. S.).

5 L

3.3 Tongue (C. S.) with reference to mucosa papillae and taste buds.

4. Histological study of Alimentary canal and Liver: 6 L

4.1 Oesophagus (T. S.).

4.2 Stomach (T. S.).

4.3 Duodenum (T. S.).

4.4 Rectum (T. S.).

4.5 Liver (C. S.).

5. Histological study of Respiratory organs: 2 L

5.1 Trachea (T. S.).

5.2 Lung (C. S.).

6. Histological study of Excretory organs: 3 L

6.1 Kidney (L. S.).

6.2 Juxtaglomerular complex.

7. Histological study of Reproductive organs: 4 L

7.1 Testis (T. S.) with reference to Seminiferous Tubules and Cells of Leydig.

7.2 Ovary (C. S.).

8. Histology of Endocrine glands: 6 L

8.1 Pituitary gland.

8.2 Thyroid gland.

8.3 Adrenal gland.

8.4 Pancreas (C. S.) including both exocrine and endocrine components.

Reference Books: -

1. A Text Book of Histology, 2014, 5th Edn. Krishna Garg, Indira Bahl & Mohini Kaul CBS Publication & Distributors, Delhi.
2. Histology, 1987, 9th Edn., Arthur W. Ham, David H. Cormack, J. B. Lippincott Co. Philadelphia.
3. Histology, 1977, 4th Edn., R. O. Greep and L. Weiss, McGraw Hill Int. Book Co., New York.
4. Hand Book of Histo-pathological & Histo-chemical Techniques, 1983, 3rd Edn. reprint, Butterworth & Co. (Publishers) Ltd, UK.

Course Title: Biological Chemistry

Course code: ZO 353

Credits: 02

ZO 353 - Biological Chemistry

Objectives –

1. To understand the basic concepts and significance of biochemistry.
2. To understand the basic concepts pH and Buffers
3. To understand the chemical structures of carbohydrate, and their biological and clinical significance.
4. To understand the structure and importance of proteins and lipids
5. To understand the variations in enzyme activity and kinetics.

Learning Outcomes for the course -

1. Learners shall be able to understand basic concepts and significance of biochemistry
2. The students will learn about the pH and Buffers.
3. The students will learn about the chemical structures of carbohydrate, and their biological and clinical significance.
4. The students will be able to understand, interpret structure and importance of proteins, carbohydrates and lipids
5. Learners will be able to comprehend variations in enzyme activity and kinetics.

Title & Contents	Number of lectures
1. Introduction of Biochemistry: Importance of Biochemistry in Life Sciences.	1 L
2. p^H and Buffers: 2.1 Concept of p ^H . 2.2 Concept of p ^H scale, biological significance of p ^H 2.3 Concept of acid and base, Ionization of acids and bases. 2.4 Derivation of Henderson-Hassel Balch equation & its applications. 2.5 Buffer - Definition, Concept, Functions, Types of buffer and Buffering Capacity.	3 L
3. Carbohydrates: 3.1 Definition, Classification & Biological importance of Carbohydrates. 3.2 Isomerism in carbohydrates - Structural and Stereoisomerism. 3.4 Significance of Gluconeogenesis, Glycogenolysis and Glycogenesis. 3.3 Clinical Significance - Hypoglycemia and Hyperglycemia.	7 L
4. Amino acids and Proteins: 4.1 General Structure of amino acids and Peptide bond. 4.2 Essential and non-essential amino acids. 4.3 Types of proteins, protein structures (primary, secondary, tertiary and quaternary structures with suitable example), Forces responsible for their stability. 4.5 Biological importance of proteins – Biocatalysts, Carrier proteins Contractile proteins, Hormonal role of proteins.	6 L
5. Enzymes: 5.1 Nomenclature, Types and properties of enzymes. 5.2 Regulatory and non-regulatory enzymes. 5.3 Enzyme inhibition. 5.4 Factors influencing enzyme activity (pH, temperature, substrate concentration). 5.5 Introduction of isoenzymes and cofactor. 5.6 Clinical significance of enzymes - PKU and AKU.	10 L
6. Lipids:	3 L

- 6.1 Introduction.
- 6.2. Fatty acids - Types and nomenclature (saturated and unsaturated).
- 6.3 Clinical significance (obesity, atherosclerosis, myocardial infarction).
- 6.4 Biological importance of lipids.

Reference books

1. Principles of Biochemistry, 1993, Lehninger A. L. Nelson D. L. & Cox M. M. W. H. Freeman Company, USA.
2. Biochemistry, 1995 5th Edn. Zuby G. W, C. Brown Communications USA.
3. Harpers Biochemistry, 1996 26th Edn. p Murray R. K., Granner D. K., Mayes P. A. & Rodwell V. W. Prentice Hall international USA.
4. Outline of Biochemistry, 1995 5th Edn, Conn E. E., Stumph P. K. Bruening G & Doi R. H. John Wiley & Sons, USA.
5. Principals of Biochemistry, 1993, 1st Edn., Pattabhiraman T. N. Gajanan Book publishers and distributors Bangalore.
6. Clinical Biochemistry, 1994, B. P. Godkar, Bhalini Publishing House, Mumbai.
7. Biochemistry, 1995 5th Edn., Stryer San Francisco, W. H. Freeman & Co.
8. Biochemistry, 1990, 8th Edn., D. Voet & J. Voet, John Willey, New York
9. David T. Plummer: An Introduction to Practical Biochemistry, IIIrd edition (1988)

Course Title: Genetics

Course code: ZO 354

Credits: 02

ZO 354 - Genetics

Title & Contents	Number of lectures
1. Introduction to genetics:	3 L
1.1 Classical and Modern concept of Gene, Cistron, Muton, Recon.	
1.2 Mendel's laws of Inheritance.	
2 Exceptions to Mendelian Inheritance:	6 L
2.1 Incomplete dominance.	
2.2 Co-dominance.	
2.3 Multiple alleles: Concept, characteristics and importance of multiple alleles, ABO & Rh - blood group system and its medico legal importance.	
2.4 Lethal alleles.	
3. Gene Mutation:	6 L
3.1 Definition.	
3.2 Types of mutations: spontaneous, induced, somatic, gametic, forward, reverse. Types of point mutation - deletion, insertion, substitution, transversion, transition.	
3.3 Mutagenic agents	
a) UV radiation and ionising radiation.	
b) Base analogs, alkylating and intercalating agents.	

- 4. Sex-determination:** **4 L**
- 4.1 Introduction.
- 4.2 Types of sex determination: -XX-XY, ZZ-ZW, XX-XO and Parthenogenesis, Hypodiploidy.
- 4.3 Gynandromorphism.
- 5. Population Genetics:** **3 L**
- 5.1 Basic Concepts in population genetics: Mendelian population, gene pool, gene / allele, Frequency, chance mating (Panmictic mating).
- 5.2 Hardy Weinberg law and its equilibrium.
- 6. Human Population Genetics:** **4 L**
- 6.1 Karyotype.
- 6.2 Genetic disorders, Structural & numerical alterations of chromosomes (chromosomal aneuploidy - Down, Patau, Edward, Turner and Klinefelter syndromes).
- 7. Sex linked inheritance in human:** **2 L**
- 7.1 Colour – blindness.
- 7.2 Haemophilia.
- 7.3 Hypertrichosis.
- 8. Application of genetics:** **2 L**
- 8.1 Genetic counselling.
- 8.2 Diagnostics & breeding technology.

Reference Books -

1. Principles of Genetics, 1997, P. D. Snustad, M. L. Simmons J. B. Jenkins, John Wiley & Sons, USA
2. Genetics, 2014, 9th Edn., Verma P. S. and Agarwal V. K., S. Chand and Co., New Delhi.
3. Genetics, 2014, 4th Edn. Gupta P. K., Rastogi Publications, Meerut.
4. Principles of Genetics, Gardner, E. J. *et al.* (2006), John Wiley and Sons Inc.
5. Genetics: A Molecular Approach, 3rd Edn, Russell, P. J., Benjamin Cummings.
6. Principles of Genetics 8th Edition, Gardner, E. J., Simmons, M. J., Snustad, D. P. (2008). John Wiley and Sons Inc.
7. Principles of Genetics. 5th Edn. Snustad, D. P. and Simmons, M. J. (2009). John Wiley and Sons Inc.
8. Concepts of Genetics, 10th Edn. Benjamin Cummings. Klug, W. S., Cummings, M. R. and Spencer, C. A. (2012).
9. An Introduction to Genetic Analysis, 11th Edn. Carroll S. B.; Doebley J., Griffiths, A. J. F. and Wessler, S. R. (2018) W. H. Freeman and Co. Ltd.

Course Title: Developmental Biology

Course code: ZO 355

Credits: 02

ZO 355 - Developmental Biology

Title & Contents	Number of lectures
1. Fundamentals of Developmental Biology:	3 L
1.1 Definition and scope.	
1.2 Concepts in Developmental Biology: Growth, Differentiation, Dedifferentiation, Cell determination, Cell communication, Morphogenesis, Induction and Regeneration.	
2. Theories of Developmental Biology:	3 L
2.1 Preformation.	
2.2 Pangenesis.	
2.3 Epigenesis.	
2.4 Axial gradient.	
2.5 Germplasm.	
3. Gametogenesis:	5 L
3.1 Spermatogenesis & Structure of sperm with respect to human.	
3.2 Oogenesis & Structure of ovum with respect to human.	
3.3 Types of eggs.	
4. Fertilization:	6 L
4.1 Concept and types.	
4.2 Chemotaxis.	
4.3 Sperm penetration: Acrosome reaction, Capacitation & Decapacitation.	
4.4 Activation of ovum: Fertilization cone.	
4.5 Prevention of polyspermy: Fast block & Slow block.	
4.6 Significance of fertilization.	
5. Cleavage and Blastula:	5 L
5.1 Planes and symmetry of cleavage.	
5.2 Types of cleavage.	
5.3 Significance of cleavage.	
5.4 Definition and types of Blastula.	
6. Gastrulation:	3 L
6.1 Definition and Concept.	
6.2 Basic cell movements in gastrulation: Epiboly, Emboly, Convergence, Invagination, Ingression & Involution with reference to frog.	
6.3 Concept of Organizer : Primary, Secondary and Tertiary.	
7. Chick Embryology:	6 L
7.1 Structure of Hen's egg.	

- 7.2 Fertilization and cleavage in Chick.
- 7.3 Formation of primitive endoderm.
- 7.4 Primitive streak development.
- 7.5 Head process and regression of Primitive streak.

References:

1. An Introduction to Embryology (2012), 5th Edition., Balinsky B. L., Fabian B. C. Brooks Cole Pub. Co., USA
2. Developmental Biology (2013), 10th Edn. Gilbert S. F., Sinauer Associates Inc.
3. Developmental Biology: Patterns, Principle and Problems (1982), Saunders J. W., Prentice Hall Coll Div.
4. Principles of Development (2007), 3rd edition, Lewis Wolpert, Oxford University Press Publisher

Course Title: Parasitology**Course code: ZO 356****Credits: 02****ZO 356 - Parasitology****Objectives:**

1. To understand the basic terminologies in parasitology.
2. To understand the concepts of animal association with examples.
3. To understand the morphology and life cycle of common parasites (Protists and Platyhelminthes).
4. To understand the phenomenon of Host-parasite relationship.
5. Explain the importance of arthropod vectors with examples.

Learning outcomes:

1. The students will be able to learn about basics and scope of parasitology.
2. The students will be able to learn the types of host and parasite with examples.
3. The students will be able to learn about the morphology, life cycle, pathogenicity and treatment of common parasites (Protists and Platyhelminthes).
4. The students will be able to learn about host -parasite relationships and their effects on host body.
5. The students will be able to learn about the arthropod parasites and their role as vector.

Title & Contents**Number of lectures****1. Introduction, Scope and Branches of Parasitology:****2 L**

- 1.1. Definition: host, parasite, vector, commensalisms, mutualism and parasitism.
- 1.2. Branches of parasitology.

2. Types of Parasites and Hosts:**3 L**

- 2.1 Ectoparasites.

- 2.2 Endoparasites and its subtypes.
- 2.3 Types of hosts - Intermediate, definitive, paratenic and reservoir.
- 3. Host - Parasite relationship: 3 L**
- 3.1 Host specificity.
- 3.2 Types of host specificity: structural specificity, physiological specificity and ecological specificity.
- 3.3 Effects of parasite on host.
- 4. Study of Parasitic Protists: 9 L**
- 4.1 *Entamoeba histolytica* - Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment.
- 4.2 *Plasmodium vivax* - Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment.
- 5. Study of Parasitic worms: 9 L**
- 5.1 *Ascaris lumbricoides* - Study of Morphology, Life Cycle, Prevalence.
- 5.2 Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment.
- 5.3 *Taenia solium* (Tapeworm) - Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment.
- 6. Study of Parasitic Arthropoda: 4 L**
- Morphology, pathogenicity and control measures of –
- 6.1 Soft tick.
- 6.2 Head louse.
- 6.3 Rat flea.
- 6.4 Bed bug.

Reference Books:

1. Parasitology: K. D. Chatterjee.
2. Parasites: ecology, diseases, and management (2013).
3. Parasitic Helminths: Targets, Screens, Drugs, and Vaccines, 201.
4. Parasitism: The Diversity and Ecology of Animal Parasites (2014) Tim Goater, Timothy M. Goater, Cameron P. and Esch, Gerald W. Cambridge University Press.
5. Principles of Veterinary Parasitology (2016), 1st Edn, Dennis E. Jacobs, Mark Fox, Lynda M. Gibbons, Carols Hermosilla, John Wiley & Sons.
6. Veterinary Parasitology (2013), Hany M. Elsheikha, Jon S. Patterson, CRC Press Taylor & Francis Group
7. Textbook of medical parasitology – C. K. Jayaram Panikar.
8. Textbook of medical parasitology – Arora & Arora.
9. Textbook of medical parasitology – S. C. Parija.
10. Veterinary Parasitology, 2013 - (Taylor, M. A.).
11. Encyclopedia of parasitology, 2008.
12. The Biogeography of Host-Parasite Interactions by Serge Morand, Boris R. Kransov, Oxford University Press.
13. Textbook of medical microbiology – Rajesh Bhatia & Itchpujani.

14. Textbook of medical microbiology – Arora & Arora.
15. Biological Control of Parasites, 2012.
16. Biology of Malaria Parasites, 2012.
17. Sherris medical microbiology: Ryan.
18. Medical microbiology: Jawetz Melnick & Adelbergs.
19. Current concepts in parasitology, 2012.
20. Textbook of Parasitology, Ashok Kumar, Discovery Publishing.
21. Introduction to parasitology: With special reference to the parasites of man, A.C. Chandler-
John Wiley & Sons.
22. A text book of Parasitology – D. P. Karyakarte & A. S. Damle.

For Practical papers of both V and VI semester, minimum 6 practicals should be conducted from each section, thus a minimum of 12 practicals should be conducted per practical paper. (C) stands for compulsory.

Course Title: Zoology Practical Paper I

Course code: ZO 357

Credits: 02

Course Title : Zoology Practical Paper - I

Section I: Practicals in Pest Management

- | | |
|--|---|
| 1. To study the plant protection appliances. | D |
| 2. Studies on beneficial insects. (C) | D |
| 3. Study of pests and diseases of honeybees. (C) | D |
| 4. Applications of IPM components in various crops. | D |
| 5. Separation of the pesticides or plant products by TLC and Column chromatography. - 2 P(C) | E |
| 6. Detection of pesticides residues in food stuffs. (C) | E |
| 7. Rearing of pest species (Any 2 species). (C) | D |
| 8. Study of life cycle of Red cotton bug and Lemon butterfly. | D |
| 9. Study of the detection of damage caused by pests. | D |
| 10. Plant disease, its intensity & calculation of VI (Virulence Index) of at least two diseases. | D |

Section II: Practicals in Histology

- | | |
|--|---|
| 1. Study of the different types of tissues with the help of permanent slides – Epithelial tissue, Connective tissue, Muscular tissue and Nervous tissue. | D |
| 2. Study of permanent histological slides of T. S. of skin, V. S. of tooth and C. S. of tongue. | D |
| 3. Study of permanent histological slides of digestive parts – T. S. of Stomach, T. S. of Duodenum, T. S. of Rectum, C. S. of Liver. | D |

- | | |
|--|---|
| 4. Study of permanent histological slides of glands - T. S. of Pituitary gland, T. S. of Thyroid gland, T. S. of Adrenal gland, C. S. of Pancreas. | D |
| 5. Study of permanent histological slides of reproductive organs- T. S. of Testis, C. S. of Ovary. | D |
| 6. Study of human blood smear to observe different types of blood cells. (C) | E |
| 7. Temporary mounting of tissues of any mammal (freshly dissected or preserved) - Striated Muscle Fibre. (C) | E |
| 8. Temporary mounting of tissues of any mammal (freshly dissected or preserved) - Smooth Muscle Fibre. (C) | E |

Course Title: Zoology Practical Paper - II**Course code: ZO 358****Credits: 02****ZO 358 - Zoology Practical Paper - II****Section I: Practicals in Biological Chemistry**

- | | |
|---|---|
| 1. To determine the enzyme activity - salivary amylase/ urease/ invertase. | E |
| 2. To determine specific activity of an enzyme. | E |
| 3. Detection of carbohydrates (monosaccharides, disaccharides and polysaccharides) with the help of suitable tests. (C) | E |
| 4. Isolation of starch from potato and digestion of starch by salivary amylase. (C) | E |
| 5. Preparation of buffer of desired pH and molarity. (C) | E |
| 6. Protein estimation by Lowry <i>et al.</i> method. (C) | E |
| 7. Isolation of Caesin from milk by adjusting iso-electric point. (C) | E |
| 8. Preparation of Acid, Alkali & it's standardisation. | E |
| 9. Principle, Working & Measurement of pH of any three samples. | E |

Section II: Practicals in Genetics

- | | |
|--|---|
| 1. Study of monohybrid ratio by providing hypothetical data and deducing applicability of Mendelian laws (Two examples). (C) | D |
| 2. Study of Dihybrid ratio by providing hypothetical data and deducing applicability of Mendelian laws (Two examples). (C) | D |
| 3. Study of genetic traits in human beings (tongue rolling, widow's peak, ear lobes, colour-blindness and PTC tasters/ non-tasters). | D |

- | | |
|---|---|
| 4. Study of blood groups in human (ABO and Rh). (C) | D |
| 5. Study of Hardy - Weinberg law with suitable recording of genetic traits. | D |
| 6. Study of human karyotypes and numerical alterations (simulated & theoretical sample data) (Down syndrome, Klinefelter syndrome and Turner syndrome). | D |
| 7. Temporary preparation of polytene chromosomes from suitable material. (C) | E |
| 8. Study of structural chromosome aberrations (dicentric, ring chromosomes and inversions in polytene chromosomes) from prepared slides / photographs. | D |
| 9. Study of external characters, life cycle and Rearing of <i>Drosophila</i> . (C) | D |
| 10. Study of <i>Drosophila</i> mutants. | D |

Course Title: Zoology Practical Paper III**Course code: ZO 359****Credits: 02****ZO 359 - Zoology Practical Paper - III****Section I: Practicals in Developmental Biology**

- | | |
|---|---|
| 1. Study of ultrastructure of Sperm and Ovum of Mammal. | D |
| 2. Study of eggs with the help of slide / Photograph / chart / Model (Insect, <i>Amphioxus</i> , Frog and Hen). (C) | D |
| 3. Study of cleavage and its types with the help of Slide / Photograph / Chart / Model. | D |
| 4. Study of blastulae (<i>Amphioxus</i> , Frog and Hen). | D |
| 5. Study of gastrulae (<i>Amphioxus</i> , Frog and Hen). | D |
| 6. Study of whole mount slides of chick embryology – 24 hrs, 33 hrs and 48 hrs. (C) | D |
| 7. Study of T. S. and V. S. of chick embryo of Brain & Heart with the help of slide / Photograph / chart / Model – 24 hrs & 33 hrs. | D |
| 8. Temporary preparation of chick embryo. (C) | E |
| 9. Ex-ovo culture of chick embryo. | D |

Section II : Practicals in Parasitology

- | | |
|--|---|
| 1. Study of parasitic association with their example -
a) Commensalism.
b) Parasitism. | D |
| 2. To study the life cycle, pathogenecity, diagnosis and treatment of <i>Entamoeba histolytica</i> and <i>Plasmodium vivax</i> through permanent slides or microphotographs. | D |
| 3. To study the life cycle, pathogenecity, diagnosis and treatment of <i>Ascaris lumbricoides</i> and <i>Taenia solium</i> through specimen, permanent slides or microphotographs. (C) | D |

- | | |
|---|---|
| 4. Study of following parasites with its role as vector - Soft tick, <i>Pediculus humanus</i> , <i>Xenopsylla cheopis</i> and <i>Cimex lectularius</i> through permanent slides or photographs. (C) | D |
| 5. Study of effects of parasites on host body. | D |
| 6. Study of the pathogenecity and control measures of - Tick (soft tick and hard tick) and Mite (<i>Sarcoptes scabiei</i>). | D |
| 7. Study of parasites from the gut of cockroach. (C) | E |
| 8. Collection & submission of various parasites. (C) | E |

Course Title: Aquarium Management**Course Code: ZO 3510****Credits: 02****ZO 3510: Aquarium Management**

Title & Contents	Number of lectures
1. Introduction to Aquarium Fish Keeping:	4 L
1.1 The potential scope of Aquarium Fish Industry as a Cottage Industry.	
1.2 Exotic and Endemic species of Aquarium Fishes.	
1.3 Nutritional value of fish.	
2. Biology of Aquarium Fishes:	6 L
2.1 Common characters and sexual dimorphism of Aquarium fishes - Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish, Butterfly fish and Fighter fish.	
3. Food and feeding of Aquarium Fishes:	4 L
3.1 Use of live fish feed organisms.	
3.2 Preparation and composition of formulated fish feeds.	
3.3 Overview on types of fish food.	
4. Fish Transportation:	4 L
4.1 Live fish transport: a) Fish handling. b) Fish packing. c) Fish forwarding techniques.	
4.2 Causes of mortality in transport.	
5. Maintenance of Aquarium:	3 L
5.1 General Aquarium Maintenance - budget for setting up an Aquarium.	
5.2 Fish Farm as a Cottage Industry, Rules & regulations of fish rearing.	
5.3 Common diseases of Aquarium fish.	
6. Physico-chemical parameters of water for fish culture:	4 L
6.1 Acidity, Alkalinity, Calcium, Nitrate, Ammonia, Total hardness.	
7. Fish preservation:	2 L
7.1 Fish preservation and processing.	

7.2 Fish preservation techniques.

8. Fish breeding:

3 L

8.1 Types of fish breeding -

- a) Natural fish breeding.
- b) Induced fish breeding.

Course Title: Poultry Management

Course Code: ZO 3511

Credits: 02

ZO – 3511 Poultry Management

Objectives:

1. To understand the basics of Poultry Farming and its important.
2. To understand breeding management of broilers and layers of chickens.
3. To understand housing management and equipment of Poultry farming.
4. To understand food, feeding and digestion mechanism of chickens.
5. To understand the poultry diseases and their control.
6. To understand the economic importance of poultry products.

Expected Outcome:

1. The students will be able to understand the Poultry farming practices.
2. The students will able to understand the poultry breeding techniques.
3. The students will be able to understand poultry rearing techniques.
4. The students will be able to understand feeding requirement and food ingredients.
5. The students will be able to understand the poultry disease and their pathogens.
6. The students will be able to understand market value of poultry products.

Title & Contents

Number of lectures

1. Introduction to Poultry Farming:

2 L

- 1.1 Definition of Poultry, Importance of Poultry Farming and Poultry Development in India.
- 1.2 Present and future prospects.

2 Breeding Management:

5 L

- 2.1 Male and female reproductive system of chicken.
- 2.2 Breeds and strains of broilers and layers of chicken.
- 2.3 General aspects of breeding for better egg production and body weight gain.
- 2.4 Selection and culling.
- 2.5 Artificial insemination.

- 3 Housing Management: 5 L**
- 3.1 Establishment of poultry farm.
 - 3.2 Housing and equipment.
 - 3.3 Incubation and hatching of eggs.
 - 3.4 Broiler and layer management.
 - 3.5 Lighting schedule for poultry.
 - 3.6 Transport strategy of Poultry birds.
- 4 Feeding Management: 6 L**
- 4.1 Digestive system and Digestion Mechanism of chicken.
 - 4.2 Feed ingredients.
 - 4.3 Feed processing.
 - 4.4 Formulation of feed viz., Starter, Grower, Layer, Finisher and Breeder ration, Feed conversion ratio (FCR), Nutritional deficiency conditions.
- 5 Health Management: 5 L**
- 5.1 Vaccination schedule for poultry birds.
 - 5.2 Common poultry diseases, i. e. Ranikhet, Marek, Chicken pox, Gumboro, Infectious bronchitis and Chronic Respiratory Disease (CRD).
 - 5.3 Control of internal and external parasites.
- 6 Poultry Products: 4 L**
- 6.1 Preservation and storage of eggs.
 - 6.2 Grading of eggs and AGMARK standard of egg.
 - 6.3 Egg powder.
 - 6.4 Slaughtering and processing of chicken.
 - 6.5 Poultry By Products – Feathers and Poultry Manure.

Reference Books

1. Commercial Chicken Meat and Egg Production (2007), 5th Edn, Bell D. Donald and Weaver D. William Jr., Springer India Pvt. Ltd., Noida.
2. Poultry Science (2015) 3rd Edn, Ensminger. M. E., International Book Distribution Co., Lucknow, India.
3. Modern Poultry Farming (2003), 1st Edn, Hurd M. Louis, International Book Distributing Company, Lucknow.
4. Handbook of Poultry Production and Management (2007), 2nd Edn., Jadhav N. V., and Siddique M. F., Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.
5. Successful Poultry Management (2007), 2nd Edn, Jull A. Morley, Biotech Books, New Delhi.
6. Poultry Husbandry (2008) 2nd Edn, Jull A. Morley, J. V. Publishing House, Jodhpur, Rajasthan.
7. Broiler Breeder Production (2001), 1st Edn, Leeson. S., and Summers J. D. International Book Distributing Company, Lucknow.
8. Poultry and Ratite Nutrition (2013), 1st Edn, Pathak N. N., Narendra Publishing House, New Delhi, India.
9. Simply Poultry Science (2011) 1st Edn, Rajini Asha R., Alfa Publications, New Delhi.

10. Poultry Production (2011) 3rd Edn, Singh, R. A., Kalyani Publishers, New Delhi.
11. Textbook of Poultry Science (2015) 1stEdn, Sreenivasaiah., P. V. Write & Print Publications, New Delhi.
12. Encyclopedia of Broiler Breeder Production: Production, Feeding and Management Techniques (2013) Vol. 1, 2 & 3, Youn Michael, Anmol Publications Pvt. Ltd., New Delhi

Note: Latest editions of the recommended books may be referred.

SEMESTER - VI

Course Title: Medical & Forensic Zoology

Course Code: ZO 361

Credits: 02

ZO 361 - Medical & Forensic Zoology

Objectives:

1. To understand the scope, need and History of Forensic Science.
2. To understand the role of different institutes & allied institutes of Forensic Science.
3. To understand the various branches of Forensic Sciences from Life Sciences.
4. To understand human physiology, post mortal investigations.
5. To understand knowledge of handling different types of evidences and their examinations.

Expected Outcome

1. The students will be able to understand the basics principles of Medical and Forensic Zoology.
2. The students will able to understand scientific methods in crime detection.
3. The students will be able to understand the advancements in the field of Medical and Forensic Zoology.
4. The students will be able to understand modern tools, techniques and skills in forensic investigations.
5. The students will be able to describe the fundamental principles and functions of forensic science and its significance to human society.

Title & Contents

Number of lectures

1. Introduction to medical zoology and its importance :	2 L
2. Medico-legal Autopsy:	6 L
2.1 Death and its Causes- External examination of deceased body – Internal Examination - Determination of time since death and cause of death.	
2.2 Injuries – Classification - Medico-legal aspects of injuries.	
2.3 Post-mortem changes - collection of post-mortem samples and Preservation.	
3. Urine Analysis:	3 L
3.1 Physical characteristics, abnormal constituents, renal failure, renal calculi, dialysis.	

- 4. Non infectious Diseases:** 2 L
4.1 Causes, Types, Symptoms, Complications, Diagnosis and Prevention of Diabetes (Type I and II), Hypertension, Hypotension, Obesity, Atherosclerosis, Myocardial Infraction.
- 5. Infectious Diseases:** 2 L
5.1 Causes, Types, Symptoms, Complications, Diagnosis and Prevention of Tuberculosis and Hepatitis.
- 6. Introduction to Forensic Zoology:** 3 L
6.1 Definition, Scope and Application of Forensic Zoology.
6.2 Forensic Laboratories in India.
6.3 Basic Principles of Forensic Science with Examples.
- 7. Forensic Medicine:** 3 L
7.1 Introduction to Forensic Medicine: Definitions of Forensic Medicine.
7.2 Medical Jurisprudence.
7.3 Medical evidence documentations.
- 8. Forensic Analysis:** 9 L
8.1 Examination of Biological Materials: Examination of Hair, Fibres, Diatoms, plants materials, human tissues.
8.2 Examination of Body Fluid: Blood, Semen and Saliva.
8.3 Forensic Importance of Insects: Insects of forensic importance - indicators of time of death stages of insect development & comparative decomposition of human body - colonization - Evidence collection of insects – Territorial & Aquatic Insects.
8.4 DNA Fingerprint Technique and Examination of Biological Traces: Liquid blood, blood stains, & swabs, semen, Seminal stains, tissues, Bones, Hairs, Teeth, Saliva, Skeletal remains.
8.5 Toxicological Investigations: Poisons – Definition, Forms of Poison – Physical, Chemical & Mechanical state. Introduction with examples of – Neurotoxic Poisons – Cerebral & Spinal, Cardiovascular Poisons, Asphyxiants, Miscellaneous poisons – Pesticides, Pharmaceutical drugs, Petroleum poisons, Food poisons, Radioactive poisons.

Reference Books

1. Godkar P. B and Godkar D. P, Textbook of Medical Laboratory Technology, II Edition, Bhalani Publications
2. Textbook of Microbiology: R. Ananthanarayan, C. K. Jayaram Panikar, University Press.
3. A textbook of Microbiology: P. Chakraborty
4. Text book of pathology: Robbins & Cotran, Vol. 1 & 2, Tenth Edition, Elsevier Publication.
5. Pathologic basis of disease: M. K. Singh & Vinay Kumar, Vol. 1 & 2, 10th edition, Elsevier.
6. Text book of General pathology: Bhende & Deodhare Part I & II.
7. Pathologic basis of Disease: Robbins & Cotran, Vol. 1 & 2, 10th edition, Elsevier publications.
8. Essentials of medical pharmacology: K. D. Tripathi, 8th edition, Jaypee brothers publishers.
9. Review of pharmacology: K. D. Tripathi, Jaypee brothers publishers.

10. Essentials of medical microbiology: Apurba S. Sastry & Sandhya Bhat, Jaypee brothers.
11. W. G. Eckert and S. H. James, Interpretation of Bloodstain Evidence at Crime Scenes, CRC Press, Boca Raton (1989).
12. The essentials of forensic medicine & toxicology: K. S. Narayan Reddy.
13. A textbook of Clinical pharmacology: Roger H. J., Spector R. G., Trounce J. R., Hodder & Stoughton publishers.
14. Pharmacology & Pharmacotherapeutics : Satoskar R. S., Bhandarkar S. D., Popular Prakashan, Mumbai.
15. The synopsis of forensic medicine & toxicology: K. S. Narayan Reddy.
16. Textbook of pathology: Harsh Mohan.
17. G. T. Duncan and M. I. Tracey, Serology and DNA typing in, Introduction to Forensic Sciences, 2nd Edition, W. G. Eckert (Ed.), CRC Press, Boca Raton (1997).
18. T. Bevel and R. M. Gardner, Blood stain Pattern Analysis, 3rd Edition, CRC Press, Boca Raton (2008).
19. Arti Nigam and Archana Ayyagari, Lab manual in Biochemistry, immunology and biotechnology, Mc Graw Hill Publishing Company Ltd.
20. Fundamentals of Forensic Science, Second Edition, Max M. Houck and Jay A Siegel, Academic Press.
21. Forensic Science, Third Edition, Stuart H James and Jon. J. Nordby.
22. Forensic Science in India and the World, Deepak Ratna and Mohd. Zaidi, Alia Law Agency, Allahabad.
23. Forensic Science in India - A Vision for 21st Century, B. B. Nanda and Dr. R. K. Tewari, Select Publishers.
24. Cell Biology, Sixth Edition International Students Edition, Gerald Karp, Wiley Publications, 2010.
25. Human Physiology: From Cells to Systems, Lauralee Sherwood, Cengage Learning, 2008.
26. Forensic Biology, Richard Li, CRC Press.
27. Human Anatomy Vol. 1,2,3,4, Chaurasia B. D.
28. Text Book of Medical Jurisprudence, Forensic Medicine and Toxicology by Parikh C. K.
29. Forensic Science: An introduction to Scientific and Investigative Techniques by S. H James, J. J. Nordby.
30. Parikh C. K., Medical Jurisprudence.

Course Title: Animal Physiology

Course Code: ZO 362

Credits: 02

ZO 362 - Animal Physiology

Course Objectives:

1. To acquaint students with the principles and basic facts of Animal Physiology and with some of the laboratory techniques and equipment used in the attainment of physiological data. The importance will be on mammalian.
2. The course will focus on organ-system physiology,
3. Furthermore, emphasis will be placed on nutritive, circulatory, respiratory, excretory, muscular, nervous, reproductive and endocrine physiology. Where appropriate, basic chemical and physical laws will be reviewed in order to enhance and to promote student understanding.

4. The laboratory module of the course is designed to support the topics discussed in theory lecture, as well as to acquaint students with some of the laboratory techniques and equipment used in the gaining of physiological facts.

Learning Outcomes:

Upon successful completion of this course, the students will be able to describe, identify, and/or explain:

1. The various physiological organ-systems and their importance to the integrative functions of the human body.
2. Understand Concept of energy requirements
3. Various aspects of Digestive physiology.
4. Circulatory system with medical conditions
5. Understand Respiratory mechanism and gases transport.
6. Eliminations of waste materials from the body.
7. Develop understanding in Structure and functions of muscles
8. Understand formation of gametes and function of endocrine glands.

Title & Contents	Number of lectures
1. Nutrition and digestion:	5 L
1.1 Nutritional requirement & balanced diet.	
1.2 Digestion and absorption of carbohydrates, proteins and lipids.	
1.3 Vitamins - outline of fat soluble and water-soluble vitamins; Sources, deficiency and diseases.	
2. Respiration:	5 L
2.1 Mechanism of respiration: Regulation of ventilation in lungs, exchange of gases at respiratory surface.	
2.2 Respiratory pigments in animals: Haemoglobin, Hemocyanin, Hemerythrin, Chlorocruorin.	
2.3 Transport of gases : O ₂ and CO ₂ transport.	
3. Circulation:	5 L
3.1 Blood: Definition and its constituents, functions of blood.	
3.2 Heart: Structure of human heart, Pace maker, Cardiac Cycle.	
3.3 Origin and conduction of heart beat.	
4. Excretion:	5 L
4.1 Structure of Uriniferous tubule.	
4.2 Mechanism of urine formation.	
4.3 Normal and abnormal constituents of urine, Elementary idea of dialysis.	
5. Muscles:	3 L
5.1 Structure of smooth, skeletal and cardiac muscles.	
5.2 Mechanism of muscle contraction by Sliding filament theory.	
6. Reproduction and Endocrine Glands:	7 L
6.1 Physiology of male reproduction, hormonal control of spermatogenesis.	
6.2 Physiology of female reproduction, hormonal control of menstrual cycle.	

6.3 Structure and functions of pituitary, thyroid, parathyroid, pancreas and adrenal glands.

Reference Books

1. Textbook of Medical Physiology, Guyton A. C. & Hall J. E., 2006, 11th Edition, Hercourt Asia Pvt. Ltd. / W. B. Saunders Company
2. Principles of Anatomy & Physiology, 2006, 11th Edition, Tortora G. J. & Grabowski S., John Wiley & sons, Inc.
3. Haematology: De Gruchi.
4. Human physiology, Vol. I & II, 1980, 12th Edn. Dr. C. C. Chatterjee, Medical Applied Agency, Kolkata
5. Text book of Animal Physiology, 2008, 2nd Edn. Nagabhusanam, S. V. S. Rana, S. Kalavathy, Oxford University Press, India.
6. Animal Physiology: Adaptation and Environment, 1997, Schmidt-Nielsen, Knut, Cambridge University Press.
7. General and Comparative Physiology, 1983, 3rd Edn., Hoar W. S., Prentice Hall, UK.7.
8. Medical Physiology, 2006, Asis Das, Books and Allied Pvt. Ltd., Kolkata.
9. Endocrinology, 2005, Lohar P. S., M J P Publishers, Chennai.
10. Vander, Sherman, Luciano's Human Physiology: The Mechanisms of Body Function, 2003, 9th Edn., Eric P. Widmaier, Hershel Raff, Kevin T. Strang, Mc Graw H.
11. Tortora, G. J. and Derrickson, B. H. (2009) Principles of Anatomy and Physiology (12th edition) John Wiley and Sons, Inc.
12. Widmaier, E. P., Raff, H. and Strang, K. T. (2008) Vander's Human Physiology (9th edition) McGraw Hill.
13. Human Anatomy and Physiology, (1998) Marieb, E. (4th edition) Addison-Wesley.
14. Experimental Physiology, (2007) Kesar, S. and Vashisht, N., Heritage Publishers.

Course Title: Molecular Biology

Course Code: ZO 363

Credits: 02

ZO 363 - Molecular Biology

Objectives:

1. The course aims to provide students with an introduction of the underlying molecular mechanisms of various biological processes in cells and organisms.
2. To understand the Structure of DNA and RNA, DNA and RNA as genetic material
3. To understand the Central Dogma of Molecular Biology
4. To understand the concept of gene regulation
5. To understand the DNA Damage and Repair
6. The course aims to develop basic understanding of structure-function relationships of nucleic acids and proteins.

Learning outcomes:

1. Learner shall get an insight into molecular mechanisms of various biological processes in cells and organisms
2. Learner shall get an insight into the Structure of DNA and RNA, DNA and RNA as genetic material
3. The course shall prepare learner to get insight into the Central Dogma of Molecular Biology

4. Learner shall also understand the concept of gene regulation
5. Learner shall get an insight into the DNA Damage and Repair

Title & Contents	Number of lectures
1. Nucleic Acids and Chromatin:	7 L
1.1 Structure of RNA & DNA.	
1.2 Types of RNA.	
1.3 DNA as genetic material - evidences (Griffith's, Avery <i>et al.</i> , Hershey and Chase experiment), RNA as genetic material - TMV 4.	
1.4 Structure of Chromatin, packaging of DNA, Heterochromatin, Euchromatin.	
2. Central Dogma of Molecular Biology:	15 L
2.1 DNA Replication - Semiconservative (Messelson and Stahl experiment), Basic mechanism of replication in prokaryotes and eukaryotes.	
2.2 Transcription -	
2.2.1 Basic mechanism of transcription in prokaryotes and eukaryotes, RNA polymerase enzyme in prokaryotes.	
2.2.2 RNA modifications and processing (splicing - mRNA, modifications at 3' and 5' end).	
2.3 Translation - Genetic code, properties of genetic code, Basic mechanism of Translation in <i>E. coli</i> and eukaryotic cells.	
3. Lac operon:	1 L
4. DNA repair mechanism:	3 L
Photo repair, dark repair, base excision repair.	
5. Recombinant DNA Technology:	4 L
Introduction, restriction enzymes, cloning vector, PCR (polymerase chain reaction), DNA finger printing.	

Reference Book:

1. Molecular biology of cell, 3rd and 4th edition, Albert's B. D. Lewis J. Raff M. Roberts K. and Watson.
2. Gene, Vol. V, VI, VII, VIII and IX, Lewin B., Oxford University Press, Oxford.
3. Molecular biology of the Gene, 1993, Watson J. Hopkins, Roberts Steitz & Weiner, Benjamin Cummings.
4. Text Book of Molecular Biology, 1994, K. Sivrama Sastry G. Padmanabhan and C. Subramanyam : MacMillan, India.
5. Cell and Molecular biology, 1996, G. Karp, John Willey & Sons, U.S.A.

6. Principles of Genetics, 1997, P. D. Snustad, M. L. Smmons, J. B. & Jenkins, John Willey & Sons, U.S.A.
7. Cell and Molecular biology, De Robertis and De Robertis, 8th & 9th Edition, Saunders Publications.

Course Title: Entomology

Course Code: ZO 364

Credits: 02

ZO 364 - Entomology

Objectives:

1. To understand the scope of Entomology and general characters of Insects.
2. To study the morphology and anatomy of Insects.
3. To learn the concept of social organization in Insects.
4. To understand metamorphosis in Insects.
5. To study the economically important insects and Pest management of harmful insects.

Course outcomes:

At the end of this course, Students will -

1. Understand basic concepts in Entomology and its scope.
2. Learn morphology and anatomy of Insects.
3. Understand the concept of social organization in Insects.
4. Understand the development process of Insects.
5. Identify disease causing insect vectors.
6. Will be able to design and implement pest controlling methods against pests.

Title & Contents

Number of lectures

- | | |
|--|------------|
| 1. Fundamentals of Entomology: | 2 L |
| 1.1 Definition and scope of Entomology. | |
| 1.2 General Classification of Insects. | |
| 1.3 General Characters of Insects. | |
| 2. Insect Morphology: | 7 L |
| 2.1 Insect Integument and its derivatives. | |
| 2.2 Insect Head, Head Orientations, Head articulations, Insect antennae and Mouth parts. | |
| 2.3 Insect Thorax, Insect Wing and modifications, Insect Leg and Modifications – a) Cursorial – Cockroach, b) Fossorial – Mole cricket, c) Saltorial – Grasshopper, d) Raptorial – Praying mantis, e) Pollen basket – Honey bee. | |
| 2.4 Insect Abdomen, Genital and Pre – genital appendages of Grasshopper. | |

- 3. Insect Anatomy (Grasshopper):** **4 L**
3.1 Digestive System.
3.2 Circulatory System.
3.3 Nervous System.
3.4 Respiratory System.
3.5 Reproductive System.
- 4. Insect Ecology:** **3 L**
4.1 Definition of Insect Ecology.
4.2 Abiotic Factors (Photoperiod, Temperature and Humidity) and Biotic Factors (Food, Foraging and Nesting).
4.3 Mimicry in insects with suitable examples.
- 5. Insect Metamorphosis:** **2 L**
5.1 Definition.
5.2 Types and examples of Metamorphosis.
- 6. Insects as social groups:** **6 L**
6.1 Definition & significance of Eusociality, Intraspecific and Interspecific relationships among insects.
6.2 Social organization in Wasps and Termites.
- 7. Economic Importance of Insects:** **3 L**
7.1 Insects in Research.
7.2 Insects in Medicines and Cosmetics.
7.3 Insects as Vectors.
7.4 Insects as food.

References

1. Social Insects: Their Origin and Evolution, 2006, W. M. Wheeler, Discovery Publishing House, Delhi.
2. Lives of Social Insects, 1968, P. P. Larson, M. W. Larson, World Pub. Co.
3. Modern Entomology, 2nd edition - By D. B. Tembhare, Himalaya Publication House, Bombay.
4. Principles of Insect Morphology - By R. E. Snodgrass, Tata Mc-Graw Hill Bombay.
5. The Insect: Structure & Function - By R. F. Chapman, E. L. B. S., & E. U. P. London.
6. General Entomology, 2nd edition - By M. S. Mani Oxford & IBH Publishing Company, New Delhi.
7. A Text book of Entomology - By H. H. Ross, John Wiley and Sons, Ins. New York.
8. An Introduction to Entomology - By J. H. Comstock, Ithaca, New York.
9. General & Applied Entomology - By K. K. Nayar, T. N. Anathakrishnan & B.V. David, Tata McGraw-Hill, New Delhi.

Course Title: Techniques in Biology**Course Code: ZO 365****Credits: 02****ZO 365 - Techniques in Biology**

Title & Contents	Number of lectures
1. Microscopy:	3 L
1.1 Definitions - Resolving Power, Limit of Resolution and Magnification, Numerical Aperture.	
1.2 Basic principle of microscopes - Light, Fluorescence, Phase Contrast, Stereo Microscope, SEM and TEM.	
2. Microtomy: Tissue fixation and Processing	8 L
2.1 Methods of tissue fixation: Chemical fixation and physical fixation.	
2.2 Procurement of tissue and importance of fixation of tissues.	
2.3 Dehydration, clearing, impregnation, embedding and block making.	
2.4 Types of microtomes.	
2.5 Section cutting: steps and precautions, common faults in section cutting, reasons & remedies.	
2.6 Mounting and spreading of ribbons.	
2.7 General procedure for staining of sections.	
2.8 Demonstration of Nucleic acid (Feulgen Reaction).	
3. Haematological Techniques:	2 L
3.1 Total count of RBCs, WBCs and Differential count of WBCs and their significance.	
3.2 Bleeding time, clotting time and their significance.	
4. Immunological Techniques:	3 L
4.1 Antigen-Antibody Interactions – Immunodiffusion.	
4.2 Principle & Working of ELISA.	
4.3 Raising Monoclonal Antibodies.	
4.4 Application of Immunological techniques in disease diagnosis.	
5. Types of PCR & DNA Barcoding :	2 L
6. Methods in Biodiversity:	4 L
6.1 Introduction to sampling and sample size.	
6.2 Biodiversity Indices - Species richness, Simpson Diversity Index, Shannon Diversity Index.	
6.3 Measuring Biodiversity- Quadrat sampling, Transect sampling, Insect survey - Active (sweep netting, aquatic nets) and Passive methodology (Pit fall traps, Light traps).	
7. Instruments in Field Biology:	3 L
7.1 Binoculars, GPS, Basic digital camera techniques: Camera lens - prime	

and kit lens, Aperture mode, Shutter mode, Megapixels, Telephoto lens, macro lens.

7.2 Adapters for camera and microscopes, Mobile's camera.

8. Laboratory techniques:

3 L

8.1 Microphotographic techniques - CCD and CMOS camera, digital camera.

8.2 Software for image analysis - Image J and GIMP.

References:

1. Welch, P. S. 1948. *Limnological Methods*. Blakiston Philadelphia. 381 pp.
2. Wetzel, R. G. 1983. *Limnology*. 2nd Ed. Saunders Coll. Philadelphia.
3. Wilson, E. O. (1992). *The Diversity of Life*. Cambridge, Mass, Belknap Press of Harvard University Press.
4. Krebs C. J., 2009. *Ecology*. Benjamin-Cummings Publishing Company or Pearson International Edition
5. Eugene P. Odum and Gary W. Barrett. *Fundamentals of Ecology Brooks / Cole*; 5th Revised edition.
6. Suzanne Bell, Keith Morris. *An Introduction to Microscopy*. CRC press.
7. Kato, M. *The Biology of Biodiversity*. Springer.
8. Robert Smith and Thomas M. Smith *Ecology and Field Biology*.
9. Bikram Grewal *et al.*, *A Photographic Field Guide to the Birds of India, Pakistan, Nepal, Bhutan, Sri Lanka, and Bangladesh*. Princeton University Press.

Course Title: Evolutionary Biology

Course Code: ZO 366

Credits: 02

ZO 366 - Evolutionary Biology

Objectives:

1. To provide comprehensive overview of Concept of Evolution.
2. To explain Origin of Life especially Prokaryotes as well as Eukaryotes in detail.
3. To explore salient features of various theories of evolution comprising of Lamarckism, Darwinism and Neo-Darwinism.
4. To impart detailed understanding of Analogy, Homology, Paleontological Evidences, Embryological Evidences and Molecular Phylogeny.
5. To provide adequate information about Geological Time Scale and Neutral Theory of Molecular Evolution.
6. To develop comprehensive knowledge regarding various Sources of Variations and their role in evolution.
7. To give detailed explanation of key concepts of Population Genetics in terms of Hardy-Weinberg Law, Genetic Drift and Types of Natural Selection.
8. To provide adequate knowledge about Micro-evolutionary changes, Speciation and Adaptive Radiation.
9. To give detailed outline of Extinctions and its types.
10. To impart descriptive knowledge regarding Origin and Evolution of Man.

11. To provide glimpse of Phylogenetic Trees and highlight their construction along with interpretation.

Learning outcomes

After completing the course, the student should be able to

1. Students will be able to learn most of the essential aspects of Evolutionary Biology in detail which will help them in acquiring better understanding regarding the subject.
2. Explain important processes, principles and concepts and critically evaluate theories and empirical research within evolutionary biology
3. Apply evolutionary theory and concepts to address empirical and theoretical questions in evolutionary biology.
4. Independently investigate evolutionary questions using literature and analyses of empirical data.
5. Communicate the principles, theories, problems and research results associated with questions that lie within the evolutionary framework to students

Title & Contents	Number of lectures
1. Introduction:	4 L
1.1 Concept of Evolution.	
1.2 Origin of life.	
1.3 Origin of eukaryotic cell (Origin of mitochondria, plastids & symbionts).	
2. Evidences of Evolution:	5 L
2.1 Analogy and Homology.	
2.2 Embryological Evidences of Evolution.	
2.3 Evolutionary & Paleontological Evidences.	
3. Historical Review of Evolutionary Concept:	3 L
3.1 Theories of Evolution.	
3.2 Lamarckism.	
3.3 Darwinism and Neo Darwinism.	
3.4 Mutation Theory.	
3.5 Modern Synthetic theory.	
4. Sources of Variations:	4 L
4.1 Variation and Mutations.	
5. Isolation	5 L
6. Speciation:	4 L
6.1 Types of speciation (Allopatric & Sympatric).	
6.2 Mechanism of speciation.	
6.3 Patterns of speciation.	
6.4 Factors influencing speciation.	

7 Population Genetics:	2 L
7.1 Hardy-Weinberg Law & Genetic Drift.	
7.2 Types of Natural Selection.	
8 Origin of Man:	4 L
8.1 Evolution of Man (Evolution of anthropoids including man) - Kenyanthropus to <i>Homo sapiens</i> .	
9 Zoogeographical Realms With reference to fauna:	2 L
10 Extinctions:	2 L
10.1 Extinction - An Overview.	

Reference Books

1. Mark Ridley. Evolution. 3rd Edition. Blackwell Publishing. (2004).
2. Mathur, Tomar, Singh. Evolution and Behaviour. Rastogi Publication, Merrut.
3. Mohan P. Arora. Evolutionary Biology, Himalaya Publishing House, Bombay.
4. P. S. Vermin and V. K. Agarwal. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, Revised Edition. S. Chand Publication (2004).
5. Strickberger. Evolution. Prentic Hall. (2002).
6. Theodore H., Jr Eaton. Evolution. 1st Edition. W. W. Norton Publication. (1970).
7. Organic Evolution, Richard Swann Lull, Light & Life Publishers.
8. Introductions to Evolution, Paul Amos Moody, Kalyani Publishers, New Delhi.
9. Organic Evolution, 1991 T.S. Gopal krishanan, Itta Sambashivarab Publ. House.
10. Evolutionary Biology, 1990, Mohan P. Arora, Himalaya Publi. House, Delhi.
11. Evolution, 1968, E. O. Dodson, Reinhold Publ. Crop., New York.
12. The major features of evolution, 1953, Simpson G. G. Columbia, New York.
13. The origin of species, 1959, Charles Darwin, New American Library, New York.

Course Title: Environmental Impact Assessment

Course Code: ZO 3610

Credits: 02

ZO 3610 - Environmental Impact Assessment

Title & Contents	Number of lectures
1. Environment:	2 L
1.1 Definition.	
1.2 Divisions.	
1.3 Importance.	
2. Pollution:	3 L
2.1 Definition and types.	
2.2 Impact on wildlife, natural resources, development.	
3. Sustainable development:	2 L

- 3.1 Definition and need.
- 3.2 Exploitation of natural resources.
- 3.3 Concept of carrying capacity.
- 3.4 Three pillars of Sustainability.
- 3.5 UN 17 Sustainable Development Goals (SDGs).
- 4. Overview of Environmental Protection acts: 5 L**
 - 4.1 The Air (Prevention and Control of Pollution) Act 1981.
 - 4.2 The Water (Prevention and Control of Pollution) Act 1974.
 - 4.3 The Environment Protection Act 1986.
 - 4.4 The National Green Tribunal Act 2010.
 - 4.5 Biological Diversity Act 2002.
- 5. Environmental Impact Assessment (EIA): 5 L**
 - 5.1 Definition, need and importance of EIA.
 - 5.2 EIA notification 2006 - key elements, History and Evolution of EIA.
 - 5.3 Categories of Industries / establishments requiring EIA, Types of EIA - strategic EIA, regional EIA, sectoral EIA, project level EIA and life cycle assessment.
 - 5.4 Rapid and comprehensive EIA.
- 6. EIA Process: 5 L**
 - 6.1 Screening, Scoping and consideration of alternatives.
 - 6.2 Baseline data collection, Impact analysis, Mitigation, Reporting, Public hearing.
 - 6.3 Review of EIA.
 - 6.4 Decision-making, monitoring clearance conditions.
- 7. Stakeholders in EIA process: 3 L**
 - 7.1 Project proponent, Environmental consultant.
 - 7.2 CPCB / MPCB.
 - 7.3 Public, EIA agency (IAA).
- 8. Overview of Scheme for Accreditation of EIA Consultant Organizations (NABET / QCI): 5 L**
 - 8.1 Eligibility and benefits.
 - 8.2 EIA coordinator (EC), Functional area experts (FAEs).
 - 8.3 Functional area associate (FAA) and team members: Role, educational qualification, experience and functions.

References:

1. Glasson, J., Therivel, R. (2019) Introduction to Environmental Impact Assessment. Routledge. London.
2. Judith, P. 1999. Handbook of Environmental Impact Assessment. Blackwell Science.
3. Marriott, B. 1997. Environmental Impact Assessment: A Practical Guide. McGraw-Hill, New York, USA.

Course Title: Project
Course Code: ZO 3611
Credits: 02

ZO 3611 - Project

Students have to complete the research project in the stipulated time and present the dissertation at the time of the examination in a proper format. Students should be encouraged to take up laboratory work, hands-on practical investigation and design experimental setup. Field work to be carried out under proper supervision and permissions from the concerned authorities.

Possible key aspects of the project work -

1. Planning the project
2. Selecting a suitable title
3. Significance of the work
4. Hypothesis, Objectives
5. Reviewing the available literature
6. Methodology to be used
7. Outcomes of the Project work
8. Conclusion and Discussion
9. Future plans

Students should be made aware of plagiarism and research ethics.

Course Title: Zoology Practical Paper - I
Course Code: ZO 367
Credits: 02

ZO 367 - Zoology Practical Paper - I

Section I: Practicals in Medical & Forensic Zoology

- | | |
|---|-------|
| 1. To carry out routine analysis of given urine sample for - | 2 (E) |
| i. Physical Properties: Volume, Colour, pH, Turbidity, Specific gravity. | |
| ii. Chemical Properties: Sugars, Protein, Bile salts & bile pigments, Ketone bodies, Blood. (C) | |
| 2. Determination of serum urea. | E |
| 3. Determination of serum uric acid. | E |
| 4. Determination of serum Calcium. (C) | E |
| 5. To examine human hair for cortex and medulla. (C) | E |
| 6. To examine hair morphology and determine the species to which the hair belongs. | E |
| 7. To prepare slides of scale pattern of human hair. (C) | E |
| 8. To Visit a Forensic Laboratory and submission of the report. | E |
| 9. To Identify and differentiate various types of Finger prints. (C) | E |

10. To prepare a case report on forensic entomology with respect to insect's succession and its relationship to determine time since death. E

Section II: Practicals in Animal Physiology

1. Haemoglobin estimation using Sahli's haemoglobinometer. (C) E
2. Preparation of haemin and haemochromogen crystals. (C) E
3. To estimate the blood glucose level from given sample. (C) E
4. Estimation of bleeding and clotting time. (C) E
5. Study of disorders caused by endocrine glands with the help of photographs. D
6. Detection of blood groups in human being. E
7. Differential count of blood. E
8. Estimation of haemoglobin percentage with the help of haemometer. E
9. Qualitative detection of nitrogenous waste products (Ammonia, urea, uric acid) in given sample. (C) E
10. Demonstration of kymograph unit, Respirometer through available resources. D
11. Measurement of lung capacity. E

Course Title: Zoology Practical Paper - II

Course Code: ZO 368

Credits: 02

ZO 368 - Zoology Practical Paper - II

Section I: Practicals in Molecular Biology

1. Lab safety techniques & sterilisation. D
2. Preparation of DNA paper model and study its characteristics. E
3. Staining of DNA and RNA by methyl green – pyronin. (C) E
4. Estimation of DNA by Diphenylamine method. (C) E
5. Estimation of RNA by Bial's Orcinol method. E
6. Isolation of DNA from Bacteria / liver / Onion. (C) – 2 P E
7. Absorption spectra of DNA isolated from Bacteria / Liver / Onion. (C) E
8. Principle & application of Spectrophotometer & PCR. D

Section II - Practicals in Entomology

1. Study of external characters of any Insect (Grasshopper / Cockroach / Plant bug). E
2. Study of Insect Head, its articulations and types of mouthparts and their modifications. D
3. Study of Insect Legs, wing and their modifications. D
4. Study of Digestive system of any locally available insect pest. (C) E

- | | |
|--|---|
| 5. Study of Reproductive system of any locally available insect pest. (C) | E |
| 6. Study of Social organization in Termites and Honey Bees. | D |
| 7. Study of Insect egg, larva, pupa and their types. | D |
| 8. Study of Insect vectors - Mosquito, House fly, Cockroaches, Bugs. | D |
| 9. Temporary mountings of Mouthparts, Antennae,
Legs and Wings of any locally available insect pest. (C) | E |
| 10. Study of Preservation of Insect pest by using spreading techniques & submission
of any five insect pests / vectors. (C) | E |
| 11. Compulsory field visit to a Wildlife Sanctuary / National Park / Tiger Reserve /
to study the Insect diversity – 2P. | E |

Course Title: Zoology Practical Paper – III**Course Code: ZO 369****Credits: 02****ZO 369 - Zoology Practical Paper III****Section I: Practicals of Techniques in Biology**

- | | |
|--|---|
| 1. Compound and Stereo microscope: Components, usage and maintenance. | D |
| 2. To observe different kind of cells under compound microscope and its measurement
using micrometer scale or by image analysis software (Ex. Image J). (C) | E |
| 3. Tissue collection, fixation & Block preparation. (C) | E |
| 4. Sectioning, staining & mounting. Submission of any three permanent
slides from three different organs. (C) | E |
| 5. To study population density and percentage frequency of different animal /
insect species of a given area. | D |
| 6. Calculating the different alpha and beta biodiversity indices of different
animal /insect species of a given area. | D |
| 7. Survey for insects using pit fall trap and light traps in your college
campus / agriculture field. | E |
| 8. Use of photography (Mobile camera / DSLR) in scientific documentation
of at least 5 species of insects / birds/ mammals. | D |
| 9. Visit to a water body / forest to study faunal biodiversity using field equipment – (C) 2P | E |
| 10. Study of Principle & working of PCR & DNA Barcoding – 2 P | E |

Section II - Practicals in Evolutionary Biology

1. Study of morphological similarities and differences between man and ape (C) D
2. Study of types of fossils with the help of specimens/ charts/ photos (C) D
3. Study of animal adaptations in: Turtle, Draco, Exocoetus, Bat and Parrot (C) D
4. Study of evidences of evolution- embryological, paleontological, connecting links, morphology and comparative anatomy. (C) E
5. Study of successive stages of evolution of man : a) Australopithecus b) *Homo erectus* c) *Homo neanderthalis* d) Cro-Magnon man e) *Homo sapiens*. (C) D
6. To record Zoogeographical distribution of animals to respective zoogeographical Realms on the world map (Lung fishes, marsupials, flightless birds, Camel, Elephant, Ostrich etc.). (C) E



Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Computer Science

(Faculty of Science & Technology)

T.Y.B.Sc. (Computer Science)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2021 – 2022

Course Structure T. Y. B. Sc.(Computer Science)

Semester V (Total credits=22)

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
DSEC - I	CS-351	Operating Systems - I	2		15	35	50
	CS-352	Computer Networks - II	2		15	35	50
	CS-357	Practical course based on CS 551		2	15	35	50
DSEC - II	CS-353	Web Technologies – I	2		15	35	50
	CS-354	Foundations of Data Science	2		15	35	50
	CS-358	Practical course based on CS 553		2	15	35	50
DSEC - III	CS-355	Object Oriented Programming - I (Core Java)	2		15	35	50
	CS-356	Theoretical Computer Science and Compiler Construction - I	2		15	35	50
	CS-359	Practical Course based on CS 555		2	15	35	50
SECC - I	CS-3510	Python Programming	1	1	15	35	50
SECC - II	CS-3511	Block Chain / Cloud Technology	1	1	15	35	50

Semester VI (Total credits=22)

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
DSEC - I	CS-361	Operating Systems - II	2		15	35	50
	CS-362	Software Testing	2		15	35	50
	CS-367	Practical course based on CS 561		2	15	35	50
DSEC - II	CS-363	Web Technologies – II	2		15	35	50
	CS-364	Data Analytics	2		15	35	50
	CS-368	Practical course based on CS 563		2	15	35	50
DSEC - III	CS-365	Object Oriented Programming - II (Advanced Java)	2		15	35	50
	CS-366	Theoretical Computer Science and Compiler Construction - II	2		15	35	50
	CS-369	Practical Course based on CS 564 and CS 565		2	15	35	50
SECC - III	CS-3610	Mobile Application Development / Software Testing Tools	1	1	15	35	50
SECC - IV	CS-3611	Project	1	1	15	35	50

<p style="text-align: center;">SavitribaiPhule Pune University T.Y.B.Sc. (Computer Science) - Sem – V Course Type: DSEC – I Course Code : CS-351 Course Title : Operating System – I</p>		
Teaching Scheme: 2.30 HRs/ week	No. of Credits: 2	Examination Scheme: IE : 15 marks UE: 35 marks
<p>Prerequisites Data structures like stack, queue, linked list, tree, graph, hashing, file structures, any structured programming language</p>		
<p>Course Objectives: 1. To understand the concept of operation system and its principle 2. To study the various functions and services provided by operating system 3. To understand the notion of process and threads</p>		
<p>Course Outcomes: After completion of this course students will be able to understand the concept of 1. Processes and Thread Scheduling by operating system 2. Synchronization in process and threads by operating system 3. Memory management by operating system using with the help of various schemes</p>		
Course Contents		
Chapter 1	Introduction to Operating Systems	6 lectures
<ul style="list-style-type: none"> • Operating Systems Overview- system Overview and Functions of operating systems • What does an OS do? • Operating system Operations • Operating system structure • Protection and security • Computing Environments- Traditional, mobile , distributed, Client/server, peer to peer computing • Open source operating System • Booting • Operating System services, • System calls Types of System calls and their working. 		
Chapter 2	Processes and Threads	6 lectures
<ul style="list-style-type: none"> • Process Concept – The processes, Process states, Process control block. • Process Scheduling – Scheduling queues, Schedulers, context switch • Operations on Process – Process creation with program using fork(), Process termination • Thread Scheduling- Threads, benefits, Multithreading Models, Thread Libraries 		
Chapter 3	Process Scheduling	6 lectures
<ul style="list-style-type: none"> • Basic Concept – CPU-I/O burst cycle, Scheduling Criteria ,CPU scheduler, Preemptive scheduling, Dispatcher • Scheduling Algorithms – FCFS, SJF, Priority scheduling, Round-robin scheduling, Multiple queue scheduling, Multilevel feedback queue scheduling 		
Chapter 4	Synchronization	5 lectures
<ul style="list-style-type: none"> • Background • Critical Section Problem 		

<ul style="list-style-type: none"> • Semaphores: Usage, Implementation • Classic Problems of Synchronization – The bounded buffer problem, The reader writer problem, The dining philosopher problem 		
Chapter 5	Memory Management	13 lectures
<ul style="list-style-type: none"> • Background – Basic hardware, Address binding, Logical versus physical address space, Dynamic loading, Dynamic linking and shared libraries • Swapping • Contiguous Memory Allocation – Memory mapping and protection, Memory allocation, Fragmentation • Paging – Basic Method, Hardware support, Protection, Shared Pages • Segmentation – Basic concept, Hardware • Virtual Memory Management – Background, Demand paging, Performance of demand paging, Page replacement – FIFO, Optimal, LRU 		
Reference Books:		
<ol style="list-style-type: none"> 1. Operating System Concepts, Avi Silberschatz, Peter Galvin, Greg Gagne, Student Edition, Wiley Asia 2. Operating Systems: Internals and Design Principles, William Stallings, Prentice Hall of India. 3. Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI 4. Advanced Concepts in Operating Systems, M Singhal and NG Shivaratri, Tata McGraw Hill Inc, 2001 (Text Book) 5. Distributed Operating Systems, Maarten van Steen, A S Tanenbaum. Third edition. Pearson Education Asia, 2001 		

SavitribaiPhule Pune University
T.Y.B.Sc. (Computer Science) Sem - V
Course Code: DSEC- I Course Code : CS-352
Course Title :Computer Networks-II

Teaching Scheme 02:30 Hrs / week	No. of Credits 2	Examination Scheme IE :15 marks UE: 35 marks
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Prerequisites:

Prerequisites: Basic knowledge of Networking and ISO/OSI model

Course Objectives

- To understand different protocols of application layer.
- To understand concepts of multimedia.
- Explore the different methods used for Network/INTERNET security.

Course Outcomes

On completion of the course, student will be able to–

- Student will understand the different protocols of Application layer.
- Developed understanding of technical aspect of Multimedia Systems
- Develop various Multimedia Systems applicable in real time.
- Identify information security goals.
- Understand, compare and apply different encryption techniques.
- Come to know about INTERNET security.

Course Contents

Chapter 1	Application Layer	10 Lect
<p>1.1. Domain Name System</p> <ul style="list-style-type: none"> • Name space-Flat name space, Hierarchical name space • Domain Name Space -Label ,Domain name,FQDN,PQDN • Distribution of Domain Name Space-Hierarchy of name servers,zone,Root server,Primary and secondary servers. • DNS in the Internet:Generic domains,Country domains,inverse domain • Resolution-Resolver,mapping names to address,mapping addresses to names,recursive resolution,iterative resolution,caching • DNS messages-Header <p>1.2. Remotelogging-Telnet:TimesharingEnvironment,Logging,NVT set,Embedding Options,mode of operation</p> <p>1.3. Electronic Mail-</p> <ul style="list-style-type: none"> • Architecture-First scenario,second scenario,Third scenario,Fourth scenario • User agent-services of user agent,types of UA Format of e-mail • MIME-MIME header • Message transfer agent-SMTP • Message Access Agent:POP and IMAP <p>1.4. File Transfer FTP-Communication over data control connection,File type,data structure,Transmission mode,anonymous FTP</p> <p>1.5. WWW-Architecture,Client,Server,URL,Cookies</p> <p>1.6. HTTP-HTTP transaction,messages</p>		
Chapter 2	Multimedia	08 Lect
<p>2.1. Digitizing audio and video,Audio and Video compression</p>		

	<p>2.2. Streaming Stored audio/video</p> <ul style="list-style-type: none"> • First approach • Second approach • Third approach • Fourth approach <p>2.3. Streaming live audio/video Real time interactive audio/video- Characteristics, Time relationship, timestamp, Playback buffer, ordering multicasting, translation</p> <p>2.4. RTP-Packet format</p> <p>2.5. RTCP-Message types</p> <p>2.6. Voice over IP-SIP,SIP session</p> <p>H.323-Architecture,Protocols</p>	
Chapter 3	Cryptography and Network Security	09 Lect
	<p>3.1. Cryptography,plain text and cipher text,cipher key,categories of cryptography- Symmetric key,asymmetric key,three types of keys comparison</p> <p>3.2. Symmetric key cryptography</p> <ul style="list-style-type: none"> • Traditional ciphers – substitution cipher,shift cipher,Transposition cipher • Simple Modern ciphers-XOR,Rotation cipher,s-box,p-box • Modern round ciphers-DES,AES,IDEA • Mode of operation-ECB,CBC,CFB,OFB <p>3.3. Asymmetric key cryptography-RSA, Diffie Hellman, Man in the middle attack</p> <p>3.4. Security Services</p> <ul style="list-style-type: none"> • Message confidentiality-With Symmetric key cryptography, with asymmetric key cryptography • Message integrity-Document and fingerprint, message and message digest • Message authentication-MAC,HMAC • Digital signature • Entity Authentication-Passwords,Fixed passwords challenge-response 	
Chapter 4	Security in the Internet	09 Lect
	<p>4.1. IPSecurity(IPSec)</p> <ul style="list-style-type: none"> • Two modes • Two security protocols • Services provided by IPSec • Security association • Internet key exchange • Virtual private network <p>4.2. SSL/TLS</p> <ul style="list-style-type: none"> • SSL services • Security parameters • Sessions and connections • Four protocols • Transport layer security <p>4.3. PGP</p> <ul style="list-style-type: none"> • Security parameters • Services • PGP algorithms • Key rings • PGP certificates 	

4.4. Firewalls

- Packet filter firewall
- Proxy firewall

Reference Books:

R1. Data communications and networking by Behrouz Forouzan 4th/5th edition, McGraw Hill Pvt Ltd.

R2. Computer Networks by Andrew S Tanenbaum, 4th/5th edition, Pearson Education

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) Sem V
Course Type:DSEC – II Course Code: CS-353
Course Title : Web Technologies I

Teaching Scheme 02.30 Hrs / week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
Prerequisites HTML basics for form designing		
Course Objectives <ul style="list-style-type: none"> • To Design dynamic and interactive Web pages. • To Learn Core-PHP, Server Side Scripting Language • To Learn PHP-Database handling 		
Course Outcomes On completion of the course, student will be able to– <ul style="list-style-type: none"> • Understand how to develop dynamic and interactive Web Page 		
Course Contents		
Chapter 1	Introduction of Web , HTML and HTTP basics	4 Lect
1.7. HTML: Creating Forms, creating Tables, Managing home page, HTML5 Semantic and Form Elements. 1.8. CSS: Three ways to use CSS, Box Model, Navigation Bar 1.9. Introduction to Web server and Web browser 1.10. HTTP basics		
Chapter 2	PHP basics	4 Lect
2.7. Introduction to PHP 2.8. What does PHP do? 2.9. Lexical structure 2.10. Language basics		
Chapter 3	Function and String	7 Lect
3.1 Defining and calling a function 3.2 Default parameters 3.3 Variable parameters, Missing parameters 3.4 Variable function, Anonymous function 3.5 Types of strings in PHP 3.6 Printing functions 3.7 Encoding and escaping 3.8 Comparing strings 3.9 Manipulating and searching strings 3.10 Regular expressions		
Chapter 4	Arrays	5 Lect
4.1 Indexed Vs Associative arrays 4.2 Identifying elements of an array 4.3 Storing data in arrays 4.4 Multidimensional arrays		

4.4 Extracting multiple values 4.5 Converting between arrays and variables 4.6 Traversing arrays 4.7 Sorting 4.8 Action on entire array		
Chapter 5	Introduction to Object Oriented Programming	6 Lect
5.1 Classes 5.2 Objects 5.3 Introspection 5.4 Serialization 5.5 Inheritance 5.6 Interfaces 5.7 Encapsulation		
Chapter 6	Files and directories	4 Lect
6.1 Working with files and directories 6.2 Opening and Closing, Getting information about file, Read/write to file, Splitting name and path from file, Rename and delete files 6.3 Reading and writing characters in file 6.4 Reading entire file 6.5 Random access to file data 6.6 Getting information on file 6.7 Ownership and permissions		
Chapter 7	Databases (PHP-PostgreSQL)	6 Lect
7.1 Using PHP to access a database 7.2 Relational databases and SQL 7.3 PEAR DB basics 7.4 Advanced database techniques		
Reference Books:		
1. HTML & CSS: The Complete Reference, Fifth Edition Author: Thomas A. Powell First published: 01 Jan 2010. 2. Programming PHP By Rasmus Lerdorf and Kevin Tatroe, O'Reilly publication 3. Beginning PHP 5, Wrox publication 4. PHP web services, Wrox publication 5. Mastering PHP, BPB Publication 6. PHP cookbook, O'Reilly publication 7. PHP for Beginners, SPD publication 8. Programming the World Wide Web, Robert W Sebesta(3rd Edition) 9. HTML 5 Black Book : Covers Css3, Javascript, XML, XHTML, Ajax, PHP And JQuery by Kogent Learning Solutions Inc, Published November 2011 by Dreamtech Press 10. www.php.net.in 11. www.W3schools.com 12. www.wrox.com		

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) Sem V
Course Type:DSEC – II Course Code: CS-354
Course Title : Fondation of Data Science

Teaching Scheme 02:30 Hrs / week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
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Prerequisites

- Problem solving using computers
- Basic mathematics and statistics
- Knowledge of Databases

Course Objectives

- Provide students with knowledge and skills for data-intensive problem solving and scientific discovery
- Be prepared with a varied range of expertise in different aspects of data science such as data collection, visualization, processing and modeling of large data sets.
- Acquire good understanding of both the theory and application of applied statistics mathematics and computer science based existing data science models to analyse huge data sets originating from diversified application areas.
- Be able to create models using the knowledge acquired from the program to solve future challenges and real-world problems requiring large scale data analysis.
- Be better trained professionals to cater the growing demand for data scientists in industry.

Course Outcomes

On completion of the course, student will be able to–

- Perform Exploratory Data Analysis
- Obtain, clean/process, and transform data.
- Detect and diagnose common data issues, such as missing values, special values, outliers, inconsistencies, and localization.
- Demonstrate proficiency with statistical analysis of data.
- Present results using data visualization techniques.
- Apply concepts of data analysis, data collection, modeling, and inference
- Prepare data for use with a variety of statistical methods and models and recognize how the quality of the data and the means of data collection may affect conclusions.

Course Contents

Chapter 1	Introduction to Data Science	6 Lect
1.11.	The Art of Data Science, The 5 V's: Volume, Velocity, Variety, Veracity, Value	
1.12.	Why Data Science?	
1.13.	Evolution of Data Science	
1.14.	Applications of Data Science	
1.15.	The Data Science Lifecycle	
1.16.	Data Scientist's Toolbox	
Chapter 2	Statistical and Mathematical Foundations	10 Lect
2.1.	Exploring Probability and Inferential Statistics	
2.2.	Basic Statistical descriptions of data	
2.2.1.	Measuring the Central Tendency: Mean, Median, and Mode	
2.2.2.	Measuring the Dispersion of Data: Range, Quartiles, Variance,	

<p>2.2.3. Standard Deviation, and Interquartile Range</p> <p>2.3. Quantifying Correlation</p> <p>2.4. Multiple hypothesis testing, Parameter Estimation methods,</p> <p>2.5. Confidence intervals, Bayesian statistics and Probability Distributions (Uniform, Normal, Poisson, Binomial, Bernoulli distribution).</p> <p>2.6. Introducing Regression Methods</p> <p>2.6.1 Linear Regression</p> <p>2.6.2: Polynomial Regression</p> <p>2.6.3: Logistic Regression</p> <p>2.7. Measuring Data Similarity and Dissimilarity, Proximity measures</p> <p>2.8. Detecting Outliers</p>		
Chapter 3	Data Collection and Preprocessing	14 Lect
<p>3.1. Properties of Data Structured, semi-structured, Unstructured Data, graph based, streaming data, Quantitative and Categorical Data, Big Data and Little Data</p> <p>3.2. Types of data Integers, Floats, Text Data, Text Files, Dense Numerical Arrays, Compressed or Archived Data, SV Files, JSON Files, XML Files, HTML Files, Tar Files, GZip Files, Zip Files, Image Files: Rasterized, Vectorized, and/or Compressed</p> <p>3.3. Data Objects and Attribute Types: What Is an Attribute?, Nominal, Binary, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes</p> <p>3.4. Data sources - Open Data, Social Media Data, Multimodal Data, standard datasets</p> <p>3.5. Collecting data Hunting, scraping, logging, Combining datasets, aggregation and grouping</p> <p>3.6. Data munging</p> <p>3.6.1. Data Quality: Why Preprocess the Data?</p> <p>3.6.2. Cleaning Data - Missing Values, Noisy Data (Duplicate Entries, Multiple Entries for a Single Entity, Missing Entries, NULLs, Huge Outliers, Out-of-Date Data, Artificial Entries, Irregular Spacings, Formatting Issues - Irregular between Different Tables/Columns, Extra Whitespace, Irregular Capitalization, Inconsistent Delimiters, Irregular NULL Format, Invalid Characters, Incompatible Datetimes)</p> <p>3.6.3. Data Transformation by Normalization, Label and One Hot Encoding</p>		
Chapter 4	Data Visualization	6 Lect
<p>4.5. Exploratory Data Analysis, purpose, types</p> <p>4.6. Visualization workflow</p> <p>4.7. Data Representation: chart types: categorical, hierarchical, relational, temporal & spatial;</p> <p>4.8. 2-D charts: bar charts, Clustered bar charts, dot plots, connected dot plots, pictograms, proportional shape charts, bubble charts, radar charts, polar charts, Range chart, Box-and-whisker plots, univariate scatter plots, histograms word cloud, pie chart, waffle chart, stacked bar chart, back-to-back bar chart, treemap.</p>		
Reference Books:		
<p>1) The Data Science Design Manual, Steven S. Skiena, Springer, 2017</p> <p>2) Introducing data science: big data, machine learning, and more, using Python tools, Clalen D., Meysman A. D., & Ali M., Manning Publications Co., 2016</p> <p>3) Python Data Science Essentials, Alberto Boschetti, Luca Massaron, Second Edition, 2016 Packt Publishing</p> <p>4) The Data Science Handbook, Field Cady, John Wiley & Sons, Inc, 2017</p>		

- 5) Python Data Science Handbook - Essential Tools for Working with Data, Jake VanderPlas, O'Reilly, 2017
- 6) Andy Kirk, Data Visualization A Handbook for Data Driven Design, Sage Publications, 2016
- 7) The Data Warehouse Etl Toolkit: Practical Techniques For Extracting, Cleaning, Conforming, And Delivering Data; by Ralph Kimball; Publisher: WILEY INDIA, Year – 2004
- 8) A Hands-On Introduction to Data Science CHIRAG SHAH University of Washington Cambridge University Press
- 9) Practical Statistics for Data Scientists: 50 Essential Concepts, Peter Bruce,Shroff/O'Reilly; First edition, 2017

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – V
Course Type: DSEC – III Course Code : CS-355
Course Title : Object Oriented Programming – I (Core Java)

Teaching Scheme 02:30 Hrs / week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
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Prerequisites

- Knowledge of C Programming language

Course Objectives

- To learn Object Oriented Programming language
- To study various java programming concept like Interface, File and Exception Handling etc.
- To design User Interface using Swing and AWT

Course Outcomes

On completion of the course, student will be able to–

- Understand the concept of classes, objects and packages.
- To develop GUI based application.

Course Contents

Chapter 1	An Introduction to Java	3 Lect
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- 1.1 A Short History of Java
- 1.2 Features or buzzwords of Java
- 1.3 Comparison of Java and C++
- 1.4 Java Environment
- 1.5 Simple java program
- 1.6 Java Tools – jdb, javap, javadoc
- 1.7 Java IDE – Eclipse/NetBeans (Note: Only for Lab Demonstration)

Chapter 2	An Overview of Java	3 Lect
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- 2.1 Types of Comments
- 2.2 Data Types
- 2.3 Final Variable
- 2.4 Declaring 1D, 2D array
- 2.5 Accepting input using Command line argument
- 2.6 Accepting input from console (Using BufferedReader class)

Chapter 3	Objects and Classes	6 Lect
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- 3.1 Defining Your Own Classes
- 3.2 Access Specifiers (public, protected, private, default)
- 3.3 Array of Objects
- 3.4 Constructor, Overloading Constructors and use of 'this' Keyword
- 3.5 static block, static Fields and methods
- 3.6 Predefined class – Object class methods (equals(), toString(), hashCode(), getClass())
- 3.7 Inner class , Anonymous Classes
- 3.8 Creating, Accessing and using Packages
- 3.9 Creating jar file and manifest file
- 3.10 Wrapper Classes
- 3.11 Garbage Collection (finalize() Method)
- 3.12 Date and time processing

Chapter 4	Inheritance and Interface	6 Lect
<p>4.1 Inheritance Basics (extends Keyword) and Types of Inheritance 4.2 Superclass, Subclass and use of Super Keyword 4.3 Method Overriding and runtime polymorphism 4.4 Use of final keyword related to method and class 4.5 Use of abstract class and abstract methods 4.6 Defining and Implementing Interfaces, 4.7 Runtime polymorphism using interface and Functional Interface 4.8 Object Cloning</p>		
Chapter 5	Exception Handling	3 Lect
<p>5.1 Dealing Errors, Exception class, Checked and Unchecked exception 5.2 Catching exception, Multiple catch block, Nested try block and exception handling 5.3 Creating user defined exception 5.4 Assertions</p>		
Chapter 6	Strings , Streams and Files	6 Lect
<p>6.1 String class and String Buffer Class , StringTokenizer class 6.2 Formatting string data using format() method , toString method 6.3 Stream classes Byte Stream classes Character Stream Classes 6.4 Using the File class , Creation of files 6.5 Reading/Writing characters and bytes 6.6 Handling primitive data types 6.7 Random Access files</p>		
Chapter 7	User Interface Components with AWT and Swing	6 Lect
<p>7.1 What is AWT ? What is Swing? Difference between AWT and Swing. 7.2 The MVC Architecture and Swing 7.3 Layout Manager and Layouts, The JComponent class 7.4 Components – JButton, JLabel, JText, JTextArea, JCheckBox and JRadioButton, JList, JComboBox, JMenu and JPopupMenu Class, JMenuItem and JCheckBoxMenuItem, JRadioButtonMenuItem , JScrollBar 7.5 Dialogs (Message, confirmation, input), JFileChooser, JColorChooser 7.6 Event Handling: Event sources, Listeners 7.7 Mouse and Keyboard Event Handling 7.8 Adapters 7.9 Anonymous inner class</p>		
Chapter 8	Applet	3 Lect
<p>8.1 Applet Life Cycle , appletviewer tool 8.2 Applet HTML Tags 8.3 Passing parameters to Applet 8.4 repaint() and update() method</p>		
Reference Books:		
<p>R1. Complete reference Java by Herbert Schildt(5th edition) R2. Java 2 programming black books, Steven Horlzner R3. Programming with Java , A primer ,Forth edition , By E. Balagurusamy R4. Core Java Volume-I-Fundamentals, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Pres</p>		

<p style="text-align: center;">Savitribai Phule Pune University T.Y.B.Sc. (Computer Science) Sem - V Course Type: DSEC- III Course Code: CS-356 Paper Title: Theoretical Computer Science and Compiler Construction I</p>		
Teaching Scheme 02:30 Hrs / week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
<p>Prerequisites</p> <ul style="list-style-type: none"> • Mathematical Preliminaries Sets (Subset, Set Operations), Relations (Properties of Relations, Closure of Relations) and Functions • Discrete Mathematics- Graphs, Trees, Logic and Proof Techniques 		
<p>Course Objectives</p> <ul style="list-style-type: none"> • To understand the Finite Automata, Pushdown Automata and Turing Machine. • To understand the Regular Language, Context Free Language, Context Sensitive Language and Unrestricted Language. • To understand the relation between Automaton and Language 		
<p>Course Outcomes</p> <p>On completion of the course, student will be able to–</p> <ul style="list-style-type: none"> • Understand the use of automata during language design. • Relate various automata and Languages. 		
Course Contents		
Chapter 1	Finite Automaton	11 Lect
<p>1.1 Introduction: Symbol, Alphabet, String, Prefix & Suffix of Strings, Formal Language, Operations on Languages.</p> <p>1.2 Deterministic finite Automaton – Definition, DFA as language recognizer, DFA as pattern recognizer.</p> <p>1.3 Nondeterministic finite automaton – Definition and Examples.</p> <p>1.4 NFA To DFA (Myhill Nerode Method)</p> <p>1.5 NFA with ϵ-transitions Definition and Examples.</p> <p>1.6 NFA with ϵ-Transitions to DFA & Examples</p> <p>1.7 Finite automaton with output – Mealy and Moore machine, Definition and Examples.</p> <p>1.8 Minimization of DFA, Algorithm & Problem using Table Method.</p>		
Chapter 2	Regular Expressions and Languages	4 Lect

<p>2.1 Regular Expressions (RE): Definition & Example</p> <p>2.2 Regular Expressions Identities.</p> <p>2.3 Regular language-Definition and Examples.</p> <p>2.4 Conversion of RE to FA-Examples.</p> <p>2.5 Pumping lemma for regular languages and applications.</p> <p>2.6 Closure Properties of regular Languages</p>		
Chapter 3	Context-Free Grammars and Languages	9 Lect
<p>3.1 Grammar - Definition and Examples.</p> <p>3.2 Derivation-Reduction - Definition and Examples.</p> <p>3.3 Chomsky Hierarchy.</p> <p>3.4 CFG: Definition & Examples. LMD, RMD, Parse Tree</p> <p>3.5 Ambiguous Grammar: Concept & Examples.</p> <p>3.6 Simplification of CFG: Removing Useless Symbols, Unit Production, ϵ-production and Nullable Symbol.</p> <p>3.7 Normal Forms: Greibach Normal Form (GNF) and Chomsky Normal Form (CNF)</p> <p>3.8 Regular Grammar: Definition.</p> <p> 3.8.1 Left linear and Right Linear Grammar-Definition and Example.</p> <p> 3.8.2 Equivalence of FA & Regular Grammar</p> <p> 3.8.3 Construction of regular grammar equivalent to a given DFA.</p> <p> 3.8.4 Construction of a FA from the given right linear grammar</p>		
Chapter 4	Push Down Automata	5 Lect
<p>4.1 Definition of PDA and examples.</p> <p>4.2 Construction of PDA using empty stack and final State method: Examples using stack method.</p> <p>4.3 Definition DPDA & NPDA, their correlation and Examples of NPDA</p> <p>4.4 CFG (in GNF) to PDA: Method and examples</p>		
Chapter 5	Turing Machine	7 Lect
<p>5.1 The Turing Machine Model, Definition and Design of TM</p> <p>5.2 Problems on language recognizers.</p> <p>5.3 Language accepted by TM.</p> <p>5.4 Types of Turing Machines (Multitrack TM, Two-way TM, Multitape TM, Non-deterministic TM)</p> <p>5.5 Introduction to LBA (Basic Model) & CSG. (Without Problems)</p> <p>5.6 Computing TM, Enumerating TM, Universal TM.</p> <p>5.7 Recursive Languages</p> <p> 5.7.1. Recursive and Recursively enumerable Languages.</p> <p> 5.7.2. Difference between recursive and recursively enumerable language.</p> <p>5.8 Turing Machine Limitations</p> <p>5.9 Decision Problem, Undecidable Problem, Halting Problem of TM</p>		

Reference Books

- R1. Introduction to Automata Theory, Languages and Computation, John E. Hopcraft, Rajeev Motwani, Jeffrey D. Ullman, Third Edition, Pearson Education Publication, 2008
- R2. Introduction to Automata theory, Languages and computation By John E. Hopcroft and Jeffrey Ullman – Narosa Publishing House, 1995
- R3. Theory of Computer Science Automata, Languages and Computation, K.L.P. Mishra, N. Chandrasekaran, Publication- Prentice Hall of India, 2008
- R4. Introduction to Computer Theory Daniel I. A. Cohen – 2nd edition – John Wiley & Sons, 1996
- R5. Introduction to Languages and The Theory of Computation John C. Martin The McGraw-Hill, Fourth Edition, 2011

Assignment 4: Data preprocessing

Apply data preprocessing techniques that are likely required for the dataset.

1) Partition them into appropriate number of bins by equal-frequency as well as equal-width partitioning.

2) Use smoothing by bin means to smooth the data based on the above partitioning.

3) Normalize the attribute based on min-max normalization and z-score normalization.

Comment on which method you would prefer to use for partitioning, smoothing, and normalization for the given attribute.

Assignment 5: Data Visualization with matplotlib

View the data using various 2-D, 3-D plots and charts, setting styles, saving the figures, customizing the legends, multiple subplots,

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) Sem – V
Course Type: DSEC - III **Course Code: CS359**
Course Title : Practical Course based on CS 355

Teaching Scheme 4 hrs 20 mins / week Batch Size : 12	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
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Course Objectives:

1. Covers the complete scope of the syllabus.
2. Bringing uniformity in the way course is conducted across different colleges.
3. Continuous assessment of the students.

Course Outcomes:

1. Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
2. Read and make elementary modifications to Java programs that solve real-world problems.
3. Validate input in a Java program.

Guidelines:

6. Operating Environment :

- **Operating system:** Linux
- **Editor :** Anylinux based editor like vi, gedit and Use of IDE – Eclipse etc.
- **Compiler :** javac

7. Submission :

Each assignment will be assessed on a scale of 0 to 5 as indicated below.

- Not done 0
- Incomplete 1
- Late Complete 2
- Needs improvement 3
- Complete 4
- Well Done 5

8. Assessment :

Easy : All exercises are compulsory.
 Medium : All exercises are compulsory.

List of Assignments :

Assignment 1 : Java Tools and IDE, Simple java programs [Slot – 2]

Introduction to the java environment
 Use of java tools like java, javac, jdb and javadoc

Use of IDE – Eclipse (demo)
Defining simple classes and creating objects.

Assignment 2 : Array of Objects and Packages [Slot – 2]

Defining a class.
Creating an array of objects.
Creating a package. (Using package command)
Using packages. (Using import command)

Assignment 3 : Inheritance and Interfaces [Slot – 2]

To implement inheritance in java.
To define abstract classes.
To define and use interfaces and Functional Interface.
Use predefined interfaces like Cloneable.

Assignment 4 : Exception Handling [Slot – 2]

Demonstrate exception handling mechanism in java.
Defining user defined exception classes.
Use of try, catch, throw, throws and finally keywords.
Defining user defined exception classes.

Assignment 5 : I/O and File Handling [Slot – 2]

Performing Input / Output operations using console and files.
Use of Types of streams, Byte and Character stream classes, File class

Assignment 6 : GUI Designing, Event Handling and Applets [Slot – 2]

To demonstrate GUI creation using Swing package and Layout managers.
Understand the Event Handling mechanism in java.
Using Event classes, Event Listeners and Adapters.
Creating java applets which run in a web browser.

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: SECC – I Course Code : CS-3510
Course Title: Python Programming (Theory)

Teaching Scheme 01:15 Hrs / week	No. of Credits 1	Examination Scheme: (Theory + Practical) IE : 15 marks UE: 35 marks
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Course Objectives

1. To introduce programming concepts using python
2. Student should be able to develop Programming logic using python
3. To develop basic concepts and terminology of python programming
4. To test and execute python programs

Course Outcomes

On completion of the course, student will be able to–

- Develop logic for problem solving
- Determine the methods to create and develop **Python programs** by utilizing the data structures like lists, dictionaries, tuples and sets.
- To be familiar about the basic constructs of programming such as data, operations, conditions, loops, functions etc.
- To write python programs and develop a small application project

Course Contents

Chapter 1	An Introduction to Python	3 Lect
<p>1.1 Introduction to Python The Python Programming Language, History, features, Applications, Installing Python, Running Simple Python program</p> <p>1.2 Basics of Python Standard data types - basic, none, Boolean (true & False), numbers, Variables, Constants, Python identifiers and reserved words, Lines and indentation, multi-line statements and Comments, Input/output with print and input ,functions Declaration, Operations on Data such as assignment, arithmetic, relational, logical and bitwise operations, dry run, Simple Input and output etc.</p>		
Chapter 2	Control Statements	5 Lect
<p>2.1 Sequence Control – Precedence of operators, Type conversion 2.2 Conditional Statements: if, if-else, nested if-else, 2.3 Looping- for, while, nested loops, loop control statements (break, continue, pass) a. Strings: declaration, manipulation, special operations, escape character, string formatting operator, Raw String, Unicode strings, Built-in String methods.</p>		
Chapter 3	Lists, functions, tuples and dictionaries, Sets	9 Lect
<p>3.1 Python Lists: Concept, creating and accessing elements, updating & deleting lists, traversing a List, reverse Built-in List Operators, Concatenation, Repetition, In Operator, Built-in List functions and methods.</p>		

<p>3.2 Functions: Definitions and Uses, Function Calls, Type Conversion Functions, Math Functions, Composition, Adding New Functions, Flow of Execution, Parameters and Arguments, Variables and Parameters, Stack Diagrams, Void Functions, Anonymous functions Importing with from, Return Values, Boolean Functions, More Recursion, Functional programming tools - filter(), map(), and reduce(), recursion, lambda forms.</p> <p>3.3 Tuples and Dictionaries: Tuples, Accessing values in Tuples, Tuple Assignment, Tuples as return values, Variable-length argument tuples, and Basic tuples operations, Concatenation, Repetition, in Operator, Iteration, Built-in tuple functions, indexing, slicing and matrices. Creating a Dictionary, Accessing Values in a dictionary, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary keys, Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Methods.</p> <p>3.4 Sets- Definition, transaction of set(Adding, Union, intersection), working with sets</p>		
Chapter 4	Modules ,Working with files, Exception handling	4 Lect
<p>4.1 Modules: Importing module, Creating & exploring modules, Math module, Random module, Time module</p> <p>4.2 Packages: Importing package, creating package, examples</p> <p>4.3 Working with files: Creating files and Operations on files (open, close, read, write), File object attributes, file positions, Listing Files in a Directory, Testing File Types, Removing files and directories, copying and renaming files, splitting pathnames, creating and moving directories</p> <p>4.4 Regular Expression- Concept of regular expression, various types of regular expressions, using match function.</p> <p>4.5 Exception Handling: Built-in Exceptions, Handling Exceptions, Exception with Arguments, User-defined Exceptions.</p>		
Chapter 5	Classes and objects	3 Lect
<p>5.1 Overview of OOP (Object Oriented Programming), Class Definition, Creating Objects, Instances as Arguments, Instances as return values, Built-in Class Attributes,</p> <p>5.2 Inheritance, Data Encapsulation, Data Hiding (double underscore prefix).</p>		
Reference Books:		
<ol style="list-style-type: none"> 1. An Introduction to Computer Science using Python 3 by Jason Montojo, Jennifer Campbell, Paul Gries, The pragmatic bookshelf-2013 2. James Payne, “Beginning Python: Using Python and Python 3.1,Wrox Publication 3. Introduction to Computer Science Using Python- Charles Dierbach, Wiley Publication Learning with Python “, Green Tea Press, 2002 4. Introduction to Problem Solving with Python by E balguruswamy, TMH publication- 2016 5. Beginning Programming with Python for Dummies Paperback – 2015 by John Paul Mueller 6. Object-oriented Programming in Python, Michael H. Goldwasser, David Letscher, Pearson Prentice Hall-2008 		

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: SECC – I Course Code : CS-3510
Course Title: Python Lab Course

Teaching Scheme 2.10 hrs / week Batch Size : 12	No. of Credits 1	Examination Scheme: (Theory + Practical) IE : 15 marks UE: 35 marks
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Course Objectives:

1. To understand why Python is a useful scripting language for developers.
2. To learn how to design and program Python applications.

Course Outcomes:

At the end of the course, the student will be able

1. To develop adequate skills in programming like write, test and debug programs.
2. To explain basic principles of python programming language
3. To understand, use and implement list, tuples, set, dictionary and functions
4. To understand, use and implement of file handling, exception handling, regular expression and object oriented concepts

Lab Book:

The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.

Programming Assignments:

Programs should be done individually by the student in their respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

Assessment:

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate Weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include-timely completion, performance, innovation, efficient codes and good programming practices.

Assignment 1 - Python Basics

a) Basic Installation and Simple Programs

- 1) Python Interpreter installation and Demonstration
- 2) Anaconda (Jupyter Notebook) Installation and Demonstration
- 3) Framework Demonstration(**Flask, Bottle, CherryPy, Dash, Django, Falcon**)
- 4) Python Program to Print Hello world!
- 5) Python Program to Calculate the Area of a Triangle
- 6) Python Program to Swap Two Variables
- 7) Python Program to Generate a Random Number

b) Control Statements and Loops

- 1) Write a Python Program to Check if a Number is Positive, Negative or Zero
- 2) Write a Python Program to Check Leap Year
- 3) Write a Python Program to Print all Prime Numbers in an Interval
- 4) Write a Python Program to Print the Fibonacci sequence
- 5) Write a Python Program to Check Armstrong Number
- 6) Write a Python Program to Find the Sum of Natural Numbers
- 7) Write a Python Program to Find the Factorial of a Number

Assignment 2 – Arrays, Strings, and Functions**Arrays**

- 1) Write a Python program to create an array of 5 integers and display the array items. Access individual element through indexes.
- 2) Write a Python program to append a new item to the end of the array.
- 3) Write a Python program to append items from a specified list.
- 4) Write a Python program to insert a new item before the second element in an existing array.
- 5) Write a Python program to reverse the order of the items in the array.
- 6) Write a Python program to get the number of occurrences of a specified element in an array.
- 7) Write a Python program to remove the first occurrence of a specified element from an array.

Strings

- 1) Write a python program to check whether the string is Symmetrical or Palindrome
- 2) Write a python program to Reverse words in a given String
- 3) Write a python program to remove i'th character from string in different ways
- 4) Write a python program Words Frequency in String Shorthands
- 5) Write a python program Convert Snake case to Pascal case
- 6) Write a python program to print even length words in a string
- 7) Write a python program to accept the strings which contains all vowels

Functions

- 1) Write a Python function to find the Max of three numbers.
- 2) Write a Python program to reverse a string.
- 3) Write a Python function to calculate the factorial of a number (a non-negative integer). The function accepts the number as an argument.
- 4) Write a Python function that accepts a string and calculate the number of upper case letters and lower case letters.
- 5) Write a Python function that checks whether a passed string is palindrome or not.
- 6) Write a Python program to access a function inside a function.
- 7) Write a Python program to detect the number of local variables declared in a function.

Assignment 3 - List, Tuples, Sets, and Dictionary**List**

- 1) Write a Python program to sum all the items in a list.
- 2) Write a Python program to multiplies all the items in a list.
- 3) Write a Python program to get the largest number from a list.

- 4) Write a Python program to get the smallest number from a list.
- 5) Write a Python program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings.
- 6) Write a Python program to get a list, sorted in increasing order by the last element in each tuple from a given list of non-empty tuples.
- 7) Write a Python program to remove duplicates from a list.

Tuples

- 1) Write a Python program to create a tuple.
- 2) Write a Python program to create a tuple with different data types.
- 3) Write a Python program to convert a tuple to a string.
- 4) Write a Python program to convert a list to a tuple.
- 5) Write a Python program to remove an item from a tuple.
- 6) Write a Python program to slice a tuple.
- 7) Write a Python program to reverse a tuple.

Sets

- 1) Write a Python program to create a set.
- 2) Write a Python program to iterate over sets.
- 3) Write a Python program to add and remove member(s) in a set.
- 4) Write a Python program to create an intersection of sets.
- 5) Write a Python program to create a union and difference of sets.
- 6) Write a Python program to create a symmetric difference.
- 7) Write a Python program to check if a set is a subset of another set.

Dictionary

- 1) Write a Python script to sort (ascending and descending) a dictionary by value.
- 2) Write a Python script to add a key to a dictionary.
- 3) Write a Python script to merge two Python dictionaries.
- 4) Write a Python program to remove duplicates from Dictionary.
- 5) Write a Python program to sum all the items in a dictionary.
- 6) Write a Python program to multiply all the items in a dictionary.
- 7) Write a Python program to remove a key from a dictionary.

Assignment 4 - File Handling and Date-Time

File Handling

- 1) Write a Python program to read an entire text file.
- 2) Write a Python program to read first or last n lines of a file.
- 3) Write a Python program to append text to a file and display the text.
- 4) Write a Python program to read a file line by line and store it into a list.
- 5) Write a Python program to read a file line by line store it into a variable.
- 6) Write a Python program to count the number of lines in a text file.
- 7) Write a Python program to copy the contents of a file to another file .

Date-Time

- 1) Write a python program to get Current Time
- 2) Get Current Date and Time using Python
- 3) Write a python to Find yesterday's, today's and tomorrow's date
- 4) Write a python program to convert time from 12 hour to 24 hour format
- 5) Write a python program to find difference between current time and given time
- 6) Write a python Program to Create a Lap Timer

- 7) Find number of times every day occurs in a Year

Assignment 5 - Exception handling and Regular expression

Exception handling

- 1) Assertions in Python
- 2) The except Clause with No Exceptions
- 3) The except Clause with Multiple Exceptions
- 4) The try-finally Clause
- 5) Argument of an Exception
- 6) User-Defined Exceptions
- 7) Raising Exception

Common Examples of Exception:

- 1) Division by Zero
- 2) Accessing a file which does not exist.
- 3) Addition of two incompatible types
- 4) Trying to access a nonexistent index of a sequence
- 5) Removing the table from the disconnected database server.
- 6) ATM withdrawal of more than the available amount

Regular expression

- 1) Write a python program to Check if String Contain Only Defined Characters using Regex
- 2) Write a python program to find the most occurring number in a string using Regex
- 3) Write a python Regex to extract maximum numeric value from a string
- 4) Write a python to Check whether a string starts and ends with the same character or not
- 5) Write a python Program to check if a string starts with a substring using regex
- 6) Write a python Program to Check if an URL is valid or not using Regular Expression
- 7) Write a python Program to Parsing and Processing URL using Python – Regex

Assignment 6 - Classes and Objects (OOP)

Classes and Objects (OOP)

- 1) Write a Python program to demonstrate working of classes and objects.
- 2) Write a Python program to demonstrate class method & static method.
- 3) Write a Python program to demonstrate constructors.
- 4) Write a Python program to import built-in array module and display the namespace of the said module.
- 5) Write a Python program to demonstrate inheritance.
- 6) Write a Python program to demonstrate aggregation/compositions
- 7) Write a Python function student_data () which will print the id of a student (student_id). If the user passes an argument student_name or student_class the function will print the student name and class.
- 8) Write a Python class named Rectangle constructed by a length and width and a method which will compute the area of a rectangle.
- 9) Write a Python class named Circle constructed by a radius and two methods which will compute the area and the perimeter of a circle.
- 10) Write a Python class named Student with two attributes student_id, student_name. Add a new attribute student_class. Create a function to display the entire attribute and their values in Student class.

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: SECC – II Course Code : CS-3511
Course Title: Cloud Computing (Theory)

Teaching Scheme 01:15 Hrs / week	No. of Credits 1	Examination Scheme: (Theory + Practical) IE : 15 marks UE: 35 marks
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Prerequisite:

Knowledge of Operating System, Fundamentals of Computer Networks.
Good Understanding of Object Oriented Programming Concepts

Course Objectives

- To understand the principles and paradigm of Cloud Computing
- To appreciate the role of Virtualization Technologies

Course Outcomes

On completion of the course, student will be able to–

- design and deploy Cloud Infrastructure

Course Contents

Chapter 1	Introduction to Cloud Computing	4 Lect
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- 1.1 Introduction
- 1.2 Definition and essential characteristics of cloud computing
- 1.3 History and Evolution of Cloud Computing,
- 1.4 Evolution of cloud computing,
- 1.5 Emerging technologies supported by cloud computing.
- 1.6 Advantages and disadvantages of cloud computing

Chapter 2	Cloud Computing Models	6 Lect
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- 2.1 Types of service (IaaS, PaaS, SaaS)
- 2.1 Deployment models of cloud computing.(Public, Private, and Hybrid.)

Chapter 3	Components of Cloud Computing	4 Lect
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- 3.1 Cloud computing architecture: virtualization virtual machines, bare metal servers
- 3.2 Types of cloud storage
- 3.3 To build a secure cloud

Chapter 4	Cloud Security, and Career Opportunities	4 Lect
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- 4.1 Cloud Security
- 4.2 Encryption
- 4.3 Careers and Opportunities

Reference Books:

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Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: SECC – II Course Code : CS-3511
Course Title: Cloud Computing Lab Course

Teaching Scheme 2.10 hrs / week Batch Size : 12	No. of Credits 1	Examination Scheme: (Theory + Practical) IE : 15 marks UE: 35 marks
Assignment 1 - Working and Implementation of Infrastructure as a service.		
Assignment 2 – Working and Implementation of Software as a service.		
Assignment 3 - Working and Implementation of Platform as a services.		
Assignment 4 - Practical Implementation of Storage as a Service.		
Assignment 5 - Working of Google drive to make spreadsheet and notes.		
Assignment 6 - Case studies on open source development tools for cloud computing (any one)		

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: SECC – II Course Code : CS-3511
Course Title: Block Chain Technology (Theory)

Teaching Scheme 01:15 Hrs / week	No. of Credits 1	Examination Scheme: (Theory + Practical) IE : 15 marks UE: 35 marks
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Prerequisite:
Understanding of Object Oriented Programming Concepts
Knowledge of Javascript or Python

Course Objectives
1. To understand the principles and paradigm of Block Chain.

Course Outcomes
On completion of the course, student will be able to–
• Design simple blockchain applications.

Course Contents

Chapter 1	Introduction to Blockchain	4 Lect
1.1 Digital Trust 1.2 Asset 1.3 Transaction 1.4 Distributed Ledger Technology 1.5 Types of network 1.6 Components of blockchain or DLT 1.7 Ledger 1.7.1 Blocks 1.7.2 Blockchain		
Chapter 2	PKI (Public Key Infrastructure) and Cryptography	6 Lect
2.1 PKI (Public Key Infrastructure) and Cryptography 2.1.1 Private Key 2.1.2 Public Key 2.1.3 Hashing 2.1.4 Digital Signature 2.2 Security 2.2.1 DDos 2.3 Cryptocurrency		
Chapter 3	How Blockchain Works	4 Lect
3.1 How Blockchain works 3.2 Structure of Blockchain 3.3 Block 3.4 Hash 3.5 Blockchain 3.6 Lifecycle of Blockchain 3.7 Actors of Blockchain		

3.8 Blockchain Developer		
3.9 Blockchain Operator		
3.10 Blockchain Regulator		
3.11 Blockchain user		
3.12 Building a small blockchain application		
Chapter 4	Applications of block chain	4 Lect
4.1 Introduction to Bitcoin		
4.2 Introduction to Ethereum		
4.3 Introduction To Hyperledger Fabric V1.1		
Reference Books:		
<ul style="list-style-type: none"> • Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016). • Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies • Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System • DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014. • Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts 		

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: SECC – II Course Code : CS-3511
Course Title: Block Chain Technology Lab Course

Teaching Scheme 2.10 hrs / week Batch Size : 12	No. of Credits 1	Examination Scheme: (Theory + Practical) IE : 15 marks UE: 35 marks
Assignment 1 - Write a blockchain application in JavaScript for the creation of Transaction block for the account holder.		
Assignment 2 – Write a blockchain application in JavaScript to calculate hash code for the transaction.		
Assignment 3 - Write a JavaScript code for the implementation of block chain technology.(At least two block).		
Assignment 4 - Write a blockchain application in JavaScript to transfer cryptocurrency from one account to another account.		
Assignment 5 - Write a blockchain application in JavaScript for the simple transaction.		

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: DSEC - IV **Course Code: CS -361**
Course Title : Operating Systems-II

Teaching Scheme: 2.30 HRs/ week	No. of Credits: 2	Examination Scheme: IE : 15 marks UE: 35 marks
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Prerequisites

Concepts of Operating System, Processes and Threads Scheduling, Synchronization

Course Objectives:

1. To understand the issue of Deadlocks in Process management.
2. To understand the concept of File system management & disk scheduling
3. To study the concept of distributed operating systems

Course Outcomes: After completion of this course students will be able to understand the concept of

1. Management of deadlocks and File System by operating system
2. Scheduling storage or disk for processes
3. Distributed Operating System and its architecture

Course Contents

Chapter 1	Process Deadlocks	7 lectures
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- System model
- Deadlock Characterization – Necessary conditions, Resource allocation graph
- Deadlock Methods- Prevention and Deadlock Avoidance - Safe state, Resource allocation graph algorithm, Banker’s Algorithm
- Deadlock Detection
- Recovery from Deadlock – Process termination, Resource preemption

Chapter 2	File system Management	5 lectures
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- File concept , File attributes, File operations
- Access Methods – Sequential, Direct, Other access methods
- Directory overview, Single level directory, Two level directory, Tree structure directory, Acyclic graph directory, General graph directory
- Allocation Methods – Contiguous allocation, Linked allocation, Indexed allocation
- Free Space Management – Bit vector, Linked list, Grouping, Counting, Space maps

Chapter 3	Disk scheduling	5 lectures
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- Overview, Disk Structure
- Disk Scheduling, FCFS Scheduling, SSTF Scheduling, Scan Scheduling-Scan Scheduling, Look Scheduling , Disk Management

Chapter 4	Introduction to Distributed operating systems & Architecture	12 lectures
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- What is a distributed system, Design goals
- Types of distributed systems
- Architectural styles : Layered architectures , Object-based architectures, Resource-centered architectures, Event-based architectures
- Middleware organization: Wrappers, Interceptors.
- System architecture. Centralized, Decentralized

- Example architectures : Network file system(NFS), Web-based distributed systems, real-time and mobile systems

Chapter 5	Communication in distributed systems	7 lectures
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- Foundations, RPC, Message-Oriented communication, Multicast communication.

Reference Books:

6. Operating System Concepts, Avi Silberschatz, Peter Galvin, Greg Gagne, Student Edition, Wiley Asia
7. Operating Systems: Internals and Design Principles, William Stallings, Prentice Hall of India.
8. Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI
9. Advanced Concepts in Operating Systems, M Singhal and NG Shivaratri, Tata McGraw Hill Inc, 2001 (Text Book)
10. Distributed Operating Systems, Maarten van Steen, A S Tanenbaum. Third edition. Pearson Education Asia, 2001

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: DSEC - IV Course Code: CS -362
Course Title : Software Testing

Teaching Scheme: 2.30HRs/ week	No. of Credits: 2	Examination Scheme: IE : 15 marks UE: 35 marks
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Prerequisites:

- Basic knowledge of algorithms, problem solving, expected inputs/outputs
- Knowledge of C and java Programming Language, compilation, debugging.

Course Objectives:

1. To provide the knowledge of software testing techniques
2. To understand how testing methods can be used as an effective tools in quality assurance of software.
3. To provide skills to design test case plan for testing software.
4. To provide knowledge of latest testing methods

Course Outcomes:

1. To understand various software testing methods and strategies.
2. To understand a variety of software metrics, and identify defects and managing those defects for improvement in quality for given software.
3. To design test cases and test plans, review reports of testing for qualitative software.
4. To understand latest testing methods used in the software industries.

Course Contents

Chapter 1	Introduction to Software Testing	Book 1, 5	5 lectures
Basics of Software Testing – faults, errors and failures Testing objectives Principles of testing Testing and debugging Testing metrics and measurements Verification and Validation Testing Life Cycle			
Chapter 2	Software Testing Strategies & Techniques	Book 1, 2, 5	10 lectures
Testability - Characteristics lead to testable software Test characteristics Test Case Design White Box Testing - Basis path testing, Control Structure Testing. Black Box Testing - Boundary Value Analysis, Equivalence partitioning. Differences between BBT & WBT			
Chapter 3	Levels of Testing	Book 1, 5	10 lectures
A Strategic Approach to Software Testing Test strategies for conventional Software <ul style="list-style-type: none"> -Unit testing - Integration testing – Top-Down, Bottom-up integration - System Testing – Acceptance, performance, regression, Load/Stress testing, Security testing, Internationalization testing. Alpha, Beta Testing Usability and accessibility testing			

Configuration, compatibility testing			
Chapter 4	Testing Web Applications	Book 1	6 lectures
Dimension of Quality, Error within a WebApp Environment Testing Strategy for WebApp Test Planning The Testing Process –an overview			
Chapter 5	Agile Testing	Book 4	5 lectures
Agile Testing, Difference between Traditional and Agile testing, Agile principles and values, Agile Testing Quadrants, Automated Tests.			
Reference Books:			
<ol style="list-style-type: none"> 1. Software Engineering – A Practitioners Approach, Roger S. Pressman, 7th Edition, Tata McGraw Hill, 20 2. Effective Methods of Software Testing, William E Perry, 3rd Edition, Wiley Publishing Inc 3. Managing the Testing Process: Practical Tools and Techniques for Managing Hardware and Software Testing, Rex Black, Microsoft Press, 1999 4. Agile Testing: A Practical Guide for Testers and Agile Teams, Lisa Crispin and Janet Gregory, 1st Edition, Addison-Wesley Professional, 2008 5. Software Testing Principles and Practices By Srinivasan Desikan, Gopaldaswamy Ramesh, Pearson 			

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science)- Sem - VI
Course Type:DSEC – V Course Code: CS-363
Course Title : Web Technologies II

Teaching Scheme 02.30 Hrs / week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
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Prerequisites

- HTML5,CSS.
- Core PHP
- Bootstrap framework utility

Course Objectives

- To Learn different technologies used at client Side Scripting Language
- To Learn XML and XML parsers.
- To One PHP framework for effective design of web application.
- To Learn Java Script to program the behavior of web pages.
- To Learn AJAX to make our application more dynamic.
- Framework has some utility features that make easy to write API in more efficient way than Core PHP

Course Outcomes

On completion of the course, student will be able to–

- Build dynamic website.
- Using MVC based framework easy to design and handling the errors in dynamic website.

Course Contents

Chapter 1	Introduction to Web Techniques	6 Lect
1.1 Variables 1.2 Server information 1.3 Processing forms 1.4 Setting response headers 1.5 Maintaining state 1.6 PHP error handling		
Chapter 2	Handling email with php	3 Lect
2.1 Email background 2.2 Internet mail protocol 2.3 Structure of an email message 2.4 Sending email with php 2.5 Email id validation and verification		
Chapter 3	XML	6 Lect
3.1 What is XML? 3.2 XML document Structure 3.3 PHP and XML 3.4 XML parser 3.5 The document object model 3.6 The simple XML extension 3.7 Changing a value with simple XML		
Chapter 4	WEB DESIGNING TECHNOLOGIES(JavaScript)	9 Lect
4.1 Overview of JavaScript 4.2 Object Orientation and JavaScript Basic Syntax(JS datatypes, JS variables) 4.4 Primitives, Operations and Expressions 4.5 Screen Output and keyboard input(Verification and Validation)		

4.6 JS Control statements and JS Functions 4.7 JavaScript HTML DOM Events(onmouseup, onmousedown, onclick, onload, onmouseover, onmouseout). 4.8 JS Strings and JS String methods 4.9 JS popup boxes(alert, confirm, prompt). 4.10 JQuery library , Including jquery library in page 4.11 JQuery selector , DOM manipulation using jquery		
Chapter 5	AJAX	5 Lect
5.1 Introduction of AJAX 5.2 AJAX web application model 5.3 AJAX –PHP framework 5.4 Performing AJAX validation 5.5 Handling XML data using php and AJAX 5.6 Connecting database using php and AJAX		
Chapter 6	PHP framework CodeIgniter	7 Lect
6.1 CodeIgniter - Overview, <u>Installing CodeIgnite</u> 6.2 Application Architecture 6.3 MVC Framework , Basic concept of CodeIgniter, Libraries 6.4 Working with databases 6.5 Load external JS and CSS page & redirecting from controller , Adding JS and CSS , Page redirection. 6.6 Loading dynamic data on page & session management, cookies management		
Reference Books:		
1. Programming PHP By RasmusLerdorf and Kevin Tatroe O'Reilly publication 2. Beginning PHP 5, Wrox publication 3. PHP web services , Wrox publication 4. AJAX Black Book Kogent solution 5. Mastering PHP BPB Publication 6. PHP cookbook O'Reilly publication 7. Professional Codeigniter , Wrox Publication, Author: Thomas Myer 8.Codeihniter 2 CookBook, PACKT Publication , Author : Rob Foster 9. JQuery CookBook, O'reilly Publication. 10. PHP for Beginners, SPD publication 11. Programming the World Wide Web , Robert W Sebesta(3rd Edition) 12. www.php.net.in 13. www.W3schools.com 14. www.wrox.com 15. https://www.tutorialspoint.com/codeigniter/index.htm 16. http://codeigniter.com/docs		

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) Sem - VI
Course Type:DSEC – V Course Code: CS-364
Course Title : Data Analytics

Teaching Scheme 02 Hrs / week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
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Prerequisites

- Basic of mathematics and statistics
- Basic programming Knowledge of python
- Knowledge of databases

Course Objectives

- Deploy the Data Analytics Lifecycle to address data analytics projects.
- Develop in depth understanding of the key technologies in data analytics.
- Apply appropriate analytic techniques and tools to analyze data, create models, and identify insights that can lead to actionable results.

Course Outcomes

On completion of the course, student will be able to–

- Use appropriate models of analysis, assess the quality of input, and derive insight from results.
- Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
- Apply modeling and data analysis techniques to the solution of real world business problems
- Analyze data, choose relevant models and algorithms for respective applications.
- Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining

Course Contents

Chapter 1	Introduction to Data Analytics	6 Lect
1.1 What is Analytics? 1.2 Data analysis vs Data analytics 1.3 Applications in Retail, E-commerce, Finance, Sports, Others - healthcare, education, telecom etc. 1.4 Diagnostic Analytics - Correlations 1.5 Predictive Analytics 1.6 Prescriptive Analytics 1.7 Exploratory Analysis 1.8 Mechanistic Analysis - Regression		
Chapter 2	Mathematical Models	6 Lect
2.1. Philosophies of Modeling Occam's Razor Bias-Variance Trade-Offs 2.2. Types of models – linear and non linear, flat and hierarchical 2.3.Evaluating Models Evaluating Classifiers, Class imbalance AUC, ROC curves Evaluating Multiclass Systems		

Evaluating Value Prediction Models		
Chapter 3	Mining Frequent Patterns, Associations, and Correlations	8 Lect
3.1 What kind of patterns can be mined: Class/Concept Description: Characterization and Discrimination, Mining Frequent Patterns, Associations, and Correlations, Classification and Regression for Predictive Analysis, Cluster Analysis, Outlier Analysis 3.2 Mining frequent patterns - Market Basket Analysis. 3.3 Frequent Itemsets, Closed Itemsets, and Association Rules 3.4 Frequent Itemset Mining Methods 3.5 Apriori Algorithm 3.6 Generating Association Rules from Frequent Itemsets		
Chapter 4	Text Analytics	8 Lect
4.1. Tokenization 4.2. Bag of words 4.3. Stemming and lemmatization 4.4. TF-IDF, stop words and n-grams, synonyms and parts of speech tagging 4.5. Sentiment Analysis 4.6. Introduction to NLP		
Chapter 5	Machine Learning Overview	8 Lect
5.1. Introduction to Machine Learning, deep learning, Artificial intelligence 5.2. Applications for machine learning in data science 5.3. The modeling process: Engineering features and selecting a model, Training your model, Validating a model, Predicting new observations 5.4. Types of machine learning - Supervised learning, Unsupervised learning, Semi-supervised learning, ensemble techniques 5.5. Regression models - Linear regression 5.6. Introduction to classification and clustering.		
Reference Books:		
1) Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann, 2012. 2) Introduction to Data mining, Pang-NING TAN, Michael SteinBach, Vipin Kumar, Pearson 3) The Data Science Design Manual, Steven S. Skiena, Springer, 2017 4) Introducing data science: big data, machine learning, and more, using Python tools, Cielen D., Meysman A. D., & Ali M., Manning Publications Co., 2016 5) Python Data Science Essentials, Alberto Boschetti, Luca Massaron, Second Edition, 2016 Packt Publishing 6) The Data Science Handbook, Field Cady, John Wiley & Sons, Inc, 2017 7) Python Data Science Handbook - Essential Tools for Working with Data, Jake VanderPlas, O'Reilly, 2017 8) A Hands-On Introduction to Data Science CHIRAG SHAH University of Washington Cambridge University Press 9) David Dietrich, Barry Hiller, "Data Science & Big Data Analytics", EMC education services, Wiley publications, 2012		

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: DSEC – VI Course Code : CS-365
Paper Title : Object Oriented Programming – II (Advanced Java)

Teaching Scheme 02: 30 Hrs / week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
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Prerequisites

- Knowledge of Core Java (CS – 355)

Course Objectives

- To learn database programming using Java
- To study web development concept using Servlet and JSP
- To develop a game application using multithreading
- To learn socket programming concept

Course Outcomes

On completion of the course, student will be able to–

- To access open database through Java programs using Java Data Base Connectivity (JDBC) and develop the application.
- To understand and Create dynamic web pages, using Servlets and JSP.
- Work with basics of framework to develop secure web applications.

Course Contents

Chapter 1	Collections	4 Lect
1.1 Introduction to the Collection framework 1.2 List – ArrayList, LinkedList and Vector, Stack, Queue 1.3 Set - HashSet, TreeSet, and LinkedHashSet 1.4 Map – HashMap, LinkedHashMap, Hashtable and TreeMap 1.5 Interfaces such as Comparator, Iterator, ListIterator, Enumeration		
Chapter 2	Database Programming	8 Lect
2.1 The design of jdbc, jdbc configuration 2.2 Types of drivers 2.3 Executing sql statements, query execution 2.4 Scrollable and updatable result sets 2.5 Metadata – DatabaseMetadata, ResultSetMetadata 2.6 Transactions – commit(), rollback(), SavePoint (Database : PostgreSQL)		
Chapter 3	Servlet	8 Lect
3.1 Introduction to Servlet and Hierarchy of Servlet 3.2 Life cycle of servlet 3.3 Tomcat configuration (Note: Only for Lab Demonstration) 3.4 Handling get and post request (HTTP) 3.5 Handling a data from HTML to servlet 3.6 Retriving a data from database to servlet 3.7 Session tracking – User Authorization, URL rewriting, Hidden form fields, Cookies and HttpSession		
Chapter 4	JSP	6 Lect
4.1 Simple first JSP program 4.2 Life cycle of JSP 4.3 Implicit Objects 4.4 Scripting elements - Declarations, Expressions, Scriptlets, Comments		

<p>4.5 JSP Directives - Page Directive, include directive 4.6 Mixing Scriptlets and HTML 4.7 JSP Actions - jsp:forward , jsp:include, jsp:useBean, jsp:setProperty and jsp:getProperty 4.8 Custom Tags 4.9 Example of forwarding contents from database to servlet , servlet to JSP and displaying it using JSP scriptlet tag</p>		
Chapter 5	Multithreading	4 Lect
<p>5.1 What are threads? 5.2 Life cycle of thread 5.3 Running and starting thread using Thread class 5.4 Thread priorities 5.5 Running multiple threads 5.6 The Runnable interface 5.7 Synchronization and interthread communication</p>		
Chapter 6	Networking	3 Lect
<p>6.1 Networking basics – protocol, Addressing, DNS, URL, Socket, Port 6.2 The java.net package – InetAddress, URL, URLConnection class 6.3 SocketServer and Socket class 6.4 Creating a Socket to a remote host on a port (creating TCP client and server) 6.5 Simple Socket Program Example</p>		
Chapter 7	Spring	3 Lect
<p>7.1 Introduction of Spring framework 7.2 Spring Modules / Architecture 7.3 Spring Applications 7.4 Spring MVC 7.5 Spring MVC Forms, Validation</p>		
Reference Books:		
<p>R1. Complete reference Java by Herbert Schildt(5th edition) R2. Java 2 programming black books, Steven Horlzner R3. Programming with Java , A primer ,Forth edition , By E. Balagurusamy R4. Core Java Volume-I-Fundamentals, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Press R5. Core Java Volume-II-Advanced Features, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Press R6. Getting started with Spring Framework: covers Spring 5 by J Sharma and <u>Ashish Sarin</u> R7. Spring 4 for Developing Enterprise Applications: An End-to-End Approach by Henry H. Liu</p>		

<p style="text-align: center;">Savitribai Phule Pune University T.Y.B.Sc. (Computer Science) Sem - VI Course Type: DSEC- VI Course Code: CS-366 Paper Title: Theoretical Computer Science and Compiler Construction II</p>		
Teaching Scheme 02 Hrs / week	No. of Credits 2	Examination Scheme IE: 15 marks UE: 35 marks
<p>Prerequisites</p> <ul style="list-style-type: none"> • Knowledge of Automata Theory and Languages. 		
<p>Course Objectives</p> <ul style="list-style-type: none"> • To understand design issues of a lexical analyzer and use of LEX tool. • To understand design issues of a parser and use of YACC tool. • To understand and design code generation and optimization techniques. 		
<p>Course Outcomes</p> <p>On completion of the course, student will be able to–</p> <ul style="list-style-type: none"> • Understand the process of scanning and parsing of source code. • Learn the conversion code written in source language to machine language. • Understand tools like LEX and YACC. 		
Course Contents		
Chapter 1	Introduction	3 Lect
<p>1.1 Definition of Compiler, Aspects of compilation. 1.2 The structure of Compiler. 1.3 Phases of Compiler – Lexical Analysis, Syntax Analysis, Semantic Analysis, Intermediate Code generation, code optimization, code generation. 1.4 Error Handling. 1.5 Introduction to one pass & Multipass compilers, cross compiler, Bootstrapping.</p>		
Chapter 2	Lexical Analysis (Scanner)	3 Lect
<p>2.1 Review of Finite automata as a lexical analyzer, 2.2 Applications of Regular Expressions and Finite Automata (lexical analyzer, searching using RE), Input buffering, Recognition of tokens. 2.3 LEX: A Lexical analyzer generator (Simple Lex Program)</p>		
Chapter 3	Syntax Analysis (Parser)	19 Lect
<p>3.1 Definition, Types of Parsers 3.2 Top-Down Parser – 3.2.1 Top-Down Parsing with Backtracking: Method & Problems 3.2.2 Drawbacks of Top-Down parsing with backtracking, 3.2.3 Elimination of Left Recursion (direct & indirect) 3.2.4 Need for Left Factoring & examples 3.3 Recursive Descent Parsing: Definition 3.3.1 Implementation of Recursive Descent Parser Using Recursive Procedures 3.4 Predictive [LL (1)] Parser (Definition, Model) 3.4.1 Implementation of Predictive Parser [LL (1)] 3.4.2 FIRST & FOLLOW 3.4.3 Construction of LL (1) Parsing Table 3.4.4 Parsing of a String using LL (1) Table. 3.5 Bottom-Up Parsers 3.6 Operator Precedence Parser -Basic Concepts 3.6.1 Operator Precedence Relations form Associativity & Precedence</p>		

3.6.2 Operator Precedence Grammar 3.6.3 Algorithm for LEADING & TRAILING (with ex.) 3.6.4 Algorithm for Operator Precedence Parsing (with ex.) 3.6.5 Precedence Functions 3.7 Shift Reduce Parser 3.7.1 Reduction, Handle, Handle Pruning 3.7.2 Stack Implementation of Shift Reduce Parser (with examples) 3.8 LR Parser: Model, Types [SLR (1), Canonical LR, LALR] Method & examples. 3.9 YACC (from Book 3) –program sections, simple YACC program for expression evaluation		
Chapter 4	Syntax Directed Definition	5 Lect
4.1 Syntax Directed Definitions (SDD) 4.1.1 Inherited & Synthesized Attributes 4.1.2 Evaluating an SDD at the nodes of a Parse Tree, Example 4.2 Evaluation Orders for SDD's 4.2.1 Dependency Graph 4.2.2 Ordering the Evaluation of Attributes 4.2.3 S-Attributed Definition 4.2.4 L-Attributed Definition 4.3 Application of SDT 4.3.1 Construction of syntax trees, 4.3.2 The Structure of a Type 4.4 Translation Schemes 4.4.1 Definition, Postfix Translation Scheme		
Chapter 5	Code Generation and Optimization	6 Lect
5.1 Compilation of expression – 5.1.1 Concepts of operand descriptors and register descriptors with example. 5.1.2 Intermediate code for expressions – postfix notations, 5.1.3 Triples, Quadruples and Expression trees. 5.2 Code Optimization – Optimizing transformations – compile time evaluation, elimination of common sub expressions, dead code elimination, frequency reduction, strength reduction. 5.3 Three address code 5.3.1 DAG for Three address code 5.3.2 The Value-number method for constructing DAG's. 5.4 Definition of basic block, Basic blocks, and flow graphs 5.5 Directed acyclic graph (DAG) representation of basic block. 5.6 Issues in design of code generator.		
Reference Books		
R1. Compilers: Principles, Techniques, and Tools, Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, 2004 R2. Principles of Compiler Design By: Alfred V. Aho, Jeffrey D. Ullman, Narosa Publication House, 2002 R3. LEX & YACC, 2 nd edition, O'reilly Publication, 2012		

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: DSEC- IV **Course Code: CS 367**
Course Title : Practical Course based on CS 361

Teaching Scheme:
4.20 Hrs/ week

No. of Credits:
2

Examination Scheme:
IE : 15 marks
UE: 35 marks

Course Objectives:

4. To implement Banker's algorithm for Deadlocks in Process management.
5. To simulate File system management
6. To study and implement various algorithms of disk scheduling

Course Outcomes: After completion of this course students will be able to understand the concept of

1. Management of deadlocks by operating system
2. File System management
2. Disk space management and scheduling for processes

Guidelines:

9. Operating system platform – Linux
10. Programming language - C/C++/Java

List of Assignments:

- Simulation of Banker's algorithm of deadlock avoidance in processes of operating system (2 slots)
- Simulation of File Allocation methods and free space management in storage - Contiguous allocation, Linked allocation, Indexed allocation (5 slots)
- Simulation of Disk Scheduling algorithms – FCFS, SSTF, Scan, Look (2 slots)
- Implementation of RPC , Remote-method invocation (3 slots)
- Implementation of a Concurrent client server application (***)

- * Write Ajax program to carry out validation for a username entered in textbox. If the textbox is blank, print 'Enter username'. If the number of characters is less than three, print 'Username is too short'. If value entered is appropriate the print 'Valid username'.

Session 10: Assignment using Ajax

- * Create employee table as follows EMP (eno, ename, designation, salary). Write Ajax program to select the employees name and print the selected employee's details.
- * Write Ajax program to print Movie details by selecting an Actor's name. Create table MOVIE and ACTOR as follows with 1 : M cardinality MOVIE (mno, mname, release_yr) and ACTOR(ano, aname).

Session 11: Assignment using PHP frame work CodeIgniter

- * installation of codeIgniter and get familiar with codeIgniter architecture
- * Application configuration setting :
- * Configure application properties
- * Learn to auto load library, helpers
- * build static pages in codeIgniter
 - Try associate view from controller Load Js and css in page
 - Notes: each method in controller class acts as endpoint from that method we can server view file you want to display.

Session 12: Assignment using PHP frame work CodeIgniter

- * **database connection and display** Dynamic data on page
- * **full curd(create,update,edit,delete) operation of any entity**

Assignment 2 : Database Programming [Slot-2]

To communicate with a database using java.
To execute queries on tables.
To obtain information about the database and tables
To understand various ways to manage Transaction (Commit, Rollback, Save-points)

Assignment 3 : Servlets [Slot-2]

To understand server-side programming.
Simple steps to create and execute servlets
How to pass parameters using doGet and doPost methods
Handling data from HTML to servlet
How to connect servlet to a database .
Use of various session tracking methods like Cookies.

Assignment 4 : Java Server Pages [Slot-2]

Concept of Servlets.
JSP life-cycle.
Use of JSP implicit objects
JSP Directives.
Use of Scripting Elements.
To understand Actions tags in JSP
Understanding flow of JSP custom tags

Assignment 5 : Multithreading [Slot-2]

To create and use threads in java.
To demonstrate multithreading using Thread Synchronization, Inter-thread Communication, Thread Priorities

Assignment 6 : Networking [Slot -1]

To understand Networking Terminology
Introduction to the java.net package -InetAddress class, URL class, URL Connection class etc.
Introduction to Socket Programming -To understand important methods of Socket and Server Socket class.
Client and Server side Programming

Assignment 7 : Spring Framework [Slot-1]

To create and understand the steps to develop Spring application

<p style="text-align: center;">Savitribai Phule Pune University T.Y.B.Sc. (Computer Science) - Sem – VI Course Type: SECC – III Course Code : CS-3610 Course Title : Mobile Application Development (Theory)</p>		
Teaching Scheme 01:15 Hrs / week	No. of Credits 1	Examination Scheme IE : 15 marks UE: 35 marks
Prerequisites: Fundamental of Networking, Object Oriented Concepts-JAVA Programming.		
Course Objectives <ul style="list-style-type: none"> • Understand system requirements for mobile applications. • Generate suitable design using specific mobile development frameworks. • Generate mobile application design. • Implement the design using specific mobile development frameworks. • Deploy the mobile applications in marketplace for distribution. 		
Course Outcomes Completion of the course, the students will be able to <ul style="list-style-type: none"> • Describe the requirements for mobile applications. • Explain the challenges in mobile application design and development. • Develop design for mobile applications for specific requirements. • Implement the design using Android. 		
Course Contents		
Chapter 1	INTRODUCTION MOBILE APPLICATIONS	3 Lect
1.17. Introduction to mobile Application. 1.18. Market and business drivers for mobile applications. 1.19. Publishing and delivery of mobile applications. 1.20. Requirements gathering and validation for mobile applications.		
Chapter 2	BASIC DESIGN	4 Lect
2.1 Design constraints for mobile applications, both hardware and software related. 2.2 Architecting mobile applications. 2.3 User interfaces for mobile applications. 2.4 Touch events and gestures. 2.5 Achieving quality constraints performance, usability, security, availability and modifiability.		
Chapter 3	TECHNOLOGY I - ANDROID	9 Lect
3.1 Introduction to Android OS. 3.2 Android architecture. 3.3 Activities and views 3.4 Interacting with UI 3.5 Persisting data using SQLite. 3.6 Google Maps. 3.7 GPS and Wifi.		
Chapter 4	TECHNOLOGY II - IOS	2 Lect
4.1 Introduction and features of iOS. 4.2 UI implementation.		
Reference Books:		
1. http://developer.android.com/develop/index.html 2. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012 3. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012 4. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012 5. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013. 6. Beginning Android Application Development Wei-Meng Lee Wiley		

Savitribai Phule Pune University T.Y.B.Sc. (Computer Science) - Sem – VI Course Type: SECC – III Course Code : CS-3610 Course Title : Mobile Application Development (Practical)		
Teaching Scheme 02:10 Hrs / week	No. of Credits 1	Examination Scheme IE : 15 marks UE: 35 marks
Prerequisites: Fundamental of Networking.		
Course Objectives <ul style="list-style-type: none"> • Generate suitable design using specific mobile development frameworks • Generate mobile application design • Implement the design using specific mobile development frameworks 		
Course Outcomes Completion of the course, Upon the students will be able to <ul style="list-style-type: none"> • Describe the requirements for mobile applications. • Explain the challenges in mobile application design and development. • Develop design for mobile applications for specific requirements. • Implement the design using Android. 		
Guidelines:		
Operating environment: Linux		
List of Assignments		
<ol style="list-style-type: none"> 1. To study Android Studio and Android studio installation. 2. Creating a new project and using emulator. 3. Create a simple “Hello World” application. 4. Create various UI controls like button, textview, edittext checkbox etc. 5. To understand Activity, Intent, Create sample application with login module.(Check username and password) 6. Design simple GUI application with activity and intents e.g. calculator. 7. Create an android app for database creation using SQLite Database. 8. “Guess Number”: The app should pick a secret number (0 – 9) and let the user guess what number it is. User is only allowed to input number in the text field. If the guess number is too high or too low, the program should provide a hint. If the guess number is correct, the program should congratulate the user. (Hint: using randomize to generate the random number) 		

Chapter 5	Testing Tools	Web Ref: 1	2 Sessions
5. Design and run Test cases using automated testing Tools for A. Text Editor like word / wordpad			
Note: Preparation of system specification, test plan, test cases, defect report, execution using Automation Tool, answers to the simple questions and timely submission of assignments carries the equal marks.			
Open Source Automation TestingTools: Selenium, JMeter, QTP, Bugzilla etc can be used.			
Reference Books:			
<ol style="list-style-type: none"> 1. Software Engineering – A Practitioners Approach, Roger S. Pressman, 7th Edition, Tata McGraw Hill, 20 2. Effective Methods of Software Testing, William E Perry, 3rd Edition, Wiley Publishing Inc 3. Managing the Testing Process: Practical Tools and Techniques for Managing Hardware and Software Testing, Rex Black, Microsoft Press, 1999 4. Software Testing Principles and Practices by Srinivasan Desikan, Gopaldaswamy Ramesh, Pearson 			
Website References:			
<ol style="list-style-type: none"> 1. http://www.selenium.dev/ 2. http://www.toolsqa.com 3. https://www.guru99.com/selenium-tutorial.html 4. https://www.tutorialspoint.com/selenium 5. https://www.softwaretestinghelp.com/ 			

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: SECC- IV **Course Code: CS3611**
Course Title : Project

Teaching Scheme 4 hrs 20 mins / week Batch Size : 12	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
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Project

Total Credits: 1

Teaching Scheme:

2.10 Hrs./Week

Guidelines:

- Students should work in a team of maximum 2 students.
- Students can choose a project topic without any restriction on technology or domain.
- The student group will work independently throughout the project work including: problem identification, information searching, literature study, design and analysis, implementation, testing, and the final reporting.
- Project guide must conduct project presentations (minimum 4) to monitor the progress of the project groups.
- At the end of the project, the group should prepare a report which should conform to international academic standards. The report should follow the style in academic journals and books, with clear elements such as: abstract, background, aim, design and implementation, testing, conclusion and full references, Tables and figures should be numbered and referenced to in the report.
- The final project presentation with demonstration (UE) will be evaluated by the project guide (appointed by the college) and one external examiner (appointed by the University).

Recommended Documentation contents:

Abstract

Introduction

- motivation
- problem statement
- purpose/objective and goals
- literature survey
- project scope and limitations

System analysis

- Existing systems
- scope and limitations of existing systems
- project perspective, features
- stakeholders

- Requirement analysis - Functional requirements, performance requirements, security requirements etc.

System Design

- Design constraints
- System Model: DFD
- Data Model
- User interfaces

Implementation details

- Software/hardware specifications

Outputs and Reports Testing

- Test Plan, Black Box Testing or Data Validation Test Cases, White Box Testing or Functional Validation Test cases and results

Conclusion and Recommendations

Future Scope

Bibliography and References

Project Related Assignments

Total Credits: 1

Teaching Scheme:

- 1.15 Hrs./week

Guidelines:

- The project assignments are a compulsory part of the project course and should be carried out by each project group.
- Project assignments are to be given by the guide for continuous internal evaluation.
- The project assignments are to be allotted to each group separately by the project guide on the basis of the implementation technology. A suggested list of assignments is given below.
 1. Project Time management: plan (schedule table), Gantt chart, Roles and responsibilities, data collection, Implementation
 2. Simple assignments to evaluate choice of technology
 3. Assignments on UI elements in chosen technology
 4. Assignments on User interfaces in the project
 5. Assignments on event handling in chosen technology
 6. Assignments on Data handling in chosen technology

7. Online and offline connectivity
 8. Report generation
 9. Deployment considerations
 10. Test cases
- Each student within the group must work actively and contribute to the assignments, project work and report writing.

Evaluation guidelines:

IA (15 marks)			UE (35 marks)		
First presentation	Second presentation	Assignments	Project Logic/ Presentation	Assignments and Project Documentation	Viva
05	05	05	15	15	05



SAVITRIBAI PHULE PUNE UNIVERSITY,PUNE

T. Y. B. Sc. Electronic Science

Choice Based Credit System(CBCS)

Under Faculty of Science and Technology

(to be implemented from June 2021)

COURSE STRUCTURE OF T. Y. B. Sc. Electronic Science (CBCS)**TO BE IMPLEMENTED FROM JUNE 2021**

Sem		Course Code	Paper	Paper title	credits	
V	Discipline Specific Elective Course	EL 351	I	Digital Design using Verilog	2	
		EL 352	II	Microcontroller Architecture and Programming	2	
		EL 353	III	Analog circuit Design and Applications	2	
		EL 354	IV	Nanoelectronics	2	
		EL 355	V	Signals and Systems	2	
		EL 356(A)	VI	A. Optics and Fiber Optic Communication		2
		EL 356(B)		B. Electronic Product Design and Entrepreneurship		
		EL 357	VII	Practical Course I	2	
		EL 358	VIII	Practical Course II	2	
		EL 359	IX	Practical Course III(Project)	2	
	Skill Enhancement Course	ELSEC 351	X	Electronic Design Automation Tools	2	
		ELSEC 352	XI	Internet of Things and Applications	2	
VI	Discipline Specific Elective Course	EL 361	I	Modern Communication Systems	2	
		EL 362	II	Embedded System Design using Microcontrollers	2	
		EL 363	III	Industrial Electronics	2	
		EL 364	IV	Manufacturing Processes for Electronics	2	
		EL 365	V	Process Control Systems	2	
		EL 366(A)	VI	A. PLC SCADA		2
		EL 366(B)		B. Sensors and Systems		
		EL 367	VII	Practical Course I	2	
		EL 368	VIII	Practical Course II	2	
	EL 369	IX	Practical Course III(Project)	2		
	Skill Enhancement Course	ELSEC 361	X	Design and Fabrication of PCB	2	
ELSEC 362		XI	Mobile Application Development	2		

Program Specific Outcomes of B.Sc. Electronic Science

The following program specific outcomes have been identified for B.Sc Electronic Science.

PSO1	Ability to apply knowledge of mathematics and science in solving electronics related problems
PSO2	Ability to design and conduct electronics experiments, as well as to analyze and interpret data
PSO3	Ability to design and manage electronic systems or processes that conforms to a given specification within ethical and economic constraints
PSO4	Ability to identify, formulate, solve and analyze the problems in various disciplines of electronics
PSO5	Ability to function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility
PSO6	Ability to communicate effectively in term of oral and written communication skills
PSO7	Recognize the need for, and be able to engage in lifelong learning
PSO8	Ability to use techniques, skills and modern technological/scientific/engineering software/tools for professional practices

PSO-CO mapping

Course title	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
Digital Design using Verilog		√	√	√				√
Microcontroller architecture and Programming		√	√	√				√
Analog circuit Design and applications	√	√	√	√				
Nanoelectronics				√	√			
Signals and Systems	√		√					
A. Optics and Fiber Optic Communication B. Electronic Product Design and Entrepreneurship			√	√	√			√
Practical Course I		√	√	√		√		√
Practical Course II		√	√	√		√		√
Practical Course III(Project)		√	√	√	√	√		√
SEC1: EDA Tools			√	√			√	√
SEC2: Internet of Things and applications		√	√				√	√
Modern Communication Systems	√	√	√		√			
Embedded System Design using Microcontrollers		√	√	√			√	√
Industrial Electronics		√	√	√			√	
Introduction to Electronics Manufacturing Processes			√		√		√	√
Process control systems	√		√				√	√
A. PLC SCADA B. Sensors and systems		√	√		√			√
Practical Course I		√	√	√		√		
Practical Course II		√	√	√		√		√
Practical Course III(Project)		√	√	√	√	√		√
Design and fabrication of PCB		√		√			√	√
Mobile application development			√	√			√	√

SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
T.Y. B.Sc. ELECTRONIC SCIENCE
2021 PATTERN CBCS
Discipline Specific Elective Course

EL 351: Paper I: Digital Design using VERILOG

SEMESTER V

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Know and understand structure of HDL and Verilog.

CO2: Understand different modeling styles in Verilog.

CO3: Use Verilog effectively for simulation, verification and synthesis of digital system.

CO4: Understand basics of programmable logic devices.

UNIT 1: Introduction to Verilog (10 LECTURES)

A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and Verilog, Introduction to Simulation and Synthesis Tools, Test Benches, Verilog Modules, Delays, data flow style, behavioral style, structural style, mixed design style, simulating design
Introduction to Language Elements: Keywords, Identifiers, White Space Characters, Comments, Format, Integers, Reals and Strings, Logic Values, Data Types-net types, undeclared nets, scalars and vector nets, Register type, Parameters, Expressions, Operands, Operators, types of Expressions

UNIT 2: Modeling Styles (12 LECTURES)

Data flow Modeling: Continuous assignment, net declaration assignments, delays, net delays.
Behavioral Modeling: Procedural constructs, timing controls, block statement, procedural assignments, conditional statement, loop statement, procedural continuous assignment
Gate level modeling: Introduction, built in Primitive Gates, multiple input gates, Tri-state gates, MOS switches, bidirectional switches, gate delay, array instances, implicit nets, Examples (both combinational and sequential logic circuits)

UNIT 3: Logic synthesis with Verilog (8 LECTURES)

Concept of logic synthesis, Synthesis design flow, Synthesis of combinational logic for two bit magnitude comparator, Synthesis of Sequential Logic with Flip-Flops

UNIT 4: Introduction to Programmable Logic Devices (6 LECTURES)

Introduction of Programmable Logic Array (PLA), Programmable Array Logic (PAL), Programmability of PLDs, Complex PLDs (CPLDs), Field-Programmable Gate Arrays

RECOMMENDED BOOKS:

1. Verilog HDL: A Guide to Digital Design & Synthesis, Samir Palnitkar, SunSoft Press, ISBN: 978-81-775-8918-4.
 2. Digital Fundamentals, Floyd and Jain, Pearson Education, ISBN: 8177587633
 3. Fundamental digital logic with Verilog design by Stephen Brown and Zvonka Vrenesic, Mc Graw Hill Publication, ISBN 0-07-282315-1 ISBN 0-07-121322-8 (ISE)
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T.Y.B.Sc. ELECTRONIC SCIENCE
2021 PATTERN CBCS
Discipline Specific Elective Course

EL 352: Paper II: Microcontroller Architecture and Programming

SEMESTER V

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Understand the basics of microcontroller.

CO2: Acquire basic programming skills in C language.

CO3: Understand and acquire basic programming skills for AVR microcontroller.

UNIT 1: Introduction to Microcontrollers

(6 LECTURES)

Features of microcontroller, classification of microcontrollers, architectural variations in microcontrollers, Applications of microcontrollers

UNIT 2: Basics of C Programming

(12 LECTURES)

Types of Programming languages, Algorithm, flowcharts, instructions, syntax, hex files, linkers, compilers, Basic data types, variables, Structure of C program, Operators in C, Arrays-concept, one, two-dimensional and multi-dimensional arrays, pointers, Input output statement, Decision making statements, Control loops, Functions: Library functions and user defined functions.

UNIT 3: AVR Programming using C

(12 LECTURES)

Architecture of AVR, Data types for AVR, Time delay generation, I/O programming, Logic operations, Data conversion, Data serialization, Memory allocation in C, Programming Timers, Counters, serial port, interrupts

UNIT 4: Interfacing Peripherals to AVR

(6 LECTURES)

LCD Interfacing, Keyboard interfacing, ADC interfacing, DAC interfacing, External memory interfacing, Stepper motor interfacing.

RECOMMENDED BOOKS:

1. The AVR microcontroller and embedded systems using Assembly and C, Muhamad ali Mazidi, Sarmad Naimi, Sepehr Naimi, PHI publications
 2. Microcontrollers: Architecture, Programming, Interfacing and System Design, Rajkamal, Pearson India, ISBN: 9788131759905
 3. Let us C, Yashwant Kanetkar, BPB Publications
 4. Embedded Systems: Architecture, Programming & Design, Raj Kamal, Tata McGraw Hill publication
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2021 PATTERN CBCS
Discipline Specific Elective Course

EL 353: Paper III: Analog circuit Design and Applications

SEMESTER V

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Understand basics of analog circuit design.

CO2: Analyze waveform generators required for testing different circuits.

CO3: Build application circuits using specialized ICs.

CO4: Design analog systems using available ICs.

UNIT 1: Fundamentals of Analog Circuit Design (6 LECTURES)

Design specifications, selection of amplifier, unwanted signals, avoiding fault conditions, offset nullifying techniques, enhancing output capabilities.

UNIT 2: Nonlinear Circuits (10 LECTURES)

Logarithmic Amplifiers, Log/Antilog Modules, Precision Rectifier, Peak Detector, Sample and Hold Circuits. OP-AMP as Comparator, Schmitt Trigger, Monostable Multivibrator, Analog Multiplier applications

UNIT 3: Waveform Generators (12 LECTURES)

Wien-bridge and twin-T oscillators, Square wave generators, Ramp Generator, Triangular wave generator, Sawtooth wave generator, Sine wave generator, Crystal Oscillator, Function Generators: Multi op-amp function generators, function generator IC's. Phase Locked Loops: Block diagram and operation, Applications as Frequency Multiplier and Frequency Shift Keying

UNIT 4: Voltage Regulators (8 LECTURES)

Design of Power Supply: Voltage Regulator, Three terminal voltage regulators, Fixed and adjustable voltage regulators (78XX, LM317), Dual power supply (LM320, LM317), Basic switching regulator and its characteristics

RECOMMENDED BOOKS:

1. OP-AMP and Linear ICs, Ramakant A. Gayakwad, Prentice Hall / Pearson Education
 2. Operational Amplifiers and Linear Integrated Circuits, Robert F. Coughlin, Frederick F. Driscoll, PHI
 3. Operational Amplifiers, G. B. Clayton, Elsevier
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
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2021 PATTERN CBCS
Discipline Specific Elective Course

EL 354: Paper IV: Nanoelectronics

SEMESTER V

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Understand basic concepts of nano electronic devices and nano technology.

CO2: Understand the electron transport mechanism in nanostructures.

CO3: Understand techniques of characterization of nanostructures.

CO4: Understand different devices constructed using nanotechnology.

UNIT 1: Introduction to Nanotechnology and Nanoelectronics (5 LECTURES)

Overview of basic Nano electronics, Limitations of conventional microelectronics, Top down approach, Bottom up approach, Flash Memory, Applications of nanotechnology in nanoelectronics. Introduction to metamaterials

UNIT 2: Electron Transport in Nanostructures (5 LECTURES)

Resonant-tunneling diode, electrons in square quantum wells of finite depth, electrons in quantum wire, electrons in quantum dots, Density of states of electrons in nanostructures

UNIT 3: Characterization of Nanostructures (12 LECTURES)

Introduction to characterization of nanostructures: Principle of operation of Scanning electron microscope (SEM), Transmission Electron Microscope (TEM), Scanning Tunneling Microscope (STM), X-Ray Diffraction analysis (XRD), UV-Vis absorption Spectrum

UNIT 4: Materials for Nanoelectronics and Devices (14 LECTURES)

Materials: Semiconductors nanoparticles, Organic semiconductors, Lattice-matched and pseudomorphic heterostructures, Inorganic nanowires, Carbon nanomaterials: nanotubes and fullerenes

Devices: Coulomb Blockade, The Single-Electron Transistor (SET), Carbon Nanotube Transistors (CNT), Semiconductor Nanowire, Quantum well laser, quantum dot LED, quantum dot laser, MOSFETS

RECOMMENDED BOOKS:

1. Nanotechnology: Principles and Practices, Sulbha K. Kulkarni, Springer 2008
 2. Introduction to Nanoelectronics Science, nanotechnology, Engineering and Applications, V. Mitin ,Viatcheslav A. Kochelap , Michael A. Stroscio Vladimir, Cambridge University Press 2008
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
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2021 PATTERN CBCS
Discipline Specific Elective Course

EL 355: Paper V: Signals and Systems

SEMESTER V

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Know basics of electronic signals.

CO2: Know different types of systems.

CO3: Analyze systems using Laplace and Fourier analysis.

CO4: Understand digital signal processing system.

UNIT 1: Fundamentals of Electronic Signals (4 LECTURES)

Definition, Classification of signals: CT and DT, Periodic and aperiodic, Even and odd signals

Elementary signals: unit step, unit impulse, unit ramp, exponential and sinusoidal signals

UNIT 2: Types of Systems (8 LECTURES)

Definition: Systems, Continuous Time systems, Discrete time systems, Static and dynamic systems, Time variant and time invariant systems, linear and nonlinear systems.

UNIT 3: Laplace Transform and Fourier Analysis (14 LECTURES)

Laplace transform: Definition, Properties, LT by using standard tables, First shifting theorem, Second shifting theorem, LT of Differential equation and integral, Convolution theorem
Inverse Laplace transform: Definition, ILT by standard tables, ILT by partial fractions

Fourier Analysis: Definition, Fourier series and Formulae for Fourier Coefficients, Fourier series analysis of periodic signals such as square wave, triangular wave, half wave rectifier

UNIT 4: Digitization of Analog Signals (10 LECTURES)

Analog to Digital conversion of signals, concept of sampling of CT signals, Shanon's Sampling Theorem, Nyquist frequency, Aliasing effect, oversampling and antialiasing filters, concept of quantization and quantization error, encoding, Introduction to DSP systems

RECOMMENDED BOOKS:

1. Network Analysis: G. K. Mittal, Khanna Publishers
 2. Signals and systems by J. S. Chitode, Technical publications
 3. Digital Signal Processing: S. Salivahan, A. Valuraj, C. Gnanapriya, Tata McGraw Hill Publications
 4. Digital Signal Processing: - Principles, Algorithms and Applications: John G Proakis, Dimitris G Manolakis, Pearson Publications
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2021 PATTERN CBCS
Discipline Specific Elective Course

EL 356(A): Paper VI(A): Optics and Fiber Optic Communication

SEMESTER V

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: To acquire Knowledge of optical fiber communication system.

CO2: To understand different parameters of optical fibers.

CO3: To learn essential optical components of Fiber Optic Communication.

CO4: To analyze and integrate fiber optical network components in variety of networking schemes.

UNIT 1: Overview of Optics and Optical Fiber Communication (14 LECTURES)

History of fiber optic systems, block diagram, Fiber material, fiber cables and fiber fabrication, fiber joints, fiber connectors, splicer, Propagation of light in optical fiber, acceptance angle, numerical aperture, Types and specification of optical fiber, Advantages of optical fiber communication, applications

UNIT 2: Transmission Characteristics of Optical Fiber (8 LECTURES)

Attenuation, absorption, linear and nonlinear scattering losses, bending losses, modal dispersion, waveguide dispersion and pulse broadening, Dispersion shifted and dispersion flattened fibers, Measurement of optical parameters, attenuation and dispersion

UNIT 3: Optical Sources and Detectors (8 LECTURES)

Sources: Coherent and non-coherent sources, quantum efficiency, modulation capability of optical sources, Working principle and characteristics of - LEDs, Laser diodes, Modulation in laser diodes, Detectors: PIN and APD, Noise analysis in optical detectors

UNIT 4: Optical Networks (6 LECTURES)

Architecture of optical transport networks (OTNs), network topologies, Introduction to Synchronous optical networking (SONET) and synchronous digital hierarchy (SDH).

RECOMMENDED BOOKS:

1. Optical fiber communication – Principles and practice, J.M. Senior, PHI
 2. Fiber optics and Optoelectronics, R.P. Khare, Oxford University Press
 3. Optical fiber communication, G. Kaiser McGraw Hill
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
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Discipline Specific Elective Course

EL 356(B): Paper VI(B): Electronic Product Design and Entrepreneurship

SEMESTER V

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Know of fundamental steps of electronic product design.

CO2: Know about product debugging and testing techniques.

CO3: Understand different types of documentation procedures required for product design.

CO4: Understand basic requirements for entrepreneurship.

UNIT 1: Introduction to Electronic Product Design (6 LECTURES)

Stages in Product Design, Five elements of successful product design, Prototyping of Product, Ergonomics

UNIT 2: Product Debugging and Testing (10 LECTURES)

Steps of debugging, Techniques of troubleshooting, characterization, Inspection and testing of components, Simulation and prototyping, Integration, Verification and validation, EMI and EMC issues

UNIT 3: Documentation (10 LECTURES)

Types of documentation, Presentation and preservation, Methods of documentation: Technical presentations, Proposals, Visual Techniques, Layout of documentation, Bill of Materials (BOM)

UNIT 4: Entrepreneurship Development (10 LECTURES)

Definition, Characteristics of an Entrepreneur, Functions of Entrepreneur, types of Entrepreneur, Motivation factors to become Entrepreneur, Entrepreneurial competencies, Entrepreneur and economic Development

RECOMMENDED BOOKS:

1. Electronic Product Design, V. S. Bagad, Technical Publications
 2. Entrepreneurship Development, E. Gordan and K. Natarajan, Himalaya Publishing House, New Delhi
 3. Electronic Product Design, R. G. Kaduskar, V. B. Baru Second edition Wiley India
 4. Development of Entrepreneurship, G. S. Batra, Deep and Deep Publications, New Delhi
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Guidelines for T.Y. B.Sc. Practical Courses

1. There are three practical courses per semester in CBCS pattern.
2. Each practical course consists of 8 experiments + one activity equivalent to 2 experiments or 2 additional experiments. There are TWO activities i.e. one for Practical course-I and other for Practical course-II per semester. The practical activity is a self-learning process.
3. The progress of the student activity will be assessed time to time/ weekly/ monthly by the teacher during regular practical timing.
4. Student has to submit full activity report individually, at the end of the semester. It will be evaluated both at internal and university practical examination.
5. The “activity concept” will allow students to carry out quality work and prepare good report (study material with practical experience) which will be useful to the teachers, departments, other students etc.
6. In the practical course examination, 20% weightage will be given to activity done by the student at internal and external examination.

The number of experiments according to groups is specified in the following Table.

Group	Title of Paper/Course	Number of Experiments
EL357: PRACTICAL COURSE I		
A	Analog circuit design and applications and Nanoelectronics	04
B	Optics and Fiber Optic Communication OR Electronic Product Design and Entrepreneurship	04
C	Activity/additional experiments	02
	Total Experiments	10
EL 358: PRACTICAL COURSE II		
A	Digital Design using Verilog	02
B	Microcontroller Architecture and Programming	03
C	C Programming	03
D	Activity/additional experiments	02
	Total Experiments	10

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Discipline Specific Elective Course
EL 357: Paper VII: Practical Course I

SEMESTER V

CREDITS: 2

There are 10 Experiments in Paper VII EL357 Practical Course- I
One activity as directed in practical course which will be equivalent to 2 experiments.

- Internal Practical Examination (Out of 15): Continuous Internal Assessment
 - 12 Marks for Experiment
 - 3 Marks for Activity
- University Semester Practical Examination (Out of 35): One experiment of 3 hours duration
 - 30 Marks for Experiment
 - 3 marks for oral
 - 2 marks for activity

Course Outcomes: After completing the course, the students will be able to
CO1: Analyze different design and test procedures for analog circuits and systems.
CO2: Measure different parameters of optical fiber communication systems
CO3: Understand importance of product design and entrepreneurship.
CO4: Develop electronic systems for given application.

LABORATORY EXPERIMENTS (Total 8 experiments)

Group A: Analog Circuit Design and Applications and Nanoelectronics (Any 4)

1. To design, build and test wave shaping circuits (Integrator / differentiator circuit)
2. To design, build and test Op-amp based clipper and clampers.
3. To design, build and test Log amplifier using Opamp
4. To study gain bandwidth product of inverting/ non-inverting amplifier.
5. To design, build and test Regulated power supply using IC 723 (Low and High Voltage, 1A Current)
6. To design, build and test Function generator using 8038/2206 or any equivalent IC
7. To design, build and test second order Butterworth active Low Pass/ High Pass/ Band Pass/ Band Reject Filter (any two)
8. To study PLL and measure lock range and capture range of PLL (IC565/ CD4046/ XR2211 or any equivalent IC)

Nanoelectronics:

1. Do it Yourself projects demonstrating nanoelectronics.

2. Simulation study of quantum dots using suitable programming language/simulation software.
3. Simulation study IV characteristics of nano devices like transistors etc. using suitable programming language/simulation software.
4. Study of flash memory.
5. Deposition of CdS layer using Spin coating.
6. Synthesis of the Silver nanoparticles by sol gel method.
7. Measurement of Electrical conductivity of thin films of different Nano-materials.

Group B (Optional paper): Optics and Fiber Optic Communication (Any 4)

Note: Use fiber optic demonstration kits

1. To measure propagation loss in optical fibers
2. To measure bending loss in optical fibers
3. To set up fiber optic voice link
4. To measure Numerical Aperture of given optical fiber.
5. To study different methods of optical fiber terminations and polishing
6. To study fiber optic sensors and their applications
7. To design, build and test fiber optic Transmitter
8. To design, build and test of fiber optic Receiver
9. Visit to telecom facility for observing splicing, alignment, fusing, OTDR operation, types of connectors, couplers and cables

Group B (Optional paper): Electronic Product Design and Entrepreneurship (Any 4)

1. Interview a successful entrepreneur
2. Visit a small business- project report.
3. Writing business proposal
4. Market Survey of electronic products
5. Quality control test procedures in industry
6. Study of methods from Prototype to product
7. Study of manufacturing process of any identified product

Group C: ACTIVITY: Any one of the following activities will be considered as equivalent to 2 experiments.

1. Any two additional experiments than specified from any Group.
2. Circuit Design and simulation using LTSPICE/Multisim.
3. Industrial /field Visit
4. Hands on training Workshop
5. Do it Yourself Open ended Project

RECOMMENDED BOOKS:

1. Operational Amplifiers, G. B. Clayton, MGHill publications
4. Optics and optical fiber communication, R. P. Khare, Oxford University Press,
5. Electronic Product Design, V. S. Bagad, Technical publications
6. National semiconductor manual

7. EXAR Manual/Signetics Manual

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Discipline Specific Elective Course
EL 358: Paper VIII: Practical Course II

SEMESTER V

CREDITS: 2

There are 10 Experiments in Paper VII EL358 Practical Course- II

One activity as directed in practical course which will be equivalent to 2 experiments

- Internal Practical Examination (Out of 15): Continuous Internal Assessment
 - 12 Marks for Experiments
 - 3 Marks for Activity
- University Semester Practical Examination (Out of 35): One experiment of 3 hours duration
 - 30 Marks for Experiment
 - 3 marks for oral
 - 2 marks for activity

Course Outcomes: After completing the course, the students will be able to

CO1: Develop and simulate design digital systems using Verilog.

CO2: Design and develop AVR microcontroller based systems.

CO3: Understand different nanoelectronic devices.

CO4: inculcate basic skills required for design and development of embedded Systems.

LABORATORY EXPERIMENTS (Total 8 Experiments)

Group A: Digital Design using Verilog (Any 2)

Note: One can use Xilinx 9i or updated versions for simulation. Use of behavioral/schematic modeling/gate level modeling styles are expected.

1. 2:1 Multiplexer and 1: 2 De-multiplexer
2. Magnitude comparator
3. Code converters
4. Binary Adder (Ripple Adder and carry look ahead adder)
5. Flipflops (R-S, J-K, T and D)
6. Counters. (Up counter/down counter, ring counter)
7. Shift Registers (SIPO/SISO/PISO/PIPO)
8. Sequence generator for stepper motor

Group B: Microcontroller Architecture and Programming (Any 3)

1. Simple programs: AVR programming in C using MPLAB or equivalent simulation software for arithmetic, logical operations, memory transfer etc.
2. Code conversions (Decimal to hex, hex to decimal, ASCII to hex , Hex to ASCII, BCD to 7 seg code)

3. Interfacing array of LEDs with AVR board
4. AVR C program to Read Push-button switch and display its status on LED.
5. Interfacing Buzzer with AVR Board.
6. Interfacing 7-Segment LED Display with AVR Board.
7. Interfacing of 16x2 LCD with Arduino board and display message on it.
8. Interfacing 4x4 matrix keyboard with AVR microcontroller.
9. Interfacing temperature sensor LM35 measurement & display on LCD

Group C: C Programming (Any 3)

Write C Programs for following:

1. Generate the Fibonacci series up to the given limit N and also print the number of elements in the series
2. Find minimum and maximum of N numbers.
3. Find the GCD of two integer numbers.
4. Calculate factorial of a given number.
5. Find all the roots of a quadratic equation $Ax^2 + Bx + C = 0$ for non-zero coefficients A, B and C
6. Calculate the value of $\sin(x)$ and $\cos(x)$ using the Fourier series. Also print $\sin(x)$ and $\cos(x)$ value using library function.
7. Generate and print prime numbers up to an integer N
8. Sort given N numbers in ascending order using bubble sort.
9. Find the sum & difference of two matrices of order MxN and PxQ
10. Find the product of two matrices of order MxN and PxQ

Group D: ACTIVITY: Any one of the following activities will be considered as equivalent to 2 experiments

1. Any two additional experiments than specified from any Group
2. AVR based system design and simulation
3. Industrial /field Visit
4. Hands on training Workshop
5. Do it Yourself Open ended Project

RECOMMENDED BOOKS:

1. AVR Microcontroller using assembly and C, Muhammad Ali Mazidi, Serpnah Naimi and naimi, Pearson Publication
 2. Verilog HDL: A Guide to Digital Design & Synthesis, Samir Palnitkar, SunSoft Press, ISBN: 978-81-775-8918-4.
 3. Let us C, Yashwant Kanetkar, BPB publications
 4. AVR Microcontroller Data sheet
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2021 PATTERN CBCS
Discipline Specific Elective Course

EL 359: Paper IX: Practical Course III(Project)

SEMESTER V

CREDITS: 2

Course Outcomes: After completing the course, the students will be able to

CO1: Understand basic methodology of selection of topic for project.

CO2: Understand how to do literature review for selected topic for project.

CO3: Apply the knowledge for design and development of the selected project.

CO4: Use different software and hardware for testing, validation and verification of circuits for successful outcome of project

CO5: Understand documentation process in the form of presentation and project report

CO6: Understand process of systematic development of electronic system and Development of skills for successful outcome

Guidelines to conduct Practical Course III(Project)

Practical Course III is a project Course of 2 Credits.

- Internal Continuous Assessment (15 marks)
- University project Examination (35 marks)

This Course should be conducted using following guidelines:

- a) In CBCS Pattern, Student has to perform project in Semester V as well as Semester VI. It can be :
 - i. separate project for each semester OR
 - ii. can perform continuous project carrying sufficient weightage of marks per semester.
- b) There should be internal continuous assessment of Project work in the form of Seminars/presentation and continuous monitoring of work.
- c) After completion of project, student has to submit the Project Report in the following format.
 - i. Title of Project
 - ii. Aim and objectives of project.
 - iii. Literature or Reference work
 - iv. Block diagram and its explanation in brief and/or algorithm of software required if any
 - v. Design and development of Circuit/system and Simulation required if any
 - vi. Circuit Diagram and its working and Program explanation if any
 - vii. Experimental Work and PCB Design/fabrication required if any
 - viii. Results and Discussion

- ix. Applications
- x. Future Scope
- xi. References

- c. There must be observations, interpretations, conclusions, results of the project work.
 - d. Algorithm, program strategy, module wise description of parts etc. be provided in case of projects related with development of computer software.
 - e. Applications, usefulness, student's contribution must be clearly specified.
 - f. Further extension work may be suggested for better outcome of the project.
 - g. It is recommended to present the projects in competitions / project exhibitions organized by various authorities.
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
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2021 PATTERN CBCS
Skill Enhancement Course

ELSEC 351: Paper X: SEC1: Electronic Design Automation Tools

SEMESTER V

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Design the electronics circuits using EDA software tools

CO2: Simulate various analog and digital circuits using EDA software tools

CO3: Plot various waveforms.

CO4: Simulate basic electronic system blocks

Note: This course is to be conducted in laboratory for more hand on experience to students.

UNIT 1: Introduction to EDA Tools

(6 LECTURES)

Definition of Simulation, Need of Simulation, Brief introduction of various simulators, Description to simulator tool, Hands on practice on available library of components, wiring and schematic designing

UNIT 2: Electronics Designing using LTSPICE/ PSPICE

(10 LECTURES)

Introduction to Simulator: Brief History, New Versions, Representing Components, Understanding the simulation Environment, Using Model Editor, designing a Circuit and drawing a schematic, Preparation for Simulation: Preparing schematic for simulation, Understand the sources for simulation, Use of different markers. DC, AC, Transient and Fourier Analysis of circuit, Digital circuit Simulation.

Simulation Experiments:

- Simulation of clipper/clamper circuit/passive filter circuits.
- Simulation of transistor biasing circuit.
- Simulation of CE single/two stage amplifier circuit.
- Failure Mode Analysis of circuit.

UNIT 3: Introduction to Multisim/ CircuitMod

(10 LECTURES)

Environment: Design Process, Setting environment preferences

The Multisim /CircuitMode : Schematic capture of circuits, Placing components, Wiring components, simulation and result display in MultiSim.

Device modeling: Design of Half-Wave rectifier, Bridge rectifier, clippers and clampers using diode, voltage regulator, AC voltage measurement, DC transfer curve analysis

Programs for Practice:

- Simulation of Half wave rectifier circuit.
- Simulation of Bridge Rectifier circuit
- Simulation of Voltage regulator circuit.

- Simulation of simple power circuit.
- Failure Mode Analysis of circuit.

UNIT 4: Introduction to Proteus/OrCAD

(10 LECTURES)

Description of simulation software tools (OrCAD / Proteus), Schematic Description: Introduction, Input files, element values, Nodes, circuit elements, sources, output variables, format of circuit and output files, drawing the schematic, Design rule Check (DRC), Netlist details

Types of analysis: DC, Transient and Frequency.

Programs to Practice:

- Simulation of Active low pass/high pass/band pass/band stop filter
- Simulation of Wein bridge oscillator/function generator

RECOMMENDED BOOKS:

1. Essential Electronic Design Automation (EDA), by Mark D. Birnbaum, Pearson, ISBN: 0131828290
 2. Electronic Design Automation for Integrated Circuits Handbook – 2, Scheffer Lavagno Scheffer Martin
 3. <http://www.linear.com/>, <http://www.expresspcb.com/http://spice.sourceforge.net/>
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
T.Y.B.Sc. ELECTRONIC SCIENCE
2021 PATTERN CBCS
Skill Enhancement Course

ELSEC 352: Paper XI: SEC2: Internet of Things and Applications

SEMESTER V

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Know the basic building blocks of IoT

CO2: Know IoT protocols

CO3: Understand how to Design and Develop IoT based system through case studies.

Note: This course is to be conducted in laboratory as hands on experience to students.

UNIT 1: Introduction of IoT

(6 LECTURES)

Definition and characteristics of IoT, Technical Building blocks of IoT, Devices, Communication Technologies, Physical design of IoT, IoT enabling technologies, IoT Issues and Challenges-Planning, Costs and Quality, Security and Privacy, Risks

UNIT 2: IoT Protocols

(6 LECTURES)

MQTT, CoAP, XMPP and AMQT, IoT communication models, IoT Communication technologies: Bluetooth, BLE, Zigbee, Zwave, NFC, RFID, Zigbee etc.

UNIT 3: Health Care and Smart City applications of IoT

(12 LECTURES)

Smart Healthcare: Characteristics of e-health and applications: monitoring of health parameters, smart medicine box, elderly people monitoring, challenges

Smart City: Characteristics and applications–Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, Smart Living, Smart Grid, Transport and Traffic Management

UNIT 4: Smart Home and Agriculture applications of IoT

(12 LECTURES)

Smart Home: Characteristics of Smart Home, Smart Home Energy Management, Smart Appliances, Communication Technologies for Smart Homes, maintenance, security, challenges

Smart Agricultural: Characteristics and Applications, Scarecrow, Smart Irrigation System, Crop Water Management, Integrated Pest Management, Sensor-based field and resource mapping, Remote equipment monitoring

Experiments for Practice:

1. To interface LED/buzzer to Arduino/Raspberry pi and write a program to make it ON or OFF
2. To interface digital sensor/push button to Arduino/Raspberry pi and write a program to make LED ON when button pressed or sensor detection

3. To interface motor to Arduino/Raspberry pi and write a program to turn ON motor when push button is pressed
4. To interface DHT 11/any temperature sensor to Arduino/Raspberry pi and write a program to print temperature and/ or humidity.
5. To interface Bluetooth to Arduino/Raspberry pi and write a program to send sensor data to smartphone using Bluetooth
6. Write a program on Arduino/Raspberry pi to upload temperature and humidity data to Thingspeak cloud.

RECOMMENDED BOOKS:

1. Internet of Things –A hands-on approach, Arshdeep Bahga, Vijay Madiseti, Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515.
 2. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, David Hanes, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 20173
 - 3.The Internet of Things: Applications to the Smart Grid and Building Automation, Olivier Hersent, Omar Elloumi and David Boswarthick, Wiley, 97811199583453.
 - 4.The Internet of Things –Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi ,Wiley,ISBN:978-1-119-99435-0
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
T.Y.B.Sc. ELECTRONIC SCIENCE
2021 PATTERN CBCS
Discipline Specific Elective Course

EL 361: Paper I: Modern Communication Systems

SEMESTER VI

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Understand the digital modulation techniques.

CO2: Understand different types of pulse modulation techniques.

CO3: Describe the evolution and importance of Mobile communication and cellular communication

CO4: Know the basics of satellite communication systems.

UNIT 1: Basics of Digital Communication

(06 LECTURES)

Introduction, digital trans receiver, Information capacity, bits, bit rate, baud rate and m-ary coding, Amplitude Shift Keying, Frequency Shift Keying, Binary Phase Shift Keying, Quadrature amplitude modulation, Block diagram of MODEM

UNIT 2: Digital modulation

(10 LECTURES)

Definition of PCM, PCM Sampling, Signal to quantization noise, PCM Methods, Delta modulation and adaptive delta modulation and generation methods
Time Division Multiplexing, Frequency Division Multiplexing

UNIT 3: Mobile and Cellular Communication

(10 LECTURES)

Introduction, mobile telephone service, cellular phone, frequency reuse, cell splitting, sectoring, segmentation and dualization, cellular telephone topology, roaming and handoffs, network components and call processing
Comparative study of GSM and CDMA, 2G, 3G and 4G concepts.

UNIT 4: Satellite Communication

(10 LECTURES)

Introduction to satellite, geosynchronous satellites, spacing and frequency allocation, satellite system link models, system parameters, FDM satellite systems: Set-Top Box, channel capacity, satellite radio navigation, FDMA, TDMA, Satellite data communication: VSAT

RECOMMENDED BOOKS:

1. Electronic Communication Systems Fundamentals through advanced, Wayne Tomasi, Pearson Education Press
2. Wirelerrss communications, Andrea Goldsmith, Cambridge University Press
3. Fundamentals of Wireless Communication, D. Tse and P. Viswanathan, Cambridge University Press.
4. Modern Wireless Communication, Haykin S. and Moher M., Pearson
5. Wireless and Mobile Network Architectures, Yi-Bing Lin Wiley.
6. WEB resources: <http://nptel.ac.in/courses/>

SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
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2021 PATTERN CBCS
Discipline Specific Elective Course

EL 362: Paper II: Embedded System Design using Microcontrollers

SEMESTER VI

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Understand features and architecture of PIC microcontroller.

CO2: Demonstrate how to interface PIC microcontroller with different peripherals

CO3: Understand features and architecture of ARM microcontroller.

CO4: Demonstrate embedded system using given microcontroller.

UNIT 1: Introduction to Embedded Systems (4 LECTURES)

Basic Concepts: Definition, Embedded system Vs general computing system, Purpose of embedded system, application areas, Elements of embedded system design-Real Time Operation, Memory footprint, reliability, size, cost.

UNIT 2: PIC16F887 Microcontroller (12 LECTURES)

Core features, Architecture, memory organization, I/O Ports, interrupts, addressing modes, instruction set

Interfacing PIC Microcontroller: LED, Switches, Solid State Relay, Seven Segment Display, 16x2 LCD display, 4x4 Matrix Keyboard, Digital to Analog Converter, Stepper Motor and DC Motor, Interfacing program examples using C language/python language

UNIT 3: ARM Microcontrollers (10 LECTURES)

Introduction to ARM based Microcontrollers, Architecture overview, status register, general purpose register file, memories, Instruction set, Simple programs using C Language/python language

UNIT 4: Embedded System case studies (10 LECTURES)

Washing Machine: Functional block diagram, Design and working

Automotive embedded system: Functional diagram, Design and working

Smart card technology, Digital Cameras

RECOMMENDED BOOKS:

1. Introduction to Embedded Systems, K. V. Shibu, TMH publication.
 2. PIC microcontroller and embedded system, Muhammad Mazidi, Mackanly, Danny Causy Pearson Education Press
 3. ARM Microcontrollers: Architecture, Programming, Interfacing and System Design, Rajkamal, Pearson Education Press
 4. Embedded System Design, Rajkamal, Pearson Education Press
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
T.Y.B.Sc. ELECTRONIC SCIENCE
2021 PATTERN CBCS
Discipline Specific Elective Course

EL 363: Paper III: Industrial Electronics

SEMESTER VI

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

- CO1: Understand basics of semiconductor power devices.
- CO2: Analyze basic power electronics circuits and demonstrate applications.
- CO3: Understand basics of motor control.
- CO4: Understand basics of Electric Vehicle systems

Note: Emphasis should be given to input and output waveforms for single phase power circuits and characteristics of power devices

UNIT 1: Power Semiconductor Devices (8 LECTURES)

Comparative study of power devices (Diodes, Transistors, DIAC, TRIAC, Thyristors/SCR), Protection of power semiconductor devices. Triggering Methods using PUT

UNIT 2: Power Circuits (10 LECTURES)

Concept of three phase, Controller Rectifiers: Half wave and Full Wave (R Load and R/L load)
Inverters: Half bridge and full bridge, Cyclo converters
Concept of Switched Mode Power Supplies (SMPS), Various schemes of SMPS, Design aspects of SMPS, UPS

High frequency heating:

Induction Heating: Basic Principle, Factors Governing the process, applications, merits and demerits over other systems

Di-electric heating: Basic Principle, Factors governing the process, applications, merits and demerits over other systems

UNIT 3: Motor control (8 LECTURES)

Classification of motors, DC motor, Single phase SCR drive, Speed control of DC motor, AC motor and Induction motor

UNIT 4: Electric Vehicle (EV) systems (10 LECTURES)

Advantages of Electric Vehicles. Comparative study of EV and Hybrid Vehicles, Types of EVs: Battery Electric Vehicle (BEV), Plug in Hybrid Electric Vehicle (PHEV), Hybrid Electric Vehicle (HEV), Fuel Cell Vehicles, Electric Vehicle Batteries

Charging EV: Tickle charge, charging at home, Charging power station, High power stations

RECOMMENDED BOOKS:

1. Power Electronics: Circuits, Devices and Applications, Mohammad Rashid, Pearson publication.
2. Power Electronics, P.C. Sen TMH, New Delhi

3. Power Electronics and Its Applications, Alok Jain Penram India
 4. Power Electronics, M D Singh, K B Khanchandani McGraw Hill, New Delhi
 5. Thyristor & its applications , Ramamurthy East West Press, New Delhi
 6. <https://nptel.ac.in/courses/108/103/108103009/>
 7. https://pluginbc.ca/wp/wp-content/uploads/2014/07/EV-Beginners-Guide_Final_Sept2_2014.pdf
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
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2021 PATTERN CBCS
Discipline Specific Elective Course

EL 364: Paper IV: Manufacturing Processes for Electronics

SEMESTER VI

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Understand basics of Passive Electronic Component Manufacturing Processes

CO2: Understand process involved in PCB manufacture and Modern Circuit Assembly

CO3: Know about the Semiconductor Device and IC Fabrication Process

UNIT 1 Passive Electronic Component Manufacturing Process (8 LECTURES)

Basic Manufacturing Processes of Electronic Passive components – Fixed value and Variable Resistors, Fixed value Capacitor, Fixed value Inductor, Transformer, Switches, Relays, Connectors and Cables

UNIT 2: PCB Manufacturing Process (10 LECTURES)

Parts of a PCB: Substrate, Copper Layer, Solder Mask, Silk Screen, Single, double and multilayer, PCB Manufacturing Process: Imaging desired layout on copper clad laminates, Etching or removing excess copper from inner layers to reveal traces and pads, Chemicals in PCB manufacturing, Creating the PCB layer stack up by laminating (heating and pressing) board materials at high temperatures, Drilling holes for mounting, through hole pins and vias, Automated Optical Inspection, PCB production equipment- Modern platers and etchers

UNIT 3: Modern Assembly Techniques for Electronic Systems (8 LECTURES)

Assembly Process for Surface Mount Technology (SMT), Thru-Hole Technology (THT) and Mixed Technology circuits - Solder Paste Stenciling, Pick and Place, Through-Hole Component Insertion, Automatic component insertion/placement systems, Vibratory insertion process for non-standard component insertion, Vision-guided assembly, Protection Against Electrostatic Damage, Manual Soldering, Reflow Soldering, Wave Soldering, Inspection and Quality Control.

Process flow for Hybrid Circuit Manufacturing (Thick film technology)

UNIT 4: Semiconductor Device and IC Fabrication Process (10 LECTURES)

Fabrication Steps for Semiconductor Devices - Crystal Growth, Thin Film Deposition, Oxidation, Diffusion, Ion Implantation, Lithography, Etching and Metallization, lead connection and encapsulation.

Process Integration and IC Manufacturing: Bipolar Technology, MOS/MES-FET Technology, Electrical Testing and Packaging

RECOMMENDED BOOKS:

1. Electronic Components and Materials: Principles Manufacture and Maintenance, S.M. Dhir, McGraw Hill
 2. Passive Components for Circuit Design, Ian Sinclair, Elseveir Publications
 3. Electronic Components, K. Padamanabhan and P. Swaminathan, Laxmi Publications
 4. Electronic Components and Materials, Madhuri A. Joshi, SPD Publishing
 5. Printed Circuit Boards: Design, Fabrication, and Assembly, R.S. Khandpur, Mcgraw Hill
 6. Fundamentals Of Semiconductor Manufacturing and Process Control, Gary S. May and Costas J.,Wiley - IEEE)
 7. Electronic Technology Handbook, Neil Sclater Mcgraw Hill
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
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2021 PATTERN CBCS
Discipline Specific Elective Course

EL 365: Paper V: Process Control Systems

SEMESTER VI

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Familiar with different types of sensors and related systems

CO2: Know different types of measurement systems.

CO3: Understand control parameters in process automation.

CO4: Understand different types of process control systems and their characteristics.

UNIT 1: Process Measurements

(8 LECTURES)

Block diagram of instrumentation system, Analog and Digital Modes of Operation, Null and Deflection Methods, Input Output configuration of Instruments and measuring systems

UNIT 2: Process Performance Parameters

(10 LECTURES)

Generalized measurement systems, zero-order System, First-order System, Second-order System, Dead-Time Element, Specifications and Testing of Dynamic Response.

Generalized Data Acquisition system- Elements of a data acquisition system, Single channel Data Acquisition system, Multichannel Data Acquisition system

UNIT 3: Fundamentals of Process Control

(8 LECTURES)

Process control principles, Continuous control, discrete state control, composite discrete/continuous control, Process Characteristics, Control system parameters, Architecture of Industrial Automation Systems, Advantages and limitations of Automation

UNIT 4: Process Control Systems

(10 LECTURES)

Two position mode, Multiposition mode, floating control mode

Continuous controller modes: Proportional control, Integral control, Derivative control

Composite modes: Proportional-Integral, Proportional derivative, Proportional-integral – derivative (PID)

RECOMMENDED BOOKS:

1. Process Control Instrumentation Technology; Curtis Johnson, Pearson Publication
 2. Instrumentation Devices & Systems, C S Rangan, G R Sarma, V S Mani, TMH
 3. Measurement Systems Application and Design, Ernest O Doebelin, Dhanesh N Manik, Tata McGrawHill
 4. Elements of Electronic Instrumentation and Measurement, Joseph J. Carr, Pearson Education
 5. Modern control technology: components & systems, Kilian, Delmar
 6. Process software and digital networks, Bela G Liptak
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
T.Y.B.Sc. ELECTRONIC SCIENCE
2021 PATTERN CBCS
Discipline Specific Elective Course
EL 366(A): Paper VI (A) : PLC and SCADA

SEMESTER VI

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Know about the basics of programmable logic controllers and their components.

CO2: Demonstrate PLC programming using ladder programming.

CO3: Develop PLC based systems by programming different components in PLC.

UNIT 1: Programmable Logic Controller (PLC)

(6 LECTURES)

Introduction, Brief History, PLC Configurations, Typical system components, System block diagram

UNIT 2: Basics of PLC Programming

(14 LECTURES)

Introduction, Basic components and their symbols: control transformers, fuses, Switches, Relays, Time delay relays, Indicator lamps

Fundamentals of Ladder diagrams: Basic diagram, Wiring, Boolean and relay logic, single cycle circuit, combined circuit. Machine control terminology, Physical components Vs Program components, Ladder program execution sequence, Mnemonic programming

Wiring Techniques: PLC power connection, Input wiring, output wiring, Relay outputs, Solid state outputs

UNIT 3: Introduction to SCADA

(8 LECTURES)

Fundamentals of SCADA system, SCADA Hardware, SCADA software, SCADA and LAN, Comparative study of SCADA, DCS and PLC

UNIT 4: Components of SCADA system

(8 LECTURES)

Block diagram of SCADA system, Advantages, Remote terminal Units (RTU), Typical requirements of RTU, SCADA Key features, Introduction to protocols, Case Study of SCADA applications

RECOMMENDED BOOKS:

1. Programmable Logic Controllers Programming Methods and Applications, John R. Hackworth and Fredrick D. Hackworth, Jr., Pearson Education
 2. Practical SCADA for Industry, David Bailey BEng, Bailey and Associates, Perth, Australia
 3. Programmable Logic Controllers, W. Bolton.
 4. Programmable Logic Controllers, Frank D. Petruzella, Third Edition, Tata McGraw Hill Education Private Limited
 5. Learning Programmable Logic Controllers with Applications, PK Srivastava, BPB Publications.
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2021 PATTERN CBCS
Discipline Specific Elective Course
EL 366(B): Paper VI (B): Sensors and Systems

SEMESTER VI

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Understand basic principles and types of different sensors.

CO2: Understand basic principles and types of actuators.

CO3: Know about signal conditioning systems for sensors.

UNIT 1: Fundamentals of Sensors

(10 LECTURES)

Definition, Classification and types of sensors, Sensors: Temperature, stress and strain, light, chemical sensors, gas sensors, vibration sensors, smart sensors

Specification and performance parameters: Accuracy, Resolution, Threshold, impedance, noise, Sensitivity, Hysteresis, Linearity, Range, Reliability, Selectivity, bandwidth

UNIT 2: Introduction to Sensor Systems

(8 LECTURES)

Sensor systems: Sensor characteristics, signal conditioning circuits, power supply, data acquisition and readout, measurement issues and criteria

Bridge amplifiers, Precision opamps characteristics for amplifiers, instrumentation amplifiers, isolation amplifiers

UNIT 3: Actuators

(10 LECTURES)

Actuators-Principle, construction and specifications,

Pressure controller, flow control actuators (Valves), Power control devices, magnetic control device - Relay, Solenoid, Electromechanical: servo, DC motor, AC motor, Stepper motor

UNIT 4: Applications of Sensors

(8 LECTURES)

Healthcare and biomedical applications, applications in building management system, industry, security and surveillance, marine, military and space

RECOMMENDED BOOKS:

1. Sensor technology handbook John Wilson, Elsevier
 2. Fundamentals of industrial instrumentation and process control, William C. Dunn, Mc Graw Hill Publication
 3. Sensors and Transducers, D Patranabis, Prentice Hall Publication
 4. Sensors and Transducers, Dr. A.D. Shaligram, Chintan Publication
 5. Sensors and Transducers, Principles and Applications, R.Y. Borse, Adhyan Publishers and Distributers, New Delhi
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Guidelines for T.Y. B.Sc. Practical Courses

1. There are three practical courses per semester in CBCS pattern.
2. Each practical course consists of 8 experiments + one activity equivalent to 2 experiments or 2 additional experiments. There are TWO activities i.e. one for Practical course-I and other for Practical course-II per semester. The practical activity is a self-learning process.
3. The progress of the student activity will be assessed time to time/ weekly/ monthly by the teacher during regular practical timing.
4. Student has to submit full activity report individually, at the end of the semester. It will be evaluated both at internal and university practical examination.
5. The “activity concept” will allow students to carry out quality work and prepare good report (study material with practical experience) which will be useful to the teachers, departments, other students etc.
6. In the practical course examination, 20% weightage will be given to activity done by the student at internal and external examination.

The number of experiments according to groups is specified in the following Table.

Group	Title of Paper/Course	Number of Experiments
EL 367: PRACTICAL COURSE I		
A	Industrial Electronics	04
B	Modern Communication Systems	04
D	Activity/additional experiments	02
	Total Experiments	10
EL 368: PRACTICAL COURSE II		
A	Embedded Systems using Microcontrollers	04
B	Fundamentals of Process Control Systems	02
C	PLC-SCADA Sensors and Systems	02
D	Activity/additional experiments	02
	Total Experiments	10

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EL 367: Paper VII: Practical Course I

SEMESTER VI

CREDITS: 2

There are 10 Experiments in Paper VII EL367 Practical Course- I

One activity as directed in practical course which will be equivalent to 2 experiments.

- Internal Practical Examination (Out of 15): Internal Continuous Assessment
 - 12 Marks for Experiments
 - 3 Marks for Activity
 - University Semester Practical Examination (Out of 35): One experiment of 3 hours duration
 - 30 Marks for Experiment,
 - 3 marks for oral
 - 2 marks for activity
-

Course Outcomes: After completing the course, the students will be able to

CO1: Demonstrate power electronic circuits.

CO2: Demonstrate different types of digital communication systems,

CO3: Understand working principles of different power devices and their characteristics

LIST OF EXPERIMENTS (Total 8 Experiments)

Group A: Industrial Electronics (Any 4)

1. To study Characteristics of power devices like BJT/MOSFET/IGBT/Triac
2. To design, build and test light dimmer circuit.
3. To design, build and test triggering circuit using PUT.
4. To study High frequency heating / induction heating
5. To demonstrate Class A/B/C/ D commutation circuit.
6. To design, build and test Single phase/Dual converter.
7. To design, build and test Half wave/Full Wave controlled rectifier.
8. To design, build and test 723/78xx voltage regulator.
9. To demonstrate SMPS/UPS
10. Comparative study of different types of EVs

Group B: Modern Communication Systems (Any 4)

1. To design, build and test PCM encoder.
2. To design, build and test Delta/Adaptive Delta modulation
3. Study of Satellite communication system
4. Comparative study of GSM, CDMA. 2G, 3G and 4G methods
5. Study of architecture of mobile communication system
6. Study QAM /QPSK techniques
7. Study of BPSK MODEM

Group C: ACTIVITY: Any one of the following activities will be considered as equivalent to 2 experiments

1. Any two additional experiments than specified from any Group
2. Circuit Design and simulation using LTSPICE/Multisim.
3. Industrial /field Visit
4. Hands on training Workshop
5. Do it Yourself Open ended Project

RECOMMENDED BOOKS:

1. Power Electronics: Circuits, Devices and Applications, Mohammad Rashid, Pearson publication
 2. Electronic Communication systems, Kennedy and Davis, Mc Graw Hill
 3. Smart Power Manual
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EL 368: Paper VIII: Practical Course II

SEMESTER VI

CREDITS: 2

There are 10 Experiments in Paper VII EL368 Practical Course- II

One activity as directed in practical course which will be equivalent to 2 experiments.

- Internal Practical Examination (Out of 15): Internal Continuous Assessment
 - 12 Marks for Experiments
 - 3 Marks for Activity
 - University Semester Practical Examination (Out of 35): One experiment of 3 hours duration
 - 30 Marks for Experiment,
 - 3 marks for oral
 - 2 marks for activity
-

Course Outcomes: After completing the course, the students will be able to

CO1: Design embedded systems using PIC microcontroller.

CO2: Design embedded systems using ARM microcontroller.

CO3: Demonstrate PLC SCADA using ladder programming.

CO4: Design and develop sensor systems for different applications.

LABORATORY EXPERIMENTS (Total 8 Experiments)

Group A: Embedded Systems using Microcontrollers (Any 4)

Write programs in embedded C/Python:

1. Simple Programs: arithmetic and logical operations using PIC/ARM
2. Interfacing LED/switch to PIC/ARM
3. Interfacing LCD to PIC/ARM
4. Interfacing sensors to PIC/ARM
5. Interfacing keyboard to PIC /ARM
6. Interfacing Bluetooth/wifi/Ethernet to PIC/ARM
7. Interfacing serial communication GSM to PIC /ARM

Group B: Fundamentals of Process Control Systems (Any 2)

1. Simulation of controller modes (P/PI/PD/PID)
 2. Design and develop ON/OFF controller using microcontroller.
 3. Ladder diagram programming for basic circuits
 4. Study of process automation system using ladder diagram (Vending machine/bottle filling plant)
 5. Design and Development of ON/OFF temperature control system using Arduino/Raspberry
-

Pi.

Group C: PLC SCADA (Any 2)

1. Ladder Programming for basic logic gates
2. Use of timers
3. Use of counters
4. Simulation of PLC SCADA system for bottle filling plant, traffic signal control systems
5. Comparative study of different PLC SCADA systems
6. Study of different components of PLC SCADA system
7. Creation of wiring diagram of basic PLC SCADA system using wiring diagram tool

OR

GROUP C: Sensors and Systems (Any 2)

1. Design, develop and test bridge amplifier for thermistor.
2. Design, develop and test Instrumentation amplifier for temperature measurement.
3. Design, develop and test signal conditioning circuit for optical sensors (LDR/Photodiode/Phototransistor)
4. Smoke detector
5. Soil moisture measurement
6. Burglar alarm
7. Study of Smart sensors

Group D: ACTIVITY: Any one of the following activities will be considered as equivalent to 2 experiments

1. Any two additional experiments than specified from any Group.
2. Circuit Design and Simulation using LTSPICE/Multisim
3. Industrial /field Visit
4. Hands on training Workshop
5. Do it Yourself Open ended Project

RECOMMENDED BOOKS:

1. Process Automation, C. D. Johnson, Pearson Education
 2. PIC microcontroller and embedded systems using assembly and C Mazidi and Mazidi
 3. ARM microcontroller, architecture and programming Rajkamal, Pearson publication
 4. Sensor handbook
 5. National semiconductor manual
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EL 369: Paper IX: Practical Course III(Project)

SEMESTER VI

CREDITS: 2

Course Outcomes: After completing the course, the students will be able to

CO1: Understand basic methodology of selection of topic for project.

CO2: Understand how to do literature review for selected topic for project,

CO3: Apply the knowledge for design and development of the selected project.

CO4: Use different software and hardware for testing, validation and verification of circuits for successful outcome of project

CO5: Understand documentation process in the form of presentation and project report

CO6: Understand process of systematic development of electronic system and Development of skills for successful outcome

Guidelines to conduct Practical Course III(Project)

Practical Course III is a project Course of 2 Credits.

- Internal Continuous Assessment (15 marks)
- University project Examination (35 marks)

This Course should be conducted using following guidelines:

- d) In CBCS Pattern, Student has to perform project in Semester V as well as Semester VI. It can perform
- iii. separate project for each semester OR
 - iv. Can perform continuous project carrying sufficient weightage of marks per semester.
- e) There should be internal continuous assessment of Project work in the form of Seminars/presentation and continuous work monitoring
- f) After completion of project, student has to submit the Project Report in the following format
- xii. Title of Project
 - xiii. Aim and objectives of project
 - xiv. Literature or Reference work
 - xv. Block diagram and its explanation in brief and/or algorithm of software required if any
 - xvi. Design and development of Circuit/system and Simulation required if any
 - xvii. Circuit Diagram and its working and Program explanation if any
 - xviii. Experimental Work and PCB Design/fabrication required if any
 - xix. Results and Discussion

- xx. Applications
- xxi. Future Scope
- xxii. References

- c. There must be observations, interpretations, conclusions, results of the project work.
 - d. Algorithm, program strategy, module wise description of parts etc. be provided in case of projects related with development of computer software.
 - e. Applications, usefulness, student's contribution in it must be clearly specified.
 - f. Further extension work may be suggested for better outcome of the project.
 - g. It is recommended to present the projects in competitions / project exhibitions organized by various authorities.
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
T.Y.B.Sc. ELECTRONIC SCIENCE
2021 PATTERN CBCS
Skill Enhancement course

ELSEC 361: Paper X SEC1: Design of Printed Circuit Boards

SEMESTER VI

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

- CO1: Understand basics of PCB.
- CO2: Know about the PCB design technology.
- CO3: Know about different soldering techniques.

Note: This course should be taught in laboratories for getting hands on experience

UNIT 1: PCB Fundamentals

(6 LECTURES)

PCB Advantages, components of PCB, Electronic components, Microprocessors and Microcontrollers, IC's, Surface Mount Devices (SMD).

UNIT 2: Classification of PCB and Materials

(10 LECTURES)

Types of PCB: Single, Double, Multilayer and flexible boards

PCB Materials: Copper, Standard FR-4 Epoxy Glass, Multifunctional FR-4, Tetra Functional FR-4, NelcoN400-6, GETEK, BT Epoxy Glass, Cyanate Aster, Plyimide Glass, Teflon (explanation with reference to operating frequency of circuit),

Properties of laminates (electrical & physical) and types of laminates

UNIT 3: PCB Design Concepts

(10 LECTURES)

PCB Designing Flow Chart: Schematic Entry, Net listing, PCB Layout Designing,

Prototype Designing: Design Rule Check (DRC), Design For Manufacturing (DFM), PCB Making, Printing, Etching or Drilling, Assembly of components

Description of PCB Layers: Electrical Layers, Top Layer, Mid Layer, Bottom Layer, Mechanical Layers, Board Outlines and Cutouts, Drill Details Documentation Layers, Components Outlines, Reference Designation

Text Keywords and their Description: Footprint, Pad stacks, Vias, Tracks, Color of Layers, PCB Track Size Calculation Formula

UNIT 4: PCB layout design

(10 LECTURES)

Tools for PCB Design: Understanding the schematic Entry, Creating Library and Components, Drawing Schematic, Flat Design / hierarchical Design, Setting up Environment for PCB Design a Board, Mechanical and Electrical design considerations, Placing and Mounting of components, Conductor spacing, heat sinks and package density

Auto routing: Introduction to Auto routing, Setting up Rules, Defining Constraints, Auto router Setup

Post Designing: Gerber Generation, Adding and Editing Pins.

PCB Technology: Trends, Environmental concerns in PCB industry.

Experiments for Practice:

1. PCB Designing of Basic and Analog Electronic Circuits
2. PCB Designing of Power Supplies
3. PCB Designing of Different Sensor modules
4. PCB Designing of Electronics Projects
5. PCB Designing of Embedded Projects

RECOMMENDED BOOKS:

1. Printed circuit Board –Design & Technology by Walter C. Bosshart, Tata McGraw Hill
 2. Printed Circuit Board –Design, Fabrication, Assembly and Testing, R.S.Khandpur, TATA McGraw Hill Publisher
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SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
T.Y.B.Sc. ELECTRONIC SCIENCE
2021 PATTERN CBCS
Skill Enhancement course

ELSEC 362: Paper XI: SEC2: Mobile Application Development

SEMESTER VI

CREDITS: 2

LECTURES: 36

Course Outcomes: After completing the course, the students will be able to

CO1: Understand basics of Mobile application development.

CO2: Develop ability to work in android development environment.

CO3: Design and develop mobile applications.

Note: This course should be taught in laboratories for getting hands on experience

UNIT 1: Android Concepts

(10 LECTURES)

Introduction to Android, Versions of Android, Features of Android, Architecture of Android, Android Devices, Installation of Required tools: Android SDK, Android Development Tool (ADT)
Practice Program: Develop an Android Application to print Hello World

UNIT 2: Basics of Android Application Development

(12 LECTURES)

Anatomy of an Android applications, Android terminologies, Android User Interface Design Essentials: Managing resources: data types, colors, images, tables, layouts, animation, media, User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

Practice Program: Develop an Android Application to change the color and size of font in text box by clicking buttons

UNIT 3: Android User Interface

(8 LECTURES)

Layouts: Linear, Absolute, Table, Relative, Frame, Scroll view, Resize and reposition - Screen orientation , Views: Text view, Edit Text, Button, Image Button, Checkbox, Toggle Button, Radio Button, Radio Group, Progress Bar, Autocomplete Text, Picker, List views and Web view– Displaying pictures with views: Gallery and Image View, Image Switcher, Grid view – Displaying Menus: Helper methods, Option and Context

Practice Program: Develop an Android Application to emulate Simple Calculator

Practice Program: Develop an Android Application for viewing analog clock and digital clock

UNIT 4: Location Access and Publish Android Application

(6 LECTURES)

Location based services: Display map, zoom control, view and change, Marking, Geocoding, Get location - Publish Android applications and Deployment

Practice Program: Develop an Android Application to display Web Page.

Practice Program: Develop an Android Application to send SMS from application,

Practice Program: Develop an Android Application to get data from Android Sensors,

RECOMMENDED BOOKS:

1. Android Wireless Application Development, T1. Lauren Darcey and Shane Conder, Pearson Education
2. Beginning Android Application Development, WeiMeng Lee ,Wrox Publications

Savitribai Phule Pune University

T. Y. B. Sc. Geology Syllabus

(To be implemented from Academic Year 2021-22)

Semester V (Total Credits 22)

Discipline Specific Electives (DSE) Theory Papers

Paper No.	Title of the paper	Credits
GL 311	Geology of India I	2
GL 312	Mineral Resources	2
GL 313	Marine Geology	2
GL 314	Engineering Geology	2
GL 315	Hydrogeology	2
GL 316	Applied Geophysics	2

Practical related to DSE

Paper No.	Title of the paper	Credits
GL 317	Practical's related to GL311 and GL312	2
GL 318	Practical's related to GL313 and GL314	2
GL 319	Practical's related to GL315 and GL316	2

Skill Enhancement Courses (SEC)

Paper No.	Title of the paper	Credits
SEC I	Geotechnology	2
SEC II	Gemmology and Gem Testing	2

Semester VI (Total Credits 22)

Discipline Specific Electives (DSE) Theory Papers

Paper No.	Title of the paper	Credits
GL 321	Geology of India II	2
GL 322	Mining and Mineral Exploration	2
GL 323	Oceanography	2
GL 324	Petroleum Geology	2
GL 325	Climate Change: Past, Present, and Future	2
GL 326	Geological Field Methods and Mapping	2

Practical related to DSE

Paper No.	Title of the paper	Credits
GL 327	Practical's related to GL321 and GL322	2
GL 328	Practical's related to GL323 and GL324	2
GL 329	Practical's related to GL325 and GL326+ (Fieldwork component)	2

Skill Enhancement Courses (SEC) (Any two)

Paper No.	Title of the paper (Any two)	Credits
SEC III	Applications of Remote Sensing in Geosciences	2
SEC IV	Oil Field Services	2
SEC V	Watershed Development	2

T.Y.B.Sc. Geology (SEMESTER - V)
Paper I: GL 311 Geology of India – I
(Total Credits: 2)
(Total No. of Lectures: 36)

(i) Course learning outcome:

The Indian sub-continent exposes a wide range of lithologies that span from 3.6 billion years to present. The geology of India is synonymous with the geology of the world and its ancient rock types from the Indian Peninsula, Cretaceous Deccan volcanism and Tethyan sediments exposed in the mighty Himalayas is noteworthy. The student will gain knowledge about the stratigraphy and geology of India with emphasis on the Stratigraphy of India with respect to Paleozoic, Mesozoic and Cenozoic Era which will help in understanding the different episodes on the earth during the geologic past.

(ii) Broad contents of the course:

The course intends to introduce students to important geological formations of India, from Precambrian to Recent times.

(iii) Skills to be learned:

At the end of the course, the students will acquire skills that will enable to recognise different geological formation, their age and economic potential. They will also learn to correlate International Geological Time Scale with Indian Stratigraphic Time Scale.

TYBSc Geology.

Title and Contents	No. of Lectures
Credit I: Precambrian Stratigraphy of Peninsular India - I	18
A) Precambrian Stratigraphic framework of India	2
B) Brief account of distribution, Geographical location, classification, lithological succession, structure and economic importance, with a broad range stratigraphic correlation.	
a. Dharwar Craton.	3
b. Singhbhum – Odisha Iron Ore Craton	3
c. Central Indian Craton/ Bastar Craton	3
d. Aravalli Craton	3
e. Bundelkhand Craton	2
f. Eastern Ghat mobile belt	2
Credit II: Precambrian Stratigraphy of Peninsular India - II	18
A) The Archaean – Proterozoic boundary	2
B) Stratigraphy, tectonics, depositional environment and correlation of the following Proterozoic Basins of India:	
a. Vindhyan Supergroup	3

b. Cuddapah Supergroup	3
c. Pranhita-Godavari Supergroup	3
d. Bhima Supergroup	3
e. Kaladgi Supergroup	2
f. Chhattisgarh Supergroup	2

REFERENCE BOOKS -

1. G.G. Deshpande (2002): Geological of Maharashtra- Geological Society of India – Special Publication.
2. Wadia, D. (1973) Geology of India. McGraw Hill Book co.
3. Krishnan, M.S. (1982) Geology of India and Burma, 6th Edition. CBS Publ.
4. Ramakrishnan M, and Vaidynadhan, R (1994) Geology of India, Geological Society of India Publication, Bangalore. Vol. I
5. Valdiya, K. S. (2010) The Making of India: Geodynamic Evolution, Springer
6. Valdiya, K.S. (1984) Aspects of tectonics, Tata Mcgrath Hill.
7. Sinha Singhum - Orissa Iron Ore Craton: Geological Society of India – Special Publication
8. Naqvi, S.M., 2005. Geological Evolution of the Indian Plate (From Haedean to Holocene -4Ga to 4Ka)

T.Y.B.Sc. Geology (SEMESTER V)
Paper II: GL 312 Mineral Resources
(Total Credits: 2)
(Total No. of Lectures: 36)

(i) Course learning outcome:

The course provides the student essential and basic concepts of mineral expiration techniques and the art and science of mining mineral resources.

(ii) Broad contents of the course:

The course envisages to expose the students to the topics such as geology in mining industry, methods of exploration, Sampling Principle, Methods, estimation of reserves, Ore Dressing and Beneficiation.

(iii) Skills to be learned:

This course tries to impart skills related to Geology in mining and enable him/her to perform duties of a geologist at the mining site.

Title and Contents	No. of Lectures
Credit I: Mineral forming processes -I	18
A) Introduction: a) Definition of ore minerals, gangue, tenor, overburden, country rock, syngenetic & epigenetic deposits. b) Classification of economically important metalliferous & non metalliferous mineral deposits.	2
B) Magmatic Concentration: a) Early magmatic deposits b) Late magmatic deposits	3
C) Hydrothermal processes: a) Principles of hydrothermal processes, characters of solutions, types of openings in rocks, factors affecting deposition from hydrothermal solution, wall rock alternations. b) Types of hydrothermal deposits 1. Cavity filling deposits: <ul style="list-style-type: none"> • Processes & characteristic features • Types of cavity filling deposits: Fissure veins & its types (in brief), stock work, saddle reefs, ladder veins, pitches and flats, breccias filling deposits, solution cavity fillings, pore space fillings & vesicular fillings 2. Metasomatic replacement: Definition, Criteria of replacement& resulting mineral deposits	7
D) Oxidation & Supergene enrichment: a. Oxidation& solution in the zone of oxidation b. Gossans & Cappings, the role of iron in gossans, indigenous& transported limonite, false gossans & gossans as guides to the hidden deposits. c. Ore deposition in the zone of oxidation & their method of precipitation d. Supergene Sulphide Enrichment: <ol style="list-style-type: none"> 1. Requirements for supergene enrichment 2. Factors influencing supergene enrichment 3. Recognition of supergene enrichment 	6

Credit II : Mineral forming processes -II	18
A) Evaporation, Residual concentration & Mechanical concentration: a. Evaporation: 1. Process of mineral formation by evaporation 2. Evaporation deposits: Brief account of deposits of oceanic water, lake water, ground water & hot springs b. Residual concentration (residual deposits): 1. Conditions favouring of residual deposits 2. Brief account of residual deposits: Bauxite, clay & iron formation c. Mechanical concentration (placer deposits): 1. Principles involved in the process of mechanical concentration 2. Study of placer deposits: Eluvial, Alluvial, Beach & Aeolia	4
B) Study of following metallic deposits with reference to mineralogy, properties, uses & their geological & geographical distribution a. Precious metals: Gold, Silver. b. Non-ferrous metals: Copper, Lead, Zinc & Aluminium c. Iron & Ferro alloy metals – Iron, Manganese, Nickel & Chromium	6
C) Study of following non-metallic deposits with reference to mineralogy, properties, uses & their geological & geographical distribution Muscovite, Gypsum, Baryte, Calcite/Dolomite, Asbestos, Fluorsopar, Wollastonite, Kyanite, Coal.	2
D) Radioactive minerals: a. Study of Uranium & Thorium deposits of India with reference to mineralogy, mode of occurrence, properties, uses & their geological & geographical distribution	1
E) Introduction to Geophysical and Geochemical methods for mineral exploration	3
F) Environmental and social issues related to mineral resource extraction	2

Reference Books-

1. Jeason and Bateman (1981) Economic mineral deposits, John Wiley and Sons
2. Gokhale & Rao (1978) Ore deposits of India, Thomson press (India) limited.
3. Krishnaswamy, Subbier (1979) *India's mineral resources*, 2d edition: New Delhi, Oxford and IBH Publishing
4. D. N. Wadia (1966) India's Minerals, National Book Trust
5. Robert L. Bates (1969) Geology of the industrial rocks & minerals, Dover Publications
6. Umeshwar Prasad (2003) Economic Geology, Satish Kumar Jain, CBS Publishers and Distributors.
7. Umate (IBM) : Economic mineral deposits of India
8. Park & Mc-dermitt (1997): Economic Ore Deposits
9. Tiwari, S.K (2010): Ore Geology, Economic Minerals and Mineral Economics
10. Aswathanarayana, U. (2005): Mineral Resources Management and The Environment
11. Guilbert, John M. and Charles Frederick Park (2007): The Geology of Ore Deposits
12. Arogyaswamy R.N.P (2017): Courses in Mining Geology

T.Y.B.Sc. Geology (SEMESTER V)
Paper III: GL 313 Marine Geology
(Total Credits: 2)
(Total No. of Lectures: 36)

(i) Course learning outcome:

A student will understand and learn about the basic concepts of oceanography and marine geology with respect to geology as to enable them to work as a marine researcher.

(ii) Broad contents of the course:

To provide essential concepts of marine geology and to study the tectonics, geology, exclusive economic zones & marine pollution with respect to the oceans.

(iii) Skills to be learned:

The students will equip himself with knowledge and skills related to dealing with the physical and chemical components and phenomena related to marine geology.

Title and Contents	No. of Lectures
Credit I: Study of Ocean floor	18
A) Physiographic divisions of oceans (the Continental Shelf, the Continental Slope, the Deep Sea Plain & the Oceanic Deeps)	5
B) Ocean floor rocks - Ultramafic rocks, Gabbroic rocks & Basalts Marine sediments.	2
C) Origin, structure and evolution of Indian Ocean shelf and margins (estuaries, deltas, tidal flats)	5
D) Applications of Geophysical Techniques for Exploration of the Sea Floor (Introduction, Explosion seismology, Reflections: echo-sounding and seismic-profiling)	6
Credit II: Marine Sediments and Pollution	18
A) Marine Sediments (Introduction, Sources, Composition, distribution & Classification of marine sediment)	6
B) Marine Pollution (Introduction, Marine Environmental Problems Associated with Petroleum Pollution - Two major case studies, Marine Environmental Problems Associated with Non-Petroleum Chemical Pollution - Sewage Sludge, DDT and PCBs, Mercury and Minamata Disease & Other Types of Chemical Pollutants)	6
C) Exclusive economic zones (EEZ) and their economic potential (Introduction, Origin, Disputes, EEZ of India)	6

REFERENCE BOOKS

1. Brown E., Coiling A., Park D., Phillips J., Rothery D., Wright J. (1998) The Ocean Basins: Their Structure and Evolution
2. Einsele, G. (1982) Sedimentary basins-evolution, facies and sediment budget. Springer-Verlag.
3. Fowler, C.M.R. (1993) The Solid Earth, Cambridge Press University.

4. Hekinlan R. (1982) Petrology of The Ocean Floor
5. Keen M. J. (1968) An Introduction to Marine Geology
6. Kenneth, J. (1982) Marine Geology and Geophysics.
7. Nittrouer, C.A., Austin, J. A., Field M. E., Kravitz J. H., Syvitski J. P. M., Wiberg P.L. (2007) Continental margin, sedimentation from sediment transport to sequence stratigraphy, Wiley Blackwell.
8. Trujillo A. P., Thurman H. V. (2018) Essentials of Oceanography
9. Turcotte, D.L. and Schubert, G (1992) Geodynamics, Wiley and Sons.

T.Y.B.Sc. Geology (SEMESTER V)
Paper IV: GL 314 Engineering Geology
(Total Credits: 2)
(Total No. of Lectures: 36)

(i) Course learning outcome:

Upon completion of the course the student will become aware of the importance of geological studies and its applicability to various engineering problems.

(ii) Broad contents of the course:

To impart sufficient knowledge of engineering geology so as to be able to anticipate the technical problems related to geology of various engineering sites and suggest possible remedial measures.

(iii) Skills to be learned:

The student will be educated on geological site investigations for engineering structures and will provide skills in geological mapping and making geotechnical measurements.

Title and Contents	No of Lectures
Credit I: Engineering Properties of Construction Material	18
A) Introduction: i. Introduction to Engineering Geology ii. Significance of Geology in Engineering and Environment projects	2
B) Rocks as Construction Material: i. Building stone, Facing stone, and Foundation material. ii. Factors influencing engineering usefulness of the rocks (Durability of rock).	4
C) Engineering properties of rocks: i. Factors controlling the engineering properties of the rock. Specific gravity, porosity, sorption, strength of rocks (Compressive, shear & tensile), elasticity of rocks, residual and shear stresses in rocks. ii. Importance of weathering and clay formations.	6
D) Use of rocks as an aggregate: i. Use of rocks as an aggregate in different types of constructions, source of different grades of aggregates ii. Types of aggregates iii. Physical and Engineering properties of aggregates	6
Credit II: Site investigations	18
A) Study of foundation rocks: i. With reference to tunnelling, dams, reservoirs and bridges, ii. Scale factor and insitu measurements, Quantitative measurements of discontinuities	3
B) Tunnels: i. Types of tunnels and Site selection for tunnel construction ii. Tunnelling in various terrains like tunnel in bedded rocks and folded rocks, influence of divisional planes, effects of faults and crushed zones. iii. Tunnels in the vicinity of slopes iv. Role of groundwater in tunnelling.	6

v. Tunnels in the Deccan Traps. Names and locations of at least six very important tunnels in India, Case study: Jawahar Tunnel	
C) Dams and Reservoirs: i. Types of Dams and reservoirs ii. Site selection for dam and reservoir construction iii. Location with type of all the important dams and hydroelectric projects in India. Case study: Sardar Sarovar Dam	6
D) Bridges: i. Types of bridges and Site selection for bridge construction ii. Names and locations of at least six very important bridges in India. Case study: Mumbai Sea-Link	3

Reference Books:

1. Blyth, F.G.H. and M. H. de Freitas (1984) Geology for Engineers, Butterworth - Heinemann Title
2. Krynine, D.P and Judd, W.R (2005) Principles of Engineering Geology and Geotechniques, CBS Publishers & Distributors
3. Ries, H. and T. L. Watson, (1949) Elements of Engineering Geology, New York, John Wiley & Sons, Inc.
4. Tony Waltham (2009) Foundations of Engineering Geology, Taylor and Francis.
5. Chenna Keshvally (2018) Text book of Engineering Geology, Laxmi Publications.
6. Gokhale, K.V.G. (2006) Principles of engineering geology, BS publications.

T.Y.B.Sc. Geology (SEMESTER V)
Paper V: GL 315 Hydrogeology
(Total Credits: 2)
(Total No. of Lectures: 36)

(i) Course learning outcome:

On completion of the course, the student will have gained an understanding of hydrogeological concepts, exploration, exploitation and recharge of groundwater and methods of monitoring groundwater quality and sources of pollution

(ii) Broad contents of the course:

To impart knowledge about groundwater, its movement, methods of its exploration, the criteria of its quality, methods of its conservation, recharge of groundwater monitoring of groundwater quantity and quality.

(iii) Skills to be learned:

Students will be able to acquire skills of systematic hydrogeological surveys and water quality monitoring

Title and Contents	No. of lectures
Credit I: Basic concepts in Hydrogeology	18
A) Definitions- Hydrology, Geo-hydrology, Hydrogeology	1
B) Water bearing properties of rocks – a. Interstices and porosity, permeability, specific yield and specific retention, storativity, transmissivity and Hydraulic conductivity b. Aquifers, Geologic formations as aquifers- Aquicludes, Aquitard and Aquifuge. c. Vertical distribution of subsurface water-zone of saturation and zone of aeration. d. Types of aquifers – unconfined, confined, Perched.	6
C) Groundwater Flow- a. Darcy's law and its validity b. Aquifer parameters-transmissivity, storage coefficient, hydraulic conductivity, Intrinsic permeability c. Groundwater flow rates and flow direction d. Laminar and turbulent groundwater flow	4
D) Field and laboratory methods used to characterize aquifer properties and hydrogeology of rocks	
a) Field methods: Pumping tests and slug test a. Principles – types of pumping tests, procedures, b. Determination of aquifer properties and well characteristics by Methods of Theim's equilibrium method.	2
b) Laboratory methods:	1

<ul style="list-style-type: none"> a. Grain size Analysis method (GSA) consolidated and unconsolidated sediments b. Permeameter method 	2
<p>a) Well inventory Water Well Construction – Selection of suitable site for well construction, Water well design criteria and specifications, maintenance of production wells and types of well.</p>	2
<p>b) Hydrogeology of rocks</p>	

<p>Credit II: Groundwater chemistry and Groundwater Resources of India</p>	18
<p>A) Groundwater chemistry:</p> <ul style="list-style-type: none"> a. chemical standards for drinking, and irrigational water b. major ion and isotope analyses, chemical tracers in groundwater c. Physical and chemical properties of water and water quality. BIS, WHO standard; d. Groundwater contamination; natural (geogenic) and anthropogenic contaminants; e. Saline water intrusion in coastal aquifers-Hymen Herzberg relation 	9
<p>B) Groundwater Resources i.e. aquifers of India</p> <ul style="list-style-type: none"> a. Unconsolidated sedimentary b. Consolidated sedimentary c. Sedimentary Aquitards d. Folded metamorphic e. Jointed Crystalline f. Fractured Crystalline 	5
<p>C) Groundwater quality hotspots in India</p> <ul style="list-style-type: none"> a. Hydrogeology in Maharashtra b. Groundwater quality hotspots in India- TDS, F, Ar, U, Fe 	4

Reference Books:

1. Todd, D.K. and Mays, L.W. (2004) Groundwater Hydrology, John Wiley & Sons.
2. Raghunath, H.M. (1987) Groundwater, New Age International
3. Brassington, R. (2017) Field Hydrogeology, Wiley Blackwell
4. Freeze, R. A. and Cherry, J. A. (1979) Groundwater, Prentice Hall
5. Pawar N.J, Das, S. And Duraiswami R.A (2012) Hydrogeology of Deccan Traps and associated Formations in Peninsular India, Geol. Soc. India, Bangalore
6. Hiscock, K. M. (2005) Hydrogeology: Principles and Practice, Blackwell Publishing

T.Y.B.Sc. Geology (SEMESTER V)
Paper VI: GL 316 Applied Geophysics
(Total Credits: 2)
(Total No. of Lectures: 36)

(i) Course learning outcome:

This course deals with methodologies for extracting geological information out of geophysical datasets generated from different petrophysical properties. In Geophysical exploration the student will gain first-hand knowledge dealing with the principles and their significance

(ii) Broad contents of the course:

The course is centered on the topics of Applied Geophysics and use of GPS in mapping the subsurface. The geophysical techniques include seismic, gravity, magnetic and electrical resistivity methods and their various applications.

(iii) Skills to be learned:

The students will acquire skills to use GPS, Electrical Resistivity and other methods for exploration. These have wide application in mineral exploration, groundwater studies, petroleum geology, etc.

Title and Contents	No of Lectures
Credit I: Geophysical Methods I	18
A) Gravity Method: a. Introduction, Principles, Types of Gravimeters, Concept of Bouguer b. Anomaly- Generalized interpretation of Gravity data- Case Study.	6
B) Magnetic Method: a. Introduction, Principles, Types of magnetometers- Magnetic anomalies and their interpretation. b. Air borne surveys in Gravity and Magnetic Methods c. Gravity and magnetics for the exploration of the minerals, oil /gas and groundwater d. Processing and interpretation.	6
C) Seismic Method: a. Introduction and Principles b. Seismic Reflection Method and Seismic Refraction Method c. Seismic instruments and Field procedures d. Processing of Seismic data and Case Study	6
Credit II: Geophysical Methods II	18
A) Electrical Method: Introduction, Principles and Anomalies	4
B) Resistivity Method: Introduction, Principles and Interpretation of resistivity data	4
C) Self-potential Method: Origin of self-potential instrumentation and field procedure	3
D) Induced polarization Method: Electrolytic and Electrode polarization- Instruments and field procedure	3
E) Electromagnetic Method: Principles, Instruments and Case Study.	4

Reference Books:

1. Dobrin, M B and Savit C H. (1988) Introduction to Geophysical Prospecting, McGraw Hill Inc.
2. Ramachandra Rao and Prasaranga, M B. (1975) Outlines of Geophysical Prospecting - A Manual for Geologists by University of Mysore, Mysore.
3. Bhimasarikaram V.L.S., (1990) Exploration Geophysics - An Outline by Association of Exploration Geophysicists, Osmania University, Hyderabad.
4. Telford, W. M., Geldart, L. P., and Sheriff, R. E., (1990) Applied geophysics (vol. 1). Cambridge University Press.
5. Lowrie, W., (2007) Fundamentals of Geophysics. Cambridge University Press
6. Parasnis D. S. (1986): Well Logging in Oil Fields, In: Principles of Applied Geophysics, Springer

T.Y.B.Sc. Geology (SEMESTER V)

Paper SEC-I: Geotechnology

(Total Credits: 2)

(Total No. of Lectures: 36)

(i) Course learning outcome:

The student will gain detail knowledge about the concepts, methods and hands on determination of soil and rock properties which will strength their knowledge of Engineering Geology. It also provides basic knowledge of surveying techniques.

(ii) Broad contents of the course:

This course deals with the Geotechnical lab measurements used in Engineering Geology. It also includes surveying and levelling methods.

(iii) Skills to be learned:

The course provides vital skills in geotechnical lab work and skills related to surveying and levelling techniques in the field.

Title and Contents	No of Lectures
Credit I: Geotechnical Studies	18
A) Geotechnical Studies:	
a. Drilling in geotechnical field and Drilling Equipments	1
b. Rock Quality Designation (RQD) and Core Recovery (CR) Core logging and bore logging	2
c. RMR(Rock Mass Rating) (Bienawiski, 1989)	1
d. Types of foundations and Safe Bearing Capacity	1
	2
B) Laboratory and Field Geotechnical Tests	
a. Introduction to Piling Packer Permeability Test (P.P.T.), Standard Penetration Test and its types. (S.P.T.)	1
b. Sieve analysis of Soil	1
c. Specific Gravity by Pycnometer	
d. Determination of Field Density by Core cutter method and Sand Replacement method	3
e. Determination of Consistency limit: Liquid Limit by Casagrande's Apparatus (Plastic Limit, Shrinkage Limit	2
f. Direct Shear Test and Vane Shear Test, Triaxial Test, Determination of Compaction properties of Soil by standard proctor Test, Differential Free Swell Test	3
g. Uses of oven	1
Credit II: Surveying and Levelling	18
A) Surveying:	
a. Definitions of Surveying and Levelling and Objectives of Survey	2
b. Measurement of horizontal and vertical angle by 1' Theodolite Measurement of distance, angle by using Total Station.	4
B) Levelling:	
a. Definitions of Terms used in Levelling, Characteristics of a Dumpy Level and a Levelling Staff, Bench Marks, Change Points.	4

b. Levelling operations and steps in Levelling: Demonstration with an exercise in the field	4
c. Principles of Levelling: Simple and Differential, Reduction of Levels: The Collimation, and Rise and Fall systems of Computation	4

Reference Books:

1. Braja M. Das (2005) Fundamentals of Geotechnical Engineering, Thomson Asia Pvt. Ltd., Singapore
2. Gopal Ranjan and Rao, P. (2002) Basic and Applied Soil Mechanics, New Age International Pvt. Limited, New Delhi
3. Kanetkar T.P. and Kulkarni S.V. (1973) Surveying & Levelling (Part I) 23rded.
4. Duggal, S.K. (2004) Surveying Vol. I and II, Tata McGraw Hill.
5. Punmia, B.C. (1994) Surveying Vol. I and II, Standard Publishers.
6. Arora, K. R. (1996) Surveying Vol. I and II, Standard Book House.

T.Y.B.Sc. Geology (SEMESTER V)
Paper SEC-II: Gemmology and Gem Testing
(Total Credits: 2)
(Total No. of Lectures: 36)

(i) Course learning outcome:

The basic idea is to make students well versed with the different terminologies used in the gem industry and to provide skills to become a successful gemmologist.

(ii) Broad contents of the course:

The course covers the various aspects of gem testing using both theoretical as well as lab work by dealing with basics to the advanced techniques of gemstone identification. Further, it deals with the methods employed by diamond industry in cutting a rough diamond into a sparkling gem and how diamonds are graded internationally. Why synthetic gemstones have flooded the market and how they are manufactured is then next topic, including their detection.

(iii) Skills to be learned

The students will acquire skills which will be useful to them in the gem industry.

Title and Contents	No of Lectures
Credit I: Gemmology	18
a. Introduction to Gems- Basic properties of gems- Formation of gem stones.	3
b. Description of following gem species with respect to their varieties (colour wise), Chemical composition, Crystal system, Physical and optical properties, Characteristic inclusions and Geographical Occurrences.	10
c. Corundum, Beryl, Garnet, Felspar, Silica, Tourmaline, Topaz, Spinel and Chrysoberyl Diamonds	1 2
d. Opaque gem varieties.	1
e. Rare Gemstones (Peridot, kyanite, iolite, sphene, zircon, apatite etc)	1
f. Gem synthesis and distinction between Synthetic and Natural gem stones.	1
g. Organic Gemstone	1
Credit II: Use of Gem Testing Instruments	18
a. Gem instruments and their use in gem stone identification (hand lens (10x), Detection of double refraction, by observing pleochroic colours with the Dichroscope, Identification of gemstones on the basis of pleochroic colours)	4
b. Use of refractometers, Polariscope, Dichroscope	2 2
c. Causes of colours in gem stones.	2
d. Treatments of gem stones and their detection (Methods of Specific Gravity determination, Detection of double refraction, interference figures and internal strain with the Polariscope, study of the fluorescent colours exhibited by various gemstones under Ultraviolet (long wave and short wave) light, Measurement of refractive indices and birefringence tests using a gem-testing Refractometer).	10

Reference Books:

1. Karanth R.V. (2000) Gems and Gem Industry in India, Geological society of India
2. Read, P. G. (1991) Gemmology, Butterworth-Heinemann Ltd.
3. Webster, R. and edited by Anderson, B.W. (1983) Gems: Their Sources, Descriptions and Identification, Butterworth-Heinemann Ltd.
4. Sinkankas, J. (1969) Mineralogy: A First Course, Van Nostrand Reinhold Company.
5. Karanth R.V (2008) Gemstones Enchanting Gifts of Nature, Geological society of India
6. Fareeduddin & R. H. Mitchell (2012) Diamonds and their Source rocks in India, Geological society of India
7. Babu T.M (1998) Diamonds in India, Geological Society of India

T.Y.B.Sc. Geology (SEMESTER V)
Practical I: GL 317 Practicals related to GL 311 and GL 312
 (Total Credits: 2)
 (Total No. of Practicals: 10)

Practicals Related to GL 311

Sr. No.	Title and Contents	No of Practicals
1	Study of typical hand specimens of rocks from different lithological units of Precambrians of India: Dharwar Craton, Bastar Craton, Aravalli Craton, Orissa-Singhbhum Craton, Bundelkhand Craton, Eastern Ghat mobile belt, Vindhyan, Cuddapah, Kaladgi, Chattisgarh Supergroups	2
2	Study of paleogeographical maps of different periods of Precambrians of India.	1
3	Geographic distribution of various geological formations of Precambrians of India.	1
4	Interpretation of geological map of India.	1

Practicals Related to GL 312

Sr. No.	Title and Contents	No of Practicals
1	Study of ore minerals in hand specimen (at least 8). Haematite, Magnetite, Galena, Sphalerite, Chromite, Pyrolusite, Malachite & Bauxite.	1
2	Study of industrial minerals in hand specimen (at least 8). Muscovite, Gypsum, Baryte, Calcite/Dolomite, Asbestos, Fluorsopar, Wollastonite, Kyanite, Coal.	1
3	Preparation of mineral maps of India showing occurrences of Ore and industrial minerals.	1
4	Mineralogical & textural study of common Ore minerals/industrial minerals under microscope.	1
5	Preparation of charts showing specifications of materials required for different industries.	1

T.Y.B.Sc. Geology (SEMESTER V)
Practical II: GL 318 Practicals related to GL 313 and GL 314
(Total Credits: 2)
(Total No. of Practicals: 10)

Practicals Related to GL 313

Sr. No.	Title and Contents	No of Practicals
1	Study of rocks of ocean floor	1
2	Plotting of distribution of major bathymetric and tectonic features in the global oceans	1
3	Identification of oozes and authigenic sediments	1
4	Distribution and plotting of carbonate and siliceous oozes, glacio-marine, pelagic clay and volcanogenic sediments in global oceans	1
5	Grain-size analysis using pipette method	1

Practicals Related to GL 314

Sr. No.	Title and Contents	No of Practicals
1	Preparation of section along mentioned directions and interpretation for construction of dam, tunnel and bridge	3
2	Study of physical and engineering properties of aggregates and building stone	2

T.Y.B.Sc. Geology (SEMESTER V)
Practical III: GL 319 Practicals related to GL 315 and GL 316
(Total Credits: 2)
(Total No. of Practicals: 10)

Practicals Related to GL 315

Sr. no.	Title and Contents	No. of practicals
1	Preparation and interpretations of hydrographs from given water level data.	1
2	Preparation of water table contour maps from given water level data.	1
3	Estimation of aquifer properties as porosity and permeability, hydraulic conductivity. Storage coefficient and Transmissivity.	1
4	Groundwater quality analysis using Piper's plot.	1
5	Morphometric analysis.	1

Practicals Related to GL 316

Sr. no.	Title and Contents	No of Practicals
1	Study of patterns of geophysical responses from various geological media.	1
2	Study of maps related to Gravity and Magnetic anomalies	1
3	Interpretation of Seismic Data	1
4	Plotting and interpretation of resistivity data.	1
5	Analysis of self-potential data.	1

T.Y.B.Sc. Geology (SEMESTER VI)
Paper I: GL 321 Geology of India – II
(Total Credits: 2)
(Total No. of Lectures: 36)

(iv) Course learning outcome:

The Indian sub-continent exposes a wide range of lithologies that span from 3.6 billion years to present. The geology of India is synonymous with the geology of the world and its ancient rock types from the Indian Peninsula, Cretaceous Deccan volcanism and Tethyan sediments exposed in the mighty Himalayas is noteworthy. The student will gain knowledge about the stratigraphy and geology of India with emphasis on the Stratigraphy of India with respect to Paleozoic, Mesozoic and Cenozoic Era which will help in understanding the different episodes on the earth during the geologic past.

(v) Broad contents of the course:

The course intends to introduce students to important geological formations of India, from Precambrian to Recent times.

(vi) Skills to be learned:

At the end of the course, the students will acquire skills that will enable to recognise different geological formation, their age and economic potential. They will also learn to correlate International Geological Time Scale with Indian Stratigraphic Time Scale.

TYBSc Geology

Title and Contents	No. of Lectures
Credit I: Phanerozoic Stratigraphy of the Peninsular Region	18
A) Stratigraphic Boundaries in India – Archean- Proterozoic, Precambrian- Cambrian, Permo- Triassic, K-T	2
B) Study of following Geological systems with reference to their type area, broad lithology, fossils content: Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Permian, Triassic, Jurassic, Cretaceous & Tertiary	2
C) Palaeozoic and Mesozoic Stratigraphy: Brief account of their distribution, Geographical location, classification lithological succession, structure and economic importance, with a broad range stratigraphic correlation.	
a. Gondwana Super group	2
b. Jurassic of Kachchh and Jurassic of Rajasthan	2
c. Cretaceous of Narmada valley/ Bagh Beds,	1
d. Cretaceous of Trichinopoly	1
e. Mesozoic of Extra Peninsular region Spiti	1
D) Cenozoic Stratigraphy	
a. Deccan Volcanic Province.	2
b. Krishna-Godavari Basin and Assam, Andaman- Nicobar Arc	2

c. Cenozoic of Kachchh	1
d. Tertiary formations along the West Coast	1
e. Quaternaries of Peninsular India	1
Credit II: Stratigraphic framework of the Himalayas and Geology of Maharashtra	18
A) The Phanerozoic Stratigraphy of Extra-Peninsular India	
a. Introduction to Himalayas: Physiographic divisions and tectono-magmatic evolution	4
b. Stratigraphy and tectonics of the Siwaliks.	4
c. Karewas of Kashmir	3
d. The Trans-Himalayan and Karakoram Granite Batholith.	3
B) State related Geology: The Geology and Stratigraphy of Maharashtra	4

Reference Books:

- 1) G.G. Deshpande (2002): Geological of Maharashtra- Geological Society of India – Special Publication.
- 2) Wadia, D. (1973) Geology of India. McGraw Hill Book co.
- 3) Krishnan, M.S. (1982) Geology of India and Burma, 6th Edition. CBS Publ.
- 4) Ramakrishnan M, and Vaidynadhan, R (1994) Geology of India, Geological Society of India Publication, Bangalore. Vol. II.
- 5) Valdiya K.S. (2010) The Making of India: Geodynamic Evolution, Springer
- 6) Valdiya K.S. (1984) Aspects of tectonics, Tata Mcgrath Hill.
- 7) Sinha Singhum - Orissa Iron Ore Craton: Geological Society of India – Special Publication
- 8) Naqvi, S.M., 2005. Geological Evolution of the Indian Plate (From Haedean to Holocene -4 Ga to 4Ka)

T.Y.B.Sc. Geology (SEMESTER VI)
Paper II: GL 322 Mining and Mineral Exploration
(Total Credits: 2)
(Total No. of Lectures: 36)

(i) Course learning outcome:

The course provides the student essential and basic concepts of mineral exploration techniques and the art and science of mining mineral resources.

(ii) Broad contents of the course:

The course envisages to expose the students to the topics such as geology in mining industry, methods of exploration, Sampling Principle, Methods, estimation of reserves, Ore Dressing and Beneficiation.

(iii) Skills to be learned:

This course tries to impart skills related to Geology in mining and enable him/her to perform duties of a geologist at the mining site.

Title and Contents	No of Lectures
Credit II: Mineral exploration	18
A) Introduction of mining: Geology in mining industry, Definition of ore minerals Gangue, Tenor, Overburden, Country rock, and Grade, Float ores and In situ ores, Gossan	1 1
B) Mineral exploration: a. Introduction to mineral exploration, Surface and sub-surface exploration methods. b. prospecting for economic minerals – drilling, sampling and assaying, c. Geophysical techniques d. Geomorphological and remote sensing techniques e. Geobotanical and geochemical methods	7
C) Mining terminology Pits, Trenches and Boreholes, core drilling, Core drill sampling, core splitting, logging, storage, sludge	5 2
D) Types of mining Surface and underground mining Equipment and accessories for mining Calculation of Specific gravity, Porosity, Bulk density, compression factor	2 2
Credit II: Mining Methods	18
A) Sampling: Sampling Principle, Methods, Size and quantity, Reduction, Errors, Sampling practices in open-cast mining	5
B) Categories of reserves, estimation of reserves, cross- sectional method,	6

Area of influence method, triangular method and weighted volume estimate method	
C) Classification of mining methods: a. Open cast mining, b. Underground mining, c. Coal mining methods Factors influencing choice of mining method	4 1
D) Mining Acts and Regulations in India and Conservation of mineral resources	2

Reference Books:

1. Arogyaswamy R.N.P. (1973) Courses in Mining Geology, Oxford and IBH Publishers Co. Ltd., 916 pages
2. Sinha R. K. and Sharma N. L. (1989) Mineral Economics, Oxford and IBH Publishers Co. Ltd, 4th Edition, 410 pages
3. McKinstry H. E.(1980)Mining Geology, Prentice Hill Inc., 667 pages.
4. Babu S. K. and Sinha D. K.(1988)Practical Manual of Exploration and Prospecting, CBS Publishers and Distributors, New Delhi
5. Sharma J. P.(2009) Environmental Studies, Laxmi Publications (P) Ltd, New Delhi, Indian Bureau of Mines publications
6. Krieter, V. M. (2004) Geological prospecting and exploration, University Press of Pacific.

T.Y.B.Sc. Geology (SEMESTER VI)
Paper III: GL 323 Oceanography
(Total Credits: 2)
(Total No. of Lectures: 36)

(i) Course learning outcome:

A student will understand and learn about the basic concepts of oceanography with respect to geology as to enable them to work as an oceanographer.

(ii) Broad contents of the course:

To provide essential concepts of oceanography and to study the physical oceanography, ocean currents, sea level changes, beach and coastal zones. resources with respect to the oceans.

(iii) Skills to be learned:

The students will equip himself with knowledge and skills related to dealing with the physical and chemical components and phenomena related to oceanography.

Title and Contents	No of Lectures
Credit I: Physical Oceanography	18
A) Physical oceanography (Introduction, Pressure, temperature, density)	2
B) Ocean salinity (Definition, Salinity Variations, Surface Salinity Variation, Salinity Variation with Depth, Processes Affecting Seawater Salinity)	6
C) Ocean currents (Introduction, Origin of surface currents, Main Components of Ocean Surface Circulation, Indian Ocean Circulation)	5
D) El-Nino-La Nino effect relation between climate and ocean in the Indian context	5
Credit II: Oceanic Processes and Coastal Regulatory Zones	18
A) Sea level changes (Introduction, Processes Affecting Sea Level, Past Sea Level Changes & Effects)	6
B) The Coast: Beach (Definition, movement of sand on beach, Features Exist Along Erosional and Depositional Shores); Coastal erosion (Introduction, Causes, Types of coasts) and conservation methods	7
C) Coastal Regulatory Zones (Introduction, Classification & Prohibited activities within CRZ & Regulation of permissible activities in CRZ)	5

REFERENCE BOOKS

1. Bender, M. (2013) Paleoclimate, Princeton Premiers in Climate
2. Bradley R. S. (1999) Paleoclimatology: Reconstructing climates of the quaternary. Academic Press v. 64 of International Geophysical series.
3. Brown E., Coiling A., Park D., Phillips J., Rothery D., Wright J. (1998) The Ocean Basins: Their Structure and Evolution
4. Dronkers J. (2005) Dynamics of coastal systems, World Scientific

5. Ruddiman, W.F. (2008) Earth's Climate, Past and Future, WH Freeman & Co.
6. Savindra Singh (2015) Oceanography
7. Stewart R. H. (2000) Introduction To Physical Oceanography
8. The Open University (1989) Ocean chemistry and deep sea sediments.
9. Trujillo A. P., Thurman H. V. (2018) Essentials of Oceanography
10. Webb P. (2019) Introduction to Oceanography
11. Woodroffe, C.D. (2013) Coast: Form, process and evolution, Cambridge University Press.
12. Wright J. and Colling A. (1995) Seawater: its Composition, Properties and Behaviour, The Open University

T.Y.B.Sc. Geology (SEMESTER VI)
Paper IV: GL 324 Petroleum Geology
(Total Credits: 2)
(Total No. of Lectures: 36)

(i) Course learning outcome:

A student will understand and learn about the basic concepts of Petrology Geology with respect to geology as to enable them to work as a Petroleum Geologist.

(ii) Broad contents of the course:

To provide the student essential and basic concepts of Petroleum Geology and to study the process and the operations involved in Petroleum exploration

(iii) Skills to be learned:

The students will be appraised about the origin, migration and accumulation of petroleum; It will also provide basic skills in prospecting, drilling and logging operation in oil exploration. Further PG studies in this subject will enable them towards getting employment in the oil industry

(iv) The detail contents of the course:

Title and Contents	No of Lectures
Credit I: Petroleum Geology I	18
a. Origin of petroleum	2
b. Kerogen: Source Material and Formation, Composition and Distribution	3
c. Petroleum Chemical composition and physical properties of crudes oil	4
d. Occurrence of petroleum, nature of source rock	3
e. Reservoir fluids: Water, oil and gas	3
f. Origin, migration and accumulation of oil and natural gas	3
Credit II: Petroleum Geology II	18
A) Study of Reservoir and Traps	5
B) Petroliferous Basins of India Bombay basin; Krishna-Godavari basin, Assam basin, Cauvery basin and Rajasthan basin	7
C) Petroliferous Basins of World Spraberry (USA), Greater Burgan (Kuwait,) and Carabobo 1 (Venezuela)	6

Reference Books:

1. Tissot, B.P. and Welte, D.H. (1984) Petroleum Formation and Occurrence, Springer- Verlag, Berlin.
2. Levorsen, A.I, (2004) Geology of Petroleum, CBS Publishers and Distributors
3. North, F.K. (1986) Petroleum Geology, Allen & Unwin, London. 607p
4. Hunt, J.M. (1996) Petroleum Geochemistry and Geology, W.H. Freeman
5. Selley, R.C., 1998, Elements of Petroleum Geology: W.H. Freeman & Company, NY.

T.Y.B.Sc. Geology (SEMESTER VI)

Paper V: GL 325 Climate Change: Past, Present and Future (Total Credits: 2) (Total No. of Lectures: 36)

i) Course learning outcome:

The course introduces the students to the Earth's climate system and explores the science of global climate change using different proxies.

ii) Broad contents of the course:

Course topics include the greenhouse effects and the science of global warming and climate change impacts.

iii) Skills to be learned:

Students should be able to describe how the Earth's climate system works and summarize general atmosphere circulation patterns, ocean circulation patterns and climate oscillations such as the El-Niño Southern Oscillation. Besides, they will also be in a position to illustrate the Earth's carbon cycle and quantitatively describe how addition of CO₂ to the atmosphere due to burning of fossil fuels influences the climate.

Title and Contents	No of Lectures
Credit I: Introduction to climate change and Processes	18
a. Composition and structure of the atmosphere, Study climate change models	3
b. The factors affecting the earth's climate will be examined, along with anthropogenic impacts both globally and regionally	3
c. Milankovitch cycles: Introductions, Earth's movement	3
d. Effects on climate change: Greenhouse gases, El Nino, Ocean circulation	7
e. Climate changes vis-à-vis atmospheric hazards	2
Credit II: Climate change and its modelling	18
a. Changes in rainfall patterns/intensity vis-à-vis storm surges, cyclone, floods, droughts	4
b. Evolution of Indian monsoon system through the geological time	3
c. Agro-climatic divisions of Indian subcontinent	4
d. Climate and landscape evolution	3
e. Use of climate proxies to model and monitor past and present climate indicators	4

Reference Books:

1. Bradley R.S. (1999) *Paleoclimatology: Reconstructing climates of the quaternary*. Academic Press v. 64 of International Geophysical series.
2. Peixoto and Oort, (1992) *Physics of Climate*.
3. Ruddiman, W.F. (2008) *Earth's Climate, Past and Future*, W H Freeman & Co.
4. Bell, M. and Walker, M.J.C. (1992) *Late Quaternary Environmental Change; Physical and human perspective*. Longman Scientific and Technical, New York.
5. Bradley, R.S. (1999) *Palaeoclimatology; reconstructing climates of the Quaternary*. 2nd Edition Harcourt Academic Press: San Diego.
6. Dawson Alastair G. *Ice Age Earth: Late Quaternary Geology and Climate (Physical Environment)*
7. Bell, Martin. *Late Quaternary Environmental change: Physical and Human Perspective*

T.Y.B.Sc. Geology (SEMESTER VI)

Paper VI: GL 326 Geological Field Methods and Mapping

(Total Credits: 2)

(Total No. of Lectures: 36)

(i) **Course learning outcome:**

This course is devised to provide basic knowledge of geological mapping and surveying techniques. It also will upgrade and relate the theoretical knowledge of geological aspects to field observations.

(ii) **Broad contents of the course:**

Students will be expected to understand how preliminary surveys are carried out especially in mining and natural resource bearing areas. They would be trained to work independently in the field of geological mapping and sampling.

(iii) **Skills to be learned:**

Skill of using of Brunton Compass and GPS is only taught and learnt in the field. Hence, these are imperative to geological mapping and preparation of cross sections.

Title and Contents	No. of lectures
Credit I: Introduction to Geological Mapping	18
A) Introduction to the study of geological field methods and mapping	1
A) Use and applications of Brunton, Clinometer Compass and GPS in fieldwork	2
B) Geological Mapping: a. Reconnaissance study of areas having igneous and metamorphic and sedimentary rocks. b. Locating oneself on topographic map, Identification, discrimination and tracing of different type of contacts, c. Geological mapping of a small area, collection, identification and labelling of rock and mineral specimens.	7
C) Students will make geological observations in the field, record data in field notes, and prepare geological maps: a. Field safety, b. Logistics, c. Navigation	8
Credit II: Techniques in geological mapping	18
A) Field mapping techniques and data collection a. Traversing b. Mapping techniques c. Data collection d. Litholog preparation and interpretation	7
B) Toposheet reading a. Toposheets: reading of toposheet with reference to toposheet number, latitude, longitude, state, district, scale, adjacent toposheet numbers and conventional signs.	4

b. Orientation of topographic sheet in field; marking location in toposheet; Bearing (Front and back)	
C) Interpretation of geological maps and data a. Reconnaissance study of areas having igneous and metamorphic and sedimentary rocks. b. Locating oneself on topographic map, Identification, discrimination and tracing of different type of contacts, c. Geological mapping of a small area, collection, identification and labelling of rock and mineral specimens.	7

References:

1. Lahee Fredrick H. (1961) Geology in the field by Robert R. Compton, John Wiley and Sons.
2. Compton Robert R. (1962) Manual of Field Geology John Wiley & Sons.
3. Lahee Fredrick H. (1961) Geology in the field by Robert R. Compton, John Wiley & Sons.
4. Gokhale N.W. (2001) A Guide to Field Geology. CBS Publishers & Distributors 1st ed.
5. Mathur S.M. (2004) Guide to Field Geology, PHI.

T.Y.B.Sc. Geology (SEMESTER VI)
Paper SEC-III: Applications of Remote Sensing in Geosciences
(Total Credits: 2)
(Total No. of Lectures: 36)

(i) Course learning outcome:

The course is meant to address the fundamental techniques used for remote sensing. At the end of this course, the student will be appraised with all the theoretical knowledge, information and skills to use Remotely Sensed data for geological applications.

(ii) Broad contents of the course:

This course intends to introduce students to the fundamental principles and techniques of remote sensing, basic properties of electromagnetic radiation and its interaction with matter, It will also include topics like instruments and platforms used for remote sensing, and the ways those systems can be used to determine geological structure and rock types.

(iii) Skills to be learned:

After completion of this course, the student will be well versed with the world of Remote Sensing and the applications and Interpretation of data related to geosciences.

Title and contents	No. of Lectures
Credit I: Principles of Remote sensing and Aerial photography	18
A) Definition, Types of Remote sensing Systems (Active & Passive), Elements of passive Remote sensing system (data acquisition & data analysis)	4
B) Energy source and radiation principles (EM wave, Wave theory, EM spectrum, particle theory, Stefan-Boltzman's law, Emissivity, Black, white & grey bodies)	4
C) Energy interactions in the atmosphere (Scattering, absorption, atmospheric windows & related sensing systems); Energy interactions with the earth (principles of the Conservation of energy, specular & diffused reflectors), Spectral reflectance of vegetation, soil & water; Data acquisition & interpretation.	4
D) Aerial Photography a. Classification of aerial photographs on the basis of Camera axis b. Film and filter combination, lens -system, types of cameras, high and low sun angle photography, digital cameras	3

<p>E) Planning of Aerial photography</p> <p>a. Time of photography, Acquiring stereographic photography, Discrepancies in aerial photographs (tip, tilt, drift, crab, gap) and their effects.</p> <p>b. Geometric characteristics of Aerial photos, marginal information on Aerial photos, Scale of Aerial photos, ground and photographic resolution of Aerial photos, Vertical exaggeration and relief displacement in Aerial photos.</p> <p>c. Mirror and pocket stereoscopes.</p>	3
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Credit II: Interpretation and application of Remote sensing data	18
<p>A) Photo Recognition Elements</p> <p>Tone, texture, pattern, shape, size, site, shadow, associations. Basic drainage patterns and their geological significance. Advantages and limitations of Aerial photos.</p>	3
<p>B) Photo-geological interpretations</p> <p>Photo characters of Sedimentary, igneous and metamorphic rocks. Interpretation of geologic structures (folds & faults), Interpretation of photo-lineament maps.</p>	4
<p>C) Introduction to Satellites, Sensors & their applications:</p> <p>Brief history, Types of Satellites (Orbital Characteristics, Sensors and applications with reference to latest IRS & LANDSAT: LANDSAT 7 and 8, IRS satellites (Oceansat, Cartosat, Resourcesat, SARAL)</p>	4
<p>D) Scanners:</p> <p>Hyperspectral Scanners, Active Remote Sensing Systems - RADAR and LIDAR (Principles & applications)</p>	2
<p>E) Image characteristics & Spectral responses of various features:</p> <p>Lithology, geologic structures, geomorphic features, vegetation (cultivated, forest), land use, water bodies (shallow, deep, clear, polluted), Utility (traffic, telecom, power, settlement etc.) & soils.</p>	3
<p>F) Applications of Remote sensing:</p> <p>In studying the natural resources like minerals, ground water, soil, forests & in geo-technical investigations.</p>	2

Reference Books:

1. Lillesand T. M., Kiefer R. W. and Chipman J. (2015) Remote Sensing and Image Interpretation, Wiley
2. Drury S.A. (1990) A Guide to Remote Sensing - Interpreting Images of Earth, Oxford Science Publications
3. Pandey S. N. (2001) Principles and Applications of Photogeology, New Age International

4. John R. Jenson (2003) An earth resource perspective
5. Miller Victor C. Miller Calvin F. (1961): Photogeology (International Series in the
6. Earth Sciences):
7. Paine, D.P (1981) management: Aerial photography and image interpretation for resource
8. Gary L. Prost: Remote Sensing for Geologists- A Guide to image interpretation
9. Reddy A. (2012): Introduction to Remote Sensing and GIS
10. Ramasamy, SM. (1999) Trends in Geological Remote Sensing

T.Y.B.Sc. Geology (SEMESTER VI)
Paper SEC-IV: Oil Field Services
(Total Credits: 2)
(Total No. of Lectures: 36)

(i) Course learning outcome:

This course is to be taken in combination with Petroleum geology. The course focuses on the mud logging component as a supplementary service industry in oil and natural; gas exploration.

(ii) Broad contents of the course:

The course deals with Oil Well Drilling, logging and monitoring. It also deals with techniques for formation evaluation and testing for oil and gas.

(iii) Skills to be learned:

The students who complete this course will have acquired all the skills needed for mud logging job and can be employed with private and public organisations engaged in oil exploration.

(iv) The detail contents of this course:

Title and contents	No. of Lectures
Credit I: Oil Well Drilling	18
A) Introduction to Oil Well Drilling,	1
a. Types oil wells and geotechnical order	2
b. Methods of Oil well drilling: Cable tool drilling and rotary drilling	2
B) Components of rotary drilling system	
a. Monitoring of drilling process Concept of Subsurface pressure	2
b. Types of Drilling Rigs, Controlled Directional Rotary Drilling and Horizontal Drilling	4
c. Drilling Mud	2
d. Introduction, Techniques and Applications of Coring in Petroleum Geology	3
Credit II: Formation Evaluation	18
A) Formation Evaluation: Wire line logs, Basic Principles, tools of SP, gamma ray, Neutron, Density, Caliper, Dipmeter, Temperature and Sonic Logs and their interpretation.	6
B) Mud logging: Principle, techniques and tools of mud logging.	6

Interpretation of gas, drilling and mud parameters. MWD (Measurement While Drilling)/LWD (Logging While Drilling). Principle and tools of MWD/LWD, data analysis and interpretation,	3
C) Formation (Drillstem) Testing: Introduction, Tools and Techniques of DST	3

Reference Books:

1. Sahay, B., Rai, A. and Ghosh, M. Wellsite (1997): Geological Techniques for Petroleum Exploration, Oxford & IBH, New Delhi
2. Nakayama K.1987 Jan.: Two-dimensional basin analysis for petroleum Exploration University of South Carolina, Columbia.
3. A.M.Akramkhodzhaev,etal :Geology and Exploration of oil and gas bearing ancient delta.
4. "The Business of Petroleum Exploration" (1992) by ed. Steinmetz, R. AAPG Treatise of Petroleum Geology: Handbook of Petroleum Geology.
5. Willard De Merit: Instrumental Methods
6. Ewing: Instrumental Methods of Analysis
7. Selley, R.C. (1984): Elements of Petroleum Geology, Academic Press, London.

T.Y.B.Sc. Geology (SEMESTER VI)

Paper SEC-V: Watershed Development

(Total Credits: 2)

(Total No. of Lectures: 36)

(i) Course learning outcome:

This course introduces the fundamental concepts of watershed management planning and principles. It encompasses the water quality issues, storm water management, drought management, soil erosion, rainwater harvesting and watershed modeling. Finally the course provides inputs for integrated watershed management.

(ii) Broad contents of the course:

Watershed Management concept and principles, Assessment of water resources i.e. surface water and ground water in a watershed: rainfall-runoff and ground water analysis. Soil erosion estimation. Water quality and guidelines. Watershed Modelling, Drought assessment and management. Integrated watershed management.

(iii) Skills to be learned:

Upon completion of this course the student will acquire all skills to undertake watershed development and integrated watershed management thereby enhancing his employability with NGOs, Government agencies, etc. working in the fields of watershed and rural development.

Title and Contents	No of Lectures
Credit I: Watershed Development	18
a. Concept of watershed, watershed characteristics	2
b. Importance of water resources in watershed, concept of watershed development in relation to water resources, salient features of development measures like contour bunding, gully plugs, stream bunds, percolation tank, subsurface dams, afforestation etc.	5
c. Significance of geology in watershed development	3
d. Assessment of water resources, i.e. surface water and ground water in a watershed: rainfall-runoff and ground water analysis	4
e. Role of NGO's and State Government in watershed development	4
Credit II: Watershed Management	18
a. Concept of watershed management in relation to water resources.	3
b. Water balance equation for watershed, sustainability of water resources, conjunctive use of surface and groundwater resources.	4
c. Watershed Modelling	3
d. Drought assessment and management	4
e. Integrated watershed management	4

Reference Books:

1. Brooks, K.N. Folliott, P.F., Magner, J.A. (2012) Hydrology and the Management of Watersheds, John Wiley & Sons
2. Murthy, J.V.S. (2012) Watershed Management New Age International Publisher
3. Heathcote, I.W. (2009) Integrated Watershed Management: Principles and Practice, John Wiley & Sons Ltd
4. Debarry, P. A. (2004) Watersheds: Processes, Assessment and Management, Wiley
5. Naiman, R.J. (1994) Watershed Management: Balancing sustainability and Environmental Change, Springer
6. Gonenc, I.E., Vadineanu, A., Wolflin, J.P. (2014) Sustainable Use and Development of Watersheds, Springer
7. Raghunath H.M. (2003) Groundwater, New age education.
8. Karanth K.R. (1987) Groundwater assessment development and management, Tata Mcgrath Hill education.
9. Todd, D. K. and Mayo, L. W. (2004) Groundwater hydrology, Wiley.

T.Y.B.Sc. Geology (SEMESTER VI)
Practical IV: GL 327 Practicals related to GL 321 and GL 322
(Total Credits: 2)
(Total No. of Practicals: 10)

Practicals related to GL 321

Sr. no.	Title and Contents	No. of Practicals
1	Study of typical hand specimens of rocks from different lithological units of Phanerozoics of India. Gondwana Supergroup, Jurassics of Kachchh and Rajasthan, Cretaceous of Narmada Valley/Bagh beds, Cretaceous of Tamil Nadu and Meghalaya, Deccan Volcanic province, Cenozoic formations.	1
2	Study of paleogeographical maps of different periods of Phanerozoics of India.	1
3	Geographic distribution of various geological formations of Phanerozoics of India.	1
4	Interpretation of geological map of India	1
5	Study of Gondwana flora	1

Practicals related to GL 322

Sr. no.	Title and Contents	No. of Practicals
1	Calculation of assay values	1
2	Exercises on mine sampling and determination of tenor, cut-off grades, ore reserves, etc.	1
3	Calculation of Specific gravity, Porosity, Bulk density	1
4	Correlation of subsurface data from different logs.	1
5	Calculation of ore reserves from the given map data.	1

T.Y.B.Sc. Geology (SEMESTER VI)
Practical V: GL 328 Practicals related to GL 323 and GL 324
(Total Credits: 2)
(Total No. of Practicals: 10)

Practicals related to GL 323

Sr. no.	Title and Contents	No. of Practicals
1	Reading coastal toposheets, hydrographic sheets and ocean floor topography	1
2	Preparing of bathymetric cross-sections using Hydrographic sheets	1
3	Assigning different kinds of marine sediments to different bathymetric settings	1
4	Study of important global surface and deep-water currents, with special emphasis on the 'Conveyor Belt'	1
5	Distribution of Global Pressure belts	1

Practicals related to GL 324

Sr. no.	Title and Contents	No. of Practicals
1	Determination of porosity and permeability by crude method / core samples	1
2	Numerical problems based on porosity and permeability	1
3	Study of Isopach maps	1
4	Panel / Fence diagrams	1
5	Study of Petroliferous basins of India	1

T.Y.B.Sc. Geology (SEMESTER VI)
Practical VI: GL 329 Practicals related to GL 325 and GL 326
(Total Credits: 2)
(Total No. of Practicals: 10)

Practicals related to GL 325

Sr. no.	Title and Contents	No. of Practicals
1	Preparation and interpretations of Isotherm and Isobar on map.	1
2	Distribution of major wind patterns on World map.	1
3	Preparation of paleogeographic maps (distribution of land and sea) of India during specific geological time intervals.	1
4	Numerical exercises on interpretation of proxy records for paleoclimate.	1
5	To show ocean current on world map	1

Practicals related to GL 326

Sr. no.	Title and Contents	No. of Practicals
1	Plane table chain survey	1
2	Magnetic compass survey or GPS survey.	1
3	Stereographic Problems involving two intersecting planar features	1
4	Field work for about ten days, in an area of geological interest anywhere in India. Systematic collection of geological samples, data collection & preparation of geological field report.	2



Savitribai Phule Pune University

(Formerly University of Pune)

Two Year Degree Program in Chemistry

(Faculty of Science & Technology)

Revised Syllabi for

M.Sc. (Chemistry) Part-I

(for Colleges Affiliated to Savitribai Phule Pune University)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course: M.Sc. (Chemistry)

Structure of the Course:

Basic structure/pattern (Framework) of the proposed postgraduate syllabus for the two year integrated course leading to M.Sc. (Chemistry) in the colleges affiliated to Savitribai Phule Pune University.

Semester-I			
S. N.	Paper No	Subject	Credits
1	CCTP-1 CHP-110	Physical Chemistry-I (Fundamentals of Physical Chemistry)	4 credit (48 L + 12T)
2	CCTP-2 CHI-130	Inorganic Chemistry-I (Molecular Symmetry and Chemistry of Main Group Elements)	4 credit (48 L + 12T)
3	CCTP-3 CHO-150	Organic Chemistry-I (Basic Organic Chemistry)	4 credit (48 L + 12T)
4	CBOP-1 CHG-190	Section-I: General Chemistry-I, Theory Course (Any one option) Elective Option-A: Introduction to Solid State of Matter Elective Option-B: Mathematics for Chemists Elective Option-C: Introduction to Chemical Biology-I	2 credit (24 L + 6T)
		Section-II: General Chemistry Practical (Any one) Elective Option-A : Inorganic Chemistry-Material Analysis, Synthesis and Applications Elective Option-B : Chemical Biology Practical-I	2 credit (48 L + 12T)
5	CCPP-1 CHP-107	Basic Practical Chemistry-I	4 credit (96 L + 24T)
Semester- II			
6	CCTP-4 CHP-210	Physical Chemistry - II (Molecular Spectroscopy and Nuclear Chemistry)	4 credit (48 L + 12T)
7	CCTP-5 CHI-230	Inorganic Chemistry -II (Coordination and Bioinorganic Chemistry)	4 credit (48 L + 12T)
8	CCTP-6 CHO-250	Organic Chemistry-II (Photochemistry, Pericyclic and Organic spectroscopy)	4 credit (48 L + 12T)
9	CBOP-2 CHG-290	Section-I: General Chemistry-II, Theory (Any one option) Elective Option-A : Material Characterization Technique Elective Option-B : Organometallic and Inorganic Reaction Mechanism Elective Option-C: Introduction to Chemical Biology-II	2 credit (24 L + 6T)
		Section-II: General Chemistry, Practical (Any one option) Elective Option-A: Electroanalytical Techniques of Analysis Elective Option-B: Chemical Biology Practical-II	2 credit (48 L + 12T)
10	CCPP-2 CHP-227	Basic Practical Chemistry-II	4 credit (96 L + 24T)
Total Credits for First Year			40

CCTP- Core Compulsory Theory Paper; CBOP-Choice Based Optional Paper; CCPP- Core Compulsory Practical Paper

2) Equivalence to 2014 pattern

Course in 2014 pattern	Course in 2019 pattern
CHP-110	CCTP-1, CHP-110
CHI-130	CCTP-2, CHI-130
CHO-150	CCTP-3, CHO-150
CHG-190	No equivalence
CHP-107	No equivalence
CHP-127	No equivalence
CHP-210	CCTP-4, CHP-210
CHI-230	CCTP-5, CHI-230
CHO-250	CCTP-6, CHO-250
CHG-290	No equivalence
CHP-247	No equivalence

Detailed Syllabus:**Semester-I****CCTP-1: CHP-110, Physical Chemistry-I, Semester - I****(Fundamentals of Physical Chemistry) (4 Credits)****SECTION - I (2 Credits, 24 L, 6T)****1. Thermodynamics (05 L)**

State function, path function, exact differential and inexact differential, internal energy and enthalpy, temperature dependent internal energy and enthalpy, reversible and irreversible adiabatic expansion. The entropy of irreversible changes, the Helmholtz and Gibbs function, Entropy and entropy change in an ideal gas with temperature and pressure, Clausius inequality, chemical potential, chemical potential of a substance in a mixture.

2. Change of State (04 L)

Partial molar quantities, methods for determination of molar quantities, ideal solutions, Raoult's and Henry's law, Thermodynamics of Gibbs function of mixing, colligative properties: Elevation in boiling point, depression in freezing point and osmosis.

3. Quantum Chemistry (08 L)

Applications of quantum chemistry- blackbody radiation, photoelectric effect, de Broglie hypothesis and uncertainty principle and its experimental evidence. Schrödinger wave equation, particle in one dimensional box, Normalization and orthogonality of wave function, particle in three dimensional box, hydrogen like atoms (no derivation). Operators: algebra of operators, commutative property, linear operators, commutator operator, the operator ∇ and ∇^2 .

4. Chemical Bonding (07 L)

Valence bond theory, hybrid orbitals, geometry and hybridization, molecular orbital theory for di and tri atomic molecule, linear variation method, approximations underlying Huckel theory, applications to simple π -systems.

SECTION – II (2 Credits, 24 L, 6 T)**Chemical Kinetics and Reaction Dynamics****1. Rate Laws (06 L)**

Recapitulations of basic concept, the temperature dependent reaction rates, reaction moving towards equilibrium, consecutive reaction, parallel reactions, pre-equilibria, unimolecular reactions.

2.

2. Kinetics of Complex Reactions (03 L)

Fast reactions: flash photolysis, flow technique, stopped flow technique, relaxation method, the steady state approximation, chain reactions - free radical polymerization reaction between H_2 and Br_2 , explosive reaction.

3. Molecular Reaction Dynamics (05 L)

Collision theory of bimolecular gas phase reactions, diffusion controlled and activation controlled reaction in solution, activated complex theory of reaction rate, Eyrings equation.

4. Enzyme Catalysis**(04 L)**

Michaelis mechanism, effect of pH and temperature on enzyme catalyzed reactions, limiting rate, Lineweaverburk and Eadie equation and plots, inhibition of enzyme action, competitive inhibition and non- competitive inhibition.

5. Molecular Thermodynamics**(06 L)**

Molecular energy levels, Boltzmann distribution law, partition functions and ensembles, translational, rotational and vibrational partition function of diatomic molecule, obtaining energy, heat capacity, entropy and equilibrium constants from partition functions, Maxwell- Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

References:

1. Physical Chemistry by P.W. Atkin and De Paul
2. Physical Chemistry by T. Engel and P. Reid
3. Physical Chemistry and molecular approach by D. Mequarie and J. Siman
4. Physical Chemistry for biological sciences by Raymond Chang (Universal books, 2000)
5. Physical Chemistry by Merron and C.F. Prouton
6. Physical Chemistry by G.M. Barrow
7. Quantum Chemistry by I. Levine 8. Quantum Chemistry by R.K. Prasad

Semester-II**CCTP-4: CHP-210, Physical Chemistry-II, Semester - II**
(Molecular Spectroscopy and Nuclear Chemistry) (4 Credits)**SECTION - I (2 Credits, 24 L, 6T)****Molecular Spectroscopy**

- 1) **Microwave Spectroscopy (03 L)**
Types of molecule on the basis of moment of inertia and rotational spectra of di- and poly-atomic molecules.
- 2) **Infra-red Spectroscopy (05 L)**
The vibrating diatomic molecule, harmonic and Anharmonic oscillator, The diatomic vibrating rotator, breakdown of the Born-Oppenheimer approximation, The vibrations of polyatomic molecule, Fourier transform spectroscopy and its advantages, The carbon dioxide laser, Applications.
- 3) **Raman Spectroscopy (05 L)**
Quantum and classical theory of Raman effect, pure rotational Raman spectra, vibrational Raman spectra, polarization of light and Raman effect, structure determination from Raman and Infra-red spectroscopy, applications.
- 4) **Electronic Spectroscopy of molecules (07 L)**
Electronic spectra of diatomic molecules - The Born- Oppenheimer approximation, Vibrational coarse structure, Frank- Condon principle, dissociation energy and dissociation product, Rotational fine structure of electronic-vibration transition, The fortrat diagram, Pre-dissociation, molecular photoelectron spectroscopy.
- 5) **Mossbauer Spectroscopy (04 L)**
Principle, Instrumentation and Applications of Mossbauer Spectroscopy.

SECTION – II (2 Credits, 24 L, 6T)
Nuclear and Radiation Chemistry

- 1) **Radioactivity (04 L)**
Types of radioactive decay, general characteristics of radioactive decay, decay kinetics, general expression for the activity of a daughter nuclide, Geiger- Nuttalis law, α -decay: A problem in classical physics, Internal conversion and the Auger effect.
- 2) **Elements of Radiation (06 L)**
Chemistry: Interaction of radiation with matter, interaction of γ radiation with matter, units for measuring radiation absorption, Radiation dosimetry, Radiolysis of water, free radicals in water radiolysis, Radiolysis of some aqueous solutions.
- 3) **Nuclear Fission: (06 L)**
The discovery of nuclear fission, the process of nuclear fission, fission fragments and their mass distribution, charge distribution, Ionic charge of fission fragments, fission energy,

fission cross-section and threshold, fission neutrons, theory of nuclear fission, Neutron evaporation and spallation.

4) Applications of Radioactivity

(08 L)

Typical reaction involved in the preparation of radioisotopes, The Szillard- Chalmers reaction, Radiochemical principles in the use of tracers, Isotopes in elucidating reaction mechanism and structure determination, physic-chemical research - The solubility of a sparingly soluble substances, surface area of a powder or precipitate rates of diffusion, Analytical applications- Isotope dilution analysis, Neutron activation analysis, Radiometric titrations, Medical applications-Thyroiditis, Assessing the volume of blood in a patient, Industrial applications thickness measurements and control, friction and wear out, gamma radiography.

References:

- 1) Elements of Nuclear Chemistry by H.J.Arnika
- 2) Source book of Atomic energy by S. Glasstone and D. Van
- 3) Chemical applications of radioisotopes by H.J.M. Brown
- 4) Fundamentals of molecular spectroscopy by C.N.Banwell and E.M.McCash

Semester-I**CCTP-2: CHI-130, Inorganic Chemistry-I, Semester - I****(Molecular Symmetry and Chemistry of Main Group Elements) (4 credits)****SECTION-I****(2Credits, 24 L, 6 T)****Molecular Symmetry and its Applications****1) Molecular Symmetry and Symmetry Groups (10L)**

Symmetry elements and operations, Symmetry planes and reflections, the inversion centre, proper axes and proper rotations, improper axes and improper rotation, products of symmetry operations, equivalent symmetry elements and equivalent atoms, general relations among symmetry elements and symmetry operations, classes of symmetry operations, symmetry elements and optical isomerism, symmetry point groups, classification of molecular point groups. Defining properties of a group, group multiplication table, some examples of group, subgroups and classes.

2) Representations of Groups (06 L)

Matrix representation and matrix notation for geometric transformation, The Great Orthogonality Theorem and its consequence, character tables (No mathematical part), wave function as basis for irreducible representations.

3) Symmetry Adapted Linear Combinations (04L)

Projection operators and their use to construct SALC (Construction of SALC for sigma bonding for molecules belonging to point groups: D_{2h} , D_{3h} , D_{4h} , C_{4v} , T_d , O_h), normalization of SALC, transformation properties of atomic orbitals, MO's for sigma bonding, AB_n molecules, tetrahedral AB_4 and O_h AB_6 cases.

4) Application of Group theory to Infrared Spectroscopy (04L)

Introduction, selection rules, polyatomic molecules, possible vibrations in a linear molecule, bending modes, symmetry of vibrations and their IR activity, Group vibration concept and its limitations, IR spectra related to symmetry of some compounds, IR spectra of complex compounds.

References:

- 1) Chemical Applications of Group Theory by F. A. Cotton
- 2) Symmetry and spectroscopy of molecules by K. VeeraReddy
- 3) Group Theory and its Chemical Application, P.K. Bhattacharya
- 4) Inorganic Chemistry by Shriver and Atkins
- 5) Concise Inorganic Chemistry by J. D. Lee
- 6) Inorganic chemistry: principle of structures and reactivity by Huheey, Keiter, Medhi

Learning outcomes:

1. Student should visualize/ imagine molecules in 3 dimensions.
2. To understand the concept of symmetry and able to pass various symmetry elements through the molecule.
3. Understand the concept and point group and apply it to molecules.
4. To understand product of symmetry operations.
5. To apply the concept of point group for determining optical activity and dipole moment.

6. Student should understand the importance of Orthogonality Theorem.
7. They should be able to learn the rules for constructing character table.
8. Using reduction formulae should be able to find out the possible type of hybridization.
9. Student should know the concept of SALC.
10. Student able to find out character for reducible representation.
11. To know about projection operator.
12. Apply projection operator to find out the normalized wave function for atomic orbital.
13. Student should correlate the application of symmetry to spectroscopy.
14. Students able to find out the possible modes of vibration.
15. From the previous knowledge of symmetry student must be able to find out which modes are IR active.

Section-II **(2 Credits, 24 L, 6 T)**

Chemistry of Main Group Elements

- 1. Hydrogen and its compounds:** **(02L)**
Classification of Hydrides, electron deficient, electron precise and electron rich hydrides.; PH₃, SbH₃, AsH₃, Selenides, Tellurides.
- 2. Alkali and Alkaline Earth Metals** **(02L)**
Solutions in non-aqueous media, application of crown ether in extraction of alkali and alkaline earth metal
- 3. Boron Group** **(04L)**
Boron Hydrides, preparation, structure and Bonding with reference to LUMO, HOMO, interconversion of lower and higher boranes, metalloboranes, carboranes, reactions of organoboranes, STYX rules and structure of higher boranes.
- 4. Carbon Group** **(03L)**
Allotropes of carbon, Diamond, Graphite, Graphene, fullerenes, carbon nanotube with synthesis, properties, Structure- single walled and multi walled and its application, Intercalation compounds of graphite, Silicates, including Zeolites.
- 5. Nitrogen Group** **(03L)**
Nitrogen activation, Boron nitride, Oxidation states of nitrogen and their interconversion, PN and SN Compounds, Applications of PN and SN compounds.
- 6. Oxygen Group** **(03L)**
Metal Selenides and Tellurides, oxyacid's, and oxoanions of Sulphur and nitrogen. Ring, Cage and Cluster compounds of p-block elements.
- 7. Halogen Group:** **(02L)**
Interhalogens, pseudohalogen, Synthesis, Properties and Applications, Structure, Oxyacid's and Oxyanions of Halogens.
- 8. Noble gases:** **(02L)**
Occurrence, Compounds of Xenon-with fluorine and Oxygen and its uses

9. Organometallic Compounds**(03L)**

Organometallic Compounds of Li, Mg, Si, Pb, As, with Classification, Nomenclature, Synthesis, Structure Properties and Uses of Li, Mg, Si, Pb, As, with Classification, Synthesis, Structure Properties and Uses

References:

- 1) Inorganic Chemistry by Shriver and Atkins
- 2) Concise Inorganic Chemistry by J. D. Lee
- 3) Inorganic chemistry by Principle of Structures and Reactivity by Huheey, Keiter, Medhi
- 4) Inorganic Chemistry by Catherine Housecraft
- 5) Inorganic Chemistry by Meissler and Tarr
- 6) Organometallics by Christoph Elschenbroich
- 7) Organometallics by A Concise Introduction by Christoph Elschenbroich and Albrecht Salzer
- 8) Basic Organometallic Chemistry by B. D. Gupta and A. J. Elias

Learning outcomes:

1. Student should understand the detail chemistry of S and P block elements w.r.t. their compounds, their reactions and applications.
2. To learn the advance chemistry of boranes, fullerene, zeolites, polymers etc.
3. Organometallic chemistry of some important elements from the main groups and their applications

Semester-II**CCTP-5: CHI-230, Inorganic Chemistry, Semester – II
(Coordination and Bioinorganic Chemistry) (4 Credits)****SECTION-I (2 Credits, 24 L, 6T)
Coordination Chemistry**

1) Concept and Scope of Ligand Fields: (05 L)
Quantum numbers, Free ion Configuration, Terms and States, Energy levels of transition metal ions, free ion terms, microstates, term wave functions, spin-orbits coupling.

2) Ligand Field Theory of Coordination Complexes (07L)
Effect of ligand field on energy levels of transition metal ions, weak cubic ligand field effect on Russell- Saunders terms, Orgel diagrams, strong field effect, correlation diagrams, Tanabe-Sugano Diagrams, Spin-Pairing energies.

3) Electronic spectra of Transition Metal Complexes (06 L)
Introduction, band intensities, band energies, band width and shapes, transition metals spectra of 1st, 2nd and 3rd row ions and complexes, electronic spectra of Lanthanide and Actinide, spectrochemical and nephelauxetic series, charge transfer and luminescence spectra, calculations of Dq, B, β parameters, percentage of covalent character for metal complexes.

4) Magnetic Properties of Coordination Complexes (06 L)
Origin magnetism, types of magnetism, Curie law, Curie-Weiss Law, Magnetic properties of complexes-Para magnetism, 1st and 2nd Ordered Zeeman effect, quenching of orbital angular momentum by Ligand fields, Magnetic properties of A, E and T ground terms in complexes, spin free and spin paired equilibria, temperature dependence of magnetism.

References:

1. Ligand field theory and its applications by B.N. Figgis and M.A. Hitchman
2. Symmetry and spectroscopy of molecules by K. Veera Reddy
3. Elements of Magnetochemistry by R. L. Datta and A. Syamal

Learning outcomes:

1. Student should be able to find out the no of microstates and meaningful term symbols, construction of microstate table for various configuration
2. Hund's rules for arranging the terms according to energy.
3. Student should understand interelectronic repulsion.
4. Student should know the concept of weak and strong ligand field.
5. Student able to find out splitting of the free ion terms in weak ligand field and strong ligand field.
6. To draw correlations diagram for various configurations in Td and Oh ligand field.
7. Student should know basic instrumentation and selection rules and relaxation in rules.
8. Student should know basic d-d transition, d-p mixing, charge transfer spectra.
9. Interpretation of electronic spectra for spin allowed oh and td complexes using Orgel diagram.
10. Understand the concept of spectro chemical series and Nephelauxetic series.

11. Should able to solve numerical based on crystal field parameters.
12. Understand the various terms involved in magnetochemistry.
13. Various phenomenons of magnetism and their temperature dependence.
14. Various experimental methods to find out magnetic moment.
15. Understand the various Quenching of orbital angular momentum.

Section-II:**(2Credits, 24 L, 6 T)****Bioinorganic Chemistry****1) Overview of Bioinorganic Chemistry****(04 L)**

Historical Background and current relevance, role of Cu, Fe, Mn and Mo in metalloprotein, and metalloenzymes.

2) Concepts of Inorganic Chemistry in Bioinorganic Chemistry**(08L)**

Thermodynamic aspects - HSAB concept, chelate effect and Irving-William series, pK_a values of coordinated ligands, Tuning of redox potential, Biopolymer effects. Kinetic aspects- Electron transfer reaction, Electronic substitution reaction. reactions of coordinated ligands and Template effect, concept of spontaneous self-assembly model compounds.

3) Functions and Transport of Alkali and Alkaline Earth Metal Ions**(04L)**

Importance of alkali and alkaline earth metals, Distribution of cationic and anionic electrolytes in blood plasma and intracellular fluid, Ionophores: Natural and Synthetic, Application of ionophores, Different mechanism involved in exchange of ions across cell wall, Na^+/K^+ -ATPase ion pump for active transport of Na^+ and K^+ .

4) Biochemistry of following Elements:**(08L)**

- (a) Ca in Blood coagulation.
- (b) Magnesium in Photosystem I
- (c) Manganese in Photosystem II
- (d) Iron in Ferritin, Transferrin, Fe-S clusters, Porphyrin based system.

References:

1. Principle of Bioinorganic Chemistry by S.J. Lippard and J. M. Berg
2. Bioinorganic Chemistry: Inorganic Elements in Chemistry of Life by W.Kaim and B. Schwederski

Learning outcomes:

- 1) Importance of bioinorganic chemistry.
- 2) Role of metals in Metalloprotein and metalloenzymes.
- 3) Similarities in coordination theory for metal complexes and metal ions complexed with biological ligands.
- 4) Importance and transport of metal ions.
- 5) Passive transport metal ions by ionophores and gramicidin.
- 6) Mechanism for active transport of Na^+ and K^+
- 7) Nerve impulse generation in rod cell of retina.
- 8) Importance and function of Ca, Fe and Mg in metalloprotein
- 9) Catalytic role of Mn in photosynthesis.

Semester-I**CCTP-3:CHO-150, Organic Chemistry-I, Semester – I (4 Credits)****SECTION-I****(2 Credits, 24 L, 6T)****Basic Organic Chemistry****1. Structure and Reactivity:****(04 L)**

Aromaticity: Benzenoid and non-benzenoid compounds, Huckel's rule, antiaromaticity, Application to carbocyclic and heterocyclic systems, annulenes, azulenes, current concepts of aromaticity.

2. Heterocyclic Chemistry**(08 L)**

Five and six membered heterocycles with one and two hetero atoms: Synthesis, reactivity, aromatic character and importance of following heterocyclic compounds, Furan, Pyrrole, Thiophene, Pyrazole, Imidazole, Pyridine, Pyrimidine

3. Stereochemistry:**(12 L)**

- Stereochemical principles, enantiomeric relationship, distereomeric relationship, R and S, E and Z nomenclature in C, N, S, P containing compounds, Prochiral relationship, stereospecific and stereoselective reactions, optical activity in biphenyls, spiranes, allenes, Topicity.
- Conformational analysis of di, tri, tetra-substituted 5 -6 membered rings and decalins.

SECTION-II**(2 Credits, 24 L, 6T)****1. Structure, Stability and Reactions of Reactive Intermediates****(06 L)**

- Carbocation, Carbanion, Free Radical, Carbenes and nitrenes
- NGP : Neighbouring group participation

2. Rearrangements:**(06 L)**

Beckmann, Hofmann, Curtius, Schmidt, Wolff, Lossen, Bayer-villiger, Sommelet, Favorskii, Pinacol-pinacolone, Benzil-benzilic acid, Fries, Tiffeneau Demjanov.

3. Ylides:**(04 L)**

Phosphorus, Nitrogen and Sulphur ylides

4. Oxidation and Reduction Reactions:**(08 L)**

Oxidising agents: CrO₃, PDC, PCC, KMnO₄, MnO₂, Swern, SeO₂, Pb(OAc)₄, Pd-C, RuO₄, OsO₄, m-CPBA, O₃, NaIO₄, HIO₄, TEMPO, IBX, CAN, Dess-Martin, DDQ, Ag₂O

Reducing agents: Boranes and hydroboration reactions, MPV reduction and reduction with H₂/Pd-C, Raney-Ni, NaBH₃CN, Willkinsons catalyst, DIBAL and Wolff-Kishner reduction, Birch, Clemenson, Dissolving metal

References:

- Organic Chemistry–by J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford)
- Advanced Organic Chemistry –by J. March 6th Edition
- Advanced Organic Chemistry (Part A) –by A. Carey and R.J. Sundberg
- A guidebook to mechanism in organic chemistry – Peter Sykes 6th Ed.
- Stereochemistry of carbon compound-by E.L. Eliel
- Stereochemistry of organic compound-by Nasipuri
- Stereochemistry conformations and mechanism by P.S. Kalsi

8. Modern Synthetic reactions- H.O. House
9. Organic Synthesis – M.B. Smith
10. Organic chemistry –by Cram, Hammond, Pine and Handrickson
11. Mechanism and structure in Organic Chemistry – E. S. Gould
12. Heterocyclic Chemistry -T. Gilchrist
13. An introduction to the chemistry of heterocyclic compounds-R M Acheso
14. Heterocyclic Chemistry- J A Joule and K Mills
15. Principles of modern heterocyclic chemistry- A Paquette
16. Handbook of Heterocyclic Chemistry- A R Katritzky, A F Pozharskii
17. Heterocyclic Chemistry-II- R R Gupta, M Kumar, V Gupta, Springer (India) pvt

Learning outcomes

At the end of the course the students will know and recall the fundamental principles of organic chemistry that include chemical bonding, nomenclature, structural isomerism, stereochemistry, chemical reactions and mechanism.

1. They will understand the criteria for aromaticity in nonbenzenoid molecules and other advanced polycyclic aromatics
2. Understand the chemistry of monocyclic heterocycles, nomenclature and reactions
3. Learn the concept stereochemistry and its importance; their rules and the concept of chirality
4. Understand the role of various reaction intermediates like carbocation, carbanion, carbenes, radicals, and nitrenes in organic reactions; concept of NGP
5. Able to describe mechanism of different rearrangement reactions. Appreciates the various steps involved in the molecular rearrangements.
6. Understand the chemistry of Ylides
7. Use synthetic reagent of oxidation and reduction for solving the problems

Course outcomes

1. To understand some fundamental aspects of organic chemistry, to learn the concept aromaticity, to understand the various types of aromaticity
2. To study heterocyclic compound containing one and two hetero atoms with their structure, synthesis and reactions.
3. To know stereochemistry of organic compounds; able to do interconversion of Fischer to Newmann, Newmann to Sawhorse and vice versa, Able to assign R and S to given molecules; understand stereoselective and stereospecific reactions; acquire knowledge on topicity.
4. To study structure, formation, stability and related name reaction of intermediates like Carbocation, Carbanion, Free Radical, Carbenes and nitrenes; Recognize neighboring group participation
5. To study rearrangement reaction with specific mechanism and migratory aptitude of different groups.
6. To study Ylides and their reaction.
7. To understands the basis of redox reaction; acquire knowledge about the reagents which causes selective oxidation / reduction in various compounds; learn the basic mechanism of oxidation / reduction in organic compounds.

Semester-II**CCTP-6:CHO – 250, Organic Chemistry-II, Semester–II
(4 Credits)****SECTION-I (2 Credits, 24 L, 6T)****Photochemistry and Pericyclic Reactions****1) Photochemistry [12 L]**

Principles of Photochemistry, photochemistry of carbonyl compounds, alkenes, dienes, and aromatic compounds, photo rearrangements, Barton reaction

2) Pericyclic Reactions [12 L]

Cycloaddition reactions, Analysis by correlation diagrams, FMO approach, Electrocyclic, sigmatropic and ene reactions, 1,3-dipolar additions,

References:

1. Advanced Organic Chemistry, Part A by F. A. Carey and R. J. Sundberg
2. Excited states in Organic Chemistry by J.A. Barltrop and J.D. Coyle
3. Organic photochemistry: A visual approach by Jan Kopecky
4. Conservation of orbital symmetry by R. B. Woodward and R. Hoffmann
5. Orbital Symmetry : A problem solving approach- R. E. Lehr and A. P. Marchand
6. Pericyclic Reactions By A. P. Marchand, Roland E. Lehr
7. Organic reactions and orbital symmetry, 2nd Ed. T. L. Gilchrist and R. C. Storr
8. Molecular Orbitals and Organic Chemical Reactions by Ian Fleming
9. Pericyclic Reactions by Ian Fleming
10. Pericyclic Reactions by A Mechanistic and Problem-Solving Approach by Sunil Kumar Vinod Kumar S.P. Singh
11. Essentials of Pericyclic and Photochemical Reactions by Dinda and Biswanath
12. Pericyclic Reactions - A Textbook: Reactions, Applications and Theory by S. Sankararaman, Roald Hoffmann (Foreword by)

SECTION-II (2 Credits, 24 L, 6T)**Spectroscopic Methods in Structure Determination of Organic Compounds****1. UV and IR Spectroscopy [04L]**

UV: Recapitulation of UV spectroscopy, calculations of λ_{max} of aromatic compounds IR spectra of important functional groups 1. With and without conjugation, 2. Ring size effect 3. Effect of H-bonding, 4. Resonance effect, 5. Inductive effect.

2. ¹H-NMR [12L]

Understanding of basic principle, chemical and magnetic nonequivalence, Homotopism, Enantiotopism, diastereotopism, chemical shifts and factors influencing chemical shift: electronegativity, NMR solvent polarity, temperature, anisotropic effect, chemical shifts of acidic protons, D₂O exchange, Multiplicity patterns and Coupling Constants: Pascal's triangle, understanding of tree diagram, complex splitting patterns in aromatic, vinylic, saturated monocyclic compounds, bicyclic compounds (fused and bridged rings), Integration: NMR of racemic mixture, relationship between integration and ee% in diastereotomers.

Problems: complex problems based on multiple coupling constants should be discussed and drawing of expected ¹H-NMR spectrum along with complex multiplicity patterns and coupling constants. Drawing of multiplicity patterns and determination of coupling constants of complex multiplets should be discussed.

3. ¹³C-NMR**[04L]**

Basic of ¹³C-NMR: Chemical shift and factors affecting chemical shifts in ¹³C NMR, off resonance and proton decoupled spectra. Simple problems on ¹³C-NMR.

4. Mass spectrometry (MS)**[04L]**

Basic principle of MS, significance of M⁺ (m/z) in determination of molecular formula, Rule of 13. Genesis of m/z fragments: alkanes (cyclic and acyclic), alcohols, amines

Problems: Based on 2-3 fragments of above mentioned functional groups should be discussed.

Combined problems: Problems based on UV, IR, MS, ¹H-NMR, ¹³C-NMR should be solved.

References:

1. Introduction to Spectroscopy by Donald L. Pavia and Gary M. Lampman
2. UV-VIS Spectroscopy and Its Applications by Perkampus, Heinz-Helmut
3. Infrared Spectroscopy: Fundamentals and Applications by Barbara H. Stuart
4. Infrared Spectroscopy by James M. Thompson
5. Spectrometric Identification of Organic Compounds by Robert M. Silverstein, Francis X. Webster, David J. Kiemle, David L. Bryce
6. Introduction to Spectroscopy by Donald L. Pavia
7. Understanding NMR Spectroscopy by James Keeler
8. Spin Dynamics: Basics of Nuclear Magnetic Resonance by Malcolm H. Levitt
9. Guide to Spectroscopic Identification of Organic Compounds by Karen Feinstein
10. Principles of Nuclear Magnetic Resonance in One and Two Dimensions by Richard R. Ernst, Geoffrey Bodenhausen, Alexander Wokaun
11. NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry by Harald Günther
12. Basic One- and Two-Dimensional NMR Spectroscopy by Horst Friebolin
13. Principles of Nuclear Magnetism by A. Abragam
14. Principles of Magnetic Resonance by Charles P. Slichter
15. Nuclear Magnetic Resonance by Peter Hore
16. Applications of NMR Spectroscopy by Atta-ur-Rahman, M. Iqbal Choudhar
17. Solving Problems with NMR Spectroscopy by Atta-ur-Rahman Muhammad Choudhary Atia-tul- Wahab

Learning outcomes:

1. Students should be able to understand free radicals' formation, stability and reactivity and should also be able to use the basic understanding in writing probable reaction mechanisms.
2. Students should be able to write MO diagram for various olefinic compounds and should be able to predict the products, the stereochemistry as well as should be able to understand the preferred reaction pathways.
3. Students should be able to calculate λ_{\max} of organic compounds containing more than one and less than four conjugated systems. Students should be able to correlate IR bands with functional groups using numerical data as well as spectral data.
4. Students should be able to solve ¹H-NMR problems and should also be able to draw the ¹H-NMR spectrum for simple organic compounds mentioning multiplicity pattern and coupling constant with the help of "Tree Diagram" Should be able to predict and analyze the multiplicity patterns with more than one coupling constants.

5. Students should be able to use ^{13}C -NMR data to interpret the structure NMR problems and should also be able to draw the ^1H -NMR spectrum for simple organic compounds mentioning multiplicity pattern and coupling constant with the help of "Tree Diagram" Should be able to predict and analyze the multiplicity patterns with more than one coupling constants.
6. Students should know various key factors responsible for the spectroscopic data acquisition and should be able to solve Problems based on UV, IR, MS, ^1H -NMR, ^{13}C -NMR.

Course outcomes:

Students will be able to understand -

1. MOT and will be able to extend this in predicting reaction mechanism and stereochemistry of electrocyclic reactions.
2. The concepts in free radical reactions, mechanism and the stereochemical outcomes.
3. The basic principle of spectroscopic methods and their applications in structure elucidation of organic compounds using given spectroscopic data or spectra.

Semester-I**CBOP-1: CHG – 190, General Chemistry-I, Semester-I (4 Credits)****SECTION-I: Theory Course (2 Credits, 24 L, 6T)****(Any one option is to be selected by candidate)****Elective Option-A : Introduction to Solid State of Matter****1. Bonding in Solids and Electronic Properties (Ref-1, 4) (05 L)**

Recollect the concepts: Crystalline solids, unit cell, and types of unit cells

Introduction, Bonding in Solids—Free Electron Theory, Electronic Conductivity, Bonding In Solids—Molecular Orbital Theory, Simple Metals, Semiconductors—Si And Ge, Photoconductivity, The *P-N* Junction—Field-Effect Transistors, Bands In Compounds—Gallium Arsenide, Bands In D-Block Compounds—Transition Metal Monoxides.

2. Defects and Non-Stoichiometry (Ref-1, 4) (07 L)

Introduction, point defects—an introduction, defects and their concentration, intrinsic defects, extrinsic defects the concentration of defects, ionic conductivity in solids, solid electrolytes, fast-ion conductors: oxygen ion conductors, fast-ion conductors: sodium ion conductors, Applications: 1) fuel cells, 2) sensors, 3) electrochromic devices, non-stoichiometric compounds, introduction, non-stoichiometry in wustite, the titanium monoxide structure.

3. Superconductivity (Ref-1, 4) (04 L)

Introduction, Discovery, The Magnetic Properties Of Superconductors, Josephson Effects, The Bcs Theory Of Superconductivity, High Temperature Superconductors, Theory Of High Tc Superconductors, Uses Of High Temperature Superconductors

4. Synthesis of Solids (Ref-2 and 3) (08L)

Introduction, Common Reactions Employed in Synthesis, Soft-Chemistry Routes, Ceramic Methods, Decomposition of Precursor Compounds, Combustion Synthesis, Mechano-chemical and Sono-chemical methods, Soft Chemistry Routes(Ion Exchange Reactions, Use of Fluxes, Sol–Gel Synthesis, Electrochemical Methods, Hydrothermal, Solvothermal and Ionothermal Synthesis), Chemical Vapour Deposition and Atomic Layer Deposition, Procedures of synthesis of some nano-materials- Gold and Silver nanoparticles, CdS nanoparticles, ZnO, TiO₂ and Fe₂O₃ nanoparticles and Porous Silica

References

Ref.-1: Elaine A. Moore, Lesley E. Smart - Solid State Chemistry - an Introduction. Third Ed. / Fourth Ed. CRC Press (2012)

Ref-2: C. N. R. Rao, Kanishka Biswas, Essentials of inorganic materials synthesis, Wiley, 2015

Ref-3: Nanotechnology: Principles and Practices, S. K. Kulkarni, Third Ed. Springer

Ref-4: Anthony R. West, Solid State Chemistry and its Applications Second Edition (Student Edition), Wiley.

Learning outcomes

At the end of course student will understand

1. Bonding in solids – band theory
2. Electronic conductivity
3. Semiconductors, photoconductivity
4. Non-stoichiometry, defects and types of defects in solids
5. Ionic conductivity and their applications
6. Superconductivity and theory of superconductivity

7. Method of synthesis of solids

Elective Option-B: Chemical Mathematics

1. Functions (14 L)

Differential and integral calculus, limits, derivatives, physical significance, basic rules of differentiation, maxima and minima, application in chemistry, exact and inexact differentiation, Taylor and McLaurin Theorem, curve sketching, partial differentiation, rules of integration, separation of variable, substitution, partial function method to solve to indefinite integrals in chemistry

2. Differential Equations (06 L)

Separation of variables, homogeneous, exact, linear equations of second order, series solution method.

3. Vectors Matrices, and Determinants (04 L)

Vectors, dot, Cross and triple products, introduction to matrix algebra, addition and multiplication of matrices, inverse, adjoints and transport of matrices, unit and diagonal matrices.

References:

- 1) Chemical Maths Book, E. Steiner, Oxford University Press (1996).
- 2) Maths For Chemists Vol. 1 and 2, Martin MCR Cockett and G. Doggett, Cambridge (2003).
- 3) Mathematical Preparation for Physical Chemistry, F. Daniels, McGraw Hill (1972)

Elective Option-C: Introduction to Chemical Biology-I

1. Overview of Biochemical Concepts (03 L)

Central dogma of cell biology, prokaryotes- eukaryotes and subcellular components, Overview of cell metabolism, Interdisciplinary approach, Biomolecules as potential drug targets

2. Chemistry of Biomembranes (06 L)

Structure, Functions and Composition, Fluid Mosaic Model by Singer and Nicholson, Properties of membrane, Transport of Ions (Na^+ , K^+ , H^+ , Ca^{2+} , Cl^-) and Molecules (Glucose, Amino acids, Proteins), transport across the membrane, Uniport, Symport, Antiport, Active and Passive facilitated transport, Exocytosis and Endocytosis (Pinocytosis, phagocytosis, receptor mediated endocytosis), Drug transport, Amphipathic nature and Significance of liposomes

3. Carbohydrates (04 L)

Classification, Structure and Properties, Derived sugars and their significance, Glycoproteins, glycolipids

4. Lipids (04 L)

Classification, Structure and Properties of lipids, Saponification number, Iodine number, Acid number, Rancidity of lipids, Lipoproteins

5. Amino Acids and Proteins (07 L)

Introduction, Classification of amino acids, Physico chemical properties, Optical properties, Peptide bond, Primary, Secondary, Tertiary and Quaternary structure of proteins, Protein-Ligand interactions, Denaturation of proteins, Oligopeptide synthesis, Concept of proteomics

References:

1. Principles of biochemistry, Albert Lehninger (CBS Publisher and Distributors Pvt. Delhi.
2. Harper's Biochemistry by R.K. Murray, D. I. Granner, P. A. Mayes, (Prentice Hall International Inc.)

3. Biochemistry by U. Satynarayana
4. Biochemistry by J. L. Jain
5. Biophysical Techniques by Upadhyaya Nath

Course Outcomes:

The goal of this course is to introduce students to fundamental concepts in Chemical Biology and methods of chemistry used to solve problems in molecular and cell biology. After completion of this course, successful students will:

- 1) Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
- 2) Students will be able to function as a member of an interdisciplinary problem solving team.
- 3) To impart the students thorough idea in the chemistry of carbohydrates, amino acids, proteins and nucleic acids etc.
- 4) Be able to describe the chemical basis for replication, transcription, translation and how each of these central processes can be expanded to include new chemical matter.
- 5) Develop skills to critically read the literature and effectively communicate research in a peer setting.

SECTION-II: Practical Course (2 Credits, 48 L 12T)
(Any one option to be selected by candidate)

Elective Option-A: Inorganic Material Analysis, Synthesis and Applications

Time allotted: One practical session of 4 hours per week for one semester

Part-I: Analysis (at least two of the following) (Ref. -1)

1. Determination of Silica and Manganese from pyrolusite ore.
2. Determination of Aluminum and Silica from Bauxite ore.
3. Determination of silica and iron from hematite ore.
4. Determination of copper and iron from Chalcopyrite ore.

Part-II: Alloy Analysis (at least two of the following) (Ref. -1)

5. Determination of tin and lead from solder alloy.
6. Determination of iron and chromium from stainless steel alloy.
7. Determination of copper and nickel from cupranickel alloy.

Part-III: Synthesis of solid state materials / nano-materials (any three) (Ref- 2 and 3)

8. Synthesis of ZnO from zinc oxalate - precursor method and determine band gap by absorption spectroscopy
9. Synthesis of TiO₂ TiCl₄ or Ti-Isopropoxide by Sol-gel method and determine band gap by absorption spectroscopy
10. Synthesis of Colloidal silver nanoparticles and determine band gap by absorption spectroscopy
11. Synthesis of Fe₂O₃ nanoparticles sol-gel/coprecipitation/hydrothermal (any one method)
12. ZnO, TiO₂, Fe₂O₃ nanoparticles powder XRD, SEM, TEM (at least one spectral analysis should be done)

Part-IV: Applications of Solid State Materials

12. Removal and kinetics of photocatalytic dyes, degradation (methylene blue) by ZnO TiO₂ photocatalysis (Ref-2)
13. Study of adsorption of phosphate ion on α -Fe₂O₃ (Ref-2)

References:

1. Text book of Quantitative Analysis by A.I. Vogel 3^{ed} (1963).
2. Experimental Inorganic Chemistry by Mounir A. Malati, Horwood
3. Nanotechnology by S. K. Kulkarni

Examination Scheme:

1. The examination structure will be given before the commencement of examination.
2. 50% students will be assigned experiment on part-I or II while remaining – (analysis of any one component) 50% students will assigned experiment on part-III and IV.
3. Use of only university supplied procedure will be allowed at the time of examination.

Elective Option - B: Chemical Biology-I Practical

Time allotted: One practical Session of 4 hours per week for one semester

1. Statistical treatment of experimental data (calculation of mean and standard deviation for given data and least square method for calibration curve method) - Compulsory

Perform at least 10 Practical from the following

1. Preparation of biological buffers.
2. Qualitative analysis of carbohydrates
3. Qualitative analysis of Lipids
4. Qualitative analysis of amino acids
5. Paper chromatographic / TLC separation of mixture of amino acids and their detection
6. Paper chromatographic separation of mixture carbohydrates and their detection
7. Quantitative estimation of Glucose by dinitro salicylic acid by using calorimetric method
8. Quantitative estimation of proteins by Lowry's method
9. Kjeldahl method of Protein Determination
10. Saponification number of fats
11. Iodine value of oil
12. Isolation Quantitative estimation of DNA by Diphenyl amine method
13. Determination of Inorganic Phosphate in Biological Samples

References:

1. A reference book of biochemistry practicals by Sadashivam
2. Practical approach to biochemistry by Plummer
3. Martin Holtzhauer, Basic Methods for the Biochemical Lab, First Edition, Springer

Examination Scheme:

1. The examination structure will be given before the commencement of examination.
2. Use of only university supplied procedure will be allowed at the time of examination.

Semester-II**CBOP-2: CHG – 290, General Chemistry -II,****(4 Credits)****SECTION-I: Theory Course****(2 Credits, 24 L, 6T)****(Any one option is to be selected by candidate)****Elective Option-A: Material Characterization Technique****1. X-Ray Diffraction Methods (Ref-1) (6 L)**

Miller and Weiss indices, X-Ray Radiation, Generation of X-Rays, X-Ray Absorption, Theoretical Background of Diffraction, Diffraction Geometry, Bragg's Law, Reciprocal Lattice, Diffraction Intensity, Structure Extinction, X-Ray Diffractometry, Instrumentation, System Aberrations, Samples and Data Acquisition, Sample Preparation, Acquisition and Treatment of Diffraction Data, Distortions of Diffraction Spectra, Crystallite Size, Applications, Crystal-Phase Identification, Quantitative Measurement, Wide-Angle X-Ray Diffraction and Scattering, Wide-Angle Diffraction, Wide-Angle Scattering. Problem on XRD (Calculation of d values, assigning planes, calculation of crystal parameters)

2. Transmission Electron Microscopy (Ref-1) (4 L)

Instrumentation, Electron Sources, Thermionic Emission Gun, Field Emission Gun, Electromagnetic Lenses, Specimen Stage, Specimen Preparation, Prethinning, Final Thinning, Electrolytic Thinning, Ultramicrotomy, Image Modes (Mass-Density Contrast, Diffraction Contrast, Phase Contrast), Selected-Area Diffraction (SAD), Selected-Area Diffraction Characteristics.

3. Scanning Electron Microscopy (Ref-1) (4 L)

Instrumentation, Optical Arrangement, Signal Detection, Detector, Probe Size and Current Contrast Formation, Electron-Specimen Interactions, Topographic Contrast, Compositional Contrast, Operational Variables, Working Distance and Aperture Size, Acceleration Voltage and Probe Current, Astigmatism, Specimen Preparation, Preparation for Topographic examination.

4. X-Ray Spectroscopy for Elemental Analysis (Ref-1) (10 L)

Features of Characteristic X-Rays, Types of Characteristic X-Rays, Selection Rules, Comparison of K, L, and M Series, X-Ray Fluorescence Spectrometry, Wavelength Dispersive Spectroscopy, Analyzing Crystal, Wavelength Dispersive Spectra, Energy Dispersive Spectroscopy, Detector, Energy Dispersive Spectra, Advances in Energy Dispersive Spectroscopy, XRF Working Atmosphere and Sample Preparation, Energy Dispersive Spectroscopy in Electron Microscopes, Special Features, Scanning Modes, Qualitative and Quantitative Analysis, Qualitative Analysis, Quantitative Analysis, Quantitative Analysis by X-Ray Fluorescence, Fundamental Parameter Method, Quantitative Analysis in Electron Microscopy, Numerical.

References:

- 1: Yang Leng, Materials Characterization -Introduction to Microscopic and Spectroscopic Methods, Second Ed. Wiley-VCH,
- 2: R. D. Braun, Introduction to Instrumental Analysis, Second Ed.
- 3: Elaine A. Moore, Lesley E. Smart - Solid State Chemistry - an Introduction. Fourth Ed. CRC Press (2012)

Learning outcomes:

At the end of course student will understand / able to explain

1. Different characterization technique of solids.
2. Principle of XRD, instrumentation of powder XRD, Bragg's law, applications of XRD for crystal structure determination, numerical problems.
3. Principle of SEM, instrumentation of SEM and interpretation of surface morphology of solid from SEM.
4. Principle of TEM, instrumentation of TEM and interpretation of TEM images.
5. Basics of X-rays, Principle of XRF, types of XRF, instrumentation, qualitative and quantitative analysis, numerical.

Elective Option - B: Organometallic and Inorganic Reaction Mechanism

1. Organometallic Chemistry (08 L)

Organic ligands and nomenclature, 18 electron rule: counting electrons, ligands having extended pi system, bonding between Metal Atoms and organic pi systems: linear pi system, cyclic pi system, spectral analysis and characterization of organometallic complexes: IR and NMR, examples.

2. Organometallic Reactions and Catalysis (08 L)

Reactions involving gain and loss of ligands: ligand dissociation and substitution, oxidative addition, reductive elimination, nucleophilic displacement, reactions involving modification of ligands: insertion, carbonyl insertion, 1-2 insertion, hydride elimination, abstraction, organometallic catalysis: Hydroformylation, Monsanto acetic acid process, Wacker Process, Hydrogenation by Willkinsons catalyst, Olefin metathesis, heterogeneous catalysis: Ziegler Natta Polymerization, Water gas reduction.

3. Coordination Compounds: Reactions and Mechanism (08L)

History and principles, Substitution reactions: Inert and labile complexes, mechanism of substitution, Kinetics Consequences of reaction pathway: dissociation, interchange, association, Experimental evidences in Octahedral Substitution: dissociation, linear free energy relationship, associative mechanism, the conjugate base mechanism, the kinetic chelate effect, Stereochemistry of reactions: substitution in trans complexes, substitution in cis complexes, isomerisation of chelate rings, substitution reactions in Sq. Pl. Complexes.

Reference

- 1) Inorganic Chemistry: Gary Miessler and Donald A. Tarr, Third Ed., Pearson (Chapter-12, 13 and 14 pages: 422 to 561)
- 2) IUPAC Nomenclature of Organometallic Compounds of Transition Metals by Salzer http://publications.iupac.org/pac/1999/71_08_pdf/7108salzer_1557.pdf

Learning Outcomes:

At the end of course students will be able to explain

1. Valence electron count, back bonding in organometallics, spectral characterization of organometallic compounds.
2. Catalytic reaction involving organometallic compounds and mechanism of these reactions
3. Types of reaction involving organometallic compounds

4. Types of reactions in coordination compounds, inert and labile complexes, substitution reactions in coordination complexes and their mechanism, stereochemistry of reaction, kinetics of reactions.

Elective Option– C: Introduction to Chemical Biology-II

1. Enzymes (06 L)

Classification w.r.t. reaction catalysis, Theory of Enzyme -Substrate (ES) formation, Active sites and its features, Enzyme specificity, Factors affecting enzyme activity, enzyme Kinetics (MM equation, LBW equation), Allosteric enzymes, Types of enzyme inhibition, Industrial applications of enzymes

2. Nucleic Acid (06 L)

Central dogma of molecular biology, Differences between DNA and RNA, Overview of replication transcription, Genetic code, translation, Gene cloning, Gene Therapy, Applications of Biotechnology

3. Metabolism of Biomolecules (06 L)

Aerobic and Anaerobic glycolysis, TCA Cycle, Beta oxidation of fatty acids, Trans amination, deamination, decarboxylation of amino acids, Urea cycle

4. Biochemical Techniques (06 L)

Protein purification and characterization, Dialysis, Chromatography, Electrophoresis, Native and SDS-PAGE

References:

1. Principals of biochemistry, Albert Lehninger (CBS Publisher and Distributers Pvt. Delhi.
2. Harper's Biochemistry by R.K. Murray, D. I. Granner, P. A. Mayes, (Prentice Hall International Inc.)
3. Biochemistry by U. Satynarayana
4. Biochemistry by J. L. Jain
5. Biophysical Techniques by Upadhyaya Nath

Learning outcomes:

The goal of this course is to introduce students to fundamental concepts in Chemical Biology and methods of chemistry used to solve problems in molecular and cell biology. After completion of this course, successful students will:

- 1) Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
- 2) Students will be able to function as a member of an interdisciplinary problem solving team.
- 3) To impart the students thorough idea in the chemistry of carbohydrates, amino acids, proteins and nucleic acids etc.
- 4) Be able to describe the chemical basis for replication, transcription, translation and how each of these central processes can be expanded to include new chemical matter.
- 5) Develop skills to critically read the literature and effectively communicate research in a peer setting.
- 6) Describe the importance of chemical biology research and interdisciplinary work.

SECTION-II: Practical Course (2 Credits, 48 L, 12T)
(Any one option to be selected by candidate)

Elective Option-A: Electrochemical Methods of Analysis

Time allotted: One practical Session of 4 hours per week for one semester

Total 11 practical to be conducted

Part-I: Conductometry: (Any three)

1. Hydrolysis of NH_4Cl or CH_3COONa or aniline hydrochloride.
2. Determination of λ_0 or λ_α and dissociation constant of acetic acid.
3. Hydrolysis of ethyl acetate by NaOH .
4. Determination of ΔG , ΔH , and ΔS of silver benzoate by conductometry.
5. Determination of critical micellar concentration (CMC) and ΔG of micellization of sodium Lauryl Sulphate / Detergent

Part-II: Polarography (any one)

6. Determination of half wave potential $E_{1/2}$ and unknown concentration of Cu or Pb or Zn ion.
7. Amperometric titration of $\text{Pb}(\text{NO}_3)_2$ with $\text{K}_2\text{Cr}_2\text{O}_7$.

Part-III: Potentiometry: (Any three)

8. Stability Constant of a complex ion.
9. Solubility of a sparingly soluble salt.
10. To determine the ionic product of H_2O
11. Estimation of halide in mixture.

Part-IV: pH metry (any two)

12. Determination of the acid and base dissociation constant of an amino acid and hence the isoelectric point of the acid.
13. Determination of dissociation constants of tribasic acid (phosphoric acid)
14. Construct pH curve for titration of strong base – strong acid, strong base - weak acid and predict the best indicator in these titrations (methyl orange, methyl orange, brocresol green, phenolphthalein, etc.)

Part-V: Table Work (any two)

15. Analysis of powder XRD of SrTiO_3 and Ag metal or any two compounds (Calculation d, lattice constant, crystal volume and density, and assigning planes to peaks using JCPDS data)
16. Cyclic voltamogram of $\text{K}_3\text{Fe}(\text{CN})_6$ in $\text{KCl}/\text{H}_2\text{O}$ / Ferrocene in TEAP//MeCN
17. Detailed interpretation of Raman spectra of diatomic molecules

References:

1. Practical physical chemistry, A. Findlay, T.A. Kitchner (Longmans, Green and Co.)
2. Experiments in Physical Chemistry, J.M. Wilson, K.J. Newcombe, A.r. Denko. R.M.W. Richett(Pergamon Press)
3. Senior Practical Physical Chemistry, B.D. Khosla and V.S. Garg (R. Chand and Co., Delhi.).
4. Experimental Physical Chemistry by D. P. Shoemaker, Mc. Growhill, 7th Edition, 2003.
5. Physical chemistry by Wien (2001)
6. Advance Physical Chemistry Experiment, Gurtu and Gurtu, Pragati Publication (Meerut)

7. Experiments in Chemistry, D. V. Jahagirdar, Himalaya Publishing House
8. Practical physical Chemistry, B. Vishwanathan and P. S. Raghwan, Viva Books

Examination Scheme:

1. The examination structure will be given before the commencement of examination.
2. Use of only university supplied procedure will be allowed at the time of examination.

Elective Option-B: Chemical Biology-II Practical

Time allotted: One practical Session of 4 hours per week for one semester

Perform at least 11 Practical

1. Dialysis and Reverse dialysis of protein salt solution
2. Separation of protein by Gel filtration method
3. Separation of protein by affinity chromatography method
4. Separation of protein by Ion exchange chromatography
5. Native and SDS PAGE of proteins
6. Separation of amino acids by paper chromatography
7. Separation of nucleic acid by Agarose gel electrophoresis
8. Effect of pH on enzyme activity
9. Effect of Temperature on enzyme activity
10. Effect of substrate concentration on enzyme activity
11. Detection of λ Max of proteins
12. Detection of λ Max of Nucleic acid

References:

1. A reference book of Biochemistry Practicals by Sadashivam
2. Practical approach to biochemistry by Plummer
3. Martin Holtzhauer, Basic Methods for the Biochemical Lab, First Edition, Springer

Examination Scheme:

1. The examination structure will be given before the commencement of examination.
2. Use of only university supplied procedure will be allowed at the time of examination.

Semester-I

CCPP-1: CHP-107: Practical Course – I: Semester -I

Basic Practical Chemistry (Compulsory)

(4 Credits, 96 L, 24T)

Time allotted: Two practical sessions of 4 hours per week for one semester (one practical session for Section-I and one practical session for Section-II per week is compulsory)

Sec-I: Physical Chemistry Practical (11 Experiments)

1. Statistical treatment of experimental data (calculation of mean and standard deviation for given data and least square method for calibration curve method) (compulsory)

Part-I: Chemical Kinetics: (Any three)

2. Kinetic decomposition of diacetone alcohol by dilatometry.
3. Determination of an order of a reaction.
4. Brönsted primary salt effect.
5. Kinetics of oxidation of ethanol by $K_2Cr_2O_7$

Part-II: Non-Instrumental: (Any Three)

6. Determination of surface excess of amyl alcohol or TX-100 surfactant by Capillary rise method.
7. Determination of molecular weight by steam distillation.
8. Glycerol radius by viscosity.
9. Partial Molar Volume (Polynometry) Determination of the densities of a series of solutions and to calculate the molar volumes of the components.

Part-III: Colorimetry and spectrophotometry (Any four experiments)

10. Simultaneous determination of Ni and Co by spectrophotometry (Ref-1)
11. Simultaneous determination of $KMnO_4$ and $K_2Cr_2O_7$ by spectrophotometry. (Ref-7)
12. To study the adsorption of certain dyes such as methyl violet, picric acid or malachite green on charcoal. (Ref-2)
13. To determine the indicator constant of bromocresolpuple by half height method (Ref-8)
14. Estimation of Cu(II) by titration with Na_2 EDTA by colorimetry
15. a. Determination of energy of n to Π^* transition in acetone and study of effect of solvent on energy of this transition by recording absorbance spectra in n-hexane and water. b. To study the effect of the extended conjugation on the λ_{max} of p-nitro phenol by recording spectrum in acidic and alkaline medium (Ref-8).

Part -IV: Radioactivity: (Any one)

10. Estimation of Mn in tea leaves by NAA.
11. Half-life of a radioactive nuclide and counting errors.
12. Determination of E-max of β radiation and absorption coefficients in Al.

References:

1. Practical physical chemistry, A. Findlay, T.A. Kitchner (Longmans, Green and Co.)
2. Experiments in Physical Chemistry, J.M. Wilson, K.J. Newcombe, A.r. Denko. R.M.W. Richett(Pergamon Press)
3. Senior Practical Physical Chemistry, B.D. Khosla and V.S. Garg (R. Chand and Co., Delhi.).

4. Experimental Physical Chemistry by D. P. Shoemaker, Mc. Growhill, 7th Edition, 2003.
5. Physical chemistry by Wien (2001)
6. Advance Physical Chemistry Experiment, Gurtu and Gurtu, Pragati Publication (Meerut),
7. Experiments in Chemistry, D. V. Jahagirdar, Himalaya Publishing House
8. Practical physical Chemistry, B. Vishwanathan and P. S. Raghwan, Viva Books

Sec-II: Organic Chemistry (11 Experiments)

Introduction to Laboratory Safety: Meaning of safety signs on container of chemicals, safety handling of chemicals, MSDS sheets: Detailed explanation at least for 4 different types of substances (e.g. nitric acid, benzene, potassium dichromate, bromine, etc.), Handling of glassware's and care to be taken, handling of organic flammable as well as toxic solvents in laboratory, use of safety goggles, shoes and gloves, fire extinguisher and its use, action to be taken in accidental cases e.g. cleaning of acid spill over, use eye wash station and bath station in emergency, etc. (compulsory)

Part-I: Purification Techniques (Compulsory) (8 Experiments)

- a) Purification of **two** organic solids by recrystallization using solvents other than water
- b) Purification of **two** organic liquids by upward/downward/traditional distillation technique
- c) Column Chromatography technique should be performed for any one of the following preparation
- d) Sublimation by Cold Thumb Method
- e) Thin Layer Chromatography technique **two mixtures**

Part-II: Introduction to Green Chemistry (Compulsory 1 Practical)

Concept of green chemistry, twelve principals of green chemistry, applications of green chemistry for sustainable development, Atom economy, Monitoring of reaction using TLC.

Green Chemistry Experiments (any two)

1. Preparation of Schiff's bases in aqueous medium.
2. Preparation of dihydropyrimidinone under solventfree conditions
3. Preparation of acetanilide from aniline and acetic acid using Zn dust

1. Examination Scheme:

1. The examination structure will be given before the commencement of examination.
2. Use of only university supplied procedure will be allowed at the time of examination.
3. One experiment from Physical chemistry and any one experiment from organic section will be assigned.

Semester-II

CCPP-2: CHP-227: Practical Course-II: Semester -II

Basic Practical Chemistry (Compulsory) (4 Credits, 96 L, 24T)

Time allotted: Two practical sessions of 4 hours per week for one semester (one practical session for Section-I and one practical session for Section-II per week is compulsory)

Section-I: Inorganic Chemistry (11 Experiments)

Part-I: Synthesis of coordination complexes (any three) (Ref. 2)

1. Synthesis and Purity of $[\text{Mn}(\text{acac})_3]$
2. Synthesis and Purity Chloropentaamminecobalt(III) chloride.
3. Synthesis and Purity Nitro pentaamminecobalt(III) chloride.
4. Synthesis and Purity Bis $[\text{TrisCu}(\text{I})\text{thiourea}]$

Part-II: Inorganic Conductometry (any two)

4. Structural determination of metal complexes by conductometric measurement. (Ref-3)
5. To study complex formation between Fe(III) with sulfosalicylic acid by conductometry (Ref-3).
6. To verify the Debye Huckel theory of ionic conductance for strong electrolytes KCl, BaCl_2 , K_2SO_4 and $[\text{K}_3\text{Fe}(\text{CN})_6]$ (Ref-3)
7. Determination of Pb(II) in solution with Na_2SO_4 solution and determination of solubility product of PbSO_4 (Ref-4)

Part-III: Inorganic characterization techniques (any two of the following)

8. Determination of equilibrium constant of M – L systems Fe(III)–Sulphosalicylic acid or Fe(III)– β –resorcinic acid by Job's continuous variation method. (Ref.-3, 5)
9. Solution state preparation of $[\text{Ni}(\text{en})_3]\text{S}_2\text{O}_3$, $[\text{Ni}(\text{H}_2\text{O})_6]\text{Cl}_2$, $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$. Record absorption spectra in solution of all three complexes and calculate 10 Dq. Arrange three ligands according to their increasing strength depending on your observations. (Ref. -5)
10. Determination of magnetic susceptibility (χ_g and χ_m) of mercury tetracyanato cobalt or $\text{Fe}(\text{acac})_3$ or Ferrous ammonium sulfate by Faraday or Gouy method. (Ref. -3, 5)

Part-IV: Inorganic Kinetics Experiment (any two)

11. Synthesis and photochemistry of $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3] \cdot 3\text{H}_2\text{O}$. (Ref-4)
12. Kinetics of substitution reaction of $[\text{Fe}(\text{Phen})_3]^{2+}$ (Ref-3)
13. Kinetics of formation of Cr(III)-EDTA complex (Ref-3)

Part-V: Ion – Exchange Chromatography (Ref. -1 and 3)

1. Separation of mixture of Zn(II) and Mg(II) using Amberlite IRA 400 anion exchanger and quantitative estimation of separated ions Zn(II) and Mg(II)

Part-VI: Solvent Extraction and colorimetric (any one experiment) (Ref. -1 and 3)

2. Determination of Cu(II) by solvent extraction as Dithiocarbamate complex (Ref-1)
3. Determination of iron by solvent extraction techniques in a mixture of Fe(III) +Al(III) or Fe(III) + Ni(III) using 8-hydroxyquinoline reagent. (Ref. -1)

References:

1. Vogel's Textbook of Inorganic quantitative analysis
2. Experimental Inorganic Chemistry, Mounir A. Malati, Horwood Series in Chemical Science (Horwood publishing, Chichester) 1999.

3. Experiments in Chemistry, D. V. Jahagirdar, Himalaya Publishing House
4. General Chemistry Experiments, Anil. J Elias, University Press (2002)
5. Practical physical Chemistry, B. Vishwanathan and P. S. Raghwan, Viva Books

Section -II: Organic Chemistry (11 Experiments)

1. Base catalyzed aldol condensation using LiOH.H₂O as a Catalyst.
2. Bromination of *trans*-stilbene using sodium bromide and sodium bromate
3. [4+2] cycloaddition reaction in aqueous medium at room temperature
4. BenzilBenzilic acid rearrangement under solvent free condition
5. Clay catalyzed solid state synthesis of 7-hydroxy-4-methylcoumarin
6. Ecofriendly nitration of phenols and its derivatives using Calcium nitrate
7. Bromination of acetanilide using ceric ammonium nitrate in aqueous medium
8. Green approach for preparation of benzopinacolone from bezopinacol using iodine catalyst,
9. Preparation of 1, 1-bis-2-naphthol under grinding at room temperature.
10. Solvent free aldol condensation between 3,4-dimethoxybenzaldehyde and 1-indanone
11. Preparation of azlactone from hippuric acid
12. Preparation of thioamide from benzaldehyde in water.

Note: Students should perform a) Relevant chemical analysis. b) Column chromatography. c) Elemental analysis. d) Spectroscopic interpretation. e) How to draw schemes and mechanism using Chem Draw / ISIS Draw etc.

N B. :

1. Use molar concentrations for volumetric /estimations/synthesis experiments.
2. Use optimum concentrations and volumes
3. Two burette method should be used for volumetric analysis (Homogeneous mixtures)
4. Use of microscale technique is recommended wherever possible

References:

1. Comprehensive Practical Organic Chemistry by V.K. Ahluwalia and Renu Aggarwal
2. Monograph on Green Chemistry Laboratory Experiments by Green Chemistry TaskForce Committee, DST

Learning Outcomes:

1. This course is designed to make students aware of how to perform organic compounds in laboratory.
2. The course includes synthesis of some derivatives and organic compounds, which will help them while working in research laboratory in future.
3. Making derivatives of organic compounds will help them in industry or while doing research in medicinal chemistry for Drug development.
4. This practical course is also designed to make student aware of green chemistry and role of green chemistry in pollution reduction.
5. The students learn how to avoid solvents and do solvent free reaction.
6. Also the work-up procedure in many experiments is made more eco-friendly to environment.

Course Outcomes:

1. Students are trained to different purification techniques in organic chemistry like recrystallization, distillation, steam distillation and extraction.
2. Students are made aware of safety techniques and handling of chemicals.

- Students are made aware of carrying out different types of reactions and their workup methods.
- This practical course is designed to make student aware of green chemistry and role of green chemistry in pollution reduction.

Examination Scheme:

- The examination structure will be given before the commencement of examination.
- Use of only university supplied procedure will be allowed at the time of examination.
- Any one experiment from inorganic chemistry and any one experiment from organic section will be assigned time the time of examination.

Pattern of Question Paper

For theory courses, end semester question papers will be set by the University and centralized assessment for theory papers done as per the rules laid down by the University. Questions will be designed to test the conceptual knowledge and understanding of the basic and advanced concepts of the subject. There will be **two sections** for each paper. Each section will be of **35 marks** and the pattern of question paper shall be:

Question 1 (10 Marks)	5 compulsory sub-questions, each of 2 marks; precisely answerable in 2-5 sentences (such as define, short problem, draw the structure / neat labelled diagram, short reasons, characteristics, applications, etc.)
Question 2 (10 Marks)	2 out of 4 – descriptive answer type questions of 5 marks each; answerable in sufficient length with graph or diagram or flow sheet if necessary.
Question 3 (10 marks)	2 out of 4 – Critical analysis / differentiation / evaluative / summarize interpret, write notes, numerical problem type of questions of 5 marks each; answerable in 15 lines with graph or diagram if applicable.
Question 4 (5 Marks)	1 out of 2 – numerical problem type question; spectral analysis, <u>For descriptive course</u> critical notes, decryption of technique, how you will apply your knowledge to solve particular problem, etc. types of question.

In question paper setting wattage for each chapter will be proportional to number of theory lectures assigned to that chapter.



Savitribai Phule Pune University

(Formerly University of Pune)

Two Year Post-Graduate Program in Chemistry

(Faculty of Science & Technology)

Choice Based Credit System Syllabus (2019 Pattern)
of

M.Sc. (Chemistry) Part-II

Physical Chemistry, Inorganic Chemistry, Organic Chemistry
Drug Chemistry and Analytical Chemistry

for

Colleges Affiliated to Savitribai Phule Pune University

Implemented from Academic Year
2020-2021

Title of the Course: M.Sc. (Chemistry) (Part-II)

1. Structure of the Course:

Basic structure/pattern (Framework) of the proposed postgraduate syllabus for the two years integrated course leading to M.Sc. (Chemistry) in the colleges affiliated to Savitribai Phule Pune University. The general structure for the M. Sc-II year Chemistry (all specializations) is as follows:

Semester - III			
Sr. No.	Paper No	Description	Credit
1	CCTP-7	Core Compulsory Theory Paper	4
2	CCTP-8	Core Compulsory Theory Paper	4
3	CCTP-9	Core Compulsory Theory Paper	4
4	CBOP-3	Choice Based Optional Paper - Theory	4
5	CCPP-3	Core Compulsory Practical Paper	4
Semester-IV			
6	CCTP-10	Core Compulsory Theory Paper	4
7	CCTP-11	Core Compulsory Theory Paper	4
8	CBOP-4	Choice Based Optional Paper - Theory	4
9	CBOP-5	Choice Based Optional Paper – Practical/ Project	4
10	CCPP-4	Core Compulsory Practical Paper	4

Choice of the optional papers: All colleges are encouraged to give the choice of optional papers to the students and conduct the separate classes if 40% or more students opt a different course than 60% or less students.

The specializations are:

1. Physical Chemistry
2. Inorganic Chemistry
3. Organic Chemistry
4. Drug Chemistry
5. Analytical Chemistry
6. Biochemistry

2. Teaching Hours

a) Theory – Each credit of theory is equivalent to 12 teaching hours + 3 tutorial hours. For 1 credit of theory there will be 1 L of 1 hour per week. Thus, 1 theory course will have total 15 weeks of teaching and it will be distributed as of 48 h for teaching and 12 h for tutorials and internal evaluation. In case of theory paper consisting of sections, each section is of 2 credits and time allotted will be 24 h teaching and 6 h for tutorials and internal evaluation.

b) Practical – Each credit of practical is equivalent to 24 teaching hours + 6 tutorial hours. For 1 credit of practical there will 2 L of 1 h per week. Thus, 1 practical course will have total 15 weeks of teaching and it will be distributed as of 96 h for performing practical and 24 h for tutorials and internal evaluation. i) Each experiment will be allotted 4 h time (one practical session) and for 1 course two sessions of 4 h per week should be allotted or ii) In case practical course is extended for one year, then total 30 weeks (15 week per sem.) and 4 h

(one practical session) per week should be allotted to one practical course. ***There shall not be more than 10 students in one batch of practical.***

3. Examination: Each theory and practical course carry 100 marks equivalent to 4 credits. Each course will be evaluated with Continuous Assessment (CA) and University Assessment (UA) mechanism. Continuous assessment shall be of 30 marks (30%) while university Evaluation shall be of 70 marks (70%). To pass the course, a student has to secure 40% mark in continuous assessment as well as university assessment i.e. 12 marks in continuous assessment and 28 marks in university assessment.

For Continuous assessment teacher must select variety of procedures for examination such as: i) Written test / Mid Semester test (not more than one for each course), ii) Term paper, iii) Viva-Voce, Project / survey / field visits iv) Tutorials v) Group discussion vi) Journal / Lecture / Library notes vii) Seminar presentation, viii) Short quiz ix) assignment x) research project by individual student or group of student xi) An open book test, etc.

Each practical course will be extended over the year and practical examination will be conducted at the end of academic year.

1. M.Sc. (II) Physical Chemistry Course Structure

Sr. No.	Paper No. & Code	Course Name	Credits
Semester III			
1	CCTP-7, CHP-310	Quantum and Solid State Chemistry	4
2	CCTP-8, CHP-311	Nuclear, Radiation and Polymer Chemistry	4
3	CCTP-9, CHP-312	Physicochemical Methods of Analysis	4
4	CBOP-3, CHP-313	A) Photochemistry and Techniques in Polymer Chemistry	4
		B) Special Topics in Physical Chemistry	4
5	CBOP-3, CHP-314 Practical	Physical Chemistry Practical : I	4
Semester IV			
6	CCTP-10, CHP-410	Molecular Structure and Spectroscopy	4
7	CCTP-11, CHP-411	Surface Chemistry and Electrochemistry	4
8	CBOP-4, CHP-412	A) Materials Chemistry and Catalysis	4
		B) Biophysical Chemistry and Special Topics in Nuclear and Radiation Chemistry	4
9	CBOP-4, CHP-413 Practical	A) Physical Chemistry Practical III	4
		B) Project	4
10	CCPP-4, CHP-414 Practical	Physical Chemistry Practical: II	4

Equivalence to Old Syllabus

New syllabus (2020)	Old Paper (2014 pattern)
Semester III	
CCTP-7, CHP-310	CHP-310
CCTP-8, CHP-311	CHP-311
CCTP-9, CHP-312	CHP-312
CBOP-3, CHP-313(A)	CHP-313
CBOP-3, CHP-313(B)	CHP-314
CCPP-3, CHP-314 Practical-I	CHP-315 Practical
Semester IV	
CCTP-10, CHP-410	CHP-410
CCTP-11, CHP-411	CHP-411
CBOP-4, CHP-412(A)	CHP-412
CBOP-4, CHP-412(B)	CHP-413
CBOP-5, CHP-413(A) Practical III CHP-413(B) Project	CHP-415 Practical/Project
CCPP-4, CHP-414: Practical: II	CHP-316 Practical

Detailed Course wise syllabus of physical Chemistry, M. Sc.-II

Semester -III	
CCTP-7 CHP-310: Quantum and Solid-State Chemistry [48 L +12 T]	
Section-I: Quantum Chemistry	[24 L +6 T]
1. Basic postulates of quantum mechanics, properties of quantum mechanical operators, Eigen functions and Eigen values, Hermitian, linear, ladder, and angular momentum operators. Spin –orbit coupling, regular and inverted multiples. (10L) 2. Approximation methods: non-degenerate perturbation method and the variation method, theorem and applications. (5L) 3. Calculation of ground state energy and wave function of Helium atom (two electron system) using Variation principle, Pauli’s exclusion principle and Slater determinant. (6L) 4. Calculation of wave function for multi-electron system: Hartree - Fock self consistent Method. (3L)	
Section II: Solid State Chemistry	[24 L +6 T]
1. Imperfections and related phenomenon: Defects in solids: point defects, line defects, diffusion in solids- mechanism, elastic and plastic deformations. (4L) 2. Crystal growth techniques: General principles, Methods of crystal growth: solution method, flux growth method, evaporation method. Theory of crystal growth. (4L) 3. Solid state reactions- Reactions of single solids: Thermal decomposition reactions and their kinetic characteristics, gas solid reactions and their characteristics, Solid –Solid reactions: addition and double decomposition reactions with and without electron transfer photographic process. (5L) 4. Properties of Insulators: Electrical properties- Dielectric properties, Piezoelectricity, electric breakdown, Optical Properties-Colour centres in ionic crystals: types, creation. Magnetic properties- exchange interactions, Antiferromagnetism, Ferrimagnetism. (5L) 5. Properties of metals and semiconductors: band theory, types of solids, intrinsic and extrinsic semiconductors, p-n junctions, optical properties, photoconductivity of crystals. (6L)	
Reference Books	
1. Quantum Chemistry (4th edition), Ira N. Levine, Prentice Hall, Englewood Cliffs, N. J. 2. Quantum Chemistry, A.K. Chandra 3. Quantum Chemistry, D. A. McQuarrie,, Viva Books, New Delhi (2003) 4. Introduction of Solids L.V Azaroff , Tata McGraw Hill 5. Principles of the Solid State H. V. Keer, Wiley Eastern (1993) 6. Selected Topics in Solid State Physics Vol. 12, The growth of crystals from liquids –J. C. Brice, North Holland/American Elsevier (1973) 7 Defects and Diffusion in Solids. S. Mrowec, Elsevier Publ.(1960) 8 Treatise on Solid State Chemistry, ED-N.B. Hannay, Plenum Press Vol –2 (1975)	
CCTP-8 CHP-311: Nuclear, Radiation and Polymer Chemistry [48 L +12 T]	
Section I: Nuclear and Radiation Chemistry	[24 L +6 T]
1. Nuclear reactions: Bethe's notation, types of nuclear reactions, conservation in nuclear reactions, compound nucleus theory, experimental evidence, specific nuclear reactions, photonuclear and thermonuclear reactions. (5L) 2. Nuclear reactors :- General aspects of reactor design, thermal, fast and intermediate reactors, reactor fuel materials, reactor moderators and reflects, coolants, control materials, shield, regeneration and breeding of fissile matter, types of research reactors. (6L) 3. Nuclear structure-: The liquid drop model, calculation of nuclear binding energies, properties of isobars, missing elements, the nuclear shell model, magic numbers, filling of nucleon shells, the collective and unified models. (5L)	

4. Ion beam analysis techniques: Particle induced X-ray emissions- projectile accelerator and target preparation, ionization and X-ray emission detection, analysis and applications. Rutherford back scattering – scattering reaction, surface analysis, depth profiling, channelling effects and applications (4L)
5. Radiation detectors: Scintillators and their properties inorganic and organic, solid state semiconductor detectors-theory, surface barrier, Li drifted and intrinsic detectors (4L)

Section II: Polymer Chemistry [24 L +6 T]

1. Basic concepts of polymer science, classification of polymers as biological - nonbiological, linear branched network, condensation, addition homo- and heterochain, thermoplastic - thermosetting, History of Macromolecular Science, molecular forces and Chemical bonding in polymers. (5L)
2. Thermodynamics of polymer solutions: Entropy and heat of mixing of polymer solutions - ideal behaviour and deviations. Experimental results, Flory - Krigbaum theory - Thermochemistry of chain polymerization. (7L)
3. Copolymerization: Kinetics of copolymerization, the copolymer equation, monomer reactivity ratios, instantaneous composition of polymer. (4L)
4. Measurements of molecular weights: characterization of polymers, Molecular weight averages, fractionation and molecular weight distribution - methods for determination of average molecular weight (end group analysis) colligative property measurements, osmometry, diffusion light scattering, viscosity, ultracentrifugation. (8L)

Reference Books

1. Essentials of Nuclear Chemistry, H. J. Arnikar, Wiley Eastern Limited, 4th Edition. (1995)
2. Nuclear and Radiochemistry, G. Friedlander, J. W. Kennedy and J. M. Miller, John Wiley (1981)
3. Introduction to Radiation Chemistry, J. W. T. Spinks and R. J. Woods, John Wiley (1990)
4. Introduction to Nuclear Physics and Chemistry, B.G. Harvey, Prentice hall (1963).
5. Sourcebook on Atomic Energy-S. Glasstone, Van Nostrand Company (1967)
6. Radiochemistry and Nuclear methods of analysis-W.D. Ehman and D.E. Vance, John Wiley (1991)
7. Textbook of Polymer Science - F. W. Billmeyer Jr., John Wiley & Sons Inc. (1971)
8. Principles of Polymer Systems - F. Rodrigues, Tata McGraw Hill Publishing Company, New Delhi
9. Principles of Polymer Chemistry - P. J. Flory, Cornell University Press, Ithaca New York (1953)
10. Polymer Chemistry - An Introduction, Seymour-Carraher, Marcel Dekker Inc, New York
11. Polymer Science - Gowarikar, Vishwanathan & Sreedhar, Wiley Eastern Ltd. New York (1988)
12. Handbook on Conducting Polymers - T. A. Skotheim, Ed., Marcel Dekker Inc, New York, 1&2 (1986)

CCTP-9 CHP-312: Physicochemical Methods of Analysis [48 L +12 T]

Section I: Physicochemical Methods of Analysis I [24L +6 T]

1. X-ray methods: Generation and properties of X-rays, X-ray absorption, Concept of absorptive edge, applications, X-ray absorptive apparatus, applications, X ray fluorescence, fundamental principles, instrumentation, wavelength dispersive and energy dispersive, qualitative and quantitative analysis, electron microprobe. (10 L)
2. Electron spectroscopy for chemical analysis: Theory, spectral splitting and chemical shift. ESCA satellite peaks, Apparatus used for ESCA, applications. (7L)
3. Thermal methods of analysis: TGA, DTA, DSC and thermometric titrations – principle, instrumentation, factors affecting TGA curve, applications. (7L)

Section II: Physicochemical Methods of Analysis II [24 L +6 T]

1. Amperometric Titrations: Introduction, Apparatus used for Amperometric Titrations,

- Technique of Amperometric Titrations, Dead stop and point method or titration with two indicator electrode, Advantages of Amperometric Titrations, Applications of Amperometric Titrations (3L)
2. Voltammetry: Excitation signals, instrumentation, Hydrodynamic voltammetry, cyclic voltammetry, pulse voltammetry, applications. (7L)
 3. Inductively coupled plasma atomic emission spectroscopy: principle, instrumentation, analysis and applications (4L)
 4. Luminescence, chemiluminescence, electrochemiluminescence, apparatus, fluorescence, phosphorescence, theory, factors affecting intensity, apparatus, and analytical applications. (5L)
 5. Coulometry: Current-voltage relationship, coulometric methods, controlled potential coulometry. (5L)

Reference Books

- 1) Introduction to Instrumental Analysis-R. D. Braun, McGraw Hill (1987).
- 2) Principles of Instrumental Analysis – Skoog, Holler, Nieman, 5th edition.
- 3) Instrumental Methods of Analysis – Willard, Merritt, Dean and Settle
- 4) Instrumental Methods of Chemical Analysis- Gurdeep R. Chatwal and Sham K. Anand

CBOP-3 CHP- 313:(A) Photochemistry and Techniques in Polymer Chemistry
(B) Special topics in Physical Chemistry

CBOP-3 CHP- 313(A): Photochemistry and Techniques in Polymer Chemistry
[48 L +12 T]

Section I: Photochemistry [24 L +6 T]

1. Introduction: Laws of photochemistry, interaction of light with matter, theory of photoluminescence, general features of photochemical and photophysical processes (4L)
2. Mechanism of absorption and emission of radiation: Einstein's treatment, selection rules, Life times of excited electronic states of atoms and molecules Types of electronic transitions in organic molecules photochemical pathways, Jablonski diagram, Fluorescence, Phosphorescence (5L)
3. Photophysical kinetics of uni and bimolecular processes, delayed fluorescence mechanisms, kinetics of collisional quenching, Stern-Volmer equation, quenching by added substances charge transfer mechanism, energy transfer mechanism (6L)
4. Photolysis, Laser-general principles, types of lasers: two, three and four level lasers, solid state Ruby and Nd/YAG laser, self-phase modulation, single photon counting, experimental techniques, flash photolysis: conventional microsecond flash photolysis, Nanosecond laser flash photolysis, Actinometry (5L)
5. Frontiers of photochemistry: Picosecond, Femtosecond flash photolysis, Applications: Solar energy, conversion and storage, photosynthesis (4L)

Section II: Techniques in Polymer Chemistry

1. Morphology and rheology of polymers - configuration of polymer chains crystal structure, crystallization processes, viscous flow, rubber elasticity, viscoelasticity, the glassy state and glass transition, mechanical properties of crystalline polymers. (8L)
2. Polymer structure and physical properties - The crystalline melting point T_m - the glass transition temperature (T_g) - properties involving small and large deformations- polymer requirements and polymer utilization. (4L)
3. Polymer processing - Plastic technology - moulding, other processing techniques fibre technology - textile and fabric properties, spinning fibre after treatments, elastomer technology- natural rubber, vulcanization, reinforcement, carbon blacks. (5L)
4. Radiation induced polymerization - kinetics and mechanism of polymerization in the liquid and solid phases, effect of irradiation on polymers - degradation and cross-linking, block copolymerization. (4L)
5. Conducting polymers - Basics, synthesis, conduction mechanism, applications. (3L)

Reference Books

1. Fundamentals of photochemistry by K.K.Rohatgi-Mukherjee New Age International Publishers Revised Edition (Reprint 2003)
2. Chemistry and light by Paul Suppan, The Royal Society of Chemistry
3. Textbook of Polymer Science - F. W. Billmeyer Jr., John Wiley & Sons Inc. (1971)
4. Principles of Polymer Systems - F. Rodrigues, Tata McGraw Hill Publishing Company, New Delhi
5. Principles of Polymer Chemistry - P. J. Flory, Cornell University Press, Ithaca New York (1953)
6. Polymer Chemistry - An introduction, Seymour-Carraher, Marcel Dekker Inc, New York
7. Polymer Science - Gowarikar, Vishwanathan&Sreedhar, Wiley Eastern Ltd. New York (1988)
8. Handbook on Conducting Polymers - T. A. Skotheim, Ed., Marcel Dekker Inc, New York, 1&2 (1986)

CBOP-3 CHP-313(B): Special Topics in Physical Chemistry [48 L + 12 T]**Section I: Special Topics in Physical Chemistry I [24 L +6 T]**

1. **Ionic equilibria and pH calculations:** Solution of an equilibrium problem, numericals, mass balance, proton condition, charge balance, exact solution, approximations on the equations, Graphical representations – the distribution diagram, the logarithmic concentration diagram. Numericals, pH concept of polyprotic acids, pH calculations. (10L)
2. **Data analysis:** Error and classification of error, minimisation of error, accuracy, precision, significant figure. Statistical treatment of data-Mean and standard deviation, least square analysis, correlation and its significance, correlation coefficient, Regression analysis, coefficient of determination. Permutation and combinations, probability. (8L)
3. **Nephelometry and Turbidimetry:** Introduction, Turbidimetry and colorimetry, Nephelometry and Fluorimetry, Choice between Nephelometry and Turbidimetry, Theory, Comparison of Spectrophotometry, Nephelometry and Turbidimetry, Instrumentation, Applications of Nephelometry and Turbidimetry (6L)

Section II: Special Topics in Physical Chemistry II [24 L +6 T]

1. **Nanoscience and Nanotechnology:** Introduction to Nanoworld, Metals, Semiconductor, Nanocrystals, Ceramics, Metal nanoparticles: Double layers, Optical properties & Electrochemistry, Magnetism, Chemical and catalytic aspects of Nanocrystals, Applications of nanoparticles (8L)
2. **Hydrogen Storage:** Fundamentals of Physisorption, temperature and pressure influence, chemisorption, adsorption energy, electrochemical adsorption. Practical adsorption-Storage of hydrogen with carbon materials, activated carbon graphene, carbon nanostructures, fullerene, carbon nanofibers and graphite. Electrochemical storage of hydrogen in carbon materials. (10L)
3. **Smart Materials:** Definition of smart materials (SM), Design of intelligent materials, actively smart and passively smart materials and their characteristics. e.g. - smart ceramics, oxides, smart polymers and gels, shape memory alloys, electrorheological fluids, ferrofluids, smart windows, smart sensors, smart electroceramics. Magnetostrictive materials, bio mineralisation and bio sensing. Integration to smart clothes, smart rooms. (6L)

Reference Books

1. Ionic Equilibrium : A Mathematical Approach, J.N.Butler, Addison- Wesley Publishing Co. Inc.
2. Analytical chemistry by G.D. Christian, 6th edition
3. Mathematical Preparation for Physical Chemistry by Farrington Daniels
4. Principles of Physical Chemistry by Puri, Sharma, Pathania
5. Instrumental Methods of Chemical Analysis- Gurdeep R. Chatwal and Sham K. Anand

6. Introduction to Instrumental Analysis-R. D. Braun, McGraw Hill (1987).
7. Tushar K. Ghosh, Energy Resources and Systems: Volume 2: Renewable Resources, Volume 2 of Energy Resources and Systems, Energy Resources and Systems, Springer Link: Bücher, Springer, 2011
- 8 Strobel a, J Garche b, P Moseley c, L J Orissen b, Golfdeview Hydrogen storage by carbon materials." Journal of Power Sources (WWW.Sciencedirect.com) 159 (June 2006): 781–801.
9. Agata Godula-Jopek, Walter Jehle, Joerg Wellnitz, Hydrogen Storage Technologies: New Materials, Transport, and Infrastructure, John Wiley & Sons, 2012
10. Yury Gogotsi, Carbon Nanomaterials, illustrated Volume 1 of Advanced Materials Series, Advanced Materials and Technologies Series, CRC Press, 2006 5.Robert A.Varin, Tomasz Czujko, Zbigniew S. Wronski , Nanomaterials for Solid State Hydrogen Storage Fuel Cells and Hydrogen Energy illustrated Springer, 2009
11. Intelligent materials – Craig A. Rogers, Scientific American, 1995,p.122
12. Smart structures and materials by B.Culshaw (Artech House, Norwood,MA1998)
13. Intelligent Gels Y. Osada and S.B. Ross – Murphy-Scientific American May1993
14. Introduction to Nanoscale science &technology Massimiliano Di Ventra, Stephane Evoye and James Heflin, Springer Publication
15. Physical Chemistry- P.W. Atkins, 8th Edn.

CCPP-3 CHP-314: Physical Chemistry Practical-I (Any 24 practical)

[96 L + 24T]

- 1) Thermodynamic data of electrochemical cell by e.m.f. measurements.
- 2) Simultaneous determination of two ions by polarography.
- 3) Determination of the equilibrium constant of triiodide ion formation
- 4) Magnetic susceptibility measurement by Gouy technique.
- 5) Determination of dipole moment of liquid at various temperatures.
- 6) Kinetics of iodination of aniline: pH effect and base catalysis.
- 7) Dissociation constant of an acid- base indicator by spectrophotometry.
- 8) Actinometry – photolysis of uranyl oxalate.
- 9) Absorption coefficient and half thickness of lead for gamma radiation.
- 10) Radiation dose measurement by Fricke dosimeter/ceric sulphate dosimeter.
- 11) Flame Photometric determination of Na / K by calibration curve method.
- 12) Flame Photometric determination of Na and K from mixture.
- 13) Estimation of Na / K by using internal standard method (Li as internal standard).
- 14) Estimation of K by standard addition method.
- 15) A photometric titration of a mixture of Bi and Cu with EDTA (-745nm).
- 16) Demonstration practical on AAS: setting of fuel to oxidizer ratio, choice of conc. of metal ion for AAS (Linearity range) (Use metal ion of which lamp is available with your laboratory).
- 17) The reaction between potassium persulphate and potassium iodide by colorimetry.
- 18) Determination of the chain linkage in poly (vinyl alcohol) from viscosity measurements.
- 18) Calibration of Gamma ray spectrometer and determination of energy of given Radioisotope.
- 19) To determine concentration of Boric acid titrating with NaOH by Conductometry.
- 20) Stability constant of silver thiosulphate by potentiometry.
- 21) Determination of SO_4^{2-} by turbidimetric titration / calibration curve method.
- 22) Determination of SO_4^{2-} by turbidimetric titration / calibration curve method.
- 23) Determination of Riboflavin by Photofluometry calibration curve method.
- 24) Determination of quinine sulfate by Photofluometry by standard addition method.
- 25) Determination of Fe / Cu/ Zn / Mn / B by AAS from soil sample.

References

1. Findlay's Practical Chemistry, S P Levitt (Editor), Longman Group Ltd
2. Experimental Physical Chemistry, Farrington Daniels and others, McGraw-Hill Book Company.

3. Experiments in Physical Chemistry, J.M. Wilson and others, Pergamon Press
4. Practical Physical Chemistry, A.M. James and P.E. Pritchard, Longman Group Ltd.
5. Experimental Physical Chemistry, V. Dathavale, Parul Mathur, New Age International Publishers.
6. Experimental Physical Chemistry, Das and Behera, Tata McGraw-Hill. Practical Physical Chemistry, D.V. Jahagirdar
7. Advanced physical Chemistry experiments by A. Gurtu, J.N. Gurtu
8. Vogel's textbook of quantitative chemical analysis, 6th Ed.

SEMESTER-IV

CCTP-10 CHP-410: Molecular Structure and Spectroscopy [48 L + 12 T]

I: Molecular Structure and Spectroscopy [24 L +6 T]

1. **Nuclear Magnetic Resonance Spectroscopy:** Nuclear spin, nuclear resonance saturation. Shielding of magnetic nuclei, chemical shift and its measurements. Factors influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant "J" Classification (ABX, AMX, ABC. A2 B2) spin decoupling, basic ideas about Instrument, NMR studies of nuclei other than proton ¹³C, ¹⁹Fand, ³¹P, FT NMR, advantages of FT NMR, use of NMR in medical diagnostics. (12L)
2. **Electron Spin Resonance Spectroscopy:** Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the "g" value. Isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and Mc Connell relationship, measurement techniques, applications. (8L)
3. **Nuclear quadrupole resonance spectroscopy:** Quadrupole nuclei, quadrupole moments, electric field gradient, coupling constant, splitting, and applications. (4L)

Section II: Molecular Structure and Spectroscopy [24 L +6 T]

1. **X- Ray diffraction:** Index reflections, Identifications of unit cell from systematic absences in diffraction pattern. Structure of simple lattices and X-Ray intensities. Structure factor and its relation to intensity and electron density, phase problems in XRD (8 L)
2. **Electron Diffraction:** Cattering intensity Vs Scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules, low energy electron diffraction and structure of surfaces. (4 L)
3. **Neutron Diffraction analysis:** Scattering of neutron by solids and liquids, Magnetic scattering, Measurement techniques, Elucidation of structure of magnetically ordered unit cell.(4 L)
4. **Magnetic susceptibility:** Pascal constant, Diamagnetic susceptibility, paramagnetic susceptibility, Langevin Equation ,Van Vlecks formula, Ferro, Ferri and Antiferromagnetism, Measurement of Magnetic susceptibility by Faraday and Gouy Techniques. (8 L)

Reference Books

1. Modern Spectroscopy J.M. Hollas, (John Wiley)
2. Spectroscopy (Atomic and Molecular) Gurdeep Chatwal, Sham Anand (Himalaya Publishing house)
3. Applied Electron Spectroscopy for Chemical Analysis Ed. H. Windawi& F.L. Ho (Wiley interscience)
4. Introduction to Magnetic resonance A. Carrington and A.D Maclachalan , Harper & Row
5. Spectroscopy B.K. Sharma
6. NMR, NQR, & Mossbauer Spectroscopy in Inorganic Chemistry R.V.Parish, Ellis Harr wood
7. Physical methods in Chemistry R.S Drago, Saunders college
8. Introduction to Molecular Spectroscopy G.M. Barro, Mc Graw Hill
9. Basic principles of spectroscopy R. Chang, Mc Graw Hill
10. A text book of Spectroscopy.O.D. Tyagi& M. Yadhav Anmol Publications
11. Introduction to Magento chemistry Alen Earnshaw, Acad Press (1968)
12. Magneto chemistry Sanyl and Dutta

13. Chemist's guide to NM spectroscopy – Mc Comber (Wiley) 2000.

CCTP-11 CHP-411: Surface Chemistry and Electrochemistry

Section I: Surface Chemistry [24 L +6 T]

1. Adsorption at liquid surfaces, Gibbs equation and its verification, Gibbs Monolayers, insoluble films on liquid substrates, states of monomolecular Films, Wetting, flotation, detergency. (8L)
2. Adsorption forces, thermodynamics of physical adsorption, heat of adsorption and its determination, measurement of adsorption by different methods, chemisorption and its mechanism. (8L)
3. Multilayer adsorption – critical comparison of various multilayer models- BET, Potential and Polanyi models (no derivation). Measurement of surface area of solids by different methods. Harkins and Jura equation. (6L)
4. Porous solids – Definition, pore size distribution, methods to determine pore size, hysteresis of adsorption, theories of hysteresis, and Adsorption behaviours of porous materials. (2L)

Section II: Electrochemistry [24 L +6 T]

1. **Ionics** - Ion-ion interaction: Activity and activity coefficients, Debye-Huckel Theory, limited and extended law. Ion transport in solution: Fick's laws of diffusion, Einstein relation between diffusion coefficient and ionic mobilities, The Nernst-Einstein equation, relation between absolute and conventional mobilities. (12L)
2. **Electrodics** – Standard electrode potentials, Liquid junction potential, Zeta potential, electrokinetic phenomena, electrode-electrolyte interface, double layer theories, Butler- Volmer equation, and Tafel equation. (8L)
3. **Applications** -Fuel cells and batteries – primary and secondary power cells, fuel cells, Li ion battery (4L)

Reference Books

1. Physical chemistry of surfaces – A. W. Adamson, Interscience publishers Inc New York, 1967.
2. Surface chemistry – Theory and applications, J. J. Bikerman, Academic press, New York 1972.
3. Adsorption, surface area and porosity – S. J. Gregg and K. S. W. Sing, Academic Press Ltd., London 1967.
4. Zeolites and clay minerals as Adsorbents and molecular sieves, R. M. Barrar, Academic Press London.
5. Physical adsorption of gases, D. M. Young and A. D. Crowell, Butterworths, London, 1962.
6. Adsorption, J. Oscik, John Wiley and Sons. New York.
7. Physical chemistry - Peter Atkins, Julio de Paula, 7th Edition Oxford University Press.
8. Modern Electrochemistry - Vol I & II J O'M Bockris and AKN eddy, Plenum Press, N.Y.
9. Fuel cells - heir Electrochemistry, J O'M Bockris and S Srinivasan, McGraw Hill, NY (1969)
10. Fuel cell systems L.I. M Blomen and M.N. Mugerwa, Plenum Press NY (1993)
11. Principles of Physical Chemistry – Samuel

CBOP-4 CHP-412(A): Materials Chemistry and Catalysis [48 L + 12 T]

Section I: Materials Chemistry [24 L +6 T]

1. **Hitech materials:** Defect perovskites, super conductivity in cuprates, preparation & characterization of 1-2-3 & 2- 1-4, Normal state properties, anisotropy, temperature dependents of electrical resistance, optical photon modes, coherent length, elastic constants position life times, heat capacity, micro wave absorption, pairing & multigap structure in hi tech materials. Application of Hitech materials. (12L)
2. **Thin films Langmuir – Blodgett films:** Preparation techniques, sputtering, chemical process, MOCVED, Langmuir – Blodgett films, Photolithography, Applications of LB films. (5L)
3. **Superconducting solid materials:** Superconducting state, high critical temperature superconductors, Low critical temperature superconductors (3L)
4. **Materials of solid devices:** Rectifiers, transistors, capacitors, IV-V compounds low dimensional quantum structures, optical properties. (4L)

Section II: Catalysis [24 L +6 T]

- Theories of catalysis-** intermediate compound formation theory and adsorption theory. Catalysis: bio catalysis, autocatalysis, negative catalysis, characteristics of catalytic reactions concept of activity, selectivity, poisoning, promotion and deactivation. Types of catalysis: homogeneous, heterogeneous. Enzyme catalysis, effect of temperature and pH on enzyme catalysis. Heterogeneous catalysis and catalytic kinetics: concept of Langmuir-Hinshelwood (8L)
- Preparation and Characterization of Catalysts:** General methods for preparation of catalysts: precipitation, sol-gel, hydrothermal, impregnation, hydrolysis, vapour deposition. Activation of catalysts: calcinations, reduction. Catalyst characterization: surface area, pore size distribution, particle size determination, XPS, AES, UV-Vis, FT-IR and thermal methods (8L)
- Catalysis in green chemistry and environmental applications:** Purification of exhaust gases from different sources: auto-exhaust catalysts (petrol vehicles, diesel vehicles), VOC removal; ozone decomposition. (3L)
- Photo-catalysis: Photoprocesses at metals, oxides and semiconductors:** concepts and mechanism. Photocatalysis application in organic pollutant degradation present in water and air. Photocatalytic water splitting, photocatalysis in the field of energy and environment. (5L)

Reference books

- Physical Chemistry of Surfaces, W. Adamson, Wiley Intersciences, (5th edition) 1990.
- Heterogeneous Catalysis: Principles and Applications. Bond, G C, Oxford University Press 1987
- Heterogeneous Catalysis, D.K. Chakrabarty and B. Viswanathan, New Age Publishers
- Principles of Physical Chemistry by Puri, Sharma, Pathania, 45th edition
- Catalytic Chemistry, B.C. Gates, John Wiley and Sons Inc. (1992)
- Solid state physics – N.W. Aschocruets & N.D. Mermin, Saunders College.
- Material science & Engineering, An Introduction - W.D. Callister, Willey.
- Principles of solid state – H.V. Keer, Willey.
- Materials Science – Anderson, Leaver, Alexander, & Rawlings, ELBS
- Theromotropic liquid crystals Gray, Willey
- Text Book of liquid crystals – Kelkar & Halz, Chemie Verlag

CBOP-5 CHP-412(B): Biophysical Chemistry and Special Topics in Nuclear Chemistry [48 L + 12 T]**Section I: Biophysical Chemistry [24 L +6 T]**

- Bioenergetics and Thermodynamics:** Molecular interpretation of Energy and Enthalpy, Non-covalent reactions, hydrophobic interactions, Protein and Nucleic Acids. Biochemical Applications of Thermodynamics, Thermodynamics of Metabolism, Role of ATP in biological Systems (hydrolysis of ATP). Biological Reactions, Double Stranded Formation in Nucleic Acids, Ionic Effect on Protein–Nucleic Acid Interactions. (8L)
- Kinetics:** Basic Concepts, Enzyme kinetics, catalytic antibodies and RNA enzymes- Ribozymes, Michaelis Menten Kinetics, Competition and Inhibition, Monod- Whyman Changeux Mechanism. (5L)
- Spectroscopy of Biomolecules:** Spectra of Proteins and Nucleic Acids, Amino acid, Polypeptides, Secondary structure, Rhodopsin: A Chromophoric Protein, Principles of Circular dichorism and optical rotator dispersion, applications to biomolecules. (6L)
- Macromolecular structure and X-ray diffraction:** Chain configuration and conformations of macromolecules, proteins and polypeptides, problems of protein folding, Fundamentals of X-rays, Braggs Law, Determination of molecular structure, calculation of diffracted intensities from atomic co-ordinates. (5L)

Section II: Special Topics in Nuclear and Radiation Chemistry [24 L +6 T]

1. Radiation hazards and safety ; Natural and manmade sources of radiations, internal and external radiation hazards, safe handling methods, personal dosimetry, reactor safety, the effects of Three miles and Chernobyl accidents, radiation protecting materials. (5L)
2. Biological effects of radiations: The interaction of radiations with biological cells, various stages, somatic and genetic effects, maximum permissible dose-ICRP recommendations. (3L)
3. Applications of radioisotopes in nuclear medicine and pharmaceuticals: general applications of radiopharmaceuticals, use of nuclear properties of indicator nuclides. In vivo diagnostic procedures, in vitro diagnostic testing therapeutic use of radiations, Use of radiation for food preservation and sterilization. (8L)
4. The origin of chemical elements, cosmology, primordial nucleosynthesis, stellar evolution and stellar nucleosynthesis, solar neutrino problem, synthesis of Be, B, Li in the cosmos. (4L)
5. Radioactive waste management: Introduction, Classification of radioactive waste, Origin of Radioactive waste, Treatment of Radioactive wastes: Radioactive waste disposal. (4L)

Reference Books

1. Biophysical Chemistry, Gurtu and Gurtu, Pragati Edition, 2007.
2. Physical Chemistry, Principles and Applications in Biological Sciences I. Tinico, K. Sauer, J. Wang and J. D. Puglisi, 4th Edition, Pearson Edition, 2007.
3. Biophysical Chemistry, A. Upadhyay, K Upadhyay and N. Nath, Himalaya Publishing House, 2005.
4. Biophysical Chemistry, James P. Allen,
5. Biophysical Chemistry, C. R.Cantor and P.R. Schimmel, WH Freeman & Company, New York, 2004.
6. Radiation Chemistry: Principles and Applications, Farhataziz and M. A. J. Rodgers (Eds.), VCH Publishers, New York (1987).
7. Radiation Chemistry: Present Status and Future Trends, C. D. Jonah and B. S. M. Rao (Eds.) Elsevier, Amsterdam (2001).
8. Essentials of Nuclear Chemistry: H. J. Arnikaar. New Age Publication Ltd. (1995).
9. Radiation chemistry and Nuclear Methods of Analysis W. D. Ehmann, D. E. Vance. John Wiley (1991).
10. Nuclear and Radiochemistry G. Friedelarder, J. W. Kennedy, E.S. Macias, J. M. Miller John Wiley (1981).
11. Source Book of Atomic Energy, S. Glasstone, D. Van Nostrand (1967)
12. Nuclear analytical chemistry- J. Tolgyessy and S. Verga Vol. 2 , University park press (1972)
13. Fundamental of Radiochemistry, D.D. Sood, A.V.R. Reddy, N. Ramamoorthy, IANCA's , Mumbai, 4th Edition

CBOP-5 CHP-413(A): Physical Chemistry Practical III (Perform any 24 practical)

[96 L + 24 T]

1. Hydrolysis constant of aniline hydrochloride by distribution coefficient method.
2. Determination of the dimerization constant of an organic acid in benzene.
3. Differential potentiometric titration.
4. Aerometric titration with platinum microelectrode.
5. Determination of the stability constant of a complex by spectrophotometry.
6. Studies on a clock reaction: determination of the energy of activation
 - a. Reactions such as bromate-bromide reaction, iodate –iodide reaction,
 - b. Formaldehyde - bisulphite reaction etc.
7. Magnetic susceptibility measurements by the Faraday technique.
8. Analysis of fruit juice for vitamin C by HPLC technique.
9. Determination of half-life of two isotopes in a mixture.
10. Study of characteristics of GM counter.
11. Effect of salt on the distribution of acetic acid between water ethyl acetate.
12. To study the effect of addition of a salt on the solubility of an acid in water.
13. Determination of concentration of sulfuric acid, acetic acid and copper sulphate by

- conductometric titration with sodium hydroxide.
14. Determine the formula and stability constant of a metal ion complex (Lead Oxalate) by polarography.
 15. To determine order of reaction of iodination of aniline.
 16. To determine second order velocity constant of ethyl acetate by conductometry.
 17. Determination of Molecular weight of a given polymer by turbidimetry
 18. Determination of surface tension of water in presence of surfactant and hence surface excess by capillary rise method/Du-Nouy Tensionometer.
 19. To investigate reaction between H_2O_2 and KI.
 20. Thermodynamic parameters of an electrochemical cell, temperature dependence of EMF.
 21. Surface tension and parachor of liquids by stalagmometer and differential capillary method.
 22. Determination of activity coefficient of electrolyte/ non electrolyte by cryoscopy.
 23. To study the formation of complex ions by cryoscopy.
 24. To determine critical composition and critical temperature for given naphthalene bi-phenyl binary phase system.
 25. Determination of diffusion coefficient and hydrodynamic radius of $K_3[Fe(CN)_6]$ by cyclic voltammetry.

References

1. Findlay's Practical Chemistry, S P Levitt (Editor), Longman Group Ltd.
2. Experimental Physical Chemistry, Farrington Daniels and others, McGraw-Hill Book Company.
3. Experiments in Physical Chemistry, J.M. Wilson and others, Pergamon Press.
4. Practical Physical Chemistry, A.M. James and P.E. Pritchard, Longman Group Ltd.
5. Experimental Physical Chemistry, V. Dathavale, Parul Mathur, New Age International Publishers.
6. Experimental Physical Chemistry, Das and Behera, Tata McGraw-Hill. Practical Physical Chemistry, D.V. Jahagirdar.
7. Advanced physical Chemistry experiments by A. Gurtu, J.N. Gurtu.

CBOP-5 CHP-413(B): Project

[96 L + 24 T]

Each student will perform project separately. Working hours are same as practical of CHP-413(A) project length should be sufficient and should be equivalent to 24 practical. ***Project report must be written systematically and presented in bound form: The project will consist of name page, certificate, content, summary of project (2-3 page) followed by introduction (4 to 7 pages), literature survey (4-7) pages (recently published about 30 papers must be included), experimental techniques, results, discussion, conclusions, Appendix consisting of i) references, 2) standard spectra / data if any and 3) safety precautions.*** If student is performing project in another institute, for such a student, internal mentor must be allotted and he will be responsible for internal assessment of a student. In this case student has to obtain certificate from both external and internal mentor. ***Systematic record of attendance of project students must be maintained by a mentor.*** Project will be evaluated jointly by three examiners and there will not be any practical performance during the examination. Typically, student has to present his practical work and discuss results and conclusions in details (20-30 min.) which will be followed by question-answer session (10 min). It is open type of examination.

CCPP- 4 CHP-414:Physical Chemistry Practical-II [96 L + 24 T] (Perform any 24 practical)

1. Solubility of a sparingly soluble salt by conductometry.
2. Coulometric estimation of arsenite by bromine.
3. Dead stop end point titration.
4. Activity coefficient of electrolyte by emf measurements.
5. Titration of polybasic acid with sodium hydroxide by pH- metry.

6. Formation constant of a complex by pH- metry.
7. Kinetics of the reaction between 2,4-dinitrochlorobenzene and piperidine.
8. Determination of solubility diagram for a three component liquid system.
9. Radiolysis of aqueous iodate solution and determination of G values.
10. Molecular weight of a polymer by end group estimation.
11. Determination of the formula of complexes such as silver –ammonia complex by titration, cuprammonium ion complex by distribution coefficient measurement.
12. Determine the transport number of silver and nitrate ions in aqueous solution from the cell potential of the concentration cell with junction potential.
13. Recording of TGA curve of CuSO_4 and NaCl and hence to find the percentage composition of the mixture.
14. Determination of the heat of ionization of phenol/weak acid.
15. Analysis of tertiary mixture by Gas chromatography.
16. To determine the relative strength of acetic acid, chloroacetic acid and tri-chloroacetic acid by conductometry.
17. To determine the solubility of given salt at room temperature from its solubility curve.
18. To study the effect of amount of different salts on critical temperature of phenol water system.
19. Use of thiocyanate dosimeter for determining the radiation dose.
20. Determination of rate constant (Oxidation/reduction of Substituted benzene) by pulse radiolysis technique
21. Determination of half-life of radioisotopes in a given mixture.
22. Determination of manganese content of steel sample by neutron activation analysis technique.
23. Study of counting errors
24. Determination of gamma energy of a given source using scintillation counter coupled with single channel analyser.
25. Determination of manganese content of steel sample by neutron activation analysis technique.
26. Kinetics of condensation polymerization by dilatometry.

References

1. Findlay's Practical Chemistry, S P Levitt (Editor), Longman Group Ltd
2. Experimental Physical Chemistry, Farrington Daniels and others, McGraw-Hill Book Company.
3. Experiments in Physical Chemistry, J.M. Wilson and others, Pergamon Press
4. Practical Physical Chemistry, A.M. James and P.E. Pritchard, Longman Group Ltd.
5. Experimental Physical Chemistry, V. Dathavale, Parul Mathur, New Age International Publishers.
6. Experimental Physical Chemistry, Das and Behera, Tata McGraw-Hill. Practical Physical Chemistry, D.V. Jahagirdar
7. Advanced physical Chemistry experiments by A. Gurtu, J.N. Gurtu

2. M. Sc. (II): Inorganic Chemistry**Course Structure**

Semester - III			
Sr. No.	Paper No. and Code	Course Name	Credit
1	CCTP-7 CHI-330	Organometallic and Homogeneous Catalysis	4
2	CCTP-8 CHI-331	Inorganic Reaction Mechanism	4
3	CCTP-9 CHI-332	Bioinorganic and Medicinal Inorganic Chemistry	4
4	CBOP-3 Theory CHI-333	A) Modern Instrumental methods in Inorganic Chemistry OR B) Inorganic Magneto and Polymer Chemistry	4
5	CCPP-3 CHI-334	Practical I -Modern Methods of Inorganic Analysis	4
Semester-IV			
6	CCTP-10 CHI-430	Heterogeneous Catalysis and its Applications	4
7	CCTP-11 CHI-431	Inorganic Nanomaterials: Properties, Applications and Toxicity	4
8	CBOP-4 Theory CHI-432	A) Material Science OR B) Inorganic Chemistry Applications in Industry	4 4
9	CBOP-5 Practical CHI-433	Practical III -A)Extended Practical in Inorganic Chemistry OR B)Project Work	4
10	CCPP-4 CHI-434	Practical II- Section-I: Inorganic Instrumental analysis and Computer applications Section-II: Preparation of Inorganic Compounds	4

Equivalence to Previous Syllabus

Semester - III			
New Syllabus 2019 Pattern		Old Syllabus 2014 Pattern	
CCTP-7 CHI-330	Organometallic and Homogeneous Catalysis	CHI-326	Organometallic and Homogeneous Catalysis
CCTP-8 CHI-331	Inorganic Reaction Mechanism	CHI-330	Inorganic Reaction Mechanism, Photochemistry and Magnetic Properties of Coordination Compounds
CCTP-9 CHI-332	Bioinorganic and Medicinal Inorganic Chemistry	CHI-331	Physical Methods in Inorganic Chemistry.
CBOP-3 Theory CHI-333	Modern Instrumental Methods in Inorganic Chemistry OR Inorganic Magneto and Polymer Chemistry	CHI-332	Bioinorganic Chemistry
CCPP-3 CHI-334	Modern Methods of Inorganic Analysis	CHI-387	Experiments & Computer Applications in Inorganic Chemistry.
Semester-IV			
CCTP-10 CHI-430	Heterogeneous Catalysis and its Applications	CHI-430	Inorganic polymer & Heterogeneous Catalysis.
CCTP-11 CHI-431	Inorganic Nanomaterials: Properties, Applications and Toxicity	CHI-431	Material Science-I Solid State & other inorganic Materials
CBOP-4 Theory CHI-432	Material Science OR Inorganic Chemistry Applications in Industry	CHI-432	Material Science-II Nanomaterials.
		CHI-445	Inorganic Chemistry Applications in Industry
CBOP-5 Practical CHI-433	Extended Practical in Inorganic Chemistry OR Project Work	CHI-488	Extended Practical in Inorganic Chemistry
CCPP-4 CHI-434	Section-I: Inorganic Instrumental analysis and Computer applications Section-II: Preparation of Inorganic Compounds	CHI-388	Practical course II.

The Detailed Syllabus of M. Sc-II Inorganic Chemistry is as Follows:

Semester - III	
CCTP-7, CHI- 330: Organometallic and Homogeneous Catalysis [48 L + 12 T]	
Section-I: Advanced Organometallic Chemistry [24 L +6 T]	
1. Introduction & Recapitulation d-block metal carbonyls.	[2L]
2. Sigma complexes: Synthesis, bonding, properties and applications. Hydrocarbyl compounds,	
3. Metal-Carbon multiple bonded compounds Carbene and Carbynes.	[4L]
4. π -complexes Alkenes di and polynes.	[2L]
5. $n^5C_nR_n$: Carbocyclic polyenes: Synthesis, bonding, properties and applications of Allyls Pentadienyls, Cyclobutadienes, Cyclo pentadienyls, Cycloheptatrienyls, Arenes.	[4L]
6. Phosphine complexes Synthesis, bonding, properties and applications.	[2L]
7. Metal-metal bonds Transition metal atom clusters Carbonyl polymers.	[4L]
8. Transition metal organo-metallics in organic synthesis. As Electrophiles, Nucleophiles, Activating agents, Protecting agents.	[4L]
9. Fluxional Behaviour of organometallic compounds,	[2L]
Section-II: Homogeneous Catalysis [24 L +6 T]	
1. Introduction to catalysis. basic principles, definition of activity & selectivity catalysis, homogenous vs. heterogeneous catalysis. Importance of homogenous catalysis in synthesis of high value chemicals.	[4L]
2. Characteristics of central metal atom & influence of attached ligands on catalytic activity, Important reaction types: oxidative addition, reductive elimination, migratory insertion, beta hydride elimination.	[4L]
3. Tollman catalytic cycles. Use of spectral techniques for identification of intermediates. (IR, NMR),	[3L]
4. Reactions of olefins: a) Polymerisation: Catalytic cycle for alkene Polymerisation, Metallocene catalysts-structure, special features advantages and mechanism of action. b) Oxidation including catalyst separation in homogeneous catalysis, Fenton Reaction- $FeBr_3/H_2O_2$, Metal catalysed liquid phase oxidation, Epoxidation, Biphasic catalysis –oxidation. c) C-C coupling (Cativa process, Heck, Suzuki, Negishi and cycloaddition reactions).	[8L]
5. Metathesis	[2L]
6. Asymmetric catalysis.	[3L]
References:	
1. Organotransition Metal Chemistry Anthony F. Hill, Royal Society of Chemistry, Tutorial	
2. Chemistry Text, 2002. Chapters 1-7.	
3. Organometallics: A concise Introduction, Ch. Elshebroich and A. Salzer, VCH, chapters, 12-16	
4. Organotransition Metal Chemistry: Applications to Organic Synthesis, S.G. Davies, Pergamon 1982.	
5. Inorganic Chemistry 3rd edn D.F. Shriver and P.W. Atkins, Oxford University Press, 1999, Chapter 16.	
6. Organometallic Chemistry –R.C. Mehrotra and A. Singh, 1992, Wiley	
7. Principles of Organometallic Chemistry, P. Powell, Chapman & Hall	
8. Organometallic Compounds, Morris, Sijlirn, IVY Publication House	
9. Organometallics in Organic Synthesis – Swan & Black	
10. Organometallic Chemistry - E.J. Elias and Gupta	
11. Homogeneous Catalysis - G.W. Parshall	
CCTP-8, CHI- 331: Inorganic Reaction Mechanism [48 L + 12 T]	
Section-I: Inorganic Reaction Mechanism [24 L +6 T]	

1. Types of Mechanisms: Basic concepts as stability and liability, stability constants; HSAB principle, chelate effect, Classification of inorganic reactions, Intimate and stoichiometric mechanism of ligand substitution. [4 L]
2. Substitution in square planar complexes: Trans effect, Trans series, applications of trans effect. [4 L]
3. Substitution in octahedral complexes: SN_1 , SN_2 , SN_1CB mechanisms, steric effects on substitution Isomerization and racemization in coordination compounds. [4 L]
4. Electron Transfer reactions: Potential energy diagrams as a conceptual tool, Marcus equation Types of and factors affecting electron transfer reactions. [6 L]
5. Inner & Outer sphere reactions, excited state outer sphere reactions & their applications [6 L]

Section -II: Photochemistry and Reaction of Co-ordinated Ligands [24 L +6 T]

1. **Photochemistry of metal complexes** [10 L]
Photochemical reactions, Prompt and delayed reactions, quantum yield, recapitulation of fluorescence & phosphorescence, photochemical reactions irradiating at d-d and CT band Transitions in metal-metal bonded systems, photochemical reactions involving chlorophyll Kinetics of excited state processes
2. **Reactions of coordinated ligand** [10 L]
i) Non-chelate forming reactions: Reaction of donor atoms (Halogenation of coordinated N atoms, Alkylation of coordinated S and N atoms, Solvolysis of coordinated phosphorus atoms). Reactions of nondonor atoms (nucleophilic behaviour of the ligand, electrophilic behaviour of the ligand). ii) Chelate ring forming reactions: (reactions predominantly involving thermodynamic template effects, reactions predominantly involving kinetic affects). iii) Chelate modifying reactions
3. **Other reaction types** [4 L]
Oxidative addition, reductive elimination, methyl migration and CO insertion

References:

1. Mechanism of Inorganic Reactions- C.F. Basselo, R.G. Pearson, Wiley, NY
2. Mechanism of Inorganic Reactions in Solution – An Introduction, D. Benson, McGraw – Hill Chapt.15, p.465, (1968)
3. Inorganic Chemistry – D.F. Shriver, P.W. Atkins, C.H. Langford – Oxford, 2nd Edition, 1994.
4. Inorganic Chemistry – Principles of Structure and Reactivity, J. E. Huheey, E. A. Keiter and R. L. Keiter, 4th edn. Harper Collins College Publ. New York, Chapt.13, p.537-76, (1993).
5. Inorganic Chemistry - Messler and Tarr - Pearson Publishers

CCTP-9,CHI-332:Bioinorganic and Medicinal Inorganic Chemistry [48L + 12T]

Section - I: Bioinorganic Chemistry [24 L +6 T]

1. **Recapitulation of Biological roles of Metals and ligands** [1 L]
Structure, function and biochemistry of enzymes containing following metals:
2. **Zinc** [6 L]
Zinc Fingers, Carboxy peptidase, Carbonic anhydrase
3. **Copper** [6 L]
Type I, Type II, Type III, Blue Proteins Azurins, Plastocynins & Blue Oxidases, Model compounds of Blue copper proteins, Non Blue Proteins eg. Tyrosinase, Galactose oxidase, SOD
4. **Cobalt** [4 L]
Vitamin B_{12} co-enzymes & model compounds, Actions of Cobalamines, Adenosylcobalamine as a coenzyme, Ribonucleotide reductase, Methylcobalamine as cofactor
5. **Molybdenum** [3 L]
Mo-cofactors, Antagonism between Cu & Mo, Hydroxylase
6. **Manganese** [2 L]
7. **Non-heme Iron** [2 L]

References:

1. Bioinorganic Chemistry: A Short Course—Rosette M. Malone 3 Wiley Interscience, 2002.
2. Biological Inorganic Chemistry—An Introduction, Robert Crichton, Elsevier Science, 2007.
3. The biological Chemistry of the Elements: The Inorganic Chemistry of Life—J. J. R.
4. Fraustoda Silva and R. J. P. Williams. Clarendon Press, Oxford, 1991.
5. Bioinorganic Chemistry: Inorganic elements in the Chemistry of life., An Introduction and Guide—Wolfgang Kaim, Brigille Schwedrski John Wiley and sons, 1994.
6. Principles of Bioinorganic Chemistry –S.J. Lippard and J.M.Berg, University Science Books, 1994.
7. The Biological Chemistry of the Elements: The Inorganic Chemistry of Life– Silva, J. J.
8. R. Fraustoda and R. J. P. Williams; 2nd Ed. Oxford University Press, 2012.

Section- II: Inorganic Pharmaceuticals and Medicinal Chemistry [24 L +6 T]**1. Overview****[2 L]**

Introduction, Metal Ions in Disease, Use of chelating agents, Metalloproteins as Drug Targets, Matrix Metalloproteases, Modulation of Cellular responses by Metal-Containing, Drugs Metal-Based Chemotherapeutic, Drugs Metal Complexes as Diagnostic Agents

2. Cisplatin-based Anticancer Agents**[3 L]**

Introduction, Clinical Properties, Cisplatin carboplatin, Iproplatin, Determination of Platinum Drug Levels and Pharmacokinetics, Platinum Chemistry Mechanism of Action, Structure-Specific Damage-Recognition Proteins, Mechanisms of Resistance to Cisplatin/Carboplatin, Circumvention of Tumor Resistance to Cisplatin, Development of New Platinum Drugs, Dose Intensification of Cisplatin/Carboplatin, Modulation of Platinum Resistance Mechanisms, Dinuclear and Trinuclear Platinum Complexes as Anticancer Agents.

3. Transition Metal Complexes as Chemical Nucleases**[4 L]**

Interaction of Metal Complexes with DNA, Reactions of Metal Complexes with DNA, Nuclease activity of $[\text{Cu}(\text{phen})_2]^+$

4. Biomedical Uses of Lithium**[3L]**

Chemistry of Lithium, Distribution of Lithium in the body and in Cells, Studies using Lithium isotopes, Biochemistry of Lithium

5. Bismuth in Medicine**[3L]**

The Chemistry of Bismuth, Properties of the element, Bi(III) Compounds, Bi(V) Compounds Bismuth in Medicine, Helicobacter Pylori bacterium, Methods for the study of Bi, Bismuth Citrate Complexes, Bismuth Complexes with Biomolecules, Bismuth binding to oxygen-containing molecules, Bismuth Complexes with thiolate ligands, Bismuth(III) complexes with Metallothionein and Transferrin, Enzyme Inhibition

6. Gold Complexes with Anti-arthritic, anti-tumor and Anti-HIV activity**[4L]**

Introduction, Chrysotherapy, History of Medicinal Uses, Gold Chemistry, Oxidation states, Gold(I) complexes, Gold(III) Complexes, Oxidation-Reduction Potentials, Gold Biochemistry and Pharmacology In-vivo metabolism and ligand displacement, Anti-tumor Activity, Anti-HIV activity

7. Vanadium Compounds as Possible Insulin Modifiers**[3L]**

Introduction, Characterization of Vanadium's Insulin-mimetic Effects, Sites of Action of Vanadium, Animal Studies and Human Trials, Toxicological Considerations, Improved Tissue Uptake with Metal Chelation

8. Therapeutic Radiopharmaceuticals:**[2L]**

Introduction, Therapeutic radio nuclides, β^- Particle emitting radionuclides, α^- Particle emitting radionuclides, Low energy electron emitters, Therapeutic radiopharmaceuticals for routine medical use, ^{131}I – sodium iodide, Intra-cavity and Intra-arterial radiopharmaceuticals, Radio-therapeutic agents for bone cancer treatment ^{89}Sr -chloride, ^{153}Sm - EDTMP,

References

1. Uses of Inorganic Chemistry in Medicine Ed. Nicholas P. Farrell
2. Metal Complexes as drugs and chemotherapeutic agents
3. Metal Complexes as Enzyme inhibitors A.Y. Louie and Thomas Meade Chem. Rev., 1999, 99, 2711.

CBOP-3,CHI-333: Theory**A) Modern Instrumental Methods in Inorganic Chemistry [48L + 12T]****OR****B) Inorganic Magneto and Polymer Chemistry [48L + 12T]****CBOP-3,CHI-333: Theory****A) Modern Instrumental Methods in Inorganic Chemistry [48L + 12T]****Section-I: Inorganic Thermal and Spectroscopic Methods of Characterization [24 L +6 T]****Chapter 1: Thermal techniques. [12L]**

Principle, instrumentation, working and applications of following spectroscopic techniques

1. TGA
2. DTA
3. DSC
4. TPD study

Chapter 2: Spectroscopic techniques. [12L]

Principle, instrumentation, working and applications of following spectroscopic techniques:

1. X-Ray diffraction
2. NMR
3. ESR
4. Auger
5. FT-IR
6. Fluorescence

Section-II: Imaging and Analytical Techniques [24 L +6 T]**Chapter 1: Imaging techniques. [12L]**

Principle, instrumentation, working and applications of following spectroscopic techniques:

1. TEM
2. SEM
3. XPS
4. STEM
5. UV

Chapter 2: Analytical techniques. [12L]

Principle, instrumentation, working and applications of following spectroscopic techniques:

1. Cyclic voltammetry
2. Flame Photometer
3. Magnetic susceptibility
4. Photodegradation

Reference Books:

- 1- Instrumental methods of analysis by B.K Shrama
- 2- Instrumental methods of chemical analysis- Chatwal and Anand
- 2- Introduction to Instrumental Analysis- R. D. Braun, Pharma ed Press, Indian
- 3- Principles of Instrumental Analysis, 5th edition- D. A. Skoog, F.J. Holler, T. A. Nieman, Philadelphia Saunders College Publishing (1988)
- 5- Materials characterization, Introduction to microscopic and spectroscopic methods, Yang Leng, John Wiley and Sons Pvt.ltd.

OR

CBOP-3,CHI-333: Theory**B) Inorganic Magneto and Polymer Chemistry [48L + 12T]****Section-I: Magneto-chemistry [24 L +6 T]****1. Introduction****[4 L]**

Definition of magnetic properties and types of magnetic substances, magnetic susceptibility, anisotropy in magnetic susceptibility, experimental arrangements for determination of magnetic susceptibility: Gouy method, Faraday method, Evans method, SQUID.

2. Paramagnetic Susceptibility**[2 L]**

Simplification and application of Van-Vleck susceptibility equation, temperature independent paramagnetism.

3. Magnetic properties**[6 L]**

Magnetic properties of transition metal complexes in cubic and axially symmetric crystal fields, low spin, high-spin crossover, magnetic behaviour of lanthanides and actinides, magnetic exchange interactions.

4. Anti-ferromagnetism**[2 L]**

Transition metal monoxides and halide salts of transition metals, ferrimagnetism (ferrites), magnetic anisotropy.

5. Anomalous magnetic moments**[4 L]**

Anomalous magnetic moments in magnetically dilute and concentrated system in various symmetrical environments of coordination complexes. Study of mixed valence compounds, their magnetic behaviour

6. Magnetic materials**[6 L]**

Soft and hard ferrites, i.e. structure and magnetic interactions in spinels, garnets, hexagonal ferrites. Application of magnetic materials, Molecular magnets, Single chain magnet, Photoinduced magnetism, Spin canting, Magnetic ordering.

Reference Books:

1. Elements of Magnetochemistry, 2ndEdn., R. L. Datta and A. Syamal (1993) Affiliation, East-Wiley Press (p) Ltd.
2. Introduction to Magnetochemistry, A. Earnshaw, Academic Press, (1968).
3. Magnetism and Transition Metal Complexes, F. E. Mabbs and D. J. Machin (1973) Chapman and Hall, London.

Section - II: Inorganic Polymer [24 L +6 T]**1. Inorganic polymers:****[8 L]**

Overview and classification of polymers. Coordination Polymers: Homopolar and heteropolar inorganic polymers. Polyphosphazenes, Polysilanes, Polysiloxanes, Boron Polymers, Borazines, Phosphorous based polymer, polymeric compounds of sulphur, polythiazoles, silicates with reference to preparation, properties, structures, bonding and applications.

2. Natural polymers**[4 L]**

Natural polymers and reactions yielding coordination polymers. Synthesis of coordination polymers.

3. Pre-ceramic Inorganic polymers:**[6 L]**

Silicon carbide, Boron nitride, Aluminium nitride, Phosphorous nitride.

4. Applications of Inorganic Polymers:**[6 L]**

Metal containing polymer for medical purposes, Inorganic polymers as catalysts, Luminescent Inorganic polymers.

Reference Books:

1. I. S. Butler and J. F. Harrod, Inorganic Chemistry – Principles and Applications, The Benjamin/Cummings Publishing Co., Inc., Redwood City, California (USA) (1989) Chapter 15 to 17, pp 441-503.

2. Randal D. Archer, Inorganic and organometallic polymers, A John Wiley and Sons, Inc. publication (USA) 2001
3. N. H. Ray, Inorganic Polymers, Academic Press (1978).

CCPP-3, CHI-334: Modern Methods of Inorganic Analysis [96L + 24T]

A. Analysis (12 experiments)

- 1-2. Stainless steel Alloy. [iron, chromium and nickel from sample]
- 2-3. Ilmenite Ore [acid-insoluble matter (combined oxides), iron and titanium from ore]
- 4-5. Analysis of Cement (Al(III), Mg(II), Fe(III), Ca(II))
6. Analysis of zinc-chrome Pigment [e.g. Chromium from Zinc chrome]
- 7-8. Pharmaceutical products **any two** i) magnesium from tablet of "Milk of magnesia", calcium from calcium supplementary tablet, ii) iron from iron supplementary capsule iii) zinc from iron-zinc supplementary capsule or insulin.
9. Consumer products [e.g. aluminium from alum]
10. Ion exchange chromatography [separation and estimation of mixture of anions]
- 11-12. Purity & Percentage of Metal in Coordination Complexes.
- 13-14. Organometallic Compounds: Synthesis and characterization of Acetyl ferrocene.
15. Preconcentration of Co(II) using ion exchange resin and colorimetric estimation. (Ref-7)

B. Inorganic Practical (12 experiments)

1. Photometric Titrations Cu Vs. EDTA, Fe Vs. EDTA using salicylic acid.
2. Photochemistry of ferrioxalate a) Preparation b) Photochemistry
3. Preparation of complex and Kinetics by conductometry.
4. Preparation of complex and Kinetics by spectrophotometry.
5. To study metal-DNA interaction spectrophotometrically.
- 6-7. A) Synthesis of Tetrakis(triphenylphosphine)nickel(0) and its application for cross coupling reactions.
- 8-9. Synthesis of Ferrocene and its derivative such as Acetyl Ferrocene.
- 10-11. Flame photometry: determination of the ppm of i) sodium by calibration curve method and ii) calcium by standard addition method in the water sample.
12. Determination of phosphate in detergent by spectrophotometry.
13. Atomic absorption spectrophotometer (AAS): Demonstration and determination of amount of iron from tap water sample.
14. Chemical mineralization of pollutants by Fenton's Process (Ref-5)
15. Estimation of Vitamin-C by reaction with Fe(III) and estimation of Fe(II) colorimetrically. (Ref-6)

Each experiment includes standardization of reagents, calibration of instrument with known reagents and analysis of an unknown.

Reference Books:

- 1) Text book of Quantitative Analysis, A.I. Vogel 4th edn (1992).
- 2) Experimental Inorganic Chemistry, Mounir A. Malati, Horwood Series in Chemical Science (Horwood publishing, Chichester) 1999.
- 3) Experiments in Chemistry, D. V. Jahagirdar, Himalaya Publishing House
- 4) General Chemistry Experiments, Anil. J Elias, University press (2002)
- 5) Environmental Chemistry, Microscale Laboratory Experiments, Jorge G. Ibanez, Margarita Hernandez-Esparza, Carmen Doria-Serrano, Arturo Fregoso-Infante, Mono Mohan Singh, published by Springer.
- 6) Vitamin C as a Model for a Novel and Approachable Experimental Framework for Investigating Spectrophotometry, Journal of Chemical Education, DOI:10.1021/acs.jchemed.9b00197.
- 7) Separation, Preconcentration and Spectrophotometry in Inorganic Analysis, by Z. Marczenko and M. Balcerzak, Analytical Spectroscopy Library – 10, Elsevier

Semester-IV

CCTP-10,CHI-430: Heterogeneous Catalysis and its Applications [48L + 12T]

Section - I: Heterogeneous Catalysis [24 L +6 T]

- | | |
|---|------|
| 1. Principles of Heterogeneous Catalysis | [1L] |
| 2. Development of industrial heterogeneous catalysis, Important milestones | [2L] |
| 3. Quantitative aspects of adsorption on solid surfaces | [2L] |
| 4. Basic Adsorption Isotherms and their applications | [1L] |
| 5. Classification of heterogeneous catalysts | [1L] |
| 6. Metals, Bimetals, metal oxides, supported metal catalysis | [2L] |
| 7. Preparation of Solid Catalysts: Precipitation and co-precipitation, impregnation, High temperature fusion and alloy leaching, Hydrothermal synthesis, vacuum pore impregnation, impregnation of porous support | [3L] |
| 8. Post synthetic treatment: Drying, calcinations, activation and forming | [2L] |
| 9. Characterization of Solid Catalysts: BET surface area, temperature programmed techniques (TPD, TPR, TPS, TPO), spectroscopic techniques (XRD, SEM TEM, XPS, FTIR, solid state NMR) | [3L] |
| 10. Metal-Support Interactions, Support selection and role of support | [1L] |
| 11. Chemistry of zeolites: | [2L] |
| a. General Introduction, Nomenclature and classification of zeolites | |
| b. Hydrothermal synthesis Zeolite (eg. ZSM-5) and factors influencing on zeolite synthesis. | |
| c. Zeolite framework structure and selected zeolite framework type such as Sodalite, LTA, FAU, MFI (ZSM-5), MEL (ZSM-11), BEA (zeolite beta). | |
| d. Zeolite characterization by powder XRD method. | |
| 12. Factors Influencing Catalytic Action: Promoters and Poisons, Deactivation and Regeneration of catalyst | [1L] |
| 13. Heterogenization of Transition Metal Complexes to Inorganic Oxides: supported aqueous phase catalyst (SAPC), Supported ionic liquid phase catalyst (SILPC), and Phase transfer catalysis | [2L] |
| 14. Types of Chemical reactors | [1L] |

Section - II: Applications of Heterogeneous catalysis in organic synthesis [24 L +6 T]

- | | |
|---|------|
| 1. Catalysis by acidic solids: Application of zeolites in catalysis: Hydrocracking, Shape selective catalysis, Hydrogen transfer, Catalytic reforming, oxidation catalysis. | [2L] |
| 2. The Fischer-Tropsch (FT) Synthesis Process | [2L] |
| 3. Water Gas Shift Reaction | [1L] |
| 4. Methanol Synthesis | [1L] |
| 5. Alkylation of Aromatics | [1L] |
| 6. Selective Hydrogenation of Hydrocarbons | [2L] |
| 7. Heterogeneous Catalysis for Oxidation of Alcohols | [2L] |
| 8. Photocatalysis: semiconducting oxides w.r.t. Titanium Oxide as Photocatalysts | [2L] |
| 9. Use of BiMoO ₄ as Oxidation and Ammoxidation catalysts | [2L] |
| 10. Conversion of biomass on solid catalysts | [1L] |
| 11. MCM-41 as a catalyst | [2L] |
| 12. Clays and Intercalated clays as catalyst | [1L] |
| 13. Industrial Electrocatalysis | [2L] |
| 14. Catalysis in Environmental Protection: Automotive Exhaust catalysts: The catalytic converter, Perovskite and related oxides as catalysts | [3L] |

References:

1. Handbook of Heterogeneous Catalysis: Wiley International Wiley-VCH Verlag GmbH & Co. KGaA, 2008
2. Catalysis: Concepts and Green Applications: Gadi Rothenberg, Wiley-VCH; First edition, 2015

3. Heterogeneous catalysis by B.Viswanathan and D. K.Chakrabarty, New Age International Private Limited, 2007.
4. Heterogeneous Catalysis for the Synthetic Chemist By Robert L. Augustine, Marcel Dekker Inc. New York, 1996
5. Gerard, V. S.; Ferenc, N. Heterogeneous Catalysis in Organic Chemistry; Academic Press; New York. First edition, 2006.

CCTP-11, CHI-431: Inorganic Nanomaterials: Properties, Applications and Toxicity [48L + 12T]

Section - I: Nano-structural Materials and its Applications [24 L +6 T]

Chapter 1: Nanoscience and Nanotechnology: [6L]

- a) What is nanoscience and nanotechnology?
- b) Natural and artificial nanoparticles
- c) Ancient Nanotechnology
- d) Stalwarts of nanotechnology- Feynman, Drexler and Taniguchi
- e) Moore's law
- f) Basics of nanophotonics.

Chapter 2: Effects of making into small [6L]

- a) Size dependence of material properties
- b) Special properties
 - i. Structural properties
 - ii. Thermal properties
 - iii. Chemical properties
 - iv. Mechanical properties
 - v. Magnetic properties
 - vi. Optical properties
 - vii. Electronic properties
 - viii. Biological properties

Chapter 3: Classification of nanotechnology [6L]

- a) Classification of nanomaterials
- b) Classification of Nanotechnology
 - i. Wet nanotechnology
 - ii. Dry nanotechnology
 - iii. Computational nanotechnology
- c) Concept of 0D, 1D, 2D and 3D nanostructures.

Chapter 4: Applications of nanomaterials [6L]

- a) Carbon nanomaterials
- b) Nanocomposites include metal nanomaterials such as single particle as well as core-shell nanomaterials.
- c) Polymer Nanotechnology
- d) Organic Electronics
- e) Nanotribology
- f) Nanobiotechnology

Section - II: Nanotoxicology and Biosafety [24 L +6 T]

Nanotoxicology

1. Introduction to Nanotoxicology [3L]
2. Nano etymology [3L]
3. Nanotoxicology challenges [2L]
4. Physico-chemical characteristic dependent toxicology [4L]
5. Epidemiological evidences [4L]

6. Mechanism of nanotoxicity	[4L]
7. Assessment of nanomaterial toxicity: In vitro toxicity assessment-cell viability and in vivo toxicity assessment	[4L]
Reference Books:	
<ol style="list-style-type: none"> 1. The Chemistry of Nanomaterials edited by C.N.R.Rao, A.Muller, A.K.Cheetham Wiley-VCH Verlag GmbH & co. Volumes 1&2. 2. Nanomaterials by Dr. Sulbha Kulkarni. 3. T. Pradeep, "A Textbook of Nanoscience and Nanotechnology", Tata McGraw Hill Education Pvt. Ltd., 2012 4. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press, 2008 5. Handbook of Nanotoxicology, Nanomedicine and Stem Cell Use in Toxicology. Saura C Sahu, Daniel A Casciano 	
CBOP-4, CHI-432: A) Material Science (4 Credits) [48L + 12T]	
OR	
B) Inorganic Chemistry Applications in Industry [48L + 12T]	
CBOP-4, CHI-432, Theory: A) Material Science [48L + 12T]	
Section – I: Crystal Defects, Magnetic and Superconducting Materials [24 L +6 T]	
1. Crystal defects and Non stoichiometry , Diffusion in solids, phase transformation in solids, solid state reactions and crystal growth. Preparation methods of solids.	[4L]
2. Magnetic Materials	[12L]
Atomic magnetism and solids, type of magnetic materials, exchange interactions, hysteresis loop and their classification, calculation of magnetic moment from saturation magnetisation, magnetic domains, examples of magnetic materials, soft & hard ferrites, structure & magnetic interactions in spinel, garnet hexagonal ferrites, application of magnetic materials	
3. Superconducting materials	[8L]
Definition, superconductivity, critical temperature, critical field, BCS theory, properties & classification of superconductors, high T _c superconductors, examples with structure and applications, fullerenes, intermetallic superconductors, synthesis, applications	
Section-II: Ceramic, composite, Cementitious and Bio Materials [24 L +6 T]	
1. Ceramic Materials	[6L]
Classification of ceramics, dielectric properties and polarization properties of ceramics, piezo-, pyro- and ferro-electric effect of ceramics, sol-gel processing of ceramics. Examples and application of ceramics: oxides, carbides, borides, nitrides.	
2. Composite Materials	[6L]
Definition, glass transition temperature, fibers for reinforced plastic composite materials (i.e. glass fibers, carbon fibres, and aramid fibers); concretes and asphalt materials. Application of composite material	
3. Cementitious Materials	[8L]
Difference between Blended and Non-Portland cements; Non-portland cements; high alumina cements, calcium sulfoaluminate cements, phosphate cements. Chemicals in cement hydration; hydration process, set retarders and accelerators, plasticizers, slip-casting processing. Application of cementitious materials.	
4. Bio-materials	[4L]
Definition of biomaterials and biocompatibility; Type of bio-materials: Metallic materials, Biopolymeric materials, Bioceramic materials (dense hydroxyapatite ceramics, bioactive glasses, and bioactive composites); Basic requirement of bone implants; Coating of hydroxyapatite on porous ceramics; Biomaterials in tissue attachments; Application of Biomaterials	
References	

1. Solid state Chemistry: An Introduction – L.E. Smart & E.A. Moore, CRC, Taylor & Francis, 3rd Edn.
2. Materials Science & Engineering – V. Raghvan, 2nd Edn.
3. Introduction to Solids – L.V. Azaroff, 2nd Edn. 1980
4. Elements of materials science and engineering – Van Vleck, 5th Edn.
5. Insight to Speciality Inorganic Chemicals – D. Thompson, Royal Society of Chemistry, 1995.

CBOP-4, CHI-432, Theory: B) Inorganic Chemistry Applications in Industry
[48L + 12T]

Section - I: Inorganic Chemistry Applications in Industry [24 L +6 T]

1. Inorganic Chemicals as metallic Corrosion Inhibitors [2L]

Introduction, Principles of corrosion inhibitors, corrosion as an electrochemical process, Practical aspects of corrosion inhibition, Anion inhibitor properties in neutral electrolytes, some application of corrosion inhibitors (cooling water circulation-once through and open systems, engine radiation & cooling systems, central heating system, refrigeration plants and high chloride systems, water for steam raising, corrosion inhibitors for paintcoating).

2. Industrial gases: [4L]

Introduction, Separation of gases from air, Hydrogen, Carbon dioxide, Carbon monoxide, Oxygen, Acetylene, Sulphur dioxide, Nitrous oxides.

3. Chemical explosives and propellants: [6L]

Introduction, Potential energy of explosives, Properties of explosives, Manufacture of explosives, Explosives made by nitration, Dynamite, Commercial high explosives containing no nitroglycerine, Initiating devices, Sporting and military explosives, Disruptive explosives for military use, Handling and storage of explosives.

4. Metal finishing technology: [4L]

Fundamental considerations, Electrodepositions of Copper, Nickel, Gold, Silver, Tin and Tin alloys for Lead free solder, Electrodeposition of Chromium, Electrodeposition of semiconductors, Electroless deposition of Copper and Nickel, Environmental aspects of electrodeposition, Ionic Liquid treatments for enhanced corrosion resistance of Magnesium based substrates.

5. Safety consideration in chemical process industries: [5L]

Introduction, Concern for chemical safety, Hazards and their control in petrochemical industries, Hazards and their control in petroleum refineries and LPG boiling plants, Hazards in storage, Handling and use of chemicals, Chemical storage- safety issues, Observations related to safety aspects, Specific recommendation for hazard control and improved plant safety, Chemical plant safety- from concept to decommissioning.

6. Green Chemistry: [3L]

Introduction, Designing a Green synthesis, Basic Principles of Green Chemistry, Green Chemistry in Day-to- Day life, Green Chemistry in sustainable development.

References:

1. Handbook of Industrial Chemistry, Vol.1, by K.H. Davis, F.S. Berner, Edited by S.C. Bhatia (CBS Publishers, Bangalore, 2004)
2. Industrial inorganic chemistry, Karl Heinz Buchel, Hans-Heinrich Moretto, Peterwoditsch
3. Modern Electroplating, By M. Schlesinger and M. Paunovic (John Wiley and sons, Hoboken, New Jersey, 5th Edition 2010)
4. Insight into Specialty Inorganic Chemicals-David Thompson (The Royal Society of Chemistry, 1995)- Chapter 15.
5. New Trends in Green Chemistry (2nd Edition)-V.K. Ahluwalia and M. Kidwai (Anamaya Publishers, 2007)

Section-II: Inorganic Chemistry Applications in Environments [24 L +6 T]

- 1. Introduction to waste water Analysis: [10L]**
Specification of treated waste water for disposal into surface water, Screening chamber, Grit Chamber, Oil & Grease removal, designing of biological unit- stabilisation pond, Aerated lagoon, Trickling filters, Anaerobic treatment.
- 2. Water Pollutants: [4L]**
Types, Disease causing agents, oxygen consuming waste, suspended solids and sediments, Dissolved solids, Regulation of water quality, Analysis of solids by different techniques.
- 3. Applications of Biotechnology for the treatment of waste water [4L]**
Introduction, Role of microorganism for the treatment of waste water, Application of biotechnology for a. high strength waste. b. Primary and secondary sludge c. Phenol & cyanide removal d. Solid phase extraction
- 4. Energy sources for future: [6L]**
- Solar Energy-Solar heating for homes and other buildings, electricity from solar thermal power collectors, electricity from photovoltaic cells.
 - Energy from biomass- Production of biomass, biofuels, biodiesel.
 - Geothermal energy,
 - water power
 - Tidal power.
 - Fuel Cells-Polymer electrolyte membrane fuel cells, Phosphoric acid fuel cell, Direct methanol fuel cell, Alkaline fuel cell, Regenerative(reversible) fuel cell, Clean cars for the future, Energy sources for the twenty first century.

References:

- Environmental Chemistry by A. K. Bagio.
- Principles of Environmental Chemistry by James Girard Bartlett Publishers.
- Waste Water Engineering by Calf & Eddy.
- Waste Water treatment for pollution control by Arceivala.
- Principles of water quality Control by T. H. Y Tebbut.
- Manual on Sewage & Sewage treatment, Ministry of Works, New Delhi.

CBOP-5, CHI-433: A) Extended Practical in Inorganic Chemistry [96 L + 24T]**A. Preparation and Purity of following complexes of**

- DMG
- 8-hydroxy quinoline
- Salicylaldehyde
- Thiourea
- Thiocarbamate ligand

With Copper, Nickel, Iron, Chromium & Manganese (any three metals)

B: Structural determination of above complexes using following techniques

- UV-Visible spectroscopy
- Magnetic susceptibility
- Thermogravimetric analysis
- IR
- Solution conductivity

C. Introduction to literature survey

Each experiment includes standardization of reagents, calibration of instrument with known reagents and analysis of an unknown.

Reference Books:

- Text book of Quantitative Analysis, A.I. Vogel 4th edn (1992).
- Experimental Inorganic Chemistry, Mounir A. Malati, Horwood Series in Chemical Science

(Horwood publishing, Chichester) 1999.

- 3) Experiments in Chemistry, D. V. Jahagirdar, Himalaya Publishing House
- 4) General Chemistry Experiments, Anil. J Elias, University press (2002)

CBOP-5, CHI-433; B) Project Work [96L + 24T]

Each student will perform project separately. Working hours are same as practical of CHI-433(A). Project length should be sufficient and should be equivalent to minimum 24 practical session of 4 h. ***Project report must be written systematically and presented in bound form: The project will consist of name page, certificate, content, summary of project (2-3 page) followed by introduction (4 to 7 pages), literature survey (4-7) pages (recently published about 30 papers must be included), experimental techniques, results, discussion, conclusions, Appendix consisting of i) references, 2) standard spectra / data if any and 3) safety precautions.*** If student is performing project in another institute, for such a student, internal mentor must be allotted and he will be responsible for internal assessment of a student. In this case student has to obtain certificate from both external and internal mentor. ***Systematic record of attendance of project students must be maintained by a mentor.*** Project will be evaluated jointly by three examiners and there will not be any practical performance during the examination. Typically, student has to present his practical work and discuss results and conclusions in details (20-30 min.) which will be followed by question-answer session (10 min). It is open type of examination.

CCPP-4:CHI-434; Practical -Inorganic Instrumental Analysis and Inorganic Preparations [96L + 24T]

Section-I: Inorganic Instrumental analysis (Equivalent to 12 practical)

1. Magnetic Susceptibility – 2 samples
2. Thermogravimetric studies – 2 samples
3. Catalytic hydrogenation Kinetics of Aquation/Isomerisation - 2experiments
4. Photochemical reactions using Nanoparticles
5. Table work – Four techniques IR, ESR, XRD, CV, NMR
6. Metal DNA interactions (Viscosity & spectrophotometry)
7. Synthetic Copper Oxidase (Copper catalysed oxidation of 2,6,disubstituted Phenols)
8. Cyclic Voltametric study of i)Potassium ferricyanide ii) Ferrocene

Section-II: Preparation of Inorganic Compounds (Equivalent to 12 practical)

Part B Preparation of Inorganic compounds:

Metal complexes

1. Trans-dichloro-bis(ethylene diamine) cobalt (III) chloride
2. [Mn(Salen)]
3. [Mn(acac)₃]
4. Hg [Co(SCN)₄]
5. [Cu(o-phen)₂]
6. Hexa thiocyanato chromate
7. Tris(triphenylphosphine)nickel(II) sulphate.
8. Chloroaquotetraaminocobalt(III) sulphate.
9. [Fe (DTC)₃]

Synthesis of Solid State Materials

1. Zinc Ferrite
2. NiO
3. Nickel Ferrite
4. Nano particles of MnO₂

Each experiment includes standardization of reagents, calibration of instrument with known reagents and analysis of an unknown.

Reference Books:

- 1) Text book of Quantitative Analysis, A.I. Vogel 4th edn (1992).
- 2) Experimental Inorganic Chemistry, Mounir A. Malati, Horwood Series in Chemical Science (Horwood publishing, Chichester) 1999.
- 3) Experiments in Chemistry, D. V. Jahagirdar, Himalaya Publishing House
- 4) General Chemistry Experiments, Anil. J Elias, University press (2002)

3. M.Sc. (II) Organic Chemistry

Course Structure

Sr. No.	Paper No. & Course Code	Course Name	Credits
Semester - III			
1	CCTP-7 CHO-350	Organic Reaction Mechanism and Biogenesis	4
2	CCTP-8 CHO-351	Structure Determination of Organic Compounds by Spectroscopic Methods	4
3	CCTP-9 CHO-352	Stereochemistry and Asymmetric Synthesis of Organic Compounds.	4
4	CBOP-3 CHO-353 Theory	CHO-353-A) Protection - De-protection, Chiron approach and Carbohydrate Chemistry	4
		Or	
		CHO-353B) Designing Organic Syntheses and Heterocyclic Chemistry	4
5	CCPP-3 CHO-354	Practical I: Solvent Free Organic Synthesis	4
Semester – IV			
6	CCTP-10 CHO-450	Chemistry of Natural Products	4
7	CCTP-11 CHO-451	Organometallic Reagents in Organic Synthesis	4
8	CBOP-4 CHO-452 Theory	CHO-452 A) Medicinal Chemistry	4
		CHO-452 B) Applied Organic Chemistry	4
9	CBOP-5 CHO-453 Practical	Practical III: Select any two Sections	4
		Section-I: Ternary Mixture Separation	2
		Section-I: Carbohydrates Synthesis and Isolation of Natural Products	2
		Section-I: Project / Industrial Training/ Internships/ Summer Project	2
10	CCPP-4 CHO-454	Practical II: Convergent and Divergent Organic Syntheses.	4

Equivalence of Previous Syllabus

New Course (2019 Pattern)	Old Course – 2014 Pattern
CHO-350: Organic Reaction Mechanism and Biogenesis	CHO-350 Organic Reaction Mechanism
CHO-351: Structure Determination of Organic Compounds by Spectroscopic Methods	CHO-351 Spectroscopic Methods in Structure Determination
CHO-352: Stereochemistry and Asymmetric Synthesis of Organic Compounds.	CHO-352 Organic Stereochemistry
CHO-353A: Protection - De-protection, Chiron approach and Carbohydrate Chemistry.	CHO-452 Carbohydrate and Chiron Approach/ Chiral Drugs and Medicinal Chemistry
CHO-353B: Designing Organic Syntheses and Heterocyclic Chemistry	CHO-453 Designing Organic Synthesis and Asymmetric Synthesis
CHO-354: Practical I: Solvent Free Organic Synthesis	CHO-347 Single Stage Preparations
CHO-450: Chemistry of Natural Products	CHO-450 Chemistry of Natural Products
CHO-451: Organometallic Reagents in Organic Synthesis	CHO-451 Advanced Synthetic Organic Chemistry
CHO-452B: Medicinal Chemistry	
CHO-452B: Applied Organic Chemistry	CHO-353 Pericyclic Reactions, Photochemistry and Heterocyclic Chemistry
CHO-453: Practical III: Select any two Sections from I, II, III Section-I: Ternary Mixture Separation Section-II: Carbohydrates Synthesis and Isolation of Natural Products Section-III: Project / Industrial Training/ Internships (including Summer Project)	CHO-448 Project/Industrial Training/ Green Chemistry and Chemical Biology Experiments
CHO-454: Practical II: Convergent and Divergent Organic Syntheses.	CHO-447: Double Stage Preparation Preparation

The detailed course wise syllabus of M. Sc-II Organic Chemistry is as follows:

Semester-III

CCTP-7, CHO-350: Organic Reaction Mechanism and Biogenesis [48L+12T]

Section I: Organic Reaction Mechanism, [24 L + 6 T]

1. Methods for determining Reaction Mechanisms

(Kinetic and nonkinetic methods), Ref -1, [4 L]

2. **Free Radicals:** Generation, stability, reactivity, Free radical substitution, addition to multiple bonds, radicals in synthesis, Inter- and intra-molecular bond formation via mercury hydride, tin hydride, thiol donors, cleavage of C-X, C-Sn, C-S, O-O bonds, Oxidative coupling, C-C bond formation in aromatics, S_NAr reactions, Free Radicals in Organic Synthesis. (Ref-2, 3, 6, 7). [8 L]

3. **Linear Free Energy Relationships**, Ref. 3, 4. [6 L]

4. Hammett plots, Hammett equation, substituent constants, reaction constants, use of Hammett plots, calculation of *k* and *K*, Deviations from straight line plots, Taft equation, solvent effects. Ref. 3, 4, 5 [6 L]

Section II: Biogenesis: The Building Blocks and Construction Mechanism, [24 L + 6 T]

1. **Terpenoids:** Mono-, Sesqui-, Di-, tri-terpenoids and cholesterol, Ref.- 8, 9, 10 [6 L]

2. **Alkaloids:** Derived from ornithine, lysine, nicotinic acid, tyrosine and tryptophan. Ref.- 8, 9, 10 [6 L]

3. **The Shikimate pathway:** Cinnamic acids, lignans and lignin, coumarins, flavonoids and stilbens, isoflavanoids and terpenoid quinones. Ref.- 8, 9, 10 [6 L]

3. **A case study:** Alkaloids isolated from the Roots of *Piper nigrum*, Ref. -11, 12 [6 L]

References:

- Mechanism and structure in Organic Chemistry E. S. Gould (Holt, Rinehart and Winston)
- Advanced Organic Chemistry –J. March, 4th edition
- Advanced Organic Chemistry- Part A: Structure and Mechanism- F. A. Carey and R. J. Sundberg, 5th Edition, Springer 2007)
- A guidebook to mechanism in Organic Chemistry- Peter Sykes
- The Hammett Equation by C. D. Johnson
- Organic Chemistry-J. Clayden, N. Greeves, S. Warren, P. Wothers, Oxford University Press
- Radical in Organic Synthesis- B. Giese, Pergamon Press (1986)
- Natural Product Biosynthesis: Chemical Logic and Enzymatic Machinery by Christopher T Walsh, Yi Tang
- From Biosynthesis to Total Synthesis: Strategies and Tactics for Natural Products- Editor Alexandros L. Zografos
- Medicinal Natural Products: A Biosynthetic Approach, 3rd Edition By Paul M. Dewick
- J. Nat. Prod. 2004, 67, 1005-1009.
- J. Org. Chem. 2005, 70, 4, 1164–1176

Additional Study Material: Organic Reaction Mechanism

<https://nptel.ac.in/courses/104/101/104101005/>

<https://nptel.ac.in/courses/104/101/104101115/>

CCTP-8, CHO-351: Structure Determination of Organic Compounds by Spectroscopic Methods [48L +12L]
Section-I: NMR Spectroscopy [24 L + 6 T]

- 1. NMR in Stereochemistry Determination:** Homotopic, enantiotopic and distereotopic protons, Chemical and Magnetic equivalence; First and second order splitting, Complex multiplicity patterns and coupling constants in asymmetric compounds; Simplification of complex spectra, NOE, Diastereomerism, Atrop or axial chirality, % Enantiomeric excess, chiral NMR solvents etc in structure elucidation. **[10 L]**
- 2. ¹³C NMR spectroscopy** - APT, DEPT and INEPT **[6 L]**
- 3. ¹⁵N, ¹⁹F and ³¹P NMR spectroscopy**
Fundamentals and applications in structure elucidation of organic compounds, catalysts and biomolecules. ***(Self learning and for internal assessment only).** **[*0 L]**
- 4. 2D NMR spectroscopy** in structure elucidation: (a)Homonuclear: COSY, TOCSY, 2D-INADEQUATE, 2D- ADEQUATE, NOESY, ROESY (b) Heteronuclear: HSQC, HMQC, HMBC **[8 L]**

Section-II: Mass Spectrometry [24 L + 6 T]

- 1. Mass Spectrometry:** Principle, ionization methods like EI, CI, ES, MALDI and FAB-Fragmentation of typical organic compounds, stability of fragments, Rearrangements, factors affecting fragmentation, ion analysis, ion abundance, High-Resolution mass spectrometry in determination of molecular formula. **[6 L]**
- 2. Applications of Mass Spectrometry:** Determination of the elemental composition, Isotopic Abundance in structure establishment; Analysis of Biomolecules: Proteins and Peptides, Oligonucleotides and Oligosaccharides **[6 L]**
- 3. Problems solving:** Structure elucidation using UV, IR, 1D (1H and ¹³C) NMR and 2D NMR (1H-1H, ¹³C- 1H COSY /HETCOR only), APT, DEPT and MS data as well as spectra. **[12 L]**

References:

- Spectrometric Identification of Organic Compounds by R. M. Silverstein, G. C. Bassler and T. C. Morrill, John Wiley.
- One and Two dimensional NMR Spectroscopy by Atta-Ur-Rehman, Elsevier (1989).
- Organic Structure Analysis-Phillip Crews, Rodriguez, Jaspars by Oxford University Press (1998).
- Organic Structural Spectroscopy by Joseph B. Lambert, Shurvell, Lightner, Cooks, Prentice-Hall (1998).
- Organic Structures from Spectra by Field L.D. Kalman J.R. and Sternhell S. 4th Ed. John Wiley and Sons Ltd.
- Mass Spectrometry Basics by Christopher G. Herbert Robert A.W. Johnstone
- Mass Spectrometry Principles and Applications by Edmond de Hoffmann and Vincent Stroobant.

CCTP-9, CHO-352: Stereochemistry and Asymmetric Synthesis of Organic Compounds [48L + 12T]
Section I- Stereochemistry [24L + 6T]

- Conformations of polysubstituted cyclohexane, six membered rings with SP² carbon, heterocycles with N and O, anomeric effect, stereochemical principles involved in reactions of six membered rings and other than six membered rings, concept of I- Strain. (Ref. 1, 2, 3, 4, 5, 6) **[8 L]**
- A) Stereochemistry of fused and bridged ring systems:** Nomenclature, synthesis; stereochemical aspects of Perhydrophenanthrene, Perhydroanthracene, hydrindane, Steroids; Bridged system (bi, tri and polycyclo system) including heteroatoms, Bredt's Rule. (Ref.-1, 2, 3, 4, 5, 6). **2. B) Conformations of following compounds with**

- justification of each:** cis and trans -1,3- and 1,4-di-t-butyl-cyclohexanes; Cis-4-di-t-butyl-cis-2,5-dihydroxycyclohexane; Twistane; bicyclo- [2.2.2]octane; Trans-anti-trans-Perhydro-anthracene and the lactone; cyclohexane-1,4-dione; 1,2,2,6,6-penta-methyl-4-hydroxy-4-phenylpiperidine; ψ -tropine; 2-hydroxy-2-phenyl quinolizidine; 4-t-butyl-4-methyl-1,3-dioxane; cis- and trans-2,5-di-t-butyl-1,3-dithianes; cis-2,5-di-t-butyl-1,3,2-dioxaphosphorinan-2-one (*Ref. 1, 7, 8*) [8 L]
3. Determination of configuration, Cram's rule, Cram's cycle model, Cram's dipolar model, Felkin-Anh Model; Resolution and analysis of stereoisomers - formation of racemization and methods of resolution. (*Ref. 1, 2, 4*), Stereochemistry of a polymer chain – Types and examples of Tacticity (*Ref. 7*), [8 L]
4. Decalols, Decalones, Octahydronaphthalenes, decahydroquinolines
*(Self learning and for internal assessment only) [*0 L]

1.

References:

1. Stereochemistry of Carbon compounds - E. L. Eliel
2. Stereochemistry of carbon compounds - E. L. Eliel and S. H. Wilen
3. Organic Chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers 1st. Ed.
4. Stereochemistry of organic compounds – Nasipuri
5. Stereochemistry of organic compounds - P. S. Kalsi
6. Organic stereochemistry – Jagdamba Singh
7. Topics in Stereochemistry (Volume 2) By Norman L. Allinger and Ernest L. Eliel.
8. Topics in Stereochemistry (Volume 8) By Ernest L. Eliel and Norman L. Allinger.

Additional Study Material: Stereochemistry

https://nptel.ac.in/content/syllabus_pdf/104105086.pdf

<https://nptel.ac.in/courses/104/105/104105086/>

Section II- Asymmetric Synthesis [24L + 6T]

1. Introduction of Asymmetric Synthesis, Chiral pool and Chiral auxiliaries.
2. Asymmetric Organocatalysis
3. Asymmetric Aldol Reaction, Enantioselective, diastereoselective and double diastereoselective Aldol reactions.
4. Transition Metal-Catalyzed Homogeneous Asymmetric Hydrogenation
5. Transition Metal-Catalyzed Homogeneous Asymmetric Hydroxylation and Epoxidation
6. Asymmetric Phase-Transfer and Ion Pair Catalysis (*Self learning)

References:

1. Catalytic Asymmetric Synthesis, 3rd ed, Ed: I. Ojima, John Wiley & Sons, New Jersey, 2010
2. Catalysis in Asymmetric Synthesis by Vittorio Caprio and Jonathan M. J. Williams
3. Angew. Chem. Int. Edn. 2008, 47, 4638–4660.
4. Principles and Applications of Asymmetric Synthesis by Guo-Qiang Lin, Yue-Ming Li, Albert S. C. Chan, A John Wiley & Sons, Inc., Publication.
15. Organic Chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers 2nd. Ed.

Additional Study material: Catalytic Asymmetric Synthesis

https://nptel.ac.in/content/syllabus_pdf/104103067.pdf

<https://nptel.ac.in/courses/104/103/104103067/>

CBOP-3, CHO-353(A): Protection - De-protection, Chiron approach and Carbohydrate Chemistry OR CHO-353(B): Designing Organic Syntheses and Heterocyclic Chemistr [48L + 12T]

CBOP-3, CHO-353(A): Protection - De-protection, Chiron approach and Carbohydrate

Section I: Protection - De-protection, Chiron approach [24L + 6T]

1. Protection and de-protection of functional group in organic synthesis: Hydroxyl group- alkyl ether, benzyl ether, acyl, PMB, Trityl, TMS, TBDMS, THP, MOM, MEM, MIP ether; **Diol** - Acetone, Cyclohexanone; **Amines**- Benzyl, Acyl, CBZ, BOC, Fmoc, **Carboxyl group**-Ester, DCCI, DIPCDI; **Ketone and aldehydes**- Glycol, Thioglycol, Ketal, Acetal; Orthoesters as protecting groups, Protection de-protection approach - In Solid phase synthesis of polypeptide; polynucleotide, cyclitols, and amino-sugars. (Ref. 1, 2, 3, 4)[12 L]

2. Chiron approach: a) Introduction, b) The concept of chiral templates and chirons wherein the carbon skeleton is the chiral precursor, c) Utilization of the basic concepts in synthesis of (S) Propanediol, (R) and (S) - Epichlorohydrin, L (+)-Alanine, (-) Multistratin, (-) Pentenomycin and (-) Shikimic acid (Ref. 2, 5, 6, 7). [12 L]

Section - II: Carbohydrate Chemistry [24 L + 6T]

a) **Basics of Carbohydrates:** Introduction of sugars, structures of monosaccharides, triose, tetrose, pentose, hexose, D/L forms of aldoses and ketoses in Fischer projections, cyclic hemiacetal forms of monosaccharides, representation of monosaccharide structure (Fischer, Zig-zag, Mills, Haworth projection and Chair conformation), The structure of Glucose, the anomeric configuration, mutarotation (D-Glucose), Conformations of monosaccharides, the anomeric effect. Modified monosaccharides, Alditols, Cyclitols, Nomenclature of monosaccharides, Cyclic forms of the α and β -D-aldoses.

b) **Synthesis of Glycosides:** glycosyl donor acceptor concept, general methods for glycosyl bond formation: Glycosyl halides, Trichloroacetimides, Glycals and Glycal derivatives, Thioglycosides, Phosphites, n-Pentyl glycosides, Sulfoxides Diazirines, Alkylation of reducing sugars

c) **Synthesis of disaccharides, trisaccharides, polysaccharides:** Stereoselective synthesis of α -Mannosides, Synthesis of 2-Deoxy Sugars, Orthogonal strategy in Oligosaccharide synthesis, Effect of protecting groups on glycosylation stereoselectivity and coupling efficiency, Intramolecular glycosylation, Total synthesis of natural products: Oligosaccharides and Glycoconjugates. (Ref. 5, 8, 9, 10, 11, 12)

[24 L]

References:

- Greene's protective groups in organic synthesis – Peter G. M. Wuts and Theodor R. A. Green 4th Edn. Wiley-India
- Organic Chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford Press)
- Modern organic synthesis-An introduction- George S. Zweifel, Michael H. Nantz.
- Advanced Organic chemistry, Part B – F. A. Carey and R. J. Sundberg, 5th edition (2007)
- Chiron Approach in organic synthesis – S. Hanessian
- Organic Chemistry – R. P. Morrison and R. N. Boyd
- Organic Chemistry – I. L. Finar, volume II.
- Essentials of Carbohydrate Chemistry and Biology: Thisbe K. Lindhorst, WILEY-VCH, 2000, Chapter 3.
- Monosaccharides: Their Chemistry and their Roles in Natural Products: Peter M. Collins, Robert J. Ferrier: John Wiley & Sons, 1995.
- Carbohydrate in Chemistry and Biology: Part 1 Chemistry of Saccharides Vol.1. WILEY-VCH, 2000.
- The Organic Chemistry of Sugars; By: Daniel E. Levy Peter Fugedi
Publication: Taylor & Francis, Published on 2006
- Handbook of Chemical Glycosylation by Alexei V. Demchenko, Wiley VCH, 2008

CBOP-3, CHO-353(B): Designing Organic Syntheses and Heterocyclic Chemistry

[48 L + 12 T]

Section I: Designing Organic Syntheses [24 L + 6 T]

1. **Concepts of Retrosynthesis:** Retrosynthetic analysis, disconnection approach, Synthons, multiple step synthesis, functional group interconversion, Illogical two group interconversion, C-C disconnection, Donor and acceptor Synthons, two group disconnection, 1,5 related functional group disconnection, Umpolung, convergent synthesis, special methods for small rings, Heteroatom and Heterocyclic compounds, problems, (*Ref.*-1, 2, 4). [12 L]
2. **Application of Retrosynthetic Approach:** Retrosynthesis and synthesis of following Molecules: Strychnine, Reserpine, Thienamycin, Asteltoxin, Indolizomycin, Erythronolide B. *Ref*-3 [12 L]

References:

1. Designing Organic Syntheses by Stuart Warren
2. Organic Chemistry from Retrosynthesis to Asymmetric Synthesis, by Vitomir Sunjic, Springer; 1st ed. 2016 edition
3. Classics in Total Synthesis by K.C. Nicolaou and E.J.Sorensen

Additional Study material: NPTEL Lecture:

A Study Guide in Organic Retrosynthesis: Problem Solving Approach (https://nptel.ac.in/content/syllabus_pdf/104105087.pdf)

Section II: Advanced Heterocyclic Chemistry [24 L + 6 T]

1. Systematic nomenclature (Hantzsch-Widman System) for monocyclic, fused and bridged heterocycles. Tautomerism in aromatic heterocycles. Strain-bond angle, torsional strains and their consequences in small ring heterocycles. [4 L]
2. General chemical behaviour of heterocyclic compounds and their applications in: Biological systems (Anthocyanins, Flavones, Neurotransmitters), Natural Products (Alkaloids: Nicotin, Quinine), Drugs and Medicines (Omeprazole, Amlodipine, Cilostazol) [4 L]
3. **Synthesis, reactions and structural effects of heterocyclic rings** [16 L]
 - a) Common Methods in Ring Synthesis of Aromatic Heterocyclic Systems: Typical ring synthesis involving C – Heteroatom, C – C bond formations, Electrocyclic processes in heterocyclic Synthesis: 1,3 -dipolar cycloadditions producing five - membered heterocycles, Nitrenes in heterocyclic synthesis, Palladium catalysis in the synthesis of Benzo - Fused heterocycles, Fischer synthesis, Epoxidation, Use of Sulphur Ylides, Azides for small rings
 - b) Three and four membered heterocycles: Aziridines, Oxiranes, Thirienes, Azetidines, Oxitanes and Thietanes
 - c) Five-membered and benzo-fused five membered heterocycles: Oxazole, Isoxazole, Thiazole, Pyrazole, Imidazole, Benzothiazole and Benzimidazole
 - d) Six membered and benzo-fused six membered heterocycles: Pyrazine, Pyridazine, Pyrimidine, Quinazoline, Quinoxaline, Aziridines, Quinoline

Self Learning: Isoquinoline, Indoles

References

1. Heterocyclic Chemistry by T. Gilchrist.
2. An Introduction to the Chemistry of Heterocyclic Compounds by RM Acheson.
3. Heterocyclic Chemistry by J A Joule and K. Mills.
4. Principles of Modern Heterocyclic Chemistry by A Paquette.

5. Heterocyclic Chemistry by J A Joule and Smith.
6. Handbook of Heterocyclic Chemistry by A R Katritzky

Additional Study Material: Heterocyclic Chemistry

https://nptel.ac.in/content/syllabus_pdf/104105034.pdf
<https://nptel.ac.in/courses/104/105/104105034/>

CCPP-3, CHO-354: Practical-I Solvent Free Organic Synthesis**[96L +24T]****Note:**

The students should perform any 24 Syntheses from the following list. Students should acquire **pre-experiment** (Reading MSDS, purification of reactants and reagents, mechanism, stoichiometry etc) and **post-experiment** skills (work-up, isolation and purification of products, physical constants characterization using any spectroscopic methods etc.)

A) Solvent Free Carbon–Carbon Bond Formation

1. Pinacol coupling reaction (Page 36)
2. Reformatsky reaction/Luche reaction (Page 36)
3. Knoevenagel condensation (Page 40)
4. Dieckmann condensation (Page 42)
5. Corrole Synthesis (Page 42)
6. Knoevenagel condensation, 3-carboxycoumarin (Page 45)
7. 3-(ethoxycarbonyl)-4-hydroxy-5-(1-hydroxyalkyl)-2-isoxazoline-2-oxide (Page 46)
8. Biginelli reaction (Page 46)
9. Claisen reaction(Page 47)
10. Pechmann reaction (Page 50)
11. calix[4]resorcinarene (Page 50)

B) Solvent-Free C–N Bond Formation

1. terephthalic acid dihydrazide (Page 205)
2. azomethine synthesis (Page 213)
3. diazepinone synthesis (Page 218)
4. dibenzyl sulfone Synthesis (Page 297)

C) Solvent-Free C–S Bond Formation

1. 1,3-dithiolane synthesis (Page 299/300)

D) Solvent-Free C–X Bond Formation

1. Cinnamic acid/ stilbene halogenations (Page 319)
2. Phenol bromination using , *N*-bromosuccinimide (Page 320)

E) Solvent-Free N–N Bond Formation

1. Triazenes Synthesis (Page 335)
2. Beckmann rearrangement (Page 346)

F) Other Solvent-Free Reactions

1. D-mannitol protection using phenylboronic acid (Page 388)
2. Baeyer-Villiger reaction
3. 2-Hydroxybenzaldehyde oxidation using urea-hydrogen peroxideComplex (Page 13)
4. Alumina-supported permanganate oxidation (Page 15)
5. Sulfide oxidation using MnO₂ (Page 21)
6. Oxidative coupling of thiol using MnO₂ (Page 22)
7. Iodine catalysed S-S bond formation of Cystine (Page 28)

G) Solvent free supramolecular assembly formation

1. Caffeine and oxalic acid (Page 420)
2. *rac*-Bis-beta-naphthol and benzoquinone
3. Isovaleraldehyde and pyrogallol

Reference:

Solvent-free Organic Synthesis by Koichi Tanaka (Copyright © 2009 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, ISBN: 978-3-527-32264-)

Additional Study Material: <https://nptel.ac.in/courses/104/106/104106108/>

Semester IV**CCTP- 10, CHO-450: Chemistry of Natural Products [48L +12T]****Section I: [24 L + 6 T]**

1. Understanding and planning of total synthesis while maintaining the stereochemistry. A case study: **Longifolene** – (All Nine syntheses from Advanced Organic Chemistry Carey, Sundberg; Part B). [12 L]

2. Total Synthesis of

i. Hirsutellone B (Angew. Chem. Int. Ed. 2009, 48, 6870–6874.)

ii. Ribisins A and B : (J. Org. Chem. 2019, 84, 15165–15172)

iii. Subincanadine E : (*For Self-Learning) (J. Org. Chem. 2017, 82, 11126-11133) [12 L]

Section II : [24 L + 6 T]**A) Vannusals**

References:

1. J. Am. Chem. Soc. 2010, 132, 20, 7138-7152.

2. J. Am. Chem. Soc. 2010, 132, 20, 7153-7176.

3. Angew. Chem. Int. Ed. 2009, 48, 5642–5647.

4. Angew. Chem. Int. Ed. 2009, 48, 5648–5652

B) Pinnaic acid

References:

1. Angew. Chem. Int. Ed. 2001, 40 (23), 4450-4452.

2. Angew. Chem. Int. Ed. 2001, 40, (23), 4453-4456.

3. Angew. Chem. Int. Ed. 2007, 46, 5746–5749

CCTP- 11, CHO-451: Organometallic Reagents in Organic Synthesis

[48 L + 12T]

1. Transition metal complexes in organic synthesis; Pd, Ni, Ru, Fe, Ir and Cu only (C-C, C-N, C-O bond formation reactions with catalytic cycle, ligand and % mole concepts)[18 L]

2. C=C formation reactions: Wittig, Horner-Wordworth-Emmons, Shapiro, Bamford-Stevens, McMurry, Julia-Lythgoe and Peterson olefination reactions. [6 L]

3. Multi-component reactions: Ugi, Passerini, Biginelli and Mannich reaction [3 L]

4. Ring formation reactions: Pausan-Khand, Bergman and Nazarov cyclization [3 L]

5. Click chemistry: criterion for click reaction, Sharpless azides cycloadditions. Click reactions in synthesis of bioconjugates (**sugars and proteins**) [4 L]

6. Metathesis: Schrock and Grubbs catalyst, Olefin cross coupling (OCM), ring closing (RCM) and ring opening (ROM) metathesis, application in polymerization and synthesis of small organic molecules. [6 L]

7. Use of Boron and Silicon reagents in organic synthesis. [8 L]

8. Other important reactions: Baylis Hilman, Eschenmoser-Tanabe fragmentation, Mitsunobu reaction. [*Self Learning]

References:

1. C–N bond forming cross-coupling reactions: an overview: by Jitender Bariwalab and Erik Van der Eycken *Chem. Soc. Rev.*, 2013, **42**, 9283

2. Iron Catalysis in Organic Synthesis *Chem. Rev.* 2015, 115, 3170–3387.

3. Recent advances in homogeneous nickel catalysis *Nature* 2014, Vol 509, Page 299-309.
4. Ruthenium-Catalyzed Reactions for Organic Synthesis *Chem. Rev.* **1998**, 98, 2599-2660.
5. Organic Synthesis Involving Iridium-Catalyzed Oxidation *Chem. Rev.* 2011, 111, 1825–1845.
6. Aerobic Copper-Catalyzed Organic Reactions *Chem. Rev.* 2013, 113, 6234–6458.
7. Transition Metals for Organic Synthesis Volume 1 *Edited by M. Beller and C. Bolm* WILEY-VCH Verlag GmbH & Co. KGaA ISBN: 3-527-30613-7
8. Multicomponent Reactions Edited by Jieping Zhu, Hugues Bienayme WILEY-VCH Verlag GmbH & Co. KGaA
9. Organic chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford Press),
10. Some modern methods of organic synthesis – W. Carruthers (Cambridge)
11. Organic synthesis – Michael B. Smith
12. Advanced organic chemistry, Part B – F. A Carey and R. J. Sundberg, 5th edition (2007).
13. Strategic Applications of named reactions in organic synthesis-Laszlo Kurti and Barbara Czako
14. Name Reactions Jie Jack Li (Fourth Expanded Edition), Page No: 1-582.
15. Organic Synthesis Using Transition Metals, by Roderick Bates, Second Edition, A John Wiley & Sons, Ltd., Publication.

**CBOP-4, CHO-452(A): Concepts and Applications of Medicinal Chemistry
OR**

CHO-452(B): Applied Organic Chemistry [48L + 12T]

**CBOP-4, CHO-452(A): Concepts and Applications of Medicinal Chemistry
[48L + 12T]**

Section-I: [24 L + 6 T]

1. Introduction to Peptides and proteins, Proteins as biological catalyst Nucleic acids, Metabolism, Chemistry of cofactors/coenzymes, Chemistry of TPP, PLP, Folic Acid and other vitamins, Principle of drug design, Chemistry of diseases and Drug development, Proton pump inhibitors and Problem solving. [8 L]
Additional study material: NPTEL lecture: Organic Chemistry in Biology and Drug Development (full course) https://nptel.ac.in/content/syllabus_pdf/104105120.pdf
<https://nptel.ac.in/courses/104/105/104105120/>
2. Peptides, sequencing and applications in therapeutics, Solution phase and solid phase peptide synthesis and Modern techniques for biomolecules and disease diagnosis. [6 L]
Additional study material: NPTEL lecture (only 3 topics): Essentials of Biomolecules: Nucleic Acids and Peptides https://nptel.ac.in/content/syllabus_pdf/104103121.pdf
<https://nptel.ac.in/courses/104/103/104103121/>
3. Introduction to medicinal Chemistry. History, drug targets, Drug discovery, design and development, Case Study: Design of Oxamniquine. [4 L]
4. Pharmacokinetics and Pharmacodynamics of drug: Drug absorption, distribution, metabolism, elimination and toxicity, drug metabolism, biotransformation, Drug receptor interactions, Hansch Equation and significance of terms involved in it. [6 L]

Section II:	[24 L + 6 T]
<p>1. Structure and activity Relationship: QSAR, Applications of SAR and QSAR in drug design, physio-chemical parameters lipophilicity, partition coefficient, electronic ionization constant, Case Study: Statins [10 L]</p> <p>2. Introduction, Developments, SAR, Mode of action, limitations and adverse effect of Anti-infective Agents, Beta lactam antibacterial agents (Penicillins, Cephalosporins), Tetracyclins, Macrolides, Chloramphenicol, Polyenes, Amphotrecin-B, Azoles, Amantadine, Acyclovir, Quinine, Quinolines, Quinolones, Refamycine, Sulphonamides [14 L]</p>	
References:	
<ol style="list-style-type: none"> 1. Medicinal Chemistry and Drug Discovery by Burger 2. Introduction to Medicinal Chemistry by Grham and Patrick 3. Introduction to Drug Design by J. R. Dimmock and S.S. Pandeya 4. The Organic Chemistry of Drug Design and Drug Action, 3rd Edition, R. B. Silverman, Academic Press, 2014 5. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F Dorge, 12th Edition, 2010 6. Chemistry of Heterocycles by T. Eicher and S. Hauptmann, Thieme 	
CBOP-4, CHO-452(B): Applied Organic Chemistry [48 L + 12T]	
Section-I:	[24 L + 6 T]
<p>1. Covalent Organic Frameworks: Structures, Synthesis, and Applications. [12 L] (Ref: Review article by Maria S. Lohse and Thomas Bein <i>Adv. Funct. Mater.</i> 2018, 28(33), 1705553.)</p> <p>2. Organic Electroluminescent Materials, [12 L] (Ref: Review article by L.S. Hunga and C. H. Chen <i>Materials Science and Engineering</i> 2002, R 39, 143–222)</p>	
Section –II :	[24 L + 6 T]
<p>1. Supramolecular Organic Compounds [8 L] (Ref: Review by Matthew C. T. Fyfe and J. Fraser Stoddart <i>Accounts of Chemical Research</i> 1997, 30 (10), 393-401.) (Ref: Review article by Wei Chen and et al. <i>Chem. Soc. Rev.</i>, 2015, 44, 2998-3022)</p>	
<p>2. Single Molecule Switches [8 L] (Refs: Review article by Wei Chen and et al. <i>Chem. Soc. Rev.</i>, 2015, 44, 2998-3022.)</p>	
<p>2. Molecular Machines [8 L] (References:</p> <ol style="list-style-type: none"> 1. Review article by David A. Leigh and et al. <i>Chem. Rev.</i> 2015, 115, 10081–10206. 2. Redox-Gated Tristable Molecular Brakes of Geared Rotation. <i>J. Org. Chem.</i>, 2017, 82(10), 5354-5366. 3. Massimo Baroncini, Serena Silvi, Alberto Credi. <i>Chem. Rev.</i> 2020, 120 (1), 200-268). 	
References:	
<ol style="list-style-type: none"> 1. The Chemistry of Metal–Organic Frameworks- Wiley Online. Print ISBN: 9783527338740, Online ISBN:9783527693078, DOI:10.1002/9783527693078 2. Covalent Organic Frameworks - 1st Edition - Atsushi Nagai, ISBN 9789814800877, Published January 24, 2020 by Jenny Stanford Publishing. 	

**CBOP-5, CHO-453: Practical-III: Select ANY TWO Section I, II and III
[96 L + 24 T]**

Section-I: Ternary Mixture Separation [48 L + 12 T]

Separation of minimum 12 mixtures containing three components. The mixtures should also involve separation of nitrophenols, amino acids, low boiling and water soluble and insoluble compounds solids and liquids with **multifunctional groups**. The mixture separation should be carried out on micro-scale using ether or water.

The students should be able to

1. Understand and employ concept of type determination and separation
2. Meticulously record physical constants
3. Perform micro scale chemical elemental analysis
4. Perform qualitative estimation of functional groups
5. Recrystallize /distill the separated compounds
6. Extend these skills to organic synthesis

**Section-II: Carbohydrates Synthesis and Isolation Natural Products
[48 L + 12 T]**

Unit I: Carbohydrate Synthesis (Any 3)

- 1) Synthesis and structural determination of α - and β -D-glucose penta- acetate.
- 2) Selective deacylation of α - and β -D-glucose penta-acetate.
- 3) Benzoylation of D-glucose.to D-glucose penta-benzoate.
- 4) Selective debenzoylation of D-glucose penta-benzoate
- 5) Synthesis 1,2:5,6-di-O-isopropylene-D-glucofuranose.
- 6) Synthesis of 1,2: 5,6 – di-O-isopropylene-3-O-benzyl –D-glucofuranose.

Note:

Carbohydrate (sugar molecules) are highly soluble in water, to derivatives the sugar molecules require special practical skill in order to get product in hand.

- i) To understand the meaning of dry condition in reaction.
- ii) How to prepare dry solvents.
- iii) Workup of reaction in minimum quantity of water.
- iv) To acquire skill in handling of carbohydrates reaction.

Unit II: Isolation of pigments from the natural products (Any 3)

1. Orange Marigold
2. Rose
3. Sunflower
4. Hibiscus
5. Any colored flowers/fruits available in the local area (**only one is allowed**).

Note: Students should be able to collect reasonable quantities of color pigments to do the characterization (Physical Constant, Elemental analysis functional group test etc) and should also form the appropriate derivative. They are encouraged to use these pigments for developing food grade natural colors from lesser known plant sources.

Unit III: Isolation of essential oils from the natural products (Any 3)

1. Ginger
2. Lemongrass
3. Garlic
4. Ajwain/ajowan/Trachyspermum ammi
5. Vekhand (achourus calamus) root

6. Any natural products available in the local area (**only one is allowed**)

Note: Students should be able to collect a reasonable quantities of essential oils to do the characterization (Physical Constant, Density, Elemental analysis functional group test) Should form the appropriate derivative. They are encouraged to use these essential oils for the development of the products like soap, perfumes etc.

Unit IV: Isolation of medicinally important component from the natural products (Any 3)

1. Nimbin from Neem leave
2. Amyrin from Apati/Apta bark
3. Eujenol from Tulsi leaves
4. D-Galacturonic Acid from Jeshtamadh
5. Piper from Betel leaf

6. Any medicinally important plants available in the local area (**only one is allowed**)

At least one natural product should be isolated by using column chromatographic techniques (Use micro columns to avoid excess use of solvents)

Note: Students should be able to collect a reasonable quantities natural products to do the characterization (Physical Constant, solubility, Elemental analysis functional group test etc) and should also form the appropriate derivative. They are encouraged to study novel medicinal plants from their local area.

References for Carbohydrates:

1. Essentials of Carbohydrate and Chemistry and Biology: Thisbe K. Lindhorst, WILEY-VCH, 2000.
2. Kawanata , K. P. R. Tetrahedron Lett. 1986, 27, 3415.
3. Bessodes, M., Shamszar, J. Antonakies, K., Synthesis, 1988, 560.

Section-III: Project [48 L + 12 T]

Project/ Industrial Training/Summer Training/ Internships

1. Students should carry out a small research project.
2. This should make them familiar with
 - i. Literature survey, research methodologies
 - ii. Data Analysis
 - iii. Column and TLC chromatographic techniques
 - iv. Characterization of the products by analytical and spectral methods.
3. **Project report must be written and submitted in a proper format as follows;**
 - i) Certificate (Signed by Project guide and Head of the Department)
 - ii) Certificates for Poster/Paper presented in conferences (if any)
 - iii) Self declaration certificate for plagiarism
 - iv) Introduction (not more than 6 pages)
 - v) Results and Discussions
 - vi) Experimental Section
 - vii) Conclusion
 - viii) References (Use ACS format)
 - ix) Spectroscopic or other relevant supporting data
 - x) Acknowledgement
4. Interdisciplinary projects shall be encouraged; however there **must be some organic chemistry component.**
5. Students should spend enough time for the project works (**at least 4 hours per week for 15 weeks**)
6. At least 30% students should undertake projects/summer training/Internships etc.
7. If student is performing project in another institute, for such a student, internal mentor must be allotted and he will be responsible for internal assessment of a student. In this

case student has to obtain certificate from both external and internal mentor. **Systematic record of attendance of project students must be maintained by a mentor.** Project will be evaluated jointly by three examiners and there will not be any practical performance during the examination. Typically, student has to present his practical work, discuss results and conclusions in details (20-30 min.) which will be followed by question-answer session (10 min). It is open type of examination.

CCPP-04, CHO-454: Practical-II: Convergent and Divergent Organic Syntheses [96 L + 24T]

Note: Any 3 sets should be conducted from the following convergent and divergent synthesis sets.

Students should acquire **pre-experiment** (Reading MSDS, purification of reactants and reagents, mechanism, stoichiometry etc) and **post-experiment skills** (work-up, isolation and purification of products, physical constants characterization using any spectroscopic methods etc.)

SET-I

A) Convergent Synthesis 1 (Three Stage Synthesis)

1. Stage I: Anisole to 4-nitro anisole to 4-amino anisole (2 steps)
2. Stage II: Toluene to 4-nitro toluene to 3-acyl nitro toluene (2 steps)
3. Stage III: Synthesis of N-(1-(2-methyl-5-nitrophenyl) ethyl) aniline from 4-amino anisole, 3-acyl nitro toluene and SBH (One pot synthesis: MCR)

B) Divergent Synthesis 1 (5 Single Stage Synthesis from Acetyl acetone):

1. Acetyl acetone to Pyrimidine
2. Acetyl acetone to 2,4-dimethyl-1H-benzo[b][1,4]diazepine
3. Acetyl acetone to Pyrazole
4. Acetyl acetone with 1mmol benzaldehyde to 3-benzylidenepentane-2,4-dione
5. Acetyl acetone with 3 mmol benzaldehyde into 3-benzylidene-6-phenylhex-5-ene-2,4-dione

SET-II

A). Convergent Synthesis 2(Three Stage Synthesis)

1. Stage I: 4-Nitro toluene to 4-amino toluene (Reduction by using Sn/HCl)
2. Stage II: Phenol into 2-hydroxy benzaldehyde (Reimer-Tiemann reaction)
3. Stage III: Synthesis of amidoalkyl-2-naphthols from β -Naphthol, 4-amino toluene and of 2-hydroxy benzaldehyde (One pot synthesis: MCR)

B). Divergent Synthesis (5 Single Stage Synthesis from β -Naphthol)

1. β -Naphthol to Synthetic dye (By diazonium coupling)
2. β -Naphthol to 6-Bromo-2-naphthol (Bromination reaction)
3. β -Naphthol to β -Naphthyl methyl ether (Methylation reaction)
4. β -Naphthol to temperature dependent sulfonation (Sulfonation reaction)
5. β -Naphthol to (\pm) Binol then Resolution of Binol (Resolution technique)

SET-III

A). Convergent Synthesis-3 (Three Stage Synthesis)

1. Stage I: Salicylic acid to 5-Chloro-2-hydroxybenzoic acid
2. Stage II: o- Anisidine to 2-methoxy-4-nitroaniline
3. Stage III: Synthesis of 5-chloro-2-hydroxy-N-(2-methoxy-4-nitrophenyl) benzamide from 5-Chloro-2-hydroxybenzoic acid, -methoxy-4-nitroaniline (One pot synthesis: MCR)

B). Divergent Synthesis-3 (5 Single Stage Synthesis from Salicylaldehyde)

1. Salicylaldehyde to Salicylaldehyde phenylhydrazone
2. Salicylaldehyde with melanonitrile to 2-iminochromene by intramolecular cyclization.
3. Salicylaldehyde to 2-hydroxy-3,5-dinitrobenzaldehyde

4. Salicylaldehyde to o-Formylphenoxy acetic acid
5. Salicylaldehyde to catechol

SET-IV**A) Convergent Synthesis- 4 (Three Stage Synthesis)**

1. Stage I: Benzene to acetophenone (F.C acylation)
2. Stage II: 4-Nitrochlorobenzene into 4-amino chlorobenzene (Reduction by using hydrazine)
3. Stage III: Quinoline synthesis by using acetophenone, 4-amino chlorobenzene and styrene (One pot synthesis: [3 + 2 + 1] cycloaddition reaction)

B). Divergent Synthesis-4 (5 Single Stage Synthesis from Acetophenone)

1. Acetophenone to Ethyl benzene by Wolf Kishner reduction
2. Acetophenone to m-Nitro acetophenone by nitration
3. Acetophenone to Chalcone using aromatic aldehyde
4. Acetophenone into Schiff base using aromatic amine
5. Acetophenone to Benzoic acid and Iodoform

References

1. Practical organic chemistry by Mann and Saunders
2. Text book of practical organic chemistry –by Vogel
3. The synthesis, identification of organic compounds –Ralph L. Shriner, Christine K.F.
4. Hermann, Terence C. Morrill and David Y. Curtin

Important Notes for Practical Courses

- All experiments should be carried out on micro-scale and by considering stoichiometric quantities of reactants and reagents with the proper understanding of the mechanism.
- Post graduate departments should arrange at least **one study visit to relevant industry/national research laboratory/premier academic institute.**
- Students must read MSDS and should handle chemicals and reactions accordingly.
- The necessary reactions should be carried out in fume hood and appropriate safety measures should be taken during the laboratory experiments and projects.
- All reactions should be **monitored using alumina coated TLC plates.**
- Certified journals should be presented at the time of final examination.
- Students opting for the projects are encouraged to participate in AVISHKAR, national and international conferences and other project competitions.
- Teachers are encouraged to give the project ideas based on the societal needs.

4. M. Sc. (II) Drug Chemistry Course Structure

Sr. No.	Paper No.	Course Name	Credit
Semester – III			
1	CCTP-7 CHD-360	Advanced Analytical Methods	4
2	CCTP-8 CHD-361	Drug Discovery and Development	4
3	CCTP-9 CHD-362	Stereochemical Principles and Applications	4
4	CBOP-3 Theory CHD-363	CHD-363(A) Chemistry of Heterocycles and Biologically active Molecules	4
		CHD-363(B): Any two sections	4
		Sec-I: Microbiology, Immunology	2
		Sec-II: Bioinformatics, Biostatistics in Drug Discovery	2
		Sec-III: Entrepreneurship Development	2
5	CCPP-3 CHD- 364	Practical-I: Two Stage Preparation	4
Semester-IV			
6	CCTP-10 CHD-460	Advanced Medicinal Chemistry	4
7	CCTP-11 CHD-461	Drug Design	4
8	CBOP-4 Theory CHD-462	CHD-462(A) Advanced Synthetic Methods in Chemistry	4
		OR	
		CHD-462(B) Supramolecular, Green Chemistry and Forensic chemistry	4
9	CBOP-5 Practical CHD-463	Practical-III: Select any two sections from I, II, III, IV	4
		Section-I: Microbiology, Drug Chemistry	
		Section-II: Practical For Forensic Chemistry	
		Section-III: Ternary Mixture Separation	
		Section-IV: Project / Industrial Training	
10	CCPP-4 CHD- 464	Practical-II: Synthesis of Heterocycles and Drug Molecules	4

Equivalence to Previous Syllabus

New Syllabus 2019 pattern		Old Syllabus 2014 syllabus	
CCTP-7 CHD-360	Advanced Analytical Methods	CHD-362	Advanced Analytical Methods
CCTP-8 CHD - 361	Drug Discovery and Development	CHD-363	Microbiology, Immunology & Drug Discovery and Development
CCTP-9 CHD -362	Stereochemical Principles and Applications	CHD-364	Stereochemistry, Assymmetric synthesis and Pericyclic Reactions
CBOP-3 Theory CHD-363	A) Chemistry of Heterocycles and Biologically active Molecules	CHD-361	Chemistry of Heterocycles and Drug Synthesis
	B-I) Microbiology, Immunology		No Equivalence
	B-II) Bioinformatics, Biostatistics in Drug Discovery		No Equivalence
	B-III) Entrepreneurship Development,		No Equivalence
CCPP –3 CHD - 364	Practical-I: Two Stage Preparation	CHD- 367	Practical Course I Organic Synthesis
CCTP –10 CHD - 460	Advanced Medicinal Chemistry	CHD- 462	Advanced Medicinal Chemistry
CCTP –11 CHD - 461	Drug Design	CHD- 463	Principles and applications in Drug Design
CBOP-4 Theory CHD-462	A) Advanced Synthetic Methods in Chemistry	CHD- 461	Advanced Organic Synthesis- Principles and Strategies
	B) Supramolecular, Green Chemistry and Forensic Chemistry		No Equivalence
CBOP-5 Practical CHD-463	Practical-III: I) Microbiology, Biochemistry	CHD- 468	Practical Course II Microbiology and Biochemistry
	II) Practical on Forensic Chemistry		No Equivalence
	III) Ternary Mixture Separation		No Equivalence
	IV) Project / Industrial Training	CHD- 469	Practical Course III Project /Industrial training
CCPP – 4 CHD - 464	Practical-II: Synthesis of Heterocycles and Drug Molecules	CHD- 469	Practical Course III Project /Industrial training / Advanced practical

The detailed course wise syllabus of M. Sc-II Drug Chemistry is as follows:

Semester-III	
CCTP-7, CHD-360: Advanced Analytical Methods [48L + 12T]	
SECTION I: Spectroscopy-I [24 L +6 T]	
1. ¹H NMR Spectroscopy	[14 L]
<p>Recapitulation: shielding and deshielding, Chemical shift, factors influencing chemical shift, Chemical and magnetic shift equivalence. Chemical shift(δ): correlation for protons bonded to carbons (aliphatic, olefinic, aldehydic, aromatic) and other nuclei (oxygen and nitrogen);</p> <p>Spin-spin splitting: (n+1) rule, origin of spin-spin splitting, pascal triangle. Coupling Constant (J): Mechanism of coupling, Type (Geminal, vicinal coupling, long range and W coupling), factors effecting geminal and vicinal coupling constant; Spin System: classification of spin system, spin notations (A₂, AB, AX, AB₂, AX₂, ABC, ABX, AMX, A₂B₂, A₂X₂), complex spin-spin interaction between two, three and four nuclei (First Order Spectra and Second order spectra); Simplification of complex spectra: nuclear magnetic double resonance, spin decoupling, contact shift reagents, solvent effects, chiral resolving agent, nuclear overhauser effect (NOE), resonance of other nuclei like ³¹P, ¹⁹F. Problems and Assignment of PMR signal</p>	
2. ¹³C NMR spectroscopy	[10 L]
<p>Recapitulation: ¹³C Nucleus, Chemical Shift and factor affecting ¹³C NMR, Types of ¹³C NMR Spectra: proton coupled (spin-spin splitting), Proton decoupled, Off resonance, Pulse sequence: spin and magnetization vector, DEPT, APT and NOE, Coupling constants: Homo nuclear (¹³C-¹³C) and Hetero nuclear (¹³C-¹H, ¹³C-¹⁹F, ¹³C-³¹P). Problems and Assignment of ¹³C NMR signal</p>	
SECTION II: Spectroscopy-II [24 L +6 T]	
3. Correlation Spectrometry; 2D NMR	[04 L]
<p>Pulse sequence in 1 D and 2 D spectra, type of 2D (Homo and Hetero nuclear); 2D in structure determination: ¹H- ¹H Correlation spectroscopy (COSY), Double Quantum Filtered COSY (¹H-¹H), Heteronuclear Correlation (HETCOR, HMQC and HMBC); Applications: INADEQUATE, Totally correlated spectroscopy (TOCSY), NOESY and ROESY experiments.</p>	
4. Mass Spectrometry	[10 L]
<p>Instrumentation, various methods of ionization: Gas phase ionization (electron impact and Chemical) Desorption ionization (field desorption, FAB, Plasma, Laser), Evaporative ionization (Thermospray and Electrospray mass spectrometry); Detectors: Quadrupole mass filter, time of flight (TOF). EI mass spectra interpretation: intensity of molecular ion peak, base peak, fragment ion peak and isotope peak (M+1, M+2); Nitrogen Rule, Molecular formula determination (Rule of 13). Fragmentation Pattern and McLafferty rearrangement. Fragmentation of functional groups: Hydrocarbons, Ether, Aldehyde, Ketone, Carboxylic Acid, Ester, Amide, Sulfur and halogen compound.</p>	
5. Problems based on joint application of UV, IR, PMR, CMR, Mass and 2-D NMR. [10 L]	
References	
<ol style="list-style-type: none"> 1. Introduction to Spectroscopy – D. L. Pavia, G.M. Lampman, G. S. Kriz, 3rd Ed. (Harcourtcollege publishers). 2. Spectrometric identification of organic compounds R. M. Silverstein, F. X. Webster, 7th Ed. John Wiley and Sons. 3. Spectroscopic methods in organic chemistry – D. H. Williams and I. Flemming Mc Graw Hill 	

4. Absorption spectroscopy of organic molecules – V. M. Parikh
5. Nuclear Magnetic Resonance – Basic Principles- Atta-Ur-Rehman, Springer-Verlag (1986).
6. One- and two-dimensional NMR Spectroscopy – Atta-Ur-Rehman, Elsevier (1989).
7. Organic structure Analysis- Phillip Crews, Rodriguez, Jaspars, Oxford University Press (1998)
8. Organic structural Spectroscopy- Joseph B.Lambert, Shurvell, Lightner, Cooks, Prentice-Hall (1998).
9. Organic structures from spectra –Field L.D., Kalman J.R. and Sternhell S. 4th Ed. John Wiley and sons Ltd.
10. Spectroscopic identification of organic compound- R M Silverstein, G C Bassler and T CMorril, John Wiley
11. Introduction to NMR spectroscopy-R J Abrahm, J Fisher and P loftus Wiley
12. Organic spectroscopy-William kemp, E L B with McMillan
13. Spectroscopy of organic molecule-PS Kalsi,Wiley, Esterna, New Delhi
14. Organic spectroscopy-RT Morrison and RN Boyd
15. Practical NMR spectroscopy-ML Martin, J J Delpench, and D J Martyin
16. Spectroscopic methods in organic chemistry-D H Willson, I Fleming
17. Spectroscopy in organic chemistry- C N R Rao and J R Ferraro
18. NMR –Basic principle and application-H Guntur
19. Interpretation of NMR spectra-Roy H Bible
20. Mass spectrometry organic chemical applications, J H Banyon

Learning Outcome

1. Understand the principle, working and application of Nuclear magnetic resonance spectroscopy.
2. Understand the use of coupling constant values in structure determination.
3. Understand the principle, working and application of Mass spectrometry.
4. Understand the structure elucidation using combined spectroscopic data.

CCTP-8, CHD-361: Drug Discovery and Development [48L + 12T]**SECTION-I: Drug Discovery****[24 L +6 T]**

1. Introduction to drugs, History and classification, their action and discovery **[2L]**
2. Drug targets- lipids, carbohydrates, proteins, and nucleic acids **[4L]**
3. Sources of drugs, Microbial, Plant, Marine, synthetic, A historical perspective. **[4L]**
4. Introduction to the different systems of medicines-Ayurveda, Allopathy, Unani and Homeopathy **[6L]**
5. Routes of drug administration, formulation of Dosage forms, Types of dosage forms **[8L]**

SECTION-II: Drug Development**[24 L +6 T]**

1. **Discovery and Development of Drugs** **[8L]**
History of drug discovery, Strategies in drug discovery, lead discovery, pharmacophore identification, lead development, Bioassays, screening of compounds.
2. **Toxicological evaluation of new drugs** **[8L]**
Pre-Clinical testing, Clinical trials, Bioavailability of drugs, Bioequivalence
3. **Patents and intellectual property rights** **[4L]**
4. **Pharmacokinetics and Pharmacodynamics of drug action** **[4L]**
From R & D to plant, QA, QC scale up process. GMP, FDA Documentation, Pharmacopeia, Industrial hygiene and safety

References

1. Medicinal Chemistry an Introduction-Gareth Thomas 2nd Ed. Wiley
2. An introduction to medicinal chemistry-Graham L. Patrick 5th Ed. Oxford

3. Introduction to Medicinal Chemistry-Alex Gringauz (Wiley)
4. Comprehensive Medicinal Chemistry Vol-I (Hansch (1990) Pergamon press
5. Principle of Drug action-Goldstein.
6. Bioavailabinty and Bio equivalence-H.P.Tinis.
7. Pharmacoepia of India, British pharmecoepia, US Pharmacoepia
8. Pharmaceutical Dosage forms and Drug Delivery system VIthEdn. .Arnel (Wessl
9. Organic Chemistry of Drug Design and Drug Action. R.B.Silverman (1993) Academic Press

Learning Outcomes:-

1. Student should understand the various systems of medicines.
2. To understand concept of drug and different sources of drugs.
3. Student should able to learn lead discovery and pharmacophore identification.
4. To know about bioassays and toxicological evaluation of new drugs.
5. Student should understand the pre-clinical testing and clinical trials.
6. Student should able to understand the concept of Patents and intellectual property rights.
7. To know about Pharmacokinetics and Pharmacodynamics of drug action.
8. Student should able to understand the different dosage forms of drugs.

CCTP-9, CHD-362: Stereochemical Principles and Applications [48L + 12T]**SECTION - I Stereochemistry****[24 L +6 T]****1. Stereochemistry of six membered rings-**

Relation to physical properties, conformation and chemical reactivity, conformational effects in six membered rings containing unsaturation. **[8L]**

2. The shapes of rings other than six membered rings: five membered, medium rings, transannular effects, concept of I strain – **[6L]**

3. Fused rings and bridged rings **[6L]**

4. Stereochemistry of Drug molecules

Saquinavir (HIV protease inhibitor), Abiraterone (drug for prostate cancer), ephedrine and pseudoephedrine, *R- and S-enantiomers of Ibuprofen* (non-steroidal anti-inflammatory), *R- and S-enantiomers of thalidomide*. **[4L]**

SECTION II: Principles and Applications of Asymmetric Synthesis [24 L +6 T]**1. Principles and applications of asymmetric synthesis:**

Stereoselectivity in cyclic compounds, enantio-selectivity, diastereo-selectivity, enatiomeric and diastereomeric excess, stereoselective aldol reactions. Cram's rule, Felkin Anh rule, Cram's chelate model, Asymmetric synthesis, use of chiral auxiliaries, chiral reagents and catalysts, asymmetric hydrogenation, asymmetric epoxidation and asymmetric dihydroxylation. Synthetic and Industrial applications. **[18L]**

2 Racemization and Resolution methods **[04L]****3. Stereochemistry of a polymer chain – Types and examples of Tacticity** **[02 L]****References:**

1. Stereochemistry of carbon compound-by E.L. Eliel
2. Stereochemistry of organic compound-by Nasipuri
3. Stereochemistry of carbon compounds – E. L. Eliel and S. H. Wilen
4. Organic Chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers,
5. Topics in Stereochemistry (Volume 2) By Norman L. Allinger and Ernest L. Eliel
6. Stereochemistry of organic compounds-P. S. Kalsi
7. Organic stereochemistry – Jagdamba Singh

Learning Outcome:

On the successful completion of the course, students will be able to:

1. Understand the stereochemistry, reactivity and conformational effects of six membered rings.
2. Understand the stereochemistry, shapes of rings other than six membered rings.
3. Understand the role various resolution methods, stereoselective synthesis and asymmetric synthesis.
4. Understand the stereochemistry of polymer chain.

CBOP-3, CHD-363(A) : Chemistry of Heterocycles and Biologically active Molecules

OR

CBOP-3, CHD-363(B) : Any two section from I, II, III

Section-I : Immunology and Microbiology.

Section-II : Bioinformatics, Biostatistics in Drug Discovery

Section-III: Entrepreneurship Development

CBOP-3, CHD-363(A) - Chemistry of Heterocycles and Biologically active Molecules [48L + 12T]

Section-I: Chemistry of Heterocycles

[24 L + 6 T]

1. **Condensed five membered heterocycles:** Indole, Benzofuran and Benzothiophene- Nomenclature, reactivity, synthesis and reactions. **[6L]**
2. **Condensed six membered heterocycles:** Quinoline, Isoquinoline, Coumarines and Chromones- Nomenclature, reactivity, synthesis and reactions. **[6L]**
3. **Five membered, condensed five member, six membered and condensed six membered heterocycles with more than one heteroatom-** Oxazole, imidazole, Thiazole, 5ydrazine, pyrazole, isothiazole, triazole (1,2,3-triazole, 1,2,4-triazole), pyrimidine, pyrazine, oxazine, thiazine, benzimidazole, benzoxazole, benzthiazole Nomenclature, reactivity, synthesis and reactions. **[12L]**

Section-II: Chemistry of Biologically Active Natural And Synthetic Molecules

[24 L +6 T]

1. Synthesis of biologically active natural products: Prostaglandin PGF₂, Cephalosporin-C, Reserpine, Taxol, Periplanone B, Aspidophytine Penicillin, Griseofulvin. **[12L]**
2. Synthetic Drugs and their derivatives: Nalidixic acid, metronidazole, Ciprofloxacin, Ibuprofen, Atenolol, Captopril, Diazepam, Chloroquine, Barbiturates, pyrazinamide, Miconazole, Omeprazole, Astemizole, Orcanozole, lomustine, carmustine, procarbazine, Ranitidine. **[12L]**

Learning Outcomes

1. Knowledge of name reactions in synthesis
2. Different application of name reactions
3. Drug molecule and their uses in treatment
4. Synthetic strategy involved in preparation
5. Recent drug developments

References

1. John A. Joule, Keith Mills.; Heterocyclic Chemistry, 5th Edition, April 2010, ©2010, WileyBlackwell, ISBN: 978-1-4051-3300-5.
2. Gilchrist, T. L. Heterocyclic chemistry; 3rd ed.; Addison Wesley Longman: Edinburgh Gate
3. Joule, J. A.; Mills, K.; Heterocyclic chemistry; 4th ed.; Blackwell Science: Oxford, 2000.
4. An Introduction to Medicinal chemistry: Graham, Patric third edition
5. Classics in total synthesis- More target, Strategies, methods-Nicolaou- Snyder, (Wiley-VCH)
6. The organic Chemistry of drug synthesis-Daniel Lednicer, Lester A. Mitscher (Wiley and

Sons) vol-3

7. Classics in Total Synthesis- Target, Strategy, methods-Nicolaou- Sorensen, (Wiley-VCH)

CBOP-3, CHD – 363(B): Any two section from I, II, III**Section-I: Immunology and Microbiology.****Section-II: Bioinformatics, Biostatistics in Drug Discovery****Section-III: Entrepreneurship Development****Section-I: Immunology and Microbiology.****[24 L +6 T]****1. Microbial Drug Development****[12L]**

Introduction to Microbiology and classification of Microbes. Screening of Microbes fermentation process, concept of primary and secondary screening, characterization of ideal industrial strains, Microbial growth, kinetics, Isolation and Improvement of Individual micro- organism, fermenter designing, Media designing, antimicrobial assays; Down Stream process and effluent treatment (Microbial and Chemical)

2. Immunology and Immunopharmacology**[12L]**

Overview of the immune system and its role, three lines of defence, Types of immunity – active, passive, cell mediated and humoral immunity. Antigen and antibody, organs of immune system (Primary and secondary). Adaptive and innate Immunity. Immune response and the underlying mechanisms, Hypersensitivity, immunodeficiency, Autoimmunity, Immunization, Immunosuppressants, Immunomodulators, Immunological techniques – Agglutination reaction (Haemagglutination, bacterial agglutination), Precipitation reaction (single and double Immunodiffusion), Diagnostic techniques – ELISA, RIA, FACS

References:

1. Principles of Medicinal Chemistry including Proteomics S. Rangnathan & Jerad Suresh 2011 CBS press
2. Statistical Methods in Biology-Norman Bailey (1995) Cambridge
3. Molecular Modeling, Principles and applications -Andrew Leach (Longman) 1998.
4. Comprehensive Medicinal Chemistry vol.4 Corwin Hansch (1990) pergaman press.
5. Organic Chemistry of drug design and drug action-RB. Silverman 2nd Ed. (2004) Elsevier
6. Basic and Chemical Immunology-Stites (1987) Prentice Hall.

Learning Outcomes: Students will

1. Understand recent trends in drug development
2. Learn various biological databases and their applications
3. Learn applications of bioinformatics and chemoinformatics
4. Learn applications of biostatistics

SECTION-II: Bioinformatics, Biostatistics [24 L +6 T]

1. Bioinformatics: Introduction to biological databases, types of databases, Information retrieval from biological databases. Gene prediction programs, promoter and regulatory elements prediction programs. Structural bioinformatics, Phylogenetics and structural bioinformatics. Elements of genomics, transcriptomics proteomics and metabolomics and applications Elements of Cheminformatics: Representation of molecular structure, graphs connection tables, linear notations, canonical representations. Structure and substructure searching algorithms. Reaction databases, representation of patents and patent databases. Relational databases for molecules. Use of Chembioinformatics in drug designing with case studies. **[12 L]**

2. Biostatistics: Fundamentals of statistics, various statistical parameters, statistical tests, use of statistics in drug discovery and development and in clinical trials **[12 L]**

References

1. Principles of Medicinal Chemistry including Proteomics S. Rangnathan & Jerad Suresh 2011 CBS press
2. Statistical Methods in Biology-Norman Bailey(1995) Cambridge
3. Molecular Modeling, Principles and applications -Andrew Leach (Longman) 1998.
4. Comprehensive Medicinal Chemistry vol.4 Corwin Hansch(1990) pergaman press.
5. Organic Chemistry of drug design and drug action-RB. Silverman 2nd Ed. (2004) Elsevier

Learning Outcomes:

Students will learn

1. Understand recent trends in drug development
2. Learn various biological databases and their applications
3. Learn applications of bioinformatics and chemoinformatics
4. Learn applications of biostatistics

SECTION III: Entrepreneurship Development [24 L +6 T]**1. Fundamentals of Entrepreneurship Development:**

Concept and need of Entrepreneurship, Development and Definition of Entrepreneurship, Entrepreneurship, Innovation, Invention, Creativity, Business, Idea, Opportunities, through change, Concept of Entrepreneurship, Manager, Entrepreneur/ cooperate, Entrepreneur-comparative study-Roles, Responsibilities, Career opportunity, Entrepreneurship as a carrier, Entrepreneurship as style of management, The changing role of Entrepreneur: mid career dilemmas, -Closing the window; Sustaining competitive-Maintaining competitive advantages. [6L]

2. Theory of Entrepreneurship:

- a. Innovation Theory by Schumpeter & Imitating
- b. Theory of High Achievement by McClelland
- c. X-Efficiency Theory by Leibenstein
- d. Theory of profit by Knight
- e. Theory of Social change by Everett Hagen

[6L]

3. Influence of Entrepreneurship development:

- a. Entrepreneur Traits, b. External influence on Entrepreneurship Development: Socio-cultural, political, Economical, Personal, Entrepreneurial culture with special reference to Entrepreneurship, Corporate Entrepreneurship c. Entrepreneurial Success and failure: Reasons and Remedies

[6L]

4. Business planning process:

The business plan as Entrepreneurial tool, Element of Business plan, Objectives, market Analysis, Development of product /idea, Marketing Finance, Organization & Management, Ownership, Critical risk, contingencies of the proposal, Scheduling and Milestones. [6L]

References

1. Entrepreneurship –Robert D Hisrich, Michael P, Peters, Dean A Shepherd
2. Entrepreneurship as strategy –G, Dale Meyer, Kurt A. Heppard
3. Project Management: K. Nagarajan
4. The Culture of Entrepreneurship-Brigitte Berger
5. Entrepreneurship: New venture Creation –David H Holt

Learning Outcomes: Students will learn

1. Understand aspects of entrepreneurship development
2. Innovation and creativity
3. Development of an idea in marketing and finance
4. Entrepreneurship success and failure

CCPP-3, CHD – 364: Practical-I: Two Stage Preparation**[96L + 24T]**

At least eight two stage heterocyclic preparations from the following should be carried out. The preparations should be carried out on micro scale

1. Benzaldehyde → Benzalacetophenone → Epoxide
2. 4-Nitro toluene → 4-nitro benzoic acid → 4-Amino benzoic acid
3. Resorcinol → 4-methyl-7-hydroxy coumarin → 4-Methyl-7-acetoxy coumarin
4. Cyclohexanone → Phenyl hydrazine → 1,2,3,4-tetrahydrocarbazole
5. Hydroquinone → Hydroquinone diacetate → 1,2,4-Triacetoxy benzene
6. Acetanilide → p-Acetamidobenzene sulphonyl chloride → P. acetamidobenzene sulphonamide
7. p-Amino phenol → p-acetyl amino phenol → p-Ethoxy acetanilide
8. Cyclohexanol from cyclohexanone (LAH reduction)
9. p-Cresol → p-Cresyl benzoate → 2-Hydroxy-5-methyl benzophenone
10. Phthalimide → N-benzylphthalimide → benzylamine
11. Grignard Reaction
12. Phthalic acid → phthalimide → Anthranilic acid
13. Benzyl cyanide → p-Nitrobenzyl cyanide → p-Nitro phenyl acetic acid
14. Hydroquinone → Hydroquinone diacetate → 2,5-dihydroxy acetophenone
15. Cyclohexanone → Enamine → 2-acetyl cyclohexanone
16. α-Pinene → Disiamyl borane → Pinanol
17. Benzoin → Desylbenzoate → 2,4,5-triphenyl Oxazole
18. Phenylacetate → O-Hydroxyacetophenone → Chromone -2-carboxylic acid

References

1. Practical organic chemistry by Mann and Saunders
2. Text book of practical organic chemistry –by Vogel
3. The synthesis, identification of organic compounds –Ralph L. Shriner, Christine K.F. Hermann, Terence C. Morrill and David Y. Curtin

Learning Outcomes: Students will

1. Understand different name reactions
2. Learn monitoring of reactions
3. Be able to purify and characterize the reaction products

Semester-IV**CCTP-10, CHD-460: Advanced Medicinal Chemistry****[48L + 12T]****SECTION I :****[24 L +6 T]**

1. Antimicrobial therapy -Development and mechanism of action for Penicillins, Cephalosporins and Quinolones. An Overview of Aminoglycosides, Macrolides, Tetracyclines, Sulfa drugs. Peptides and polyene antibiotics. **[10L]**
2. Antifungals, Antiviral, Antimalarial, Antimycobacterials **[8L]**
3. Cancer and its Chemotherapy, including developments in Immunotherapy **[6L]**

SECTION II:**[24 L +6 T]**

1. Cardiovascular system and its disorders: Hypertension, Heart Failure, Angina Pectoris, Arrhythmia, Myocardial Infarction, Ischaemic heart diseases, Stroke. Management of these disorders with drugs. **[6L]**
2. Central Nervous System, CNS disorders, A study of antidepressants, Anticonvulsants. **[6L]**
3. Pain, Inflammation, Analgesics, anti-inflammatory agents. **[3L]**
4. Endocrine system and Hormonal therapy. **[4L]**
5. Gastrointestinal tract disorders and Drugs. **[3L]**
6. Diabetes and Management of Diabetes. **[2L]**

References

1. Medicinal Chemistry -Burger vols. I to IV (John Wiley)
2. Principles of Medicinal Chemistry- W.Foye.
3. Comprehensive Medicinal Chemistry -C. Hansch (Pregaman Press).
4. Selective Toxicity –A. Albert (Chapman Hall)
5. Principles of Drug action - A. Goldstein.
6. Organic Chemistry of Drug action and Drug design -LB. Silverman (Elsevier)
7. Physiology and Anatomy- Carolla.
8. Medicinal Chemistry-Biochemical approach, Thomas Nogardy.
9. Essential of pharmacology -K. D. Tripathi.
10. Pharmacology-Hanney
11. Pharmacology-Goodman and Gilman.
12. An introduction to medicinal Chemistry Graham Patrick (Oxford)
13. Introduction to the Principles of Drug design and action. IVth Ed. H. John Smith (Taylor and Francis)2010
14. Introduction to Medicinal chemistry Alex Gringauz (Wiley India)
15. Medicinal Chemistry An introduction II nd Edition. Gareth Thomas (Wiley India)2011
16. Wilson and Gisvolds Textbook of Organic, Medicinal and Pharmaceutical Chemistry 12th Ed. John M beale and John H Block 2011 Lippincott Williams and Wilkins

Learning Outcomes: Students will

1. Understand development of various antibiotics.
2. Understand mode of actions of different antibiotics.
3. Study pharmacokinetics and pharmacodynamics of antibiotics
4. Understand the selective toxicity and side effects of various antibiotics.
5. Will understand diseases caused by various pathogens and their treatment.
6. Will biochemical basis of cancer and different approaches to treat cancer.
7. Will study functioning of systems like CNS, CVS, Gastrointestinal system and endocrine system, coordination among these, systemic diseases and their treatment.

CCTP-11, CHD-461: Drug Design [48 L +12 T]**SECTION I:****[24 L +6 T]**

1. Membrane and Receptors- Structure, functions and the mechanism of drug action (Receptor Response), Clasifications, types of receptors. GPCR & Ion channels Design of agonist and antagonists as drugs. Receptor theories, Models and their types. Receptors and metabolic disorders imp in drug design. **[10L]**
2. Case studies on drug design from Patricks 5th Ed.2013 **[4L]**
3. Physicochemical principles of Drug action- Drug Receptor interactions, Quantitative 4. Description of physicochemical parameters and their calculation. QSAR, Hanschanalysis, COMFA, COMSIA, Free Wilson Method, Topliss manual and batchwise approach. Craig's models. Current trends. **[5L]**
4. Design of Drugs based on pharmacokinetics, Bio activation and metabolism Pro-drug Design. Design of enzyme inhibitors. **[5L]**

SECTION II:**[24 L +6 T]**

1. Molecular Biology, Genetic engineering and Biotechnology in production of biological as drugs. Antisense therapeutic agents: design and use of siRNA with examples. An overview of Genomics, Metabolomics, pharmacogenomics and Toxicogenomics etc. **[10L]**
2. Combinatorial Chemistry and high throughput Screening. **[5L]**
3. Computers Aided Drug design: Basic concept of Computational chemistry like Quantum Mechanics, Molecular Mechanics, Force fields, Energy minimization, Conformational

search, Molecular dynamics. Ligand based drug design; Receptor based drug design. Analog approach, pharmacophore mapping. Molecular-modeling, Dock, Autodock and Flexidock etc. Virtual Screening. [8L]

4. Current trends in the field of drug discovery and design. [1L]

References

1. An Introduction to Medicinal Chemistry- 5th Edn. Patrick(Qxford 2013)
2. Medicinal Chemistry Vol. I Burger.
3. Molecular Modeling, Principles and applications -Andrew Leach (Longman) 1998.
4. Comprehensive Medicinal Chemistry vol.4 Corwin Hansch (1990) Pergaman press.
5. Organic Chemistry of drug design and drug action-RB. Silverman 2nd Ed. (2004) Elsevier
6. A Text book of Drug design and development IInd Edn. Povl.Krogsgaard-Larsen Tommy L. and U Madsen (1996) Harwood Acad. Publishers.
7. Medicinal Chemistry An introduction Gareth Thomas 2nd Edition (Wiley India)
8. Introduction to the Principles of Drug design and action. IVth Ed. H.John Smith (Taylor and Francis)2010

Learning Outcomes:

1. Student should understand the various types of receptors and its superfamilies.
2. To understand concept of Receptor theories.
3. Student should able to understand the Receptors and metabolic disorders important in drug design.
4. To know about signal transduction mechanism of various receptors.
5. Student should understand the physicochemical principles of Drug action.
6. Student should able to understand the concept of Quantitative description of physicochemical parameters and their calculation.
7. To know about Pharmacokinetics and Pharmacodynamics of drug action.
8. Student should able to understand the different dosage forms of drugs.
9. To understand concept of Design of Drugs based on pharmacokinetics.
10. Student should understand the concept of Pro-drug design strategy.
11. Student should know the concept of molecular biology.
12. To know about Computers Aided Drug design.
13. To know about Ligand based drug design and Receptor based drug design.

CBOP-4, CHD-462(A): Advanced Synthetic Methods in Chemistry

OR

CHD-462 (B): Supramolecular, Green Chemistry and Forensic Chemistry

CBOP-4, CHD-462(A): Advanced Synthetic Methods in Chemistry [48L + 12T]

Section-I: Designing of Organic Synthesis [24 L +6 T]

1. Protection and de-protection of hydroxyl, amino, carboxyl, ketone and aldehyde functions as illustrated in the synthesis of polypeptide and polynucleotide [4L]
2. Enamines in synthesis [2L]
3. Umpolung synthons and reagents in organic synthesis [4L]
4. Retrosynthesis [14L]

Section-II: Transition metal complexes in synthesis [24 L, 6T]

1. Multi-component reactions: Ugi, Passerini, Biginelli and Mannich reactions [3L]
2. Ring formation reactions: Pausan-Khand, Bergman and Nazarov cyclization [2L]
3. Transition metal complexes in Organic synthesis. Suzuki, Heck, Sonogashira, Stille, [3L]
4. Fukuyama, Kumada, Hiyama, Negishi, Buchwald-Hartwig, Noyori, Reppe, Oxo process [4L]
5. Organolithium, Aluminium, Phosphorous and Boranes, Synthetic applications [6L]

6. Click chemistry: criterion for click reaction, Sharpless azides cycloadditions	[2L]
7. Biomimetic synthesis	[2L]
8. Domino Reactions	[2L]

References

1. Designing Organic synthesis - S Warren (Wiley Interscience)
2. Organic synthesis through disconnection approach- P. S. Kalsi – 2nd edition
3. Some modern methods of Organic synthesis. W Carruthers (Cambridge)
4. Organic Chemistry -Clayden, Greeves, Warren of wothers (Oxford press)
5. Organic synthesis M. B. Smith.
6. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=5> Paper 14: Organic chemistry IV- Advance organic synthesis, supramolecular chemistry and carbocyclic ring
7. Principles of Organometallic Chemistry- G. E. Coates, Green and K Wade
8. Transition Metal Intermediates in Organic synthesis C W Bird, Logos (1967)
9. Organometallics in Organic synthesis- J. M. Swan and DC Black (Chapman Hall)
10. Modern synthetic Reactions- HO House, Benjamin
11. Domino reactions in organic synthesis- L.F. Tietze, G. Brasche, K. m. Gericke

Learning outcome :

1. Use and applications of protecting and deprotecting reagent
2. Applications of enamine and umpolung in synthesis
3. Retro analysis of one and more functional group
4. Synthons, Convergent and divergent synthesis
5. Applications of multicomponent and Cyclic ring formation reactions in synthesis
6. Different name reactions involving transition metal viz. Pd, Ni, Ru, Co, Fe, Cu etc.
7. Organometal applications and uses of Al, Li, P, B
8. Sharpless azide cycloaddition, Domino and biomimetic synthesis

CBOP-4, CHD-462(B): Supramolecular, Green Chemistry and Forensic Chemistry

[48L + 12T]

Section-I: Supramolecular, Green Chemistry [24 L +6 T]

1. Supra-molecular Chemistry **[12L]**

Properties of covalent bond, bond length, inter-bond angles, force constant, bond and molecular dipole moments, molecular and bond polarizability, bond dissociation enthalpy, entropy, Intermolecular forces, hydrophobic effects, Electrostatics, induction, dispersion and resonance energy, magnetic interactions, magnitude of interaction energy, force between microscopic bodies, medium effects, hydrogen bond, Principles of molecular association and organization as exemplified by in biological macromolecules like enzymes, nucleic acids, membrane and model systems like micelles and vesicles, molecular receptors and design principles. Cryptands, cyclophanes, calixeranes, cyclodextrins. Supramolecular reactivity and catalysis. Molecular channels and transport processes. Molecular devices and nontechnology.

2. Green chemistry **[12L]**

1. Atom Economy and Principles of chemistry Green
2. Solvent free reactions
3. Organic synthesis in solid state: Michael addition, Beckmann rearrangement, solid support organic synthesis, synthesis of aziridine, pyridine, chromans and flavones.
4. Aqueous phase Reactions: Diels –Alder reaction, Heck reaction, epoxidation, dihydroxylation [syn & Anti].
5. Microwave Technology: Microwave solvent free reactions- Deacetylation, deprotection, saponification of ester, alkylation of reactive methylene compounds, synthesis of nitrile from aldehyde, reductions.

6. Microwave assisted reaction in water: Hoffmann elimination, hydrolysis, oxidation, saponification reactions
7. Ultrasound assisted reactions: introduction, substitution reactions, addition, oxidation, reduction reactions.
8. Ionic liquids: Introduction and application in organic synthesis.
9. Use of bio-catalyst in organic synthesis.

References

1. Supramolecular Chemistry- Concepts and perspectives by J.M. Lehn
2. Green Chemistry-Theory and practical, By Paul and Anastas and John C. warner.
3. New trends in greenchemistry-by V.K. Ahuwalia and Kidwai
4. Organic synthesis special techniques. by V.K. Ahuwalia and Renu Agrawal
5. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=5> Paper 14: Organic chemistry IV- Advance organic synthesis, supramolecular chemistry and carbocyclic ring

Learning outcome:

- 1) Concept of supramolecular chemistry
- 2) Application of supramolecular chemistry in drug synthesis
- 3) Concept of green chemistry, various green synthetic strategies
- 4) Use of microwave and ultrasound techniques in synthetic chemistry

Section-II: Forensic Chemistry [24 L +6 T]**1. General Drugs, Other Chemicals****[8L]**

Introduction, Pharma drugs [barbiturates, benzodiazepine & other pharma drugs],

Drug abuse in sports & Date rape drugs: Introduction, common prohibited substances, analytical approach, Forensic Pharmacological studies, Ingestion of drugs, absorption, distribution, metabolism, pathways of drug metabolism, drug metabolism and drug toxicity, excretion of drugs, detection of drugs on the basis of their Metabolic studies.

Solvent Abuse [chlorinated hydrocarbons, Aromatic hydrocarbons, alcohols, glycols, fuel and fuel additives]: absorption, distribution, and metabolism, psychological & clinical effects.

Analysis: collection of samples, distillation & extraction, Analysis by GC, HPLC.

2. Narcotic Drugs and Psychotropic Substances**[6L]**

Introduction to narcotic drugs, Analysis of Narcotic Drugs and Psychotropic Substances, Classification of Narcotics and other drugs, Analytical techniques for identification of drugs. Characterization and synthesis of 1) Narcotics- heroin and cocaine. 2) Stimulants- caffeine, amphetamines. 3) Depressants- Barbiturates, Benzodiazepines analysis of NDPS evidence by various procedures prescribed by U.N. Manual, DFS manual, spot tests, microcrystal tests, extraction methods, TLC, UV-Vis spectrophotometry, IR spectrophotometry, GC-HPLC, MS, GC-MS, NMR and XRD as exemplified by cocaine, cannabis, amphetamines, opiates and hallucinogens (LSD, psilocybine and mescaline), evidence handling & sampling techniques, clandestine laboratory investigation and designer drugs.

3. Fingerprinting & Other Impressions**[10L]**

Fingerprint: Nature, Location, Classification, Types, Patterns of Fingerprints, Poroscopy & Edgescopy, Classification of Fingerprints: Henry's Classification, Single Digit Classification, Extended Henry's System, Types of Fingerprints [Latent, Patent and Plastic], Invisible Fingermarks development methods [Powder methods, Fuming methods, Chemical Methods, etc.] Recent techniques [Digital Imaging & Enhancement, Laser & other radiation-based techniques, Preservation and photography of fingerprints on various surfaces. Ridge counting, Ridge tracing, Minutiae Identification & Matching [Manual and Automated: AFIS].

Palm Prints: Nature, Location, Types, Classification, Development, Lifting, Evaluation, Analysis, Forensic Significance. Footprints: Importance, Gait pattern analysis, Evaluation and analysis of various casts. Electrostatic lifting of latent footprints and comparison with reference sample. Tyre marks / prints and skid marks and comparison with control samples.

Cheiloscopy: Nature, location, collection and evaluation of lip print. Ear prints: Introduction, growth & development, evaluation and analysis of ear print.

References:

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=16> Paper 03: Fingerprint and other impression
2. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=16> Paper 09: Drug of Abuse
3. Krishnamurthy, R., Introduction to Forensic Science in Crime Investigation, 2011, Selective & Scientific Books, New Delhi.
4. Clark, E.G.C.; Isolation and Identification of Drugs, Vol. I and Vol. II, Academic Press, (1986).
5. Moenssens: Finger Prints Techniques, 1975, Chitton Book Co., Philadelphia, New York.
6. Mehta, M. K. : Identification of Thumb Impression & Cross Examination of Finger Prints, 1980 N. M. Tripathi (P) Ltd. Bombay.
7. Cummins & Midlo : Finger Prints, Palms and Soles, 1943, The Blakiston office London
8. Sharma B. R. : Footprints, Tracks and Trials. 1980. Central Law Agency. Allahabad
9. Iannarelli, A V; Ear Identification, Forensic Identification series, Paramount (1989)
10. Saxena's : Saxena's Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery, Central Law Agency, Allahabd (Ed. A.K. Singla).
11. Menzel, E Roland; Fingerprint detection with lasers, Marcel Dekker, NY (1999)

Learning Outcomes:

1. Identification of Type of Drug
2. Expertise in handling UV, IR, GC and HPLC
3. Interpretation of data and comparative study with literature
4. Crime investigation of drug abuse
5. Methods of development of fingerprint
6. Role of Fingerprinting in investigation

CBOP-5, CHD-463: Practical III

Select any two Sections from sections I to IV [96L + 24T]

Section-I: Microbiology, Biochemistry

Section-II: Practical on Forensic Chemistry

Section-III: Ternary Mixture Separation

Section-IV: Project/ Industrial Training

CHD- 463 Section-I: Microbiology and Biochemistry [48 L + 12T]

1. Microbiology - Differentiation, Gram staining Morphology, Protoplast fusion, Screening of bacterial substances, sterility testing. Microbial assays, Production of penicillin by fermentation, Immunology practicals
2. Biochemistry- Isolation, purification and characterisation of Enzymes, stability studies, Kinetics determination of K_m , V_{max} , 1-50, Inhibition studies, reversible, irreversible and K_{cat} . Electrophoresis, Isolation and estimation of DNA, DNA-drug interaction studies, Determination of drug in blood and urine.

References

1. Practical Organic Chemistry, Al. Vogel (ELBS).
2. Pharmacological Basis of Therapeutics (Pergman press, New York) Goodman and Gilman.

3. Evaluation of Drug Activities- Pharmacometrics, Lawrence D. R. Bacharach AL. (Academic press London)
4. Screening Methods in Pharmacology, Turner R..A (Academic press London).
5. Physiological Chemistry, Hawk.
6. Clinical Biochemistry, Vol I and II Varley.
7. Fundamentals of Experimental Pharmacology, Ghosh M.N.(Scientific Book Agency, Calcutta)
8. Practical Biochemistry Plummer
9. Practical Microbiology. :
10. Practical Biochemistry, Jayaraman.

Learning Outcomes: Students will

1. Understand the various microbial and biochemical techniques
2. Study drug – DNA interactions
3. Learn Synthesis, characterization and purification of drug molecules
4. Learn analysis of biological matrices

CHD- 463 Section-II: Practicals on Forensic Chemistry [48 L + 12T]

(Six practical's to be perform based on instrumentation.)

1. Systematic identification of Narcotic Drugs and Psychotropic substances (opiates, cannabis, barbiturates, benzodiazepines and amphetamines) by spot colour tests. TLC, UV, IR, GC and HPLC. (min. 2 Nos.)
2. Systematic extraction and identification of acidic and basic drugs from viscera (simulated sample) by wet test & GC. (min. 2 Nos)
3. Detection of pesticides and insecticides from blood
4. Systematic analysis of cosmetic products as per IPC specification by using HPLC
5. Systematic analysis of cosmetic products as per IPC specification by using GC

References for Forensic Practicals

1. Practical Organic Chemistry; J.B. COHEN
2. Spot test in Organic Chemistry; Feigl
3. Practical Organic chemistry; Vogel
4. Quantitative Inorganic Analysis; Vogel
5. The Merck index; Stetcher & others
6. Inorganic Semi micro qualitative analysis; Griffin & Plunky
7. Peerson's Chem. Analysis of food; H.Egan, Kirk
8. Clerk's Analysis of Drugs & Poisons VOL.-I & II; Clerke
9. Development & Validation of Analytical Methods; Christopher, M.Riley, Thomas W
10. Steroid analysis by HPLC; Marie P. Kautsky
11. TLC VOL.-II; Jork, Funk & Others

Learning Outcomes: Students will

1. Expertise in handling UV, IR, GC and HPLC
2. Blood sample pesticide and insecticide detection.
3. Interpretation of data and comparative study with literature

CHD- 463 Section-III: Ternary Mixture Separations [48 L + 12T]

Separation of at least Eight mixtures containing three components. The mixtures should also involve separation of nitro phenols, amino acids, low boiling substances, water soluble substances. Amines, Phenols and acids used should also contain other elements and functional groups. The mixture separation should be carried out on micro-scale using ether.

Learning Outcomes: Student will

1. Determine the type
2. Separation of mixture using ether
3. Microscale workup

CHD – 463 Section-IV: Project / Industrial Training [48L + 12T]

Students should carry out a small research project. This should make them familiar with literature survey, research methodologies, Identification of products by analytical and spectral methods and familiarity with chromatographic techniques. Project report must be written and submitted in format.

1. Students should carry out a small research project separately.
2. This should make them familiar with
 - i. Literature survey, research methodologies
 - ii. Data Analysis
 - iii. Column and TLC chromatographic techniques
 - iv. Characterization of the products by analytical and spectral methods.
3. **Project report must be written and submitted in a proper format as follows;**
 - i. Certificate (Signed by Project guide and Head of the Department)
 - ii. Certificates for Poster/Paper presented in conferences (if any)
 - iii. Self declaration certificate for plagiarism
 - iv. Introduction (not more than 6 pages)
 - v. Results and Discussions
 - vi. Experimental Section
 - vii. Conclusion
 - viii. References (Use ACS format)
 - ix. Spectroscopic or other relevant supporting data
 - x. Acknowledgement
4. Interdisciplinary projects shall be encouraged; however there **must be some chemistry component**.
5. Students should spend enough time for the project works (**more than 4 hours per week for 15 weeks**)
6. At least 30% students should undertake projects/summer training/Internships etc.
7. If student is performing project in another institute, for such a student, internal mentor must be allotted and he will be responsible for internal assessment of a student. In this case student has to obtain certificate from both external and internal mentor. ***Systematic record of attendance of project students must be maintained by a mentor.*** Project will be evaluated jointly by three examiners and there will not be any practical performance during the examination. Typically, student has to present his practical work and discuss results and conclusions in details (20-30 min.) which will be followed by question-answer session (10 min). It is open type of examination.

Learning Outcomes; Students will

1. Learn Referencing
2. know about various scientific databases
3. understand applications of various characterization techniques
4. learn how to write project report
5. learn presentation skills

CCPP-4 CHD – 464, Practical II:**Synthesis of Heterocycles and Drug Molecules [96L + 24T]**

At least fourteen preparations should be carried out on micro scale.

1. 2-Phenyl indole (Fischer indole synthesis),
2. 7-Hydroxy -3-methyl flavone (Baker-Venkatraman reaction),
3. 7-Hydroxy-4-methyl coumarin (Pechmann Reaction)
4. Acridone
5. Triphenyl or diphenyl methyl carbinol (Grignard reaction)

6. Benzotriazole
7. 1-Phenyl-3-methyl pyrazol-5-one
8. O-nitroaniline →O-phenylene diamine →Benzimidazole
9. 2,4-diethoxycarbonyl-3,4-dimethyl pyrrole from ethyl acetoacetate
10. Quinoline from aniline (Skraup synthesis)
11. Benzimidazole from benzyl
12. Glycine→2,5-dioxopiperazine
13. 3,5-diacetyl-1,4-dihydro-2,6-trimethylpyridine
14. Hippuric acid →Azalactone→4-benzylidene 2-phenyl oxazol-5-one
15. Benzocaine
16. Antipyrine
17. Paracetamol
18. Aspirin
19. Ibuprofen
20. Barbiturate

References:

1. Practical Organic Chemistry, Al. Vogel (ELBS).
2. Microscale and Macro scale Preparations Williamson and Williamson.
3. Practical Heterocyclic Chemistry, Fitton and Smalley (AP)
4. Organic Synthesis Collective Volumes, Vol I to VIII
5. Comprehensive Practical Organic Chemistry by V.K. Ahluwalia and Renu Aggarwal
6. Practical Chemistry, Fitton and Smalley

Learning Outcomes: Students will

1. Learn different syntheses of heterocycles
2. Use of various synthetic strategies in drug synthesis

5. M. Sc. (II) Analytical Chemistry**To be Implemented from Academic Year 2020-21**

Sr. No.	Paper No. & Code	Course Name	Credit
Semester - III			
1	CCTP-7 CHA-390	Electrochemical and Thermogravimetric Methods of chemical analysis	4
2	CCTP-8 CHA-391	Analytical Method Development and Extraction Techniques	4
3	CCTP-9 CHA-392	Advanced Chromatographic Methods of Chemical Analysis	4
4	CBOP-3 Theory CHA-393	CBOP-3, CHA-393-A: Bioanalytical Chemistry Or CBOP-3, CHA-393-B: Analysis of Food and Controlled Substances	4
5	CCPP-3 CHA-394	Practical I: Basics of Instrumental Methods of Chemical Analysis	4
Semester-IV			
6	CCTP-10 CHA-490	Advanced Analytical Spectroscopic Techniques	4
7	CCTP-11 CHA-491	Chemical Methods of Pharmaceuticals Analysis	4
8	CBOP-4 Theory CHA-492	CBOP-4, CHA-492-A: Laboratory Automation and Environmental Analytical Chemistry Or CBOP-4, CHA-492-B: Analytical Chemistry of agriculture, polymer and Detergents	4
9	CBOP-5 Practical CHA-493	Practical III: CBOP-5, CHA-493-A: Optional Analytical Chemistry Practical OR CBOP-5, CHA-494-B: Project	4
10	CCPP-4 CHA-494	Practical II: Applied Analytical Chemistry Practical	4

Equivalence to Previous Syllabus

Old Paper (2014 pattern)	New syllabus (2020)
Semester - III	
CHA-390	CCTP-7, CHA-390
CHA-380	CCTP-8, CHA-391
CHA-391	CCTP-11, CHA-491
CHA-392	CBOP-4, CHA-492 (A)
CHA-387-Practical	CCPP-4, Practical, CHA-394
Semester - IV	
CHA-490	CCTP-10, CHA-490
CHA-491	CBOP-4(B), CHA-492 (B)
CHA-492	CBOP-4, CHA-492(A)
CHA-481	CBOP-3(A), CHA-393(A)
CHA-487, Practical	CCPP-4, Practical, CHA-494
CHA-488, Practical / Project	CBOP-5, CHA-493: A) Practical / B) Project

Detailed of Syllabus: Semester and Paper Wise

Semester-III	
CCTP-7, CHA-390: Electrochemical and Thermogravimetric Methods of Chemical Analysis [48L + 12T]	
Section-I: Electroanalytical Techniques [24 L +6 T]	
1. Coulometry	[6 L]
Current voltage relationship during an electrolysis, Operating cell an at fixed applied potential, constant current electrolysis, Electrolysis at constant working electrode potential, Coulometric methods of analysis, Faradays laws of electrolysis, Instrumentations-Constant current and constant voltage instruments, potentiation coulometry-Instrumentation and applications, coulometric titrations - apparatus and applications, problems.(<i>Ref.-1:696-712, Ref-2: relevant pages</i>)	
2.Voltammetry and Polarographic Methods of Analysis.	[18 L]
<p>a) Polarography (linear scanpolarography): Polarographic principles, Instrumentation (different types of microelectrode such as dropping mercury electrode, the static drop mercury electrode, rotating disc and ring disc electrode, cell for polarography, reference and counter electrode and circuit diagram), polarogram and polarographic currents, charging or capacitive current, role of supporting electrolyte, factors affecting on polarographic wave, Ilkovic Equation, advantages and disadvantages of DME, polarographic maxima and maxima suppressors, interference due to dissolved oxygen, Applications (qualitative analysis, quantitative analysis by calibration curve and standard addition methods), specific examples of analysis – analysis of Cu, Cd, Zn, Pb, etc. from tap water and alloys., problems.(<i>Ref-1: 716-723, Ref-2, Supplementary Ref. 3 and 4</i>)</p> <p>b) Hydrodynamic Voltammetry: Hydrodynamic voltammetry and applications of hydrodynamic voltammetry (volatameric detectors in chromatography and flow injection analysis, Voltametric oxygen sensors, amperometric titration. (<i>Ref-1: 723-735</i>))</p> <p>c) Cyclic Voltammetry: Principle of cyclic Voltammetry, cyclic voltamogram of $K_3[Fe(CN)_6]$ and parathion (<i>Fundamental studies</i>), determination of analytes using CV, criteria of reversibility of electrochemical reactions, quasi-reversible and irreversible processes(<i>Ref-1:735-742 Ref-2: Relevant pages, Supplementary Ref.-5: 27-68</i>)</p> <p>d) Pulse Polarography: different types of excitation signals in pulse polarography, Differential pulse polarography, square wave polarography, and Stripping method. Voltammetry with ultra-microelectrode, Applications of these techniques Cu and Zn from tap water by differential pulse polarography and by square wave polarography, Vitamin-C by differential pulse polarography, Determination of Pb in tap water by stripping method. (<i>Ref-1: 742-753 2, Supplementary Ref. 3 and 4</i>)</p>	
References	
<ol style="list-style-type: none"> 1. Principles of Instrumental Analysis, Skoog, West, Holler, 6th Ed. Cengage Publication. 2. Vogel's Text Book of quantitative analysis 6th Ed. 3. Introduction to Instrumental Analysis by R. D. Braun, Pharmamed Press. 4. Analytical Chemistry, A Modern Approach to Analytical Science, Ed. by R. Kellner, J. M. Mermet, O. Otto, M. Valcarcel, H. M. Widmer, Second Ed. Wiley –VCH 	

5. Cyclic Voltammetry, Simultaneous Analysis and Reaction Mechanism, David K Gosser, VCH, 1994.

Section-II: Thermal Methods of Analysis [24 L +6 T]

1. Introduction to Thermal Methods [2 L]

Introduction, Historical development, Definitions: *Thermal analysis, Equilibrium -A Kinetic Diversion, General apparatus*, Factors affecting thermal analysis results, *The sample, The crucible, The rate of heating, The atmosphere, The mass of the sample*, Simultaneous and complementary techniques (**Ref-1: 1-21**)

2. Thermogravimetry [5 L]

Introduction, Historical, Definition of thermogravimetry, Apparatus, *The balance, Furnace, Programmer, Samples, Temperature calibration, Atmosphere, Kinetics of reactions*, Kinetics of Reactions, *Measurement of α and da/dt , Constant rate methods*, Thermogravimetric curves: *Decomposition Of Magnesium Hydroxide, Calcium oxalate monohydrate, Copper sulphate pentahydrate, Degradation of polymers*, Analysis of mixtures: *mixtures of alkaline earth oxalates, polymer blends, soils*, Oxidation studies, Reduction studies, Controlled rate thermogravimetry and Hi-Res™ TGA, *Polymer blends, Drugs. (Ref-1:22 to 62)*

3. Differential Thermal Analysis and Differential Scanning Calorimetry [7 L]

Introduction, Historical, Definitions: *Differential thermal analysis (DTA), Differential scanning calorimetry (DSC)*, Apparatus: *The sensors, The furnace and controller, The computer and display, The reference material*, Theory of DTA and DSC, Heat flux DSC, Power-compensated DSC, *The effect of higher temperatures, Sample size, Calibration*, Applications: *Physical changes and measurements (crystalline phase transitions, potassium nitrate, liquid crystalline transitions, thermoplastic polymer phase changes, heat capacity measurements, glass transition temperatures), Chemical reactions, Inorganic compounds and complexes (calcium oxalate monohydrate, metal complexes, high alumina cements, clays and other minerals), Organic compounds (oxidative degradation, protein denaturation, polymer degradation). (Ref-1: 63-113)*

4. Thermomechanical and Dynamic Mechanical Analysis [4 L]

Introduction, Definitions: *Thermomechanical analysis, Dynamic mechanical analysis, Mechanical moduli*, Thermomechanical analysis: *Apparatus (probes, calibration)*, Applications: *coefficients of expansion, solvent swelling of polymers, phase transitions, sintering*, *Chemical reactions (inorganic hydrates, polymer cure)*, Dynamic Mechanical Analysis: *Apparatus (DMA configurations, calibration)* Applications: *glass transition temperatures, beta and other transitions, relaxation kinetics, polymer miscibility, characterising cross-linking, studying 'problem samples, characterising film formation (Ref-1: 123-151)*

5. Simultaneous Techniques and Product Analysis [4 L]

Introduction, Simultaneous Thermal Analysis: *Simultaneous TG-DTA and TG-DSC applications, (sodium tungstate dihydrate, fire-retarded wood, poly(vinyl chloride), pharmaceuticals, reactive atmosphere effects*, Evolved gas analysis, Instrumentation: Apparatus, Detection and identification of evolved gases: *Physical methods, Chemical*

methods, Spectroscopic methods (mass spectrometry (MS) and simultaneous TG-MS, calcium oxalate monohydrate, poly (ethylene oxide), brick clays), Infrared and simultaneous TA-infrared, *Apparatus, Applications, Gas chromatography and pyrolysis GC-FTIR.*(*Ref-1: 163-184*)

6. Problem Solving and Applications of Thermal Methods [2 L]

Introduction, List of examples, Problems: *Inorganic materials, Polymeric materials, Fine chemicals and pharmaceuticals, Other materials*, Solutions to problems.

(*Ref-1: 206-270*)

(*This topic is for student's self-preparation*)

References

1. Thermal Methods of analysis, principles, applications and problems, P. J. Haines, Springer-Science Business Media B.V. 1st Ed.
2. Principles of Thermal Analysis and Calorimetry, P. J. Haines, Royal Society of Chemistry
3. Principles and Applications of Thermal Analysis, Paul Gabbott, Blackwell Publishing Ltd. (2008).
4. Thermal Analysis in Practice, Fundamental Aspects, Matthias Wagner, Hanser Publications, 2018.

Learning Objective: At the end of course, students should able to-

1. Define various terms in electrochemistry and thermogravimetry.
2. Explain instrumentation in electrochemistry and thermogravimetry.
3. describe basic principles of electrochemistry and thermogravimetry.
4. Explain /Describe applications of electrochemistry and thermogravimetry in industry and in analytical laboratory.
5. Apply / select particular method of analysis for sample to be analysed.
6. Solve numerical problems on electrochemistry and thermogravimetry.
7. Interpret polarogram, cyclic voltammogram, pulse polarogram, thermogram, differential thermogram and DSC thermogram.
8. Differentiate among the various methods of electrochemistry and thermogravimetry.

CCTP-8, CHA-391: Analytical Method Development and Extraction

Techniques

[48L + 12T]

Sec-I: Analytical Extraction Techniques [24 L +6 T]

1. Assay Validation and Inter Laboratory Transfer [2 L]

Introduction, fundamental definitions, Essential principles of method transfer, method validation report, the interlaboratory qualification (ILQ) process. (*Ref-1:pp 3 to 14*)

2. Statistical Analysis and analytical Figure of Merit [14 L]

Introduction, Errors (gross errors, systematic errors, random errors), accuracy, validation parameters: Accuracy, precision, mean and standard deviation, calibration, (linear response functions (linear regression-errors in slope and the intercept, error in the estimate of concentration, standard additions), non-linear response functions and weighted

regression analysis, internal standards), selectivity and specificity (chromatographic methods), limits of detections (spectrophotometric methods, chromatographic methods and related techniques, receptor binding assay), limit of quantification, sensitivity, ruggedness and robustness, analyte stability in the sample matrix, how to reduce systematic errors, mean and standard deviation, reliability of results, confidence interval, comparison of results, comparison of two means of two samples, experimental design. (*Ref-1: 15 to 68, Ref-2, p145-197*)

3. Overview of World Wide Regulations (2 L), Ref-1: 75 to 98)

4. Specific methods and Applications: Dissolution Studies [4 L]

Introduction, Dissolution test, Apparatus – USP type –I and II, Sampling and analytical instrumentation, Single point test Vs. Dissolution profile, Calibration, regulatory guidelines, analytical validation, linearity, accuracy, precision, specificity. (*Ref-1: 169 to 182*)

5. Specific Examples [2 L]

Explain these method w.r.t. method development and validation of specified analyte from the research papers. (*Ref-4 to 7*)

References

1. Development and validation of Analytical Methods, Progress Pharmaceutical and Biomedical Analysis, Vol-3, Edited by Chitofer M. Riley and Tomas W. Rosanske (Elsevier).
2. Vogel's Textbook of quantitative Chemical Analysis, Sixth Ed., Mendham, Denney, Barnes, Thomas, Pub: Pearson Education.
3. Development and validation of a colorimetric method for the quantitative analysis of thioamide derivatives, R.B. Ali et al., Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 220 (2019) 117154.
4. HPLC Method Development and Validation for Formaldehyde in Enteric Coating of Hard Gelatine Capsules, Journal of Liquid Chromatography, 18(13), 2683-2693 (1995).
5. Development and Validation of Stability Indicating RP-HPLC Method for Analysis of Lercanidipine in Bulk Drug and Microemulsion Formulation, Journal of Liquid Chromatography & Related Technologies, 36:143-154, 2013.
6. Development and validation of an LC-MS/MS method for simultaneous quantification of voriconazole and its main metabolite voriconazole N-oxide in human plasma and its clinical application, Journal of Liquid Chromatography & Related Technologies, 40:20, 1047-1053.
7. Development and validation of the spectrophotometric method of butaphosphan determination in veterinary preparations, Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 233 (2020) 118171.

Section-II: Analytical Extraction Techniques [24 L +6 T]

1. Pre and Post Extraction Consideration [1 L]

Organic compounds of interest, pre-sampling issues, sampling strategies-solid, aqueous and air samples, chromatographic method of analysis, sample preconcentration methods. (*Ref-1: 1-29*)

2. Classical Approach for Aqueous Extraction [6 L]

Introduction, Liquid-Liquid extraction (LLE), Theory of LLE: distribution ratio and coefficient, solute remaining unextracted, percent extraction, separation factor, factors favouring solvent extraction, quantitative treatment to solvent extraction equilibria, synergic extraction, extraction reagents for metals, selection of solvents, solvent extraction,

problems with LLE process), purge and trap for volatile organics in aqueous samples, Examples of Solvent Extraction- estimation individual metal ions Be, B, Cu, Fe and Pb by solvent extraction. Problems. (**Ref-2: relevant pages and Ref-1: 39-45**)

3. Solid Phase extraction (SPE)

[6 L]

Introduction, Types of SPE media, SPE formats and apparatus, method for SPE operation, solvent selection, factors affecting SPE, selected methods of analysis for SPE: *application of normal phase SPE, application of reversed phase SPE, application of ion exchange SPE, applications of molecularly impaired polymers*, Automation and On-Line SPE and its applications. (**Ref-1: 49-78**)

4. Solid phase micro-extraction

[6 L]

Introduction, theoretical considerations, experimental, Methods of analysis: SPME-GC: *direct immersion SPME, headspace SPME, analysis of compounds from solid matrix, other SPME-GC application*. Methods of analysis: SPME-HPLC-MS: *analysis of abiotic dehydroabietic acid in food samples, analysis of fungicide in water*. Automation of SPME and its application, New development in micro extraction (Introduction, stirbar sorptive extraction, liquid phase micro-extraction, , membrane micro extraction, micro extraction in packed syringe).(**Ref-1: 85-110, Ref-3**)

5. Solid -Liquid Extraction, Microwave extraction

[6 L]

Classical Approach: Introduction, Soxhlet extraction, Automated Soxhlet extraction, other approaches, **Pressurized Fluid Extraction:** Introduction, theoretical consideration, Instrumentation for PFE, method development and applications. **Microwave assisted extraction:** Introduction, instrumentation, Applications(**Ref-1: 125-174**)

References

1. Extraction Techniques in Analytical Science, John R. Dean, Wiley
2. Vogel's Textbook of quantitative Chemical Analysis, sixth Ed., Mendham, Denney, Barnes, Thomas, Pub: Pearson Education.
3. Solid Phase Microextraction, A Practical Guide, Edited by Sue Ann Scheppers Wercinski, CRC press, Taylor and Francis.

Learning Objective - At the end of course students should able to-

1. Define / understand various terms in analytical extraction and method development and validation.
2. Explain instrumentations and methodology in analytical extraction.
3. Explain / describe basic principles of analytical extraction method development and validation.
4. Explain /Describe applications analytical extraction and method development and validation in industry and in analytical laboratory.
5. Apply / select particular method of analysis for sample to be analysed.
6. Solve numerical problems on analytical extraction and method development and validation.
7. Develop analytical method for analysis of given sample. Apply statistical treatment to the analytical data. Select appropriate parameters for the development of analytical method
8. Differentiate among the methods of analytical extraction.

CCTP-9, CHA-392: Advanced Chromatographic Methods of Analysis

[48L + 12T]

Section-I: Mass spectrometry and Gas Chromatography [24 L +6 T]**1. Mass Spectrometry [6 L]**

Fundamentals, Electron ionization, Chemical ionization, Instrumentation: *Quadrupole mass spectrometers, Magnetic sector mass spectrometers, TOF mass analyser, detector*; Interpretation of mass spectra, Types of ions Isotopic abundances and characteristic ion clusters, Nitrogen rule and rings-plus-double-bonds, steps in interpretation, Examples (**Ref-1: 39-72, Supplementary Ref.- 4**)

2. Fundamentals of Chromatographic Methods of Analysis [4 L]

Fundamentals of Chromatographic Separation (overview, the development of chromatogram), Characteristics value in chromatogram, Chromatographic theories (plate theory, kinetic theory), R_s as measure of peak separation, qualitative and quantitative analysis. Problems. (**Ref-2, Supplementary Ref-1, 6**)

3. Gas Chromatography [4 L]

Retention data and partition coefficient, separation in the gas phase, Components of gas chromatography: *Carrier gas, sample injection, split injection, spitless injection, cold on column injection, programmable temperature vaporization, head space injection, solvent effects, column, detectors- TCD, FID, ECD*, Stationary phases for GC: *stationary phases for packed column, capillary column, deactivation of surface, different stationary phases*, Applications of GC, Problem on quantitative analysis. (**Ref.-2, Supplementary Ref-1, 6**)

4. Gas Chromatography-Mass Spectrometry [8 L]

Vacuum and gas flow, Basic principles, Analysis of vacuum and gas flow, Interfaces, Computerization, Computerized operation, Characteristics, Data analysis, Reconstructed gas chromatogram, Mass chromatogram, Selected ion monitoring, Background subtraction, Biller-Biemann stripping technique, Compound identification using reference spectra matching, Mass spectral compilations, Methods of computerized mass spectral search, Commercial mass spectral computer search systems, Quantitative analysis by selected ion monitoring, Choice of ions: basic considerations, Magnetic sector versus quadrupole analysers, Identification and quantitation procedures, Use of isotopically labelled standards, Precision, accuracy and limit of detection, Automated GC-MS operation, Automated data acquisition, Automated data analysis. (**Ref-1: 79-134**)

5. Applications of GC and GC-MS [2 L]

- Quantitative analysis by GLC-different methods, Elemental Analysis using Gas Chromatography, analysis of Al, analysis of a mixture using the internal normalisation method, determination of sucrose as its trimethylsilyl derivative using gas-liquid chromatography, **Ref-4**
- Phenols in waste water by LLE-GC method (*sec-6420 phenols*), Organochlorine pesticides in water: LLEG method-1, LLEG method-2 (*sec-6630 organochlorine pesticides*), volatile organic compounds – Purge and trap capillary column GC-MS method (*Sec-6200-A,B,C*), Tributyl tin by GC-MS and FID method (*Sec-6710-A,B,C*) **Ref- 5**

References

1. Basic Gas Chromatography Mass Spectrometry, Principles and Techniques, F.W. Karasek and R.E. Clement, Elsevier, (Elsevier Science B.V.) 1988
2. Analytical Chemistry, Ed. by Kellner, Mermet, Otto, Valcarcel, Widmer, Second Ed. Wiley –VCH
4. Vogel's, Textbook of Quantitative Chemical Analysis 6th Ed.
5. Standard methods for the examination of water and waste water, 23rd Ed. Rodger Baird, Andrew Eatson, Eugene Rice, jointly published by: American Public Health Association, American Water Works Association, Water Environment Federation,
6. Forensic applications of Gas Chromatography by Michelle Carlin and John Dean, CRC press, 2013)

Section-II: Liquid Chromatography [24 L +6 T]**1. Instrumentation of HPLC****[4 L]**

Introduction: *HPLC-A powerful separation method, A first HPLC experiment, Liquid chromatographic separation modes, The HPLC instrument*, Pumps: General requirements, The short-stroke piston pump, Preparation of Equipment up to Sample Injection: *Selection of the mobile phase, Preparation of the mobile phase, Gradient systems, Sample injectors, Sample solution and sample volume*; Solvent Properties: *Table of organic solvents, Solvent selectivity, Miscibility, Buffers, Shelf life of mobile phases, The mixing cross*; *Detectors: General, UV detectors, Refractive index detectors, Fluorescence detectors, Electrochemical (amperometric) detectors, Light-scattering detectors, Multiple detection*; Columns and Stationary Phases: *Columns for HPLC, Precolumn, General properties of stationary phases, Silica, Chemically modified silica, Styrene-divinylbenzene, Column care and regeneration* (**Ref.-2: 1-9, 59-136, Ref-1**)

2. HPLC Methods**[6 L]**

- a) Adsorption Chromatography:** Normal-Phase Chromatography: What is adsorption?, The eluotropic series, Selectivity properties of the mobile phase, Choice and optimization of the mobile phase, Applications (**Ref.-2: 159-168, Ref-1**)
- b) Reversed-Phase Chromatography:** Principle, Mobile phases in reversed-phase chromatography, Solvent selectivity and strength, Stationary phases, Method development in reversed-phase chromatography, Applications, Hydrophobic interaction chromatography. (**Ref.-2: 173-191, Ref-1**)
- c) Chromatography with Chemically Bonded Phases:** Introduction, Properties of some stationary phases, Hydrophilic interaction chromatography, (**Ref.-2: 195-200, Ref-1**)
- d) Ion-Exchange Chromatography:** Introduction, Principle, Properties of ion exchangers, Influence of the mobile phase, Special possibilities of ion exchange, Practical hints, Applications (**Ref.-2: 203-213, Ref-1**)
- e) Ion-Pair Chromatography:** Introduction, Ion-pair chromatography in practice, Applications (**Ref.-2: 217-221, Ref-1**)
- f) Ion Chromatography:** Principle, Suppression techniques, Phase systems, Applications (**Ref.-2: 225-230, Ref-1**)

g) Size-Exclusion Chromatography: Principle, The calibration chromatogram, Molecular mass determination by means of size-exclusion chromatography, Coupled size-exclusion columns, Phase systems, Applications. (*Ref.-2: 231-244, Ref-1*)

h) Affinity Chromatography: Principle, Affinity chromatography as a special case of HPLC, Applications. (*Ref.-2: 249-252*)

3. Analytical HPLC [2 L]

Qualitative analysis, Trace analysis, Quantitative analysis, Recovery, Peak-height and peak-area determination for quantitative analysis, Integration errors, The detection wavelength, Derivatization, Unexpected peaks: Ghost and system peaks. (*Ref.-2: 285-308*)

4. Separation of Enantiomers [2 L]

Introduction, Chiral mobile phases, Chiral liquid stationary phases, Chiral solid stationary phases, Indirect separation of enantiomers. (*Ref.-2: 333-345*)

5. Mass Spectrometry, LCMS Interface and applications [8 L]

Interface Technology: Introduction, Thermo-spray interface, The electron spray interface (mechanism of electron-spray ionization, sample types, the electro-spray spectrum, structural information from electrospray ionization), atmospheric pressure chemical ionization interface and the mechanism of atmospheric pressure chemical ionization. Data acquisition (identification, quantitation-selected ion monitoring), Processing of mass spectra (total ion current trace, qualitative analysis, quantitative analysis). **Applications:** Molecular weight determination of small molecules (Method Development for Structural Studies, The Use of Target-Compound Analysis and LC-MS-MS for the Identification of Drug Metabolites, The Use of High-Accuracy Mass Measurements in Combination with LC-MS for the Structure Determination of Drug Metabolites, The Use of Cone-Voltage Fragmentation in Conjunction with High-Accuracy Mass Measurements and LC-MS for Metabolite Identification, The Use of LC-MSⁿ for the Identification of Drug Metabolites), Quantitation (requirements, quantitative standardization, matrix effect in LC-MS, the method of standard addition to overcome matrix effect). (*Ref-3: 75, 94-123, 189-218*)

Chapter-6: Super Critical Fluid Chromatography and Extraction [2 L]

Properties of supercritical fluid, Supercritical fluid chromatography: *Instrumentation and operating variables, effect of pressure, stationary phases, mobile phases, detectors, comparison with other types of chromatography, Applications*, supercritical fluid extraction: *Advantages of SFE, instrumentation, of line and on line extraction, applications.* (*Ref-4: 856-865, supplementary Ref-1*)

1. Analytical Chemistry, Ed. by Kellner, Mermet, Otto, Valcarcel, Widmer, Second Ed. Wiley –VCH

2. Practical High-Performance Liquid Chromatography, Veronika R. Meyer, Fifth Ed. John Wiley and Sons, Ltd.

3. Liquid Chromatography Mass Spectrometry: An Introduction by Bob Ardery, Publisher: Wiley India Pvt. Ltd. (2003). A book from series- Analytical techniques in the Science.

4. Principles of Instrumental Analysis, Skoog, West, Holler, 6th Ed. Cengage Publication.

Learning Objective - At the end of course students should able to-

1. Define / understand various terms in chromatography (GC and HPLC) and mass spectroscopy.
2. Explain instrumentations in chromatography (GC and HPLC) and mass spectroscopy.
3. Explain / describe i) basic principles of chromatography (GC and HPLC) and mass spectroscopy. ii) separation in GC / HPLC column. iii) Functioning and construction of GC / HPLC/ MS detectors.
4. Explain /Describe applications chromatography (GC and HPLC) in industry and in analytical laboratory.
5. Apply / select particular method / instrumental parameters for analysis for sample GC / HPLC.
6. Solve numerical problems on chromatography (GC and HPLC) and mass spectroscopy.
7. Integrate GC and HPLC chromatogram, Mass spectrum
8. Differentiate among the chromatography (GC and HPLC) methods of analysis.

CBOP-3, CHA-393: A) Bioanalytical Chemistry OR

B) Analysis of Food and Controlled Substances

CBOP-3, CHA-393: A) Bioanalytical Chemistry [48L + 12T]

Section-I: Bioanalytical Techniques [24 L +6 T]

1. Introduction to Electrophoresis [6L]

General introduction to Electrophoresis: *Introduction and applications of electrophoresis*; Types of electrophoretic systems: *Moving boundary electrophoresis, Zone electrophoresis, Steady state electrophoresis*; Support media in Zone electrophoresis: *filter paper, cellulose acetate, gel media*; Factors Affecting Electrophoretic Mobility: *Characteristic of charged molecules, Characteristic of the electrophoretic system*; Detection in electrophoresis: optical methods, radiochemical methods, biological assay methods (*Ref-1: 1-70*)

2. Capillary Electrophoresis: Basics, Instrumentation and Application [10 L]

a) Basic Principles: Basic Electrophoretic Separation Modes, Zone Electrophoresis, Isotachopheresis, Isoelectric Focusing, Set-up for Capillary Electrophoresis, Theory of Electrophoretic Migration, Determination of Effective Mobility, Electroosmosis, Performance Criteria, Efficiency, Resolution. (*Ref-2: 5-33*)

b) Instrumentation: Injection, Hydrodynamic Injection, Electro-kinetic Injection, General Aspects of Injection, Detection, General Aspects, Evaluation of Detector Performance, UV -VIS Absorbance Detection, Light Sources for UV -VIS Detection, Optical Layout of a UV -VIS Detector for CE, Design of the Detection Cell, Fluorescence Detection: Excitation Sources for Fluorescence Detection, Optical Layout of a Fluorescence Detector, Derivatization with Fluorescent Tags, Pre- and Post-Column Derivatization, Electrochemical Detection, Conductometric Detection, Amperometric Detection, Capillary Column, Sample Collection, Commercial Instruments. (*Ref-2: 103-141, 151-158*)

c) Qualitative and Quantitative Analysis and Applications: General Aspects of Qualitative and Quantitative Analysis, Application: Drugs and Natural Products, Amino Acids, Peptides and Protein (*Ref-2: 243-246, 261-274, 278-303*).

3. HPTLC and Detectors for HPTLC [8 L]

Thin layer chromatography, High performance thin layer chromatography. (*Ref-3*)
 Planar Chromatography Detectors, Transmittance Measurements in Thin-Layer Chromatography, The Lambert-Beer Law, Reflectance Measurements in TLC and HPTLC, The Kubelka–Munk Equation, Reflectance Measurements with a Diode-Array Scanner, Spatial Resolution on the Plate, Spectral Distribution on HPTLC Plates, Spectral Evaluation Algorithm, Mass Spectrometric Detection in TLC, Direct Plate Extraction (SSSP), MALDI Techniques (MALDI-MS), Atmospheric Pressure Mass Spectrometry. Applications. (*Ref-4: 231-257*)

References:

1. Electrophoresis, Analytical chemistry through open learning Series, Wiley
2. Capillary Electrophoresis: Principles and Practice, R. Kuhn S. Hoffstetter-Kuhn, SpringerLaboratory, Springer-Verlag
3. Vogels's Textbook of Quantitative Chemical Analysis, 6th Ed.
4. Quantitative Thin-Layer Chromatography-A Practical Survey, Bernd Spangenberg, Colin F. Poole, Christel Weins, Published by Springer

Section-II: Clinical Analytical Chemistry [24 L +6 T]

1) Analysis of blood and urine[12 L]

a) Collection of Specimens: Blood: Collection of Blood specimens, storage and preservation, Urine: Collection of Urine, physical characteristics of urea, preservation and storage, Faeces: Collection and preservation. **b) Analysis of Blood and urine:** Determination of blood and plasma glucose by glucose oxidase method, Determination of urine for glucose, Determination of ketone bodies in blood, Oral Glucose tolerance test, Determination of serum creatinine, estimation of serum bilirubin, Estimation of serum cholesterol, determination of blood haemoglobin, Urate: determination of serum urate, Determination of urea in urine by urease method and by direct colorimetry, Estimation of Na, K, Ca by flame photometry, inorganic phosphate by colorimetry. **c) Determination of vitamins in body fluid:** Classification of vitamins with example, Each vitamin must be explained with respect of functions, deficiency diseases, daily requirement, and analytical method i) Retinol (determination of retinol and serum carotene in serum using TFA), Vit D₃ (cholecalciferol), Vitamin E (Tocopherols, Determination of serum tocopherol by spectrophotometry by dipyrindyl method), Vitamin B₁ (thiamine determination by flurometry), Vitamin B₂ (riboflavin, Photofluorometric method), Vitamin B₆ (Pyidoxine, Fluorometric determination of Xanthuric acid), Nicotinic acid and Niacin: determination by fluorometry, Ascorbic acid (vitamin –c) Volumetric method using 2,6 dichlorophenol method, colorimetric determination of leucocyte ascorbate. (**Ref.-1**, Relevant pages)

2. Immunological methods of analysis

[10 L]

a) Basic of immunology: The immune response, Antigen, Adaptive Immunity and Clonal Selection, Antibodies, Antigen (Antibody production in response to antigen stimulus, affinity and avidity, antibody production in response to immunization vaccination, Antibody production in response to infectious agents, relation between antigen and antibody in vivo, diagnostic usefulness of antigen and antibody in infection disease), Antigenic Commonness, **b) Basic Principles of ELISA:** Reactions scheme, Direct

ELISA, Indirect ELISA, Sandwich ELISA, Competition ELISA, Choice of Assay, **Stages in ELISA:** Solid phase (Immobilization of antigen on solid phase coating, coating time and temperature, coating buffer, desorption, binding capacity, nonspecific binding, covalent antigen attachment), Washing, Addition of reagents, incubation, blocking conditions and non-specific reactions, enzyme conjugates, conjugation with enzymes, Development of label, stopping reactions, reading. **Practical Exercise for Direct ELISA:** Explain with respect to learning principles, reaction scheme, basis of assay, materials and equipment's, practical details, data explained, aspects of assay described, conclusions. The pregnancy test on urine. (Ref-2, 3)

3. Radioimmunoassay**[2L]**

Radioimmunoassay (RIA), Principle, RIA Reagents, RIA Steps, RIA Results Interpretation (Ref-1, 4)

References:

1. Varley's Practical Clinical Biochemistry, Gowenlock A. H., 6th Edition, 2006, CBS Publishers, New Delhi.
2. Methods in Molecular Biology, Vol-42, ELISA-Theory and Practice, by John R. Crowther, Humana Press, Totowa, New Jersey.
3. Enzyme-linked Immunosorbent Assay (ELISA) From A to Z, Samira Hosseini, Patricia Vázquez-Villegas, Marco Rito-Palomares, Sergio O. Martinez-Chapa, published by Springer,
4. Basic Serological Testing, Rowa Yousef Alhabbab, Published by Springer

Learning Objective - At the end of course students should able to-

1. Define / understand various terms in Electrophoresis, capillary electrophoresis, HPTLC, Body fluid analysis, ELISA, RIA.
2. Explain instrumentations in in Electrophoresis, capillary electrophoresis, HPTLC, Body fluid analysis, ELISA, RIA.
3. Explain / describe i) basic principles of chromatography (GC and HPLC) and mass spectroscopy. ii) Separation in GC / HPLC column. iii) Functioning and construction of GC / HPLC/ MS detectors.
4. Explain /Describe applications chromatography (GC and HPLC) in industry and in analytical laboratory.
5. Apply / select particular method / instrumental parameters for analysis for sample GC / HPLC.
6. Solve numerical problems on chromatography (GC and HPLC) and mass spectroscopy.
7. Integrate GC and HPLC chromatogram, Mass spectrum
8. Differentiate among the chromatography (GC and HPLC) methods of analysis.

CBOP-3, CHA-393: B) Analytical Methods of Food and Controlled**Substances****[48L + 12T]****Section-I: Analytical methods of Food [24 L +6 T]**

1. **Introduction to Food Analys** (Ref-1: 1-13) **[1 L]**
2. **Sampling and Sample Preparation** **[1 L]**
Introduction, Selection of Sampling Procedures, Sampling Procedures, Preparation of Samples, Grinding, Enzymatic Inactivation, (Ref-1: 71-80)
3. **Moisture and Total solids Analysis** **[1 L]**

Introduction, Importance of Moisture Assay, Moisture Content of Foods, Forms of Water in Foods, Sample Collection and Handling, Oven Drying Methods: *General Information, Removal of Moisture, Decomposition of Other Food, Constituents, Temperature Control, Types of Pans for Oven Drying Methods, Handling and Preparation of Pans, Control of Surface Crust Formation (Sand Pan Technique), Calculations*; Distillation Procedures, Chemical Method: Karl Fischer Titration. (**Ref-1** 87-96).

4. Ash Analysis

[1 L]

Introduction: *Definitions, Importance of Ash in Food Analysis, Ash Contents in Foods*; Methods: *Sample Preparation, Plant Materials, Fat and Sugar Products, Dry Ashing, Principles and Instrumentation, Procedures, Special Applications, Wet Ashing, Principle, Materials, and Applications, Procedures, Microwave Ashing, Microwave Wet Ashing, Microwave Dry Ashing, Other Ash Measurements, Comparison of Methods*

5. Analysis of Lipids

[5 L]

a) Definition, Classification, General Considerations, Solvent Extraction Methods: Sample preparation, Solvent selection, Sample Preparation, Solvent Selection, Continuous Solvent Extraction Method: Goldfish Method, Semicontiguous Solvent Extraction Method: Soxhlet Method, Discontinuous Solvent Extraction Methods, Total Fat by GC for Nutrition Labelling (AOAC Method 996.06), Nonsolvent Wet Extraction Methods, Babcock Method for Milk Fat (AOAC Method 989.04 and 989.10), Gerber Method for Milk Fat, Instrumental Methods, Comparison of Methods. (**Ref.-1:** 119-130) **b) Characterization of Lipids** (bulk such as oils): Estimation of free fatty acids, Saponification value of oils, iodine value, Determination of acid value of oil, determination of peroxide value of oil, p-anisidine Value and Totox Value, Thiobarbituric Acid Reactive Substances Test, Conjugated Dienes and Trienes, Lipid Oxidation: Evaluating Oxidative Stability, Methods for Lipid Components, Identification and quantification of fatty acids, Problem on quantitative methods. (**Ref-1:** 241, 246-258, *Supplimentary-2, 3*).

6. Proteins

[5 L]

a. Protein Analysis: Introduction, Classification and General Considerations, Importance of Analysis, Content in Foods, Methods: Following methods with respect to principle, reactions, procedures and applications a) Kjeldahl's Method b) Dumas (Nitrogen Combustion) Method, c) Infrared Spectroscopy, d) Biuret Method e) Lowry Method f) Dye-Binding Methods g) Bicinchoninic Acid Method h) Ultraviolet 280nm, Comparison of Methods. (**Ref-135 – 142**, *Supplimentary-2, 3*). **b. Protein Characterization Procedures:** Amino Acid Analysis, Protein Nutritional Quality: Introduction, Protein digestibility, Protein efficiency ratio, and net protein ratio, Other Protein Nutritional Quality Tests, Assessment of Protein Functional Properties, Determination of net protein utilization, digestibility and biological value, Problem on quantitative methods (**Ref-1:** 271 - 277, *Supplimentary-2, 3*)

7. Carbohydrates:

[5 L]

Introduction, Mono- and Oligosaccharides: Extraction, Total Carbohydrate: Phenol-

Sulfuric Acid Method, total reducing sugars by Nelson Somyogi method, Specific Analysis of Mono- and Oligosaccharides - High-performance Liquid, Gas Chromatography, Enzymic Methods, Chromatography, Mass Spectrometry, Thin-layer Chromatography, Polysaccharides: Starch, Total Starch, Degree of Gelatinization of Starch, Degree of Retrogradation of Starch, Non-starch Polysaccharides, Dietary Fibres: Major Components of Dietary Fibre, General Considerations, Methods. (*Ref-1: 149-169 Supplementary-2, 3*).

8. Determination of food preservatives

[5 L]

Definition, SO₂ legislation and determination by Tanners method, Nitrate and nitrites legislation and determination, boric acid legislation and determination, Benzoic acid legislation and determination, 4-hydroxybenzoate legislation and determination, ascorbic acid legislation and determination. Sweeteners: Saccharine identification and determination, Colours: Identification by general methods, Natural colours. Problem on quantitative methods. (*Ref-4: Relevant pages*)

References

1. Food Analysis, Edited by S. Suzanne Nielsen, Fourth Edition, Springer
2. Hand Book of Food Analytical Chemistry: Water, Proteins, Enzymes, Lipids, and Carbohydrates by Edited by Ronald E. Wrolstad, Terry E. Acree, Eric A. Decker, Michael H. Penner, David S. Reid, Steven J. Schwartz, Charles F. Shoemaker, Denise Smith, Peter Sporns, Wiley Interscience, a John Wiley & Sons, Inc., Publication.
3. Biochemical Methods, By S Sadashivan, A. Manickam; Third Edition, New Age International Publishers
4. Pearson's Chemical Analysis of Food

Section-II: Analytical Methods of Controlled Substances [24 L +6 T]

1. The narcotic drug and Psychotropic Substances (NDPS) Act-1985 [1 L]

Important Definition: *Drug, Cannabis (Indian Hemp), Cannabis Products, Coca-derivatives, Coca Leaf, Coca Plant, Illicit Traffic, Controlled Substance, Manufactured Drug, Opium, Opium Poppy, Poppy Straw, Poppy Straw Concentrate, Psychotropic Substance, Prohibition Control and Regulation of NDPS (Ref.-1: 122-134, Ref-2)*

2. Chemical Screening and Microcrystal Tests [2 L]

a) Chemical tests: Introduction, Chemistry of Color Formation, Limitations of Chemical Color Tests, Chemical Color-Test Methods, Documentation, Chemical Colour Tests: *Chen's Test, Dille-Koppanyi's Test, Mecke's Test, Marquis' Test, Nitric Acid Test, Primary Amine Test, Secondary Amine Test, Tertiary Amine Test, Van-Urk's Test, Duquenois-Levine Test, Froehde's Test, Janovsky Test, Weber Test.* **b) Microcrystal Techniques:** Introduction, Advantages of Microcrystal Techniques, Disadvantages of Microcrystal Techniques, Documentation, Microcrystal Test Techniques, Aqueous Test Technique, Volatility Test Technique, Acid and Anionic Test Technique, Aqueous Test Reagents, (*Ref-3: 79-95*)

3. Analysis of Drugs/Narcotics

[21 L]

- a) **Amphetamine and Related Compounds:** Introduction, Qualitative Identification of Amphetamines, Sampling and Physical Description of Amphetamines, Presumptive Testing of Amphetamines, Thin Layer Chromatography of Amphetamines, Definitive Identification of Amphetamines, Quantification of Amphetamines, Comparison and Profiling of Amphetamine Samples, The Leuckart Synthesis of Amphetamine, The Reductive Amination of Benzyl Methyl Ketone, The Nitrostyrene Synthesis, Impurity Extraction and Sample Comparison. (Ref.-4: 13-34)
- b) **The Analysis of LSD:** Introduction, Qualitative Identification of LSD, Sampling and Physical Description of LSD Blotter Acid, Extraction of LSD Prior to Analysis, Presumptive Testing for LSD, Thin Layer Chromatography of Samples Containing LSD, Confirmatory Tests for the Presence of LSD (Ref.-4: 37-43)
- c) ***Cannabis sativa* and Products:** Introduction, Origins, Sources and Manufacture of Cannabis, Analytical Sequence, Bulk and Trace Sampling Procedures, Qualitative Identification of Cannabis, Identification of Herbal Material, Identification of Other Materials, Comparison of Cannabis Samples. (Ref.-4: 49-65)
- d) **Diamorphine and Heroin:** Introduction, Origins, Sources and Manufacture of Diamorphine, Appearance of Heroin and Associated Paraphernalia, Bulk and Trace Sampling Procedures, Identification, Quantification and Comparison of Heroin Samples, Presumptive Tests for Heroin, Thin Layer Chromatography of Heroin Samples, Gas Chromatographic–Mass Spectroscopic Identification of Heroin, Quantification of Heroin Samples, Comparison of Heroin Samples (Ref.-4: 73-92)
- e) **Cocaine:** Introduction, Origins, Sources and Manufacture of Cocaine, Extraction and Preparation of Coca Paste, Synthesis of Pure Cocaine, Qualitative Identification of Cocaine, Presumptive Tests for Cocaine, Thin Layer Chromatography, Definitive Identification of Cocaine, Quantification of Cocaine, Quantification of Cocaine by GC–MS, Quantification of Cocaine by UV Spectroscopy, Comparison of Cocaine Samples. (Ref.-4: 97-109)
- f) **Products from *Catha edulis* and *Lophophora williamsii*:** Introduction, Products of *Catha edulis*, Identification, Quantification and Comparison of Khat Samples, Comparison of Khat Samples, Products of *Lophophora williamsii*, Physical Description and Sampling of Materials, Presumptive Tests for Mescaline, TLC Analysis of Mescaline, HPLC Analysis of Mescaline, GC–MS Analysis of Mescaline, Comparison of Peyote Samples. (Ref.-4: 113-124)
- g) **Analysis Barbiturates and Benzodiazepines:** Introduction, Analysis of Barbiturates and Benzodiazepines, Extraction of Barbiturates and Benzodiazepines from Dose Forms, Presumptive Tests for Barbiturates and Benzodiazepines, TLC of Barbiturates and Benzodiazepines, Confirmatory Analysis of Barbiturates and Benzodiazepines, Quantification of Barbiturates and Benzodiazepines, Introduction, Products of *Catha edulis*, Identification, Quantification and Comparison, of Khat Samples, Comparison of Khat Samples, Products of *Lophophora williamsii*, Physical Description and Sampling of Materials, Presumptive Tests for Mescaline, TLC Analysis of Mescaline, HPLC Analysis

of Mescaline, GC–MS Analysis of Mescaline, Comparison of Peyote Samples. (*Ref.-4: 139-149*).

Reference

1. Textbook of Forensic Pharmacy, C. K. Kokate, S. B. Ghokhale, Pharma Med Press (2008)
2. Textbook of Forensic Pharmacy, B. M. Miital
3. Basic Principles of Forensic Chemistry, Javed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr. Humana Press
4. Analysis of Controlled Substances, Michael D. Cole, Wiley (2003)

Learning Objective - At the end of course students should able to-

1. Define / understand various terms in food analysis techniques and methods, forensic science and drug substances.
2. Explain methods and principles of analysis of i) Food - carbohydrates, proteins, preservatives, ii) drug substances.
3. Select appropriate methods of food analysis for its quality.
4. Select appropriate methods for identification of drug and analysis of drug from sample.
5. Select and describe the parameters required for food quality.
6. Solve numerical problems on analysis food and drug substances.
7. Interpret food quality and drug substances from analytical results.
8. Differentiate among the different methods of analysis of food and drug substances.

CCPP-3:Practical I: Basics of Instrumental Methods of Chemical Analysis [96 L+24 T]

Section-1: Analytical method Development and Validation

Expt . No	Name of Experiments
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Compulsory experiment

1	Demonstration Practical: a. Calibration of UV-Visible spectrophotometer for control of absorbance as per IP or BP b) Theoretical basis for the choice of solvent for recording UV-Visible spectra of substances c) Theoretical basis for choice proper concentration for recording the UV-Visible spectrum d) Recording the UV-Visible spectrum of any one substance like caffeine, aspirin, paracetamol, KMnO ₄ or any other substance of interest having characteristic UV-Visible absorbance i) identification of characteristics peaks in spectrum, b) Choice of λ_{\max} for quantitative analysis c) Calculation of Molar absorptivity (ϵ) and d) Sp. absorbance (absorbance of sample solution for 1% solution). Theoretical interpretation of spectra. (Ref-6,7)
2	Table Work: a) Theoretical basis of method development and validation – Accuracy, precision, noise level, detection limit, quantitation limit, Calibration curve and standard addition method and theoretical basis of choice between two, b) Expression of results: Calculation of mean, standard deviation, error and absolute error, elimination of data, c) Regression analysis of calibration curve and its importance. (Ref-3)
3-7	Analytical method development and validation (Ref. 1, 6, 7) Study of visible spectroscopic or colorimetric method for estimation of particular metal ion or non-metal ion or organic substance with respect to: a) Selection of ligand

/ reagent and colour formation method b) Choice of reaction cond. such as concentration of analyte and colour forming reagent, pH for colour formation reaction, etc. c) Determination of λ_{\max} for quantitative analysis d) estimation of noise level, detection limit, quantisation limit and linearity range (Calculate R^2 value). Thereby set conc. limits for calibration curve method and standard addition method. e) Estimation of known of metal ion by calibration curve method and by standard addition method in triplicate for the validation of method. f) Estimation of metal ion from sample by calibration curve method and by standard addition method in triplicate (Regression analysis must be performed for both methods and results shall be accepted when R^2 is greater than 0.95) g) Detection of possible interfering metal ion.

Some suggested examples:

- i) Colorimetric / visible spectrophotometry Cu(II) or Co(II) – R-nitrososalt and estimation of Cu(II) (Sample - alloy brass or bronze or coin) (Cent. Eur. J. Chem.10(5), 2012, 1617-1623, DOI: 10.2478/s11532-012-0081-7)
- ii) Colorimetry / visible spectrophotometry Mn(II)-Formaloxime or Mn(II)-oxidized to KMnO_4 (sample - tea leaves on ashing or plant micronutrient supplement). (Ref.- 1, 7)
- iii) Colorimetry / visible spectrophotometry B as borate with curcumin reagent (Sample – Talcum powder can be taken) (Ref-1 and 3)
- iv) Colorimetry / visible spectrophotometry Ni(II) or Co(II) by alfa nitroso beta-naphthol (Sample - Steel alloy). Ref-1 and Monatshefte Fur Chemic 111, 1413 1425, Springer-Verlag 1980

Note: A student can select any other metal and own synthesized ligand system under the guidance of his mentor.

Some examples of non-metal ions

- i. NO_3^- or NO_2^- by colorimetry / visible spectrophotometry (Ref- 1 and 2)
- ii. NH_4^+ or NH_3 by colorimetry / visible spectrophotometry (alkaline phenol-perchlorate reagent) (Ref-1 and 2)
- iii. SO_4^{2-} by Colorimetry/ visible spectrophotometry (Ref-1)

Examples of Organic substances

- i) Analysis of aspirin Colorimetry (Ref. 11)
- ii) Assay of Vitamin-C by Colorimetry from lemon or orange juice (Ref- 12)
- iii) Colorimetry / visible spectrophotometry phenolic compounds (Salicylic acid, salbutamol sulfate, phenol) by Folin-Ciocalteu reagent (Ref-4)
- v) Colorimetry / visible spectrophotometry Analysis of paracetamol (Ref-8)

Note: i) A mentor can practice multiple examples in batch. ii) *Student shall prepare systematic report in the form of journal which will contain 1) introduction to UV-Visible spectroscopy, basic terms in absorption spectroscopy, Beer's law, construction and working of colorimeter and spectrophotometer, interpretation of absorbance spectra of organic and inorganic substances, basis of quantitative analysis by UV-Visible spectroscopy, calibration curve method, standard addition*

	<i>method, advantages of graphical methods, basis for simultaneous method analysis of non-interfering substance by spectrophotometry. This part will be followed by experiment 3 to 7.</i>
Any three experiments	
8	Analysis of Riboflavin by visible spectrometry and Photoflurometry. Compare results with respect to sample requirement, detection limit, accuracy of both methods. Give your choice for analysis of i) Riboflavin as raw material in pharmaceutical industry and ii) blood/ urine/vitamin supplement. Explain reason for choice of method. (<i>Ref-4, 6 and 9</i>).
9	Comparison of end point redox titration between $K_2Cr_2O_7$ and standard Fe(II) i) by potentiometry and ii) external indicator. Calculate amount of Fe(II) by both methods and compare with standard value. Give critical comment on Fe(II) content by two methods with respect to standard value i.e. accuracy of results and advantages and disadvantages of each method. (<i>Ref-3</i>)
10	Determine amount of $NaHCO_3$ from eating soda sample or from mixture of $NaHCO_3 + Na_2CO_3$: Determine amount of $NaHCO_3$ by thermal decomposition method (gravimetry) on burner as well as by volumetric method using standardized 0.05 N HCl. Compare purity or amount of $NaHCO_3$ in sample by both methods. Comment on advantages and disadvantages of each methods. Give your choice of method between two. (<i>Ref-3</i>)
11	Perform pH metric titration for estimation of CH_3COOH from vinegar using i) 0.1 M standardized NaOH simultaneously using phenolphthalein indicator and pH meter ii) 0.5 M standardized NaOH using pH meter. Compare the results of three methods and give your comment. (<i>Ref-3</i>)
12	Determine aspirin in tablet conventional titration and by potentiometric titration and compare the results of two method. (<i>Ref-10</i>)
13	Development of turbidimetric method for estimation of i) PO_4^{3-} at low level using ammonium molybadate reagent or ii) S^{2-} using reaction with suitable metal ion such as Cu(II). iii) estimation of Mg(II) by Nessler's reagent. (<i>for self development</i>)
14	Qualitative and confirmatory test for (minimum four) Test for aniline / para aminophenol, Test for antimony / mercury (No C.T.), Test for Borate (use talcum powder), Dinitrophenol pesticides, Ethanol / methanol, Formaldehyde, Hypochlorites, Iodates, Nitrate / nitrite, Paracetamol, Phenol, Salicylic acid its derivatives, Thiocynates (Note: Aq. Solutions shall be given containing prescribed conc. in monograph of the substance). (<i>Ref-13</i>).
	References: 1. Separation, Preconcentration and Spectrophotometry in Inorganic Analysis, by Z. Marczenko and M. Balcerzak, Analytical Spectroscopy Library – 10, Elsevier 2. Standard methods for the examination of water and wastewater, 23rd Ed. Roger B. Baird, Andrew D Eaton, Eugene W. Rice, American Public Health Association, Americal water works association, Water environment federation.

	<p>3. Vogels textbook of Inorganic Quantitative Analysis,</p> <p>4. Biochemical Methods, Third Edition, By S Sadashivan, A. Manickam; New Age International Publishers</p> <p>6. Indian Pharmacopeia: 2007, Vol-1, 2, 3.</p> <p>7. Chemical Analysis and Material Characterization by spectrophotometry, Bhim Prasad Kafle, Elsevier</p> <p>8. Ultraviolet and Visible Spectrophotometry in Pharmaceutical Analysis, Sandor Gorog, Published by CRC press, Taylor and Fransis.</p> <p>9. An introduction to Practical Bichemistry, David T. Plummer, Tata McGraw-Hill publishing Company Ltd.</p> <p>10. Experiments in chemistry, D. V. Jahagirdar, Himalaya Publishing Company</p> <p>11. Method Development for Analysis of Aspirin Tablets, Journal of Chemical Education, Volume 65 Number 10 October 1988.</p> <p>12. Vitamin C as a Model for a Novel and Approachable Experimental Framework for Investigating Spectrophotometry, Journal of Chemical Education, DOI:10.1021/acs.jchemed.9b00197.</p> <p>13. Basic Analytical Toxicology, R. J. Flangan, R. A. Braithwait, S. S. Brrown, B. Viddop, F. A. de Wolff, published by WHO.</p>
Section – II: Introduction to Analytical Techniques (12 experiments)	
Nitrogen Estimation	
1	Estimation organic nitrogen by Kjeldahl's Method or semi-micro Kjeldahl's method (example: milk powder, soil sample, cooked food containing pulses, fertilizer etc.). (Ref-1)
Solvent Extraction	
2	Extraction of organic substance by Soxhlet or semi micro Soxhlet extraction (such as Essential oils, carotenoids from carrot, Caffeine for tea powder) and their isolation from solvent. Purity by TLC, BP/MP. (Ref-7)
3	Isolation of carotenoids from spinach / lycopene from tomato. TLC separation to find out number of carotenoids. (Ref-6, 15)
Solid Phase Extraction, Ion exchange chromatography	
4	Determination of Ion exchange capacity of ion exchange resins (Ref-1).
5	Solid Phase Extraction: Isolation of amino acids from aqueous sample using ion exchange resin and their identification by colorimetric test (very dilute glycine solution can be used as an example of alfa amino acid) (Ref. 5) Or Isolation of caffeine using RP C-18 cartridge from cold drinks and quantitative estimation (Ref-7) Or Isolation of beta carotene from spinach leaves on silica gel cartridge by solid phase extraction and its quantification visible spectrophotometry. (Ref-7)
6	Pre conc. using solid phase extraction on ion exchange cartridge and estimation. You can any choose any metal ion which is present below detection limit. You will do preconcentration using ion exchange resin and will estimate by AAS or aqueous

	colorimetry (not solvent extraction). Example: Preconcentration of Cu(II) from brine (one can use aqueous solution of Cu(II) solution with less than 0.5 ppm conc.) and its estimation using R-Nitroso salt (<i>Ref-1, 4</i>)
Flame photometry	
7	Flame photometric analysis of water /soil sample for Na ⁺ and K ⁺ by calibration curve method (give regression analysis for both curves) (<i>Ref-1</i>)
8	Estimation of K ⁺ from soil/water sample by internal standard and its confirmation by standard addition method (give regression analysis of both curves) (<i>Ref-1</i>)
Methods of Trace Analysis of metals: Atomic Absorption Spectroscopy	
9	Demonstration Practical by Mentor: Handling of AAS and study on any metal ion estimation by AAS method with respect to 1) Effect of oxidant to fuel ratio on absorbance, ii) detection limit and iii) linearity range for calibration curve method. (give regression analysis) iv) Effect of other metal ion and absorbance of analyte. (<i>Ref-1, 15</i>)
10	Estimation of any two-metal ion by atomic absorption spectroscopy from soil or micronutrient supplement or food sample. (<i>Ref-1, 15</i>)
Turbidimetry / Nephelometry	
11	Selective estimation of Cl ⁻ from water or saline sample or food sample by calibration curve method using turbidimetry (give regression analysis) and its confirmation by standard addition method. (<i>Ref-1</i>)
12	Selective estimation of SO ₄ ²⁻ in presence of chloride from water sample or any other sample by calibration curve and its confirmation by turbidimetric titration method (give regression analysis for both curves).(<i>Ref-1</i>)
Photofluorimetry	
13	Estimation of quinine sulphate from tablet by calibration curve and its confirmation by standard addition method. (<i>Ref-1</i>)
14	Determination of Zn(II) by Photofluorimetry (<i>Ref-1</i>)
Polarimetry	
15	a) Determination of optical rotation thereby calculate specific rotation of dextrose (glucose) and sugar (sucrose). Express purity of glucose and sugar samples on the basis of specific rotation. (<i>Ref-2</i>) b) Determination of glucose in DNS saline and glucose supplement (Glucon-D) sample by polarimeter. (<i>Ref-2</i>)
Quantitative TLC	
16	Separation of Colours by TLC / Paper chromatography, their isolation by elution from paper or TLC and quantification by colorimetry. (<i>Ref-1</i>)
17	Analysis of the Composition of a Mixture of Nitroanilines by Thin-Layer Chromatography and Ultraviolet/Visible Spectrometry (<i>Ref.-8</i>)
HPLC	
17	Demonstration Practical by Mentor i. Handling of HPLC equipment, choice of mobile phase and column, sample

	preparation. ii. Record the chromatogram of pure substance and study a) Effect of conc. on peak area and peak height b) from retention time and length of column calculate number theoretical plates from. c) Qualitative analysis – spiking method and by using retention time d) Quantitative analysis by comparing peak height of sample with standard as well as by comparing peak area of sample with standard. (Ref.-1, 14, 15)
18	Estimation of APC tablet by HPLC method (Ref-1, 3, 8) or HPLC method developed in your laboratory.
Gas Chromatography	
19	Demonstration Practical by Mentor Study of GC chromatogram: Record the chromatogram of pure ethanol, acetone, methanol and their mixture. Identify peaks of respective substances in mixture and calculate relative percentage of these three substances by percent area method. Calculate N, resolution of chromatographic column. (Ref-1)
20	Analysis of vitamin-A acetate or alfa-tocopherol by GC according to IP method or any other reported method or method developed in your laboratory. (Ref-2)
Thermogravimetric Method	
21	Demonstration Practical by Mentor Study of GC chromatogram: Record the TGA of pure NaHCO ₃ (room temp to 300 °C). Explain different characteristics of thermogram and quantitative analysis by TGA. Explain how thermal decomposition reaction can be predicted from wt. loss.
22	TGA analysis of dolomite ore for CaCO ₃ and MgCO ₃ content (Ref-1)
23	TGA analysis CuSO ₄ ·5H ₂ O (Ref-1)
Cyclic Voltammetry	
24	Cyclic voltammetric study of Fe(II)/Fe(III) system. Basic principle and calculation of basic parameters from CV. (Ref-1, 10, 11)
25	Quantitative analysis using CV of any one -Vit-C / parathion / nitrobenzene / or any other substance for which your department has developed CV method. (Ref.-12,13).
Students Self activity	
1	a) Compulsory: Prepare report on construction, working, representation, uses and care of electrodes: Calomel electrode, silver-silver chloride electrode, platinum electrode, conductivity cell, and combine glass electrode. (Ref-1). b) Actual construction of standard silver-silver chloride as reference electrode (Replacement to saturated calomel electrode as it contain highly toxic Hg(II), Hg(I) and Hg metal), salt bridge and their testing. (Ref-9). c. Construct graphite electrode using graphite rod or used dry pen-cell. Perform redox titration using graphite electrode prepared by you and calomel as reference electrode. Perform same titration using Pt electrode and calomel electrode. Report does Pt can be replaced by graphite or not. Give the reasons.
References:	
1. Vogel's Textbook of Quantitative Chemical Analysis, 6 th Ed.	

2. Indian Pharmacopeia, 2007
3. Chemical Separations Principle techniques and Experiments, Clifton E Meloan, Wiley Interscience.
4. Separation, Preconcentration and Spectrophotometry in Inorganic Analysis, by Z. Marczenko and M. Balcerzak, Analytical Spectroscopy Library – 10, Elsevier
5. Standard methods for the examination of water and wastewater, 23rd Ed. Roger B. Baird, Andrew D Eaton, Eugene W. Rice, American Public Health Association, American water works association, Water environment federation.
6. Biochemical Methods, Third Edition, By S Sadashivan, A. Manickam; New Age International Publishers
7. Extraction technique in Analytical Science, John R. Dean, Wiley
8. Experiments in modern analytical chemistry, D. Kealey, Springer Science Business media, 1986.
9. Student Construction of a Gel-Filled Ag/AgCl Reference Electrode for Use in a Potentiometric Titration, Journal of Chemical Education, Vol. 76 No. 1 January 1999
10. https://chem.libretexts.org/Courses/University_of_California_Davis/UCD_Chem_115_Lab_Manual/Lab_1%3A_Cyclic_Voltammetry
11. Cyclic Voltammetry Experiment James J. Van Benschoten. Jane Y. Lewis, and William R. Heineman, Journal of Chemical Education, Volume 60, Number 9, September 1983 (772-776) and Volume 60 Number 9 September 1983 (702-706)
12. Voltammetric analysis of hydroquinone, ascorbic acid, nitrobenzene and benzyl chloride in aqueous, non-aqueous, micellar and microemulsion media, R. Sripriya M. Chandrasekaran M. Noel, Colloid Polym. Sci (2006) 285: 39–48.
13. Electrochemical Determination of Methyl Parathion using a Modified Electrode, Toxicol. and Environ. Chem., 2003, Vol. 85, Nos. 4–6, pp. 233–241.
14. Analysis of Soft Drinks: UV Spectrophotometry, Liquid Chromatography, and Capillary Electrophoresis, Journal of Chemical Education, Vol. 75 No. 5 May 1998
15. Analytical Chemistry for Technicians, John Kenkel, Third Edition, CRC Press LLC, 2003.

Learning Objective –

At the end of course students should able to-

1. Maintain proper record of analytical data in notebook. Observe personal safety in laboratory and able handle all chemicals, instruments, etc safely in laboratory.
2. Define / understand various terms involved practical methods of quantitative analysis.
3. Explain instrumentations of colorimeter, spectrophotometer, photofluorometer, TGA, HPLC, GC, Flame-photometer, CV, AAS, etc.
4. Explain / describe basic principles of chromatography different instrumental methods of analysis. Able to handle particular instrument according to SOP.
5. Design / modify and validate new analytical method for chemical analysis of particular sample.
6. Apply / select particular method / instrumental parameters for analysis of given sample.
7. Give mathematical treatment to analytical data and able to interpret the results accurately.
8. Verify theoretical principle practically or apply theory to explain practical observations.
9. To conclude the results able to take the decision regarding quality of sample.

10. Differentiate among the various analytical methods / techniques of chemical analysis.

Semester-IV

CCTP- 10, CHA-490: Advanced Analytical Spectroscopic Techniques

[48L + 12T]

Section-I: Atomic Spectroscopic Methods [24 L +6 T]

1. Sample preparation techniques [2 L]

Introduction, aqueous sample, liquid-liquid extraction, Ion exchange, co-precipitation, solid samples: decomposition techniques, microwave digestion, dry ashing, fusion, Extraction procedures: Single extraction, sequential extraction, enzymatic digestion (*Ref-1: 17-36, Supplementary reference - 2*)

2. Atomic Absorption and emission Spectroscopy [6 L]

Introduction, Atomic spectra, Instrumentation of AAS: Sample introduction system: Nebulizers, Laser Ablation technique, hydride vapour generators, atomizers: Flame atomizer - premix burner, fuel gases and oxidants, graphite furnace, hydride generator, cold vapour technique, Hollow cathode lamps, spectrophotometers, detectors, Interferences in AAS (spectral and chemical), Quantitative analysis (calibration curve method, standard addition method, internal standard addition method), Practical applications of AAS from *Ref-3. (Ref-3: Relevant pages, Supplementary references 4,5)*

3. Inductively Coupled Plasma AES and MS [10 L]

a. Inductively Coupled Plasma AES: Introduction to Atomic emission spectroscopy, inductively coupled plasma, Direct current plasma, microwave induced plasma, glow discharge, plasma spectroscopy, spectrometers, Detectors, interferences.

b. Inductively Coupled Plasma MS: Fundamental of MS, Inorganic mass spectroscopy, Interface, mass spectrometer, quadrupole mass analyser, detectors, interferences, isotope dilution analysis, mass spectral interpretation. (*Ref-1:57-117, supplementary Ref- 6*)

c. Applications: Forensic analysis of documents, Clinical analysis of blood and urine, (*Ref-1: Relevant pages*). Analysis of metals from waste water sample of ICP-MS method (*Ref-2, sec. 3120, 3125*)

4. Atomic Fluorescence Spectroscopy [6 L]

Atomic fluorescence, Apparatus for AFS, EMR source for AFS, LASERS, Cells for AFS, Plasmas- ICP and DCP, Detectors, theory of AFS, Analysis with AFS, Interferences with AFS, Resonant ionization Spectroscopy, LASER enhanced ionization spectroscopy. (*Ref-5*)

5. Elemental Analysis [2 L]

Particular analyses, Elemental organic microanalysis, Total nitrogen analysers (TN), Total sulphur analysers, Total carbon analysers, problems on empirical and molecular formula on CHONS analysis. (*Ref. -7: 441-450*)

Reference

1. Practical Inductively Coupled Plasma spectroscopy, John R. Dean, Wiley India Pvt. Ltd. (AnTs Series book)
2. Standard methods for the examination of water and waste water, 23rd Ed. Jointly published by American Public Health Association, American Water Work Association, Water

Environment Federation. 2017.

3. Vogels, Quantitative Chemical Analysis, 6th Ed.
4. Principles of Instrumental Analysis, Skoog, West, Holler, 6th Ed. Cengage Publication.
5. Introduction to Instrumental Analysis by R. D. Braun
6. Practical Guide to ICP-MS, Edited by Robert Thomas, CRC press, Francis and Taylor.
7. Chemical Analysis Modern Instrumentation Methods and Techniques, Francis Rouessac and Annick Rouessac, Second Edition, John Wiley & Sons Ltd.

Section-II: Molecular Spectroscopic Methods [24 L +6 T]

1. Molecular Luminescence spectrometry [6 L]

Introduction, theory of fluorescence and phosphorescence: *excited state producing fluorescence and phosphorescence, energy level diagram, rate of absorption and emission, deactivation process, variables affecting fluorescence and phosphorescence, Emission and excitation spectra*; Instruments for measuring fluorescence and phosphorescence: *Components of Fluorometers and Spectrofluorometers, Instrument Design, Correction and Compensation Schemes, Instrument standardization*; Applications of Photoluminescence Methods: *Methods for Organic and Biochemical Species, Phosphorometric method, Fluorescence Detection in Liquid Chromatography, Lifetime measurement, Fluorescence imaging*; **Chemiluminescence:** The Chemiluminescence phenomenon, measurement of chemiluminescence, analytical applications, problems. (*Ref.-1:399-426*)

2. Electron Paramagnetic Resonance Spectroscopy [12 L]

Basic Theory: general remarks, electron spin and magnetic moment, ESR transitions, Selection rules, g-factor, presentation of spectra, interaction of magnetic dipole with microwave radiations, Larmor precession, resonance phenomenon, relaxation process, transition probability. **Hyperfine Structure:** Nuclear hyperfine splitting, radical containing one proton, spin Hamiltonian, selection rules, radical containing a set of equivalent protons, radical containing a set of multiple protons, radical containing multiple sets of protons ($I = \frac{1}{2}$), radical containing multiple sets of proton ($I > \frac{1}{2}$), Atomic radicals, Origin of hyperfine interaction, sigma radicals, assignments of spectra using Huckel MOs, alternant hydrocarbons, hyperfine splitting constants, second order splitting, Applications. (*Ref-3: Relevant pages, Supplementary Ref-4*)

3. Electron Spectroscopy for Surface Analysis [6 L]

Basic principles, x-ray photoelectron spectroscopy, Auger Electron spectroscopy, Instrumentation: *ultra-high vacuum, source gun, electron gun, Ion gun, electron energy analysers*, Characteristics of Electron spectra: *photoelectron spectra, Auger electron spectra*, Qualitative and quantitative analysis: *qualitative analysis, peak identification, chemical shift, problems with insulating materials, Quantitative analysis: peak and sensitivity factor, composition depth profiling.* (*Ref-2: 221-250*).

References:

1. Principles of Instrumental Analysis, Skoog, West, Holler, 6th Ed. Cengage Publication.
2. Materials Characterization, introduction to microscopic and spectroscopic techniques, Yang Leng, 2nd Wiley-VCH.
3. Introduction to Magnetic Resonance of Spectroscopy ESR, NMR, NQR, D.N.

Sathyanarayana, I. K. International Publishing House Pvt. Ltd.

4. Structural Methods in Molecular Inorganic Chemistry, David W. H. Rankin, Norbert W. Mitzel, Carole A. Morrison, Wiley (John Wiley & Sons, Ltd.), 2013

Learning Objective - At the end of course students should be able to-

1. Define / understand various terms in atomic absorption, atomic emission, fluorescence, ESR and electron spectroscopy.
2. Explain instrumentation of atomic absorption, atomic emission, ICPAES, ICPAES-MS, fluorescence, ESR and electron spectroscopy.
3. To describe basic principles of atomic absorption, atomic emission, ICPAES, ICPAES-MS, fluorescence, ESR and electron spectroscopy.
4. Select appropriate methods for sample treatment in AAS / AES, ICPAES, ICPAES-MS.
5. Explain advantages of ICPAES-MS over AES spectroscopy, fluorescence spectroscopy.
6. Solve numerical problems on analysis all these spectroscopic methods.
7. Interpret ESR spectra, super hyperfine splitting and g value in ESR, and parameters affecting it.
8. Calculate theoretical parameters from ESR data and characterize compound.
9. Solve problems based on atomic absorption, atomic emission, ICPAES, ICPAES-MS, fluorescence, ESR and electron spectroscopy.

CCTP-11, CHA-491: Chemical Methods of Pharmaceuticals Analysis

[48L + 12T]

Section-I: Pharmaceutical Dosage forms and General Methods Analysis [24 L + 6 T]

1. Pharmaceutical Dosage Forms [4 L]

Capsules: *Definition, types of capsules, Tests*; Creams: *Definition, tests*; Ear Drops: *Definition, tests*; Eye Drops: *Definition, tests*; Gels: *Definition*, Inhalation Preparations: *Definition, Uniformity of delivered, Number of deliveries per container dose, Uniformity of delivered dose (only)*; Nasal preparations: *Definition and tests*; Ointments: *Definition and tests*; Oral Liquids: *Definition, types and tests*; Oral Powders: *Definition and tests*; Parenteral Preparations: Introduction, Injections: *Definition and tests*, Infusion: *Definition and tests*; Powder for Injection: *Definition and tests*; Tablets: *Definition, types of tablets and their tests. (Ref-2: 14 - 47)*, Shelf life of pharmaceutical preparation.

2. Chemical Test, Limit Test and Assay [6 L]

Important Note: Write the chemical reaction and explain theoretical basis of the limit tests and assay though it is not given in reference book.

- a) **Limit Tests:** Aluminium, Aluminium in Adsorbed Vaccines, Arsenic, Calcium in Adsorbed Vaccines, Chlorides, Heavy metals, Iron, Lead, Potassium, Sulphates, Sulphated Ash, Total Ash, Free Formaldehyde, N-N-Dimethylaniline (*Ref-1: 74-80, Ref-4, 93-149*)
- b) **Assays:** Acetyl Value, Acid Value, Cineole, Ester, Ester Value, Hydroxyl Value, Iodine value, Nitrogen, Methoxyl, Nitrite Titration, Peroxide Value, Saponification Value, Assay of Steroids, Unsaponifiable Matter, Assay of Vitamin A, Assay of Vitamin D, Water- (*Titration method and azeotropic distillation method*), Zinc, Ethanol, Assay of Insulins (*Ref-1: 80-99, Ref-3*)

3. Pharmaceutical Methods of Determination [6L]

Disintegration Test, Dissolution Test, Uniformity of Weight of Single-Dose Preparations,

Uniformity of Content of Single-Dose Preparations, Friability of Uncoated Tablets, Contents of Packaged Dosage Forms, Powder Fineness, Particle Size by Microscopy, Particulate Contamination. (Ref-1: 175-188)

4. Microbiological Assay of Pharmaceuticals

[8 L]

Biological assay in general, **a) Agar diffusion assay – Quantitative basis:** Introduction, The theory of zone formation, what happens in practice, principles of calculation of potency estimate; **b) The Theory and Practice of Tube Assay- Growth promoting substances:** Introduction, the mode of action of growth limited by amino acids, growth limited by vitamins, production of acid by lactobacilli, clinical factor in the assay of growth promoting substances; **c) The Theory and Practice of Tube Assay-Growth Inhibiting Substances:** Introduction, measurement of response, the forms of response line, historical development of the turbidimetric method, linearization of sigmoid curve, the quantitative theory of microbial growth and inhibition, a practical determined log dose – response curve, factor affecting final cell count, the influence of temperature, the influence of time, **d) What do we want assay:** pharmacopeial intension and control of antibiotic bulk materials, control in routine in manufacture, Research and development; **d) General Practical Aspects of Microbiological Assay:** Introduction, test solutions (weighing – sample of unknown, dilution of primary solution to test level, problem with very dilute solutions, the assay medium), selection of Latin squares and plating routine, Aspects of technique (the test organism, inoculating the medium, assay plate, assay tube, diluents, the sample, test solution and the effect of contamination, application of test solution-agar diffusion assay, application of test solution-turbidimetric assay; Calculation of potency, **e) Standard and reference materials**(Ref-4: 1, 9-18, 23-35, 37-56, 59-64, 65-77, 79-84, Ref-1: 45-52)

Section-II: Analysis of Raw Materials and Active Ingredients [24 L +6 T]

1. Introduction to Pharmaceutical Analytical Chemistry

[1 L]

Introduction, Official European Pharmacopoeia definitions, Pharmaceutical Analytical Chemistry, Manufacture of Pharmaceuticals, Development of New Drugs, Use of Pharmaceuticals (Ref-3: 1-7)

2. Marketing Authorizations, Pharmaceutical Manufacturing, and International Pharmacopoeias

[1 L]

Introduction, Marketing Authorization and Industrial Production, Pharmacopoeias, Life Time of Pharmaceutical Preparations and Ingredients. (Ref.3: 9-14)

3. Chemical Analysis of Pharmaceutical Ingredients

[12 L]

Pharmaceutical Ingredients, Production, and Control, Pharmacopoeia Monographs, Melting point capillary method, (monograph on paracetamol and acepromazine malate tablet, acetaminophen, acetaminophen capsules, castor oil virgin, cefaclor), Impurities in Pharmaceutical Ingredients: *Impurities in Pure Chemical Ingredients, Impurities in Organic Multi-Chemical Ingredients*; Identification of Pharmaceutical Ingredients: IR Spectrophotometry (*identification of ibuprofen, Identification of spironolactone*), UV-Vis Spectrophotometry (*Identification of mianserin hydrochloride*), Thin-Layer Chromatography (*Identification of metrifonate*), Melting Point, Optical Rotation (*Optical*

rotation for simvastatin), Liquid Chromatography (*Identification of calcitriol*), Chloride (*Identification of chloride in chlorcyclizine hydrochloride*) and Sulfate, Identification, Impurity Testing of Pharmaceutical Ingredients (Pure Chemical Ingredients): Appearance of Solution (*Appearance of solution for ibuprofen*), Absorbance (*Absorbance and color of solution of esomeprazole magnesium*) pH and Acidity or Alkalinity (*pH of esmolol hydrochloride, Acidity or alkalinity of dopamine hydrochloride*), Related Substances (*Related substances according to Ph. Eur. for omeprazole*), Residual Solvents (*Limit of acetone in olmesartan medoxomil*), Foreign Anions (*Test for foreign chlorides and sulfates in furosemide*), Sulfated Ash (*Residue on ignition for acetaminophen*), Elemental Impurities (*Test for foreign zinc in human insulin*), Loss on Drying (*Loss on drying for paracetamol*), Water (*Determination of water in ephedrine*), Identification and Impurity Testing of Organic Multi-Chemical Ingredients: *Oxidizing Substances, Only importance of the should be explained - Acid Value, Hydroxyl Value, Iodine Value, Peroxide Value, Saponification Value, Unsaponifiable Matter*), Other Tests (*Chromatographic profile for peppermint oil*), Assay of Pharmaceutical Ingredients, Aqueous Acid–Base Titration (*Assay of omeprazole, amitriptyline hydrochloride, ephedrine hydrochloride, ephedrine*), Non-Aqueous Acid–Base Titration (*metronidazole benzoate, lidocaine*), Redox Titrations (*ferrous fumarate*), Liquid Chromatography (*Assay of simvastatin*), UV-Vis Spectrophotometry (*Assay of hydrocortisone*). (**Ref-3: 305-388**)

4. Chemical Analysis of Pharmaceutical Preparations

[10 L]

Chemical Analysis of Pharmaceutical Preparations, Monographs and Chemical Analysis (*BP monograph for paracetamol tablets*), Identification of the API: Identification by IR Spectrophotometry (*Identification of aspirin, fluoxetine in fluoxetine hydrochloride oral solution, Identification of mupirocin in mupirocin calcium nasal ointment*), Identification by Liquid Chromatography (*Identification of fluoxetine in fluoxetine hydrochloride, droperidol in droperidol injection, Beclomethasone Dipropionate in Beclomethasone Dipropionate Ointment*), Identification by UV-Vis Spectrophotometry (*Identification of Diazepam in Diazepam Tablets, Flupentixol Decanoate in Flupentixol Decanoate Injection, Miconazole in Miconazole Nitrate Cream*), Assay of the Active Pharmaceutical Ingredient, Assays Based on Liquid Chromatography (*Assay of Omeprazole, Fentanyl in Fentanyl Citrate Injection, Assay of Hydrocortisone in Hydrocortisone Ointment*), Assays Based on UV Spectrophotometry (*Assay of Paracetamol in Paracetamol Tablets, Assay of Doxapram in Doxapram Hydrochloride Injection*), Assays Based on Titration (*Assay of Fe²⁺ in Ferrous Fumarate Tablets, Diphenhydramine in Diphenhydramine Hydrochloride Oral Solution*), Chemical Tests for Pharmaceutical Preparations, Test for Related Substances (*Related Substances in Paracetamol Tablets*), Uniformity of Content (*Uniformity of Content for Phenindione Tablets*), Dissolution. (**Ref-3: 391-332**)

References

- 1) Indian Pharmacopeia Volume I, 7th Ed
- 2) Indian Pharmacopeia Volume II, 7th Ed
- 3) Introduction to Pharmaceutical Analytical Chemistry, Stig Pedersen-Bjergaard, Bente Gammelgaard, Trine Grønhaug Halvorsen, Second Edition, Wiley (2012).

4. Pharmaceutical Chemical Analysis: Methods for Identification and Limit Tests, Ole Pedersen, CRC press. Taylor & Francis Group, 2006.

Learning Objective - At the end of course students should able to-

1. Define / understand various terms in pharmaceutical raw material and finished product analysis.
2. Explain various pharmaceutical dosage forms and types of raw materials used.
3. To describe basic principles of methods of pharmaceutical analysis according to IP.
4. Explain importance particular test in pharmaceutical raw material and finished product analysis.
5. Perform and explain importance of limit tests, identification tests and microbiological limit test of raw materials and finished products.
6. Solve numerical problems on analysis pharmaceutical raw material and finished product analysis.
7. Interpret IR spectra, HPLC chromatogram, UV-Visible spectra of pharmaceutical materials.
8. To perform total analysis of pharmaceutical raw material and finished product analysis according to IP / BP / USP.
9. Standardize analytical instruments according IP /BP/ USP.
10. Take a decision on the basis of analytical results regarding quality of raw materials so that material can be accepted for production or rejected.

CBOP-4, CHA-492: A) Laboratory Automation and Environmental Analytical Chemistry

OR

CBOP-4, CHA-492: B) Analytical Chemistry of agriculture, Polymer and Detergents

CBOP-4, CHA-492: A) Laboratory Automation and Environmental Analytical Chemistry [48L + 12T]

Sensor-I: Laboratory Automation and Sensor Based Techniques [24 L +6 T]

1. Introduction to laboratory Automation [2 L]

Introduction, automation, miniaturization and simplification, lab automation, flow injection analysis, miniaturized analytical systems, fast response analytical systems, chemical sensors, screening systems, process on-line systems. (*Ref-1: Relevant pages*)

2. Laboratory Automation [4 L]

Definition and concept, objective of automation in analytical chemistry, automation of analytical tools and process, automation of preliminary operations, automation of calibration, automation of measuring and transducing of analytical signals, automation of data acquisition and processing, analysers, automated management system, advantages and shortcomings of automated system. (*Ref-1: Relevant pages*)

3. Flow Injection Analysis [6 L]

Batch and continuous flow analysis, principles, basic FIA instrumentation, dispersion in FIA, FIA for reproducible and precise sample preparation, FIA system with enzymes, flow injection hydride generation scheme, online sample conditioning, and preconcentration, exploiting the physical dispersion process, FIA gradient technique, Process control,

process control analysers. (*Ref-1: Relevant pages*)

4. Miniaturized Analytical systems [4 L]

Introduction, Concept, theory of miniaturization, microfabrication, silicon and glass micro-matching, polymer replication technology, miniaturized analytical components, sampling and sample pre-treatment, system integration, serial integration, parallel integration, commercialization. (*Ref-1: Relevant pages*)

5. Chemical Sensors [4L]

Introduction, definitions, Classification of chemical sensors, descriptions of chemical sensors (electrochemical sensors, potentiometric sensors, Volta-metric chemical sensors, sensors based on conducting properties), Optical sensors (light guides, the evanescent wave, design of fibre optic sensor, indicator mediated sensor), Calorimetric sensors (catalytic gas sensor, thermal conductivity sensor), mass sensor (piezoelectric quartz crystal resonator, surface acoustic wave sensor). (*Ref-1: Relevant pages*)

6. Biosensors in analysis [4L]

Introduction, producing biological surface, methods of immobilization, Achievement of biotransduction (amperometric, potentiometric, optical). (*Ref-1: Relevant pages*)

References:

1. Analytical Chemistry, Ed. by Kellner, Mermet, Otto, Valcarcel, Widmer, Second Ed. Wiley –VCH

Sec-II: Environmental Analytical Chemistry [24 L +6 T]

1. Water Pollution and Measurement of Water Quality [16 L]

a) **Water Pollutants:** Brief explanation of following with respect to their sources and toxic effects -Inorganic pollutants (Heavy Metals (Cd, Hg, Pb), Metalloids, Organotin Compounds, Inorganic Species (CN⁻, NH₃ and other species), Asbestos), Organic Pollutants (Soaps, Detergents, and Detergent Builders, Pesticides in Water, Polychlorinated Biphenyls), Emerging Water Pollutants, Pharmaceuticals, and Household Wastes, Radionuclides in the Aquatic Environment). (**Ref-2:** 159-183 supplementary reference-3 and 4)

b) **Analysis: Physical Properties:** Colour (Visible Inspection, Spectrophotometric—Multi-Wavelength Method, Turbidity, Odour, Taste, Acidity, Alkalinity, Calcium Carbonate Saturation, (Introduction, Indices Indicating A Water's Tendency To Precipitate Or Dissolve CaCO₃, Indices Predicting The Quantity Of CaCO₃ That Can Be Precipitated Or Dissolved), Hardness, Oxidant Demand/Requirement (Chlorine Demand/Requirement, Ozone Demand/Requirement— Batch Method), Conductivity, Salinity. (**Ref-1:** 2.5, 2.8, 2.12-2.40, 2.48-2.62). **Metal ions:** Introduction, Preliminary Treatment Of Samples (*Introduction, Filtration for Dissolved and Suspended Metals, Treatment for Acid-Extractable Metals, Digestion for Metals, Nitric Acid Digestion, Nitric Acid-Hydrochloric Acid Digestion, Nitric Acid-Sulfuric Acid Digestion, Nitric Acid-Perchloric Acid Digestion, Nitric Acid-Perchloric Acid Hydrofluoric Acid Digestion, Dry Ashing, Microwave-Assisted Digestion*), Quantitative analysis by AAS, FES and ICPAES: *Only general explanation as this part is covered in detail in Analytical spectroscopy Sec-I.* (**Ref-1:** 3.1-3.35, 3.36-3.67, 3.70-3.71, 3.76-3.78, 3.82-3.84, 3.104-3.105). c) **Inorganic**

non-metal: Introduction, Determination of Anions By Ion Chromatography, Inorganic Anions By Capillary Ion Electrophoresis; Bromide (phenol red method), cyanide, Chlorine (DPD colorimetric method), Fluoride (ion selective method, complexone method), ammonia (titrimetric method, ions elective method and phenate method), NO_2^- - colorimetric method, NO_3^- (nitrate electrode and Cd reduction method), Organic nitrogen by MicroKjeldahl method, Dissolved oxygen (iodometric and membrane electrode method), phosphate (molybdate – SnCl_2 - colorimetric method), Sulfide (methylene blue and ion selective method), **d) Organic constituents:** Biochemical oxygen demand, Chemical oxygen demand, total organic carbon, phenols (direct photometric method), surfactants. (**Ref-1:** 4.1-4.14, 4.17, 4.30-4.31, 4.39-4.46, 4.61, 4.72, 4.86-4.90, 4.114-4.120, 4.124 -4.131, 4.139, 4.114, 4.149, 4.156-4.161, 4.181-4.184, 5.5-5.29, 5.49-5.58, supplementary reference-3 and 4)

2. Air Pollutants and Analysis of the Atmosphere and Air Pollutants [8 L]

a) Air Pollutants: Explanation only with respect to source and health hazards of: CO , SO_2 , NO_x , NH_3 , Cl_2 and F_2 ; Organic Pollutants (Aromatic Hydrocarbons, Carbonyl Compounds, Miscellaneous Oxygen-Containing Compounds, Organonitrogen Compounds, Organohalide Compounds, Organosulfur Compounds, Organic Particulate Matter, Hazardous Air Pollutants Organic Compounds)(**Ref-2:** 285 to 329 only relevant information from these pages)

b) Pollutant Analysis: Atmospheric Monitoring, Air Pollutants Measured, Sampling, Methods of Analysis, determination of Sulfur Dioxide, Nitrogen Oxides, Analysis of Oxidants, Contents, Analysis of Carbon Monoxide, Determination of Hydrocarbons and Organics, Determination of Specific Organics in the Atmosphere, Analysis of Particulate Matter, Filtration, Collection by Impactors, Particle Analysis, X-Ray Fluorescence, Determination of Lead in Particulate Matter, Direct Spectrophotometric Analysis of Gaseous Air Pollutants. (**Ref-2:** 707-718).

Reference

1. Standard methods for the examination of water and waste water, 23rd Ed. Rodger Baird, Andrew Eatson, Eugene Rice, jointly published by: American Public Health Association, American Water Works Association, Water Environment Federation.
2. Environmental Chemistry, Stanley E. Manahan, Ninth Edition, CRC press, Taylor and Francis, 2010.
3. Handbook of Environmental Analysis Chemical Pollutants in Air, Water, Soil, and Solid Wastes by Pradyot Patnaik, Third Edition, CRC press, Taylor and Francis, 2018.
4. Environmental Chemistry, A. K. Day, New Age Publication Company

Learning Objective - At the end of course students should able to-

1. Define / understand various terms in – i) Laboratory automation and sensors, ii) environmental pollution, analysis water and air.
2. Explain instrumentation of automated laboratory analysis and sensors.
3. To describe basic principles of automated laboratory analysis and sensors.
4. Explain importance of automated laboratory analysis and sensors.
5. Describe sources of water and air pollution and pollutants.
6. Describe / explain methods / techniques of sampling of water and air and their analysis.

7. Solve numerical problems on analysis water and air.
8. Draw conclusion regarding water and air quality from analytical results.

CBOP-4, CHA-492: B) Analytical Chemistry of agriculture, Polymer and Detergents [48L + 12T]

Section-I: Agricultural Analytical Chemistry [24 L +6 T]

1. Analysis of soil [10 L]

a) Sampling of soil, sample preparation, Pre-treatment of Samples and Contamination, Trace Element Analysis, Sub-sampling, Drying Techniques, Milling, Grinding and homogenization, **b) Weighing and Dispensing:** Weighing Errors, Dispensing Errors, **c) Acid-digestion, Ashing and Extraction Procedure:** Acid-digestion and Washing: *Acid-digestion of soils, Total soil nitrogen; Microwave acid-digestion, Dry ashing, Nitrate and water-soluble carbohydrate*; Extraction Procedures for soils: *pH extractants, Phosphate extractants, Potassium extractants, Trace element extractants*, **d) Analysis of Soil:** Soil Analytical Procedures - Determination of extractable boron, Cation exchange capacity, exchangeable bases and base Saturation, Determination of CEC and exchangeable cations, Measurement of calcium and magnesium by AAS, Measurement of potassium and sodium by flame photometry, Determination of cation exchange capacity (CEC), Determination of effective cation exchange capacity (ECEC), Determination of fulvic and humic acids, Discussion - Determination of available nitrogen, Method-a: Determination of nitrate by selective ion electrode, Discussion - Determination of total mineralized nitrogen, Method-b: Determination of extractable ammonium-N, Method-b: Determination of extractable nitrate-N, Discussion, Determination of organic plus ammonium nitrogen, Method-a: Determination of soil nitrogen by autoanalysis, Method-a: Reduction of nitrate before digestion and colorimetric auto analysis, Method-b: Determination of organic plus ammonium-N by digestion and distillation, Discussion, Determination of soil organic matter, Method-a: Determination of soil organic matter by loss on ignition, Method-b: Determination of easily oxidizable organic C by Tinsley's wet combustion, Discussion 5.8. Determination of pH and lime requirement, Method-a: Measurement of pH, Method-b: Determination of lime requirement, Method-c: Determination of pH in soils with soluble salts, Discussion - Determination of extractable phosphorus, Method-a: Determination of extractable phosphorus (manual method), Method-b: Determination of extractable phosphorus (automated method), Method-c: Determination of resin extractable phosphorus (automated method), Determination of extractable magnesium, potassium and Sodium, Determination of extractable trace elements, Discussion-Determination of extractable sulphur, Method-a. Determination of extractable sulphur (manual method), Method-b. Determination of extractable sulphur (automated method). (*Ref-1: 17-35, 50-104, Ref.-2: 1-14, 71-331*)

2. Fertilizer Analysis: [6 L]

Discussion -Determination of total nitrogen in presence of nitrate and organic, Method-a: Determination of total nitrogen in presence of nitrate and organic N, with final determination by distillation, Method-b: Determination of total nitrogen in presence

of nitrate and organic N, with final determination by auto-analysis, Discussion - Determination of phosphorus in fertilizers, Method-a. Determination of water-soluble phosphorus(extraction), Method-a: Determination of water-soluble phosphorus, (auto-analysis), Method-a: Determination of water-soluble phosphorus(manual method), Method-b. Determination of 2% citric acid-soluble phosphorus– method for basic slags (Thomas phosphate), Method-c: Determination of total phosphorus in the acid digest from Method-b. with final determination by auto-analysis, Discussion-Determination of potassium in fertilizers, Method-a: Determination of water-soluble potassium, Method-b. Determination of ammonium oxalate-soluble potassium, Method-c: Determination of potassium in the acid digest from, Liming Materials, Determination of the moisture and neutralizing value of liming materials, Determination of fineness of grinding. (*Ref.-1: 106-123*)

3. Analysis of Pesticide Residues

[8 L]

Preparation of Samples, Collection and Preparation of Soil Samples, Collection and Preparation of Water Samples, **Individual Pesticide Residue Analytical Methods:** Aldicarb(GC), Captafol (GC Method), Captafol (HPLC), Captan (HPLC), Chlorothiophos (GC), Ethylene Thiourea (GC), Folpet (HPLC), 1-naphyl acetic acid (GC), Paraquat (photometric); **Multiple Pesticide Residue Analytical Methods:** Substituted Phenyl Urea Herbicides (GC), Organochlorine and Organophosphorus Pesticides (GC and TLC), Dithiocarbamate and Thiuram Disulphide Fungicides (photometric), Phthalimide fungicides (HPLC). (*Ref-3: 17-23, 87-116, 135-148, 167-172, 241-250, 297- 307, 353-359, 401-406*).

References:

1. Methods in Agricultural Chemical Analysis: A Practical Handbook, N.T. Faithfull, CABI Publishing, Typeset by Wyvern 21 Ltd, Bristol (2002).
2. Soil Sampling and Methods of Analysis, Edited by M.R. Carter E.G. Gregorich, Canadian Society of Soil Science, Second Edition (2008)
3. Manual of Pesticide Residue Analysis Volume I, Edited by Hans-Peter Thier and Hans Zeumer, Pesticides Commission, VCH, New York.

Sec-II: Analytical Chemistry of Polymer and Detergents [24 L +6 T]

Section-II: Polymer Analysis and Detergent analysis

1. Polymer analysis

a. Introduction

[1 L]

Introduction and Types of polymers. (*Ref-1: 1-28*)

b. Identification:

[4 L]

Introduction, Preliminary Identification Methods: Solubility, Density, Behaviour on Heating; Infrared Spectroscopy, Raman Spectroscopy, Nuclear Magnetic Resonance Spectroscopy, Ultraviolet-Visible Spectroscopy, Differential Scanning Calorimetry, Mass Spectrometry, Chromatography, Emission Spectroscopy. (*Ref-1: 31-64, Supplementary-2*)

c. Molecular Weight

[3 L]

Introduction, Molecular Weight Calculations, Viscometry, Chromatography, Ultracentrifugation, Osmometry, Light Scattering, End-Group Analysis, Turbidimetric

Titration. (*Ref-I: 103-119, Supplimentary-2*)

d. Structural Methodology

[4 L]

Introduction, Isomerism, Chain Dimensions, Crystallinity, Orientation, Blends, Thermal Behaviour, Dilatometry, Infrared Spectroscopy, Raman Spectroscopy, Nuclear Magnetic Resonance Spectroscopy, Optical Microscopy, Transmission Electron Microscopy, X-Ray Diffraction, Neutron Scattering, (*Note: Thermal Analysis and thermal degradation are excluded as explained in TGA*); (*Ref-I: 121-149, 161-170, Supplimentary-2*)

e. Mechanical Properties

[4 L]

Introduction, Stress-Strain Behaviour, Viscous Flow, Viscoelasticity: *Creep, Models, Stress Relaxation*; Elasticity, Processing Methods, Tensile Testing, Flexural Testing, Tear-Strength Testing, Fatigue Testing, Impact Testing, Hardness Testing, Viscometry, Dynamic Mechanical Analysis. (*Ref-I: 209-233*).

2. Analysis of Surfactants

[8 L]

a) Surfactant types; classification, identification, separation: Why analyse surfactants, Features peculiar to surfactant analysis, Basic Definitions (surfactant, anionic surfactant, cationic surfactant, non-ionic surfactant, amphoteric surfactant, weakly acidic and basic surfactants), Common types of surfactants of all four classes, **b) Elemental analysis:** Metals, Determination of nitrogen, Determination of sulphur, Determination of phosphorus. **c) Basic techniques:** Extraction of surfactants (Liquid-solid extraction: *Liquid-liquid extraction using separating funnels, Liquid-liquid extraction using extraction columns*), Acid-base titration: (*general principles, end point detection, Determination of weak acids and bases and their salts, Potentiometric titration: Principle, Applications, Methods for esters, amines, alcohols and unsaturated fatty materials, Two-phase titration of ionic surfactants with surfactants of opposite charge, Introduction, ISO 2271: Principle and procedure, Potentiometric titration with surfactants of opposite charge using a surfactant-sensitive electrode, Advantages of potentiometric titration, Construction and performance of surfactant-sensitive electrodes, Titration procedure, Open-column chromatography.* **d) Analysis of Representative surfactants:** **i) Analysis of Anionics:** Introduction, general methods- *Para-toluidine precipitation/titration method, Analysis of Alkane sulphonates: Determination of total alkane sulphonate, Determination of mean molecular weight of alkane monosulphonates, Separation and determination of alkane mono- and disulphonates, Carboxylates: Titration with benzethonium chloride, Solvent extraction, Acid-base titration, Determination of soaps in fatty products,* **ii) Analysis of nonionics:** Analysis of Ethoxylated alcohols, alkylphenols and fatty acids: *Composition, Determination by potentiometric titration, Determination by the cobaltothiocyanate colorimetric method, Determination of total nonionics and polyethylene glycols, Volumetric determination of polyethylene glycols, Determination of oxyethylene groups, Fatty acid ethoxylates: determination of polyethylene glycols, free fatty acid and mono- and diester;* **iii) Analysis of cationics and amphoterics:** Introduction, Analysis of Quaternary ammonium salts: *Two-phase titration with sodium dodecyl sulphate, Two-phase titration with sodium tetraphenylborate, Determination of free amine and amine hydrochloride, Amines: Determination of molecular weight and total, primary, secondary and tertiary amines*

(Ref-3: 1, 8, 17-24, 31-36, 42-75, 105-109, 119-124, 142-143, 149-160, 171-177, 222-226, 264-280, 310-317, Supplementary reference-4)

Reference

1. Polymer analysis, Barbara H. Stuart, Analytical Techniques in the Sciences (AnTS), John Wiley and Sons Ltd.
2. Analytical Methods for Polymer Characterization Rui Yang, CRC Press Taylor & Francis Group, 2018
3. Introduction to Surfactant Analysis, Edited by D. C. Cullum, Springer-Science + Business Media, B.V, 1994.
4. Handbook of Detergents, Editor-In-Chief Uri Zoller, Part-C, Heinrich Waldhoff, Rüdiger Spilker, Marcel Dekker, New York, 2005.

Learning Objective - At the end of course students should able to-

1. Define / understand various terms in soil analysis, pesticide residue analysis, detergent analysis and polymer analysis.
2. Explain / describe techniques / methods of soil analysis, pesticide residue analysis, detergent analysis and polymer analysis.
3. To describe basic principles techniques / methods soil analysis, pesticide residue analysis, detergent analysis and polymer analysis.
4. Explain importance of soil analysis, pesticide residue analysis, detergent analysis and polymer analysis.
5. Choose suitable method / techniques to characterize quality of soli polymer and detergent.
6. Describe / explain results of analysis soil, pesticide residue, detergent and polymer.
7. Solve numerical problems on analysis soil, pesticide residue, detergent and polymer.
8. Draw conclusion regarding soil, detergent and polymer quality from analytical results.

CBOP-5, CHA-493: Practical III

CHA-493-A: Optional Analytical Chemistry Practical

OR

CHA-493-B: Project

CBOP-5, CHA-493: A) Optional Analytical Chemistry Practical [96 L +24 T]

Section-I: Any 12 experiments

1	Table Work: Characterization of organic compounds by VU-Visible, IR and NMR spectroscopy (any two compounds, Example- paracetamol and aspirin - actual spectra must be given for analysis)
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Analytical Chemistry for Self-Employment: (any five experiments from 2 to 9): Preparation / Isolations Analytical Standards or reference material for analytical laboratories (**Imp. Note:** all these materials can be used for further experiments).

2-3	Solvent extraction: Isolation and purification caffeine. Impurity present if any by TLC. Indian Pharmacopeia Tests: identification tests, MP, loss on drying, Total heavy metal and assay. (Spectral characterization may be performed) (Ref-5)
4-5	Synthesis of Paracetamol (or any other medicinal compound) by green chemistry route and recrystallization. Test as per IP: TLC, MP, Identification tests, limit test for chloride, LOD and assay. (spectral characterization may be performed) (Ref-5 and 4)

6-7	Synthesis, recrystallization of ligands used in analytical chemistry: Example- diethyldithiocarbamate (or other dithiocarbamate ligand), salicylaldehyde ethylenediamine, 8-Hydroxyquinoline, or any other, purity by suitable method. (Packaging and labelling - student self-work).
8	Preparation of <u>Analytical Reagent Kit</u> (any one) which will contain all the reagents for determination of specific analyte, labelling and packaging of reagents and writing of standard protocol to use the kit and testing of kit, detection limits should be mentioned. (such kits are used in commercial analytical laboratories) (You cannot adopt procedures from commercialized kits which available in market). Suggested examples: a student can select other example with permission of his mentor. 1) Analysis of creatinine (trinitrophenol method) (Ref-3) 2) Blood cholesterol (ferric chloride method) (Ref-3) 3) Analysis of proteins by Lowry method (Ref-3, 6) 4) Analysis of reducing sugar by colorimetry method. (Ref-3, 6) 5) Regents for qualitative test of carbohydrates and protein for higher secondary laboratories – Fehling solution-A, Fehling solution-B, Iodine solution, Molisch reagent, Barford reagen, Benedicts reagent, Seliwanoff reagent, Bials reagent, biuret reagent. (Ref-6) 5. Preparation of standard solutions required for limit tests of pharmaceuticals as per I. P. (Note: These kits should be used for experiments and can be prepared 1 week before the schedule of such an experiment)
9	Synthesis of Methyl red indicator, purification, MP/ TLC and test for colour change with respect to change in pH of indicator, (packaging and forwarding – student self-work) (Ref-8)
Chromatographic Methods (any three)	
10	Identification of amino acids / sugars / or any other mixture by two-dimensional chromatographic method (TLC or paper) (Ref.-3)
11	Sephadex gel separation of proteins (Ref-6)
12	Determination of molecular weight by gel permission column chromatography (Sephacryl S-200 column) (Ref-6)
13	Separation of leaf pigments by adsorption Chromatography (Ref-6)
14	Separation of amino acids by ion exchange chromatography (Ref-6)
15	Separation of proteins by ion exchange (DEAE cellulose) chromatography (Ref-6)
Part-III (any three)	
16	Analysis of phenolics in Aurvedic solution / syrup preparations / black tea – hence determine their antioxidant activity (Ref-3)
17	Estimation of total proteins Lowry method (Ref-3)
18	Estimation of thiamine by photoflurimetry from multivitamin capsule by

	calibration curve and its confirmation by standard addition method. (Ref-3)
19	Determination of total sugars or Glucose content in glucose supplement by (glucon-D) by titration with Fehling solution (FSSAI manual)
Section – II: 12 experiments from 1 to 23	
Part-I: Volumetric and Gravimetric methods for quantitative analysis of complex materials (Any six)	
1-2	Analysis of Cement for: SiO ₂ , Calcium, Iron, Magnesium and Aluminium (Ref-1)
3-4	Analysis of mixed fertilizer sample for total nitrogen, K and phosphate content. (Ref-1)
5	Analysis of dolomite ore with respect to SiO ₂ , Ca and Mg (Ref-1)
6	Analysis of brass alloy for Cu and Sn (Ref-1)
7	Determination of total Ash, Ash Insoluble in Hydrochloric acid, Alkalinity of soluble ash in coffee [FSSAI manual]
8	Separation of Chloride and Bromide on anion exchange resin and quantitative estimation (Ref.-1)
9	Electrogravimetry determination of Cu(II) or Ni(II) (Ref-1)
10	Identification of form of iodine (qualitative test) in table salt and its quantitative estimation by volumetric method. (Ref. 9)
Part-II: Instrumental Methods of selective analysis from complex materials (Any five)	
10-11	Analysis of fertilizer Micronutrient Supplement for Fe, Mn, Cu, and B. Colorimetry: Fe with thiocyanate, Mn as KMnO ₄ , B using curcumin reagent, and Cu using diethyldithiocarbamate ligand. (Ref-1, 2) (any two)
12	Analysis of Chloride, Bromide and Iodide from mixture by potentiometry (Ref-1)
13	Use of ion selective electrodes for determination (F, Cl, Ca, NH ₄ ⁺ etc. from water)
14	TGA/DTA analysis of polymer for binders, polymer content, etc. (Ref-7)
15	Determination of Ca in milk powder by flame photometry by standard addition or calibration curve method (FSSAI Manual]
16	Estimation of Fe(III) from detergent by solvent extraction (Ref.-1)
17	Selective estimation of Ni(II) from steel alloy or (Ni(II) -Fe(III) synthetic solution) by solvent extraction (Ref.-1).
Part-III: Any one of the following	
18	Apply Limit test of heavy metals and iron to Aurvedic medicinal preparations (Ref-4)
19	Determination of total cation in water by cation exchange method (Ref-1)
Students self-activity - Compulsory: Review of five research paper on the same research topic must be performed by an individual students and report must be submitted to the mentor. This is evaluative part of internal assessment. All the papers must be selected from UGC care list for which mentor should help to the students.	
References	
1. Vogel's Textbook of Inorganic Quantitative Analysis, A. I. Vogel, 3 rd Ed.	
2. Separation, Preconcentration and Spectrophotometry in Inorganic Analysis, by Z.	

- Marczenko and M. Balcerzak, Analytical Spectroscopy Library – 10, Elsevier
3. Lab Manual in biochemistry, immunology and biotechnology, Arti Nigam, Archana Ayyagari, Tat-McGraw-Hill Publication.
 4. Indian Pharmacopeia, 7th Ed.
 5. Green Chemistry Synthesis, Pawia
 6. An introduction to Practical Biochemistry, David T. Plummer, Tata McGraw-Hill Publishing Company Ltd.
 7. Polymer Synthesis and Characterization, A Laboratory Manual, Stanely R Sandler, Wolf Karo, Jo-Anne Bonesteel, Eli M Pearce, Published by Academic press (Elsevier).
 8. <https://pubs.acs.org/doi/pdf/10.1021/ie50163a037>, *Org. Synth.* **1922**, 2, 47DOI: 10.15227/orgsyn.002.0047
 9. General Chemistry Experiments by Anil J. Elias

Learning Objective / Course Outcomes- At the end of course students should able to-

1. Maintain proper record of analytical data in notebook. Observe personal safety in laboratory and able handle all chemicals, instruments, etc safely in laboratory.
2. Define / understand various terms involved practical methods of quantitative analysis.
2. To analyse organic and inorganic materials using appropriate chemical / instrumental methods
3. Explain / describe basic principles of chemical / instrumental methods used for analysis. Able to handle particular instrument according to SOP.
4. Perform analysis of sample with described procedure. Able to handle analytical instruments.
5. Apply / select particular method / instrumental parameters for analysis of given sample.
6. Maintain appropriate reaction conditions as described in procedures.
7. To perform i) selective analysis of particular component from sample. ii) Analysis at trace level from sample.
8. To conclude the results able to take the decision regarding quality of sample.
9. To perform calculations and interpret the results.

CBOP-5, CHA-493: B) Project [96 L + 24 T]

- a) At least 1/3 students of total strength at M. Sc.-II must be allotted projects
- b) Each student will perform project separately. Working hours are same as practical of CHA-493(A) project length should be sufficient and should be equivalent to 24 practical. ***Project report must be written systematically and presented in bound form: The project will consist of Title page, certificate, content, summary of project (2-3 page) followed by introduction (4 to 7 pages), literature survey (4-7) pages (recently published about 30 papers must be included), experimental techniques, results, discussion, conclusions, Appendix consisting of 1) references, 2) standard spectra / data if any and 3) safety precautions.*** If student is performing project in another institute, for such a student, internal mentor must be allotted and he will be responsible for internal assessment of a student. In this case student has to obtain certificate from both external and internal mentor. ***Systematic record of attendance of project students must be maintained by a mentor.*** Project will be evaluated jointly by three examiners and there will not be any practical performance during the examination. Typically, student has to present his practical work and discuss results and conclusions in details (20 min.) which will be

followed by question-answer session (10 min). It is open type of examination.

Learning Objective / Course Outcomes- At the end of course students should be able to-

1. Maintain proper record of analytical data in note book for research purpose.
2. Perform review of literature related to the topic of project work and design the problem for project work.
3. Decide and describe methodology for problem to solve proposed problem in the form of project. Decide and perform application of research work.
4. To design experiment for research work. Collect the resources, design small equipment, etc. for completion of research work.
5. Collect experimental data (raw data) and analyse the data in the perspective of problem. Present data in graphical forms for the conclusive results.
6. Use computer as a tool for result analysis, presentation and writing the project.
7. To obtain concrete conclusion from the results on the basis of reported theory / research work and analytical results.
8. To perform report writing, scientifically.
9. To write research project / paper in scientific manner.

CCPP-4, CHA-494: Practical II: Applied Analytical Chemistry

[96L + 24T]

Sec-I: Analysis of Pharmaceuticals

Sr. No. Compulsory Practical

1-4	Total analysis of aspirin as raw material as per Indian Pharmacopeia except limit test for arsenic (In assay part perform standardization of HCl). Express result as aspirin content \pm Standard deviation. (Ref-1)
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Any 4 from 5-9

5	Tablet dissolution test on paracetamol Indian Pharmacopeia (Ref-1) or UV-absorbance based assay of plain paracetamol tablet using specific absorbance (British Pharmacopeia). (Ref-4)
6	Analysis of Ca-Gluconate or any Ca-supplementary tablet with respect to identification test, average wt. of 20 tablet, and Ca(II) content per tablet as per Indian Pharmacopeia. Express result as Ca-gluconate content \pm Standard deviation. (Perform standardization of Na ₂ EDTA) (Ref-1)
7	Moisture content by i) Loss on drying of caffeine (oven drying method) and water content of dextrose (anhydrous or monohydrate) by Karl Fischer Method. (Ref-1 and 2)
8	Estimation of Benzocaine after extraction in chloroform by non-aqueous titration (Ref-3) or Estimation of Nicotinamide or caffeine by non-aqueous titration method according to IP (Ref-3) [standardize perchloric acid with potassium hydrogen phthalate]
9	Limit Tests for Fe, Ba and nitrate on dibasic calcium phosphate.

Table Work (student self-activity): Analysis of IR spectra **for identification** of at least four pharmaceutical compounds from Indian Pharmacopeia or British Pharmacopeia (Spectrum from IP or BP can be used or you can record the IR spectra and analyse. (Ref-1, Ref-4)

Any 4 from 10-14

10	Determination of NaCl (Cl by potentiometric titration or Na by flame photometry) and Dextrose (by polarimetry) in dextrose – sodium chloride type of saline solution.
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	(Ref-1, 3).
11	a) Determination of refractive index of four liquids as per IP. b) Viscosity of ethyl cellulose by Oswald viscometer using viscometer which comply specification of IP.
12	The Determination of Aspirin and caffeine in a Proprietary Analgesic or given mixture by Ultraviolet (UV) Spectrometry. (Ref. – 8)
13	Analysis of Caffeine and benzoic acid from cold drink by HPLC (Ref-6, 9) Or HPLC Analysis of an Asthma Medication (Ref-7) Or Assay of Omeprazole in Gastro-Resistant Omeprazole Tablets (Solid Preparation) by LC (Ref.-6) Or Quantitative Determination of Methyl Parabenin a Prepared Sample by HPLC (Ref-9)
14	Kit method (any two): a) Analysis of glucose from blood or hydrolysed food sample and b) urea from urine, c) Cholesterol from blood or fatty material. d) Creatinine (Ref: Perform experiment as per the instructions of manufacturer of kit).
15	Visit to waste water treatment plant (industry or municipal corporation) and writing a detailed report on methods and parameters used for treatment process. Or Visit to Pharmaceutical Industry and report on function of QC department in pharmaceutical industry

Reference

- 1) Indian Pharmacopeia Volume I, 7th Ed
- 2) Indian Pharmacopeia Volume II, 7th Ed
- 3) Indian Pharmacopeia Vol-III, 7th Ed.
- 4) Introduction to Pharmaceutical Analytical Chemistry, Stig Pedersen-Bjergaard, Bente Gammelgaard, Trine Grønhaug Halvorsen, Second Edition, Wiley (2012).
5. Vogel's Textbook of Quantitative Chemical Analysis, 6th Ed.
6. Analysis of Soft Drinks: UV Spectrophotometry, Liquid Chromatography, and Capillary Electrophoresis, Journal of Chemical Education, Vol. 75 No. 5 May 1998
7. HPLC Analysis of an Asthma Medication, Man L. Muellerl and Lawrence W. Pott, Journal of Chemical Education, Volume 85 Number 10 October 1988.
8. Experiments in modern analytical chemistry, D. Kealey, Springer Science Business media, 1986.
9. Analytical Chemistry for Technicians, John Kenkel, Third Edition, CRC Press LLC, 2003.

Section-II**Any four from 1-6**

1	Analysis of waste water /natural water sample for pH, dissolved oxygen, total dissolved salts (conductometry) (Ref-1)
2	Analysis of waste water sample: turbidity, colour, total hardness (Ref-1 and 2)
3	Alkalinity and Buffering capacity of water (Ref-1)
4	COD of waste water sample (Ref-3) (Note: small scale experiment is possible where visible spectrometric method can be used for determination of Cr(VI) (Ref.-2)
5	Aqueous carbonate equilibria and corrosiveness (calcium carbonate saturation) (Ref-1, 2)

6	Biological oxygen demand (Ref-2)
Any two from 7-10	
7	Qualitative test for phosphate in hard water / soil sample / food / detergent and its estimation by colorimetry. (Ref-2, 3, 10)
8	Pre-treatment to sulphide containing water (municipal waste water sample or artificially prepared water containing sulphide) its analysis for sulphide (Ref-2)
9	Determination of Cr(VI) by diphenyl carbazide method.
10	Demonstrating the Presence of Cyanide in Bitter Seeds while Helping students Visualize Metal–Cyanide Reduction and Formation in a Copper Complex Reaction. (Ref.: 12,13)
11	Determination anionic detergents from waste water (artificially prepared water sample containing detergent or shampoo which contain sodium lauryl sulphate or ammonium lauryl sulphate) (Ref-1, 2, 3)
Any two from 12-14	
12	Electrochemical treatment to liquid waste (water soluble organics) (Ref-1, 4)
13	Photochemical remediation of pollutants (Ref-1)
14	Chemical mineralization of pollutants by Fenton's Process (Ref-1)
Any two from 15-18	
15	Vit-C in food / Lemon juice / or related juice by titration with 2,6 dichlorophenol indophenol (Ref-6, 7) or Estimation of Vitamin-C by reaction with Fe(III) and estimation of Fe(II) colorimetrically. (Ref-5)
16	Determination of total casein and lactose in milk [FSSAI Manual] (Ref.-8)
17	Saponification and iodine value of edible oil (Ref-6)
18	Adulteration Test for Milk and Milk product (Ref-8, 9)
Any two from 19-24	
19	Determination of molecular wt. of anionic detergent (Ref-10: 107-108, 120-121)
20	Determination Critical Micelle Concentration of detergent powder or pure detergent by conductometry / viscometry (Ref.-14)
21	a) Molecular weight of polystyrene by viscometer b) Determination of water absorption by polymer (Ref-11)
22	Determination of chlorine content in PVC (Ref-12)
23	a) Determination of carbon black content in polymer b) Determination of swelling network in polymers (Ref-11)
Students activity	
	<p>Estimation of Glucose – Glucose in different samples can be analysed by i) titration with Fehling solution b) Titration with Iodine c) Colorimetry Folin-Wu method or DNSA method d) Colorimetry-Glucose by oxidase peroxidase method. Samples are – a) glucose in saline (DNS), b) glucose in urine / blood sample c) glucose in glucose supplement d) glucose in food. Give your choice of method for sample assigned to you by your mentor and analyse the sample.</p> <p>Note: Such many experiments can be designed by a mentor for internal evaluation of</p>

a student.

References

1. Environmental Chemistry, Microscale Laboratory Experiments, Jorge G. Ibanez, Margarita Hernandez-Esparza, Carmen Doria-Serrano, Arturo Fregoso-Infante, Mono Mohan Singh, published by Springer.
2. Standard methods for the examination of water and waste water, 23rd Ed. Jointly published by American Public Health Association, American Water Work Association, Water Environment Federation. 2017.
3. Vogel's Textbook Quantitative Chemical Analysis, 6th Ed.
4. Laboratory Experiments on Electrochemical Remediation of the Environment. Part 4: Color Removal of Simulated Wastewater by Electrocoagulation–Electroflotation, Journal of Chemical Education, Vol. 75, No. 8, August 1998.
5. Vitamin C as a Model for a Novel and Approachable Experimental Framework for Investigating Spectrophotometry, Journal of Chemical Education, DOI:10.1021/acs.jchemed.9b00197
6. Biochemical Methods, Third Edition, By S Sadashivan, A. Manickam; New Age International publishers.
7. Lab. Manual: Manual of Methods of Analysis of Foods, Vegetables: Fruit and vegetable products:
https://old.fssai.gov.in/Portals/0/Pdf/Draft_Manuals/FRUITS_AND_VEGETABLE.pdf
8. Manual Of Methods Of Analysis Of Foods Food Safety And Standards Authority Of India Ministry Of Health And Family Welfare Government Of India New Delhi 2015 Milk And Milk Products:
https://old.fssai.gov.in/Portals/0/Pdf/Draft_Manuals/MILK_AND_MILK_PRODUCTS.pdf
9. Common milk adulteration and their detection techniques, Azad and Ahmed International Journal of Food Contamination (2016) 3:22 DOI 10.1186/s40550-016-0045-3
10. Introduction to Surfactant Analysis, Edited by D. C. Cullum, Springer-Science + Business Media, B.V, 1994.
11. Experiments in polymer science, D. G. Hundawale, V. D. Athawale, V.R. Kapadi, V.V. Gite, New Age International Publishers.
12. Improved ninhydrin-based reagent for spectrophotometric determination of ppb levels of cyanide, Environmental Forensics, Volume 17, 2016 - Issue 1, <https://doi.org/10.1080/15275922.2015.1091404>.
- 13) Demonstrating the Presence of Cyanide in Bitter Seeds while Helping students Visualize Metal–Cyanide Reduction and Formation in a Copper Complex Reaction, *J. Chem. Educ.* 2016, 93, 5, 891-897.
14. Practical Physical Chemistry, Viswanathan B., Raghawan, Viva Books

Learning Objective –

At the end of course students should able to-

1. Maintain proper record of analytical data in notebook. Observer personal safety in laboratory and able handle all chemicals, instruments, etc safely in laboratory.

2. Define / understand various terms involved practical methods of quantitative analysis.
3. To analyse organic and inorganic materials using appropriate chemical / instrumental methods
4. Explain / describe basic principles of chemical / instrumental methods used for analysis. Able to handle particular instrument according to SOP.
5. Perform analysis of sample with described procedure. Able to handle analytical instruments.
6. Apply / select particular method / instrumental parameters for analysis of given sample.
7. Maintain appropriate reaction conditions as described in procedures.
8. To perform i) selective analysis of particular component from sample. ii) Analysis at trace level from sample.
9. To conclude the results able to take the decision regarding quality of sample.
10. To perform calculations and interpret the results.

Important Notes for Practical Courses of all Subjects

1. For all three practical papers - ***Journal should be completed by the candidate on the same day before leaving of the lab.*** This is to i) avoid manipulation of data by a student ii) make habitual of writing the experimental data and calculations systematically. Chance should not be given to manipulate original data to the candidate. In fact, many students adjust or manipulate data from their lab work very close to expected or theoretical values. If journal is completed before leaving the lab it will not encourage students to “adjust” the facts from their lab work. (Ref-Journal of Chemical Education, Min J. Yang and George F. Atkinson, Designing New Undergraduate Experiments, Vol. 75, No. 7, July 1998). Higher marks should be given in internal evaluation to the systematic working and accuracy of the results and not to the journal writing.
2. Laboratory safety rules must be followed by all the students and Chemistry Department should take care of safety laboratory. Wherever required personal protective equipments must be used. A student without laboratory coat and foot wares should not be allowed in laboratory.
3. Chemistry Department should make appropriate arrangement of waste chemical treatment and management.
4. Reference books / experimental procedure should be made available to the students before laboratory hours. Before each practical, mentor must discuss procedure, precautions and safety guidelines with students.
6. During start of the practical course students should be discussed with methodology of internal evaluation. Internal evaluation is continuous type (CA). Hence during each practical, internal evaluation must be done with different tools. **Guideline for internal evaluation:** To each practical 30 marks can be assigned which can be distributed as follows:

Overall performance	Discussions during practical	Accuracy of results	Lab report / Journal	Post laboratory quiz / assignment / oral
6	4	8	6	6

At the end of semester, average marks of 24 experiments are assigned as marks of internal

evaluation i.e. out of 30. Systematic record of internal evaluation must be maintained which is duly sign by mentor and student.

For absentee of a student in regular practical zero marks will be assigned. However, pre-intimation absentee will be allowed but student have to complete the experiment in the same week with the permission of your mentor.

5. Printed journal is allowed. It should consist of Name of the student, Roll No.(first page of each experiment), date, name of experiment, principle, special instructions regarding the safety precautions and special care to be taken (if any), chemicals, apparatus, brief procedure and blank tables is allowed. It should **not contain** any details of calculations, dilutions factors, calculated amounts, reactions, and structures. At the end 5 to 7 tricky questions on experiment should be given for solving and it is compulsory activity.

6. Wherever possible use / prepare minimum amounts / required amounts of solutions. Use micro burette for titrations involving instrumental methods. Micropipettes shall be used for measuring small volumes accurately which helpful to prepare small volumes of solutions for instrumental analysis. For flame photometry / AAS typically 10 ml solution is sufficient, HPLC – 1-5 ml, colorimetry / spectrophotometry 5 ml, etc.

7. Similar strategy can be used for internal evaluation of a candidate performing project.

8. In colorimetric estimation **do not prepare more than 5 ml solution** for measurement of absorbance. Add all of the reagent with micro-burette or 1 / 2 ml graduated pipette so that student will **not require volumetric flask**. If possible, use **1 ml cuvette** with spectrophotometers (It is available in market). Solvent extraction procedure can be typically performed with total 5-ml organic solvents to decrease toxic waste.

9. Wherever feasible develop and practice micro or semi-micro methods form known / recommended procedures from the reference books. This is to i) minimization cost of experiment ii) decreases wastage of chemicals iii) decrease environmental pollution.

10. Avoid use of toxic chemicals and reagents. If possible, replace toxic reagent by non-toxic or less toxic reagent. Example: in volumetric estimation of Fe (III) SnCl_2 and then HgCl_2 is used to convert Fe (III) to Fe(II). Sn (IV) and Hg(I) produced in reaction are toxic. This can be done by using Zn metal powder. Avoid use of $\text{K}_2\text{Cr}_2\text{O}_7$, and no alternative prepare minimum /required amount of it.

11. Wherever required, **standardize $\text{Na}_2\text{S}_2\text{O}_3$ with oven dried KIO_3 in place of $\text{K}_2\text{Cr}_2\text{O}_7$ as Cr(VI) is carcinogenic and mutagenic.**

12. By trial replace CHCl_3 by other extracting solvents as chlorinated solvents are highly toxic.

13. Metal like Ag can be recovered after experiment. Device suitable method.

14. Wherever possible replace calomel electrode by Ag/AgCl reference electrode as Calomel consists of toxic element Hg and Hg(I). (Ref-Student Construction of a Gel-Filled Ag/AgCl Reference Electrode for Use in a Potentiometric Titration, Journal of Chemical Education, Vol. 76, No. 1, January 1999).

15. College / Chemistry Department of the respective college must follow all the rules of EPA / WHO regarding the toxic waste management of the chemistry laboratory produced during practical.

16. In each practical course a mentor can introduce one or two Novel experiment of

analytical chemistry. Experiment should be equivalent to one practical session (4 h duration) or two practical sessions (long experiment). For such replacement students can be exempted one or two regular experiment respectively. A teacher can promote to a student for such Novel analytical chemistry experiments provided that department is ready to support such experiment. The newly introduced experiment will be the inherent part of **external** evaluation. Example-identification and estimation of melamine from milk powder, pesticide residue from vegetables, estimation of As(III) from bore well water, synthesis / extraction of novel organic compound and its total spectral characterization, etc.

6. M. Sc.(II) Biochemistry

Outline for Semester III and IV – Biochemistry

Paper No.	Course name	Credits
Semester III		
CCTP-7, BCH-311	Molecular Biology	4
CCTP-8, BCH-312	Immunology	4
CCTP-9, BCH-313	Recombinant DNA Technology	4
CBOP-3, BCH-314 (any one)	CHB-314(A): Bio-processing and Industrial Biochemistry	4
	CHB-314(B): Pharmacology and Forensic Biochemistry	4
CCPP-3, BCH-315 Practical I	Practical I: Molecular Biology and Immunological techniques	4
Semester IV		
CCTP-10, BCH-411	Neurochemistry & Endocrinology	4
CCTP-11, BCH-412	Medical and Physiological Biochemistry	4
CBOP-4, BCH-413 (any one)	CHB-413(A): Evolution and developmental biology	4
	CHB-413(B): Clinical Nutrition and Food Technology	4
CBOP-4, BCH-414 (any one) Practical III	CHB-414(A): Principles Of Downstream Techniques In Bioprocess	4
	CHB-414(B): Clinical Biochemistry and Research Methodology (Presentation of research paper/Preparation of research project) Data interpretation	4
CCPP-4, BCH-415 Practical II	Project	4

Detailed course-wise Syllabus of M. Sc-II, Biochemistry

SEMESTER III
CCTP-7, BCH-311: Molecular Biology [48L + 12T]
Section I: [24L + 6T]
<ol style="list-style-type: none"> DNA Replication: Enzymes involved in DNA synthesis e.g. topoisomerase, helicase, ligase and others. DNA polymerase I, II, III, origin of locus, Okazaki fragments, replication fork. Mechanism in Prokaryotes and Eukaryotes. DNA Repair: DNA damages, detection and repair systems. Pyrimidine dimer formation and its repair. DNA damage and repair mechanisms : Introduction, DNA damage, types of DNA repair and their mechanisms – Direct repair, Base excision repair, Nucleotide excision repair, mismatch repair, recombinational repair, SOS repair; DNA repair genes, role of P53 gene in DNA repair and apoptosis Gene rearrangements: Recombination pathways, Holliday structures, rec A,B,C,D. SOS response, mobile genetic elements, Transposable Elements. Transcription and splicing: RNA polymerases, promoters, sigma and Rho factors, initiation,

elongation and termination of transcription (Prokaryotes), Inhibitors of transcription. Transcription in Eukaryotes, RNA pol I, II, III, enhancers. Posttranscriptional modifications of t, r and m-RNA, 5' capping, 3' poly A tailing, RNA editing, Transcription factors.

5. Splicing: Splicing phenomenon. Mechanism, spliceosomes, alternative splicing, selfsplicing, ribozyme (catalytic RNA).

Section: II [24L + 6T]

1. Translation: Role of t-RNA and Ribosome in protein synthesis. Mechanism in Prokaryotes and Eukaryotes. Epigenetic modification.
2. Protein targeting
3. Protein trafficking
4. Proteasomal degradation
5. Genome protection (RNAi, CRISPR-Cas9) Bacterial Defence Mechanism

Reference Books

1. Biochemistry (III/IV/V/VI edition, 2008) L. Stryer, WH Freeman and Co.
2. Molecular biology of the gene (V edition, 2004) J D Watson, Person education Inc.
3. Molecular Cell Biology (7th edition, 2013) by Harvey Lodish et al.
4. Molecular biology of the cell (2008) B. Alberts, Garland Pub. In., NY
5. Genes X (2010), B. Lewin, John Wiley and sons, NY.
6. CRISPR-Cas: Converting A Bacterial Defence Mechanism into A State-of-the-Art Genetic Manipulation Tool, Antibiotics (Basel). 2019 Mar; 8(1): 18.

CCTP-8, BCH-312: Immunology [48L + 12T]

Section I: [24L + 6T]

1. Cellular basis of immunity: immunological memory, specificity, diversity, discrimination between self and non self, primary and secondary lymphoid organs, T and B lymphocytes, T cell subpopulation,
2. Innate Immunity, mechanism barriers against infection, PRRs, TLR, innate versus adaptive immunity, cells of the immune system, phagocytic cells engulf and kill microorganisms, complement facilitates phagocytosis, complement mediated acute inflammatory reaction, humoral mechanism provide an additional defensive strategy, extracellular killing, cytokines, cell mediated and humoral immune responses, Clonal selection theory of antibody production, monoclonal and polyclonal antibodies, catalytic antibodies (abzymes)
3. Antigen: Antigen, antigenic determinant, Blood antigens: blood group substances and Rh factor, super antigens, Lipopolysaccharides, Adjuvant complete and incomplete antigen
4. Ig super family: T cell receptor, B cell receptor, MHC I & II structure, CD receptors. Antibody: structure of antibody, constant and variable regions, Fab, F(ab₂) and Fc fragments, different classes of antibodies and their functions, fine structures of antibodies, X ray diffraction studies, isotypes, allotypes and idiotypes,
5. Organization and Expression of Immunoglobulin Genes. Genetic Model Compatible with Ig Structure, Multi-gene Organization of Ig Genes: variable gene rearrangement, generation of antibody diversity and class switching among constant region genes. Expression of Ig genes, synthesis, assembly and secretion of immunoglobulins. Regulation of Ig-Gene transcription, antibody genes and antibody engineering.
6. Major Histocompatibility Complex: General Organization and Inheritance of the MHC, MHC molecules and genes, Detailed Genomic Map of MHC Genes, Cellular Distribution of MHC molecules, Regulation of MHC Expression, MHC and Immune

Responsiveness
Section II: [24L + 6T]
<ol style="list-style-type: none"> 1. Antigen Processing and Presentation: Self-MHC Restriction of T Cells, Role of Antigen-Presenting Cells , Evidence for Two Processing and Presentation Pathways, Endogenous Antigens: The Cytosolic Pathway, Exogenous Antigens: The Endocytic Pathway , Presentation of Nonpeptide Antigens 2. Immunodeficiency: primary B-cell deficiency, primary T cell deficiency, SCID, AIDS 3. Hypersensitivity: Type I anaphylactic hypersensitivity, Type II antibody dependant cytotoxic hypersensitivity, Type III immunecomplex mediated hypersensitivity, Type IV DTH, Type V Stimulatory Hypersensitivity, Mast cells, eosinophils, basophils. 4. Transplantation: graft rejection, types of grafts,types of rejection, mechanism of graft rejection, graft versus host response. 5. Tumor immunology: classes of tumor antigens,immune response to tumor, approaches to cancer immunotherapy , CAR-T cell therapy. 6. Autoimmune diseases 7. Immunological techniques: immuno-diffusion, immunoelectrophoresis, radioimmunoassay, immunofluorescence, ELISA, Western blotting, FACS, ChIP assay, FISH. 8. Vaccines : Passively acquired immunity,Principles of vaccination, Killed organisms as vaccines,Live attenuated organisms, Subunit vaccines, Newer approaches to vaccine development, Current vaccines,Vaccines under development
Reference:
<ol style="list-style-type: none"> 1. Essential immunology; Ivan Roitt, 13 th edition 2. Kuby-Immunology 8th edition 3. Fundamental Immunology; William E. Paul 7th edition
CCTP-9, BCH-313: Recombinant DNA Technology [48L + 12T]
Section I: [24L + 6T]
<ol style="list-style-type: none"> 1. Isolation and Quantification of DNA 2. Genetic engineering concepts: Early development in genetics, concept of gene cloning and its importance. 3. Promoter analysis. Chip-seq assay, EMSA 4. Manipulation of DNA: Enzymes in genetic engineering, Restriction endonucleases, restriction map, Ligase, polymerase modifying enzymes, ligation; putting sticky ends to blunt ended molecules. 5. Cloning and expression vectors: Vectors for <i>E. coli</i>: Plasmids, M 13 bacteriophage vectors, λ bacteriophage,. Eukaryotic cloning vectors: Cloning vectors for yeast, cloning vectors for higher plants, Ti plasmid, cloning vectors for insects, viruses as cloning vectors for mammals. 6. Introduction of DNA in living cells: Transformation/ transfection methods, identification of recombinants. Selection of recombinant DNA. 7. Construction of genomic and cDNA library. 8. Expression of foreign gene: gene expression in <i>E. coli</i>, production of recombinant proteins in eukaryotes, fungi, yeast, mammalian and insect cells systems.
Section II: [24L + 6T]
<ol style="list-style-type: none"> 1. Polymerase chain reaction: concept, types, methods and applications. 2. Sequencing genes and genomes: chain termination using ddNTPs, NGS: Oxford Nanopore, PacBio and Illumina technologies, pyrosequencing. 3. Gene Expression analysis: qPCR: delta-delta Ct method, SYBR Green and TaqMan, NGS, Northern blotting, 4. Transgenic animals: Gene transfer strategies, production of recombinant proteins and other

applications.

5. Protein Engineering: In vitro mutagenesis, Oligonucleotide directed, PCR based, applications of protein engineering.
6. Study of genomes: genome annotations, study of transcriptome, proteome.
7. RNA interference: miRNA, siRNA.
8. Genome editing: Meganucleases, talen, Zinc finger nucleases, CRISPR/Cas9
9. Reporter Genes, GUS assay.
10. Human genome project: Project period and accomplishment, Genome mapping approach, Application and proposed benefits, Ethical, Social and legal issues.

Reference Books

1. Gene cloning- An introduction, T.A Brown, 2nd and 3rd ed, Chapman &Hall.
2. Recombinant DNA- genes and genomes a short course JD Watson, R.M.Myers, A.M.Caudy, J.A.Witkowski, WH Freeman &Co. 2007 (II/ III rded)
3. Principles of gene manipulation, SB Primrose.
4. Principles and Techniques of Biochemistry and Molecular Biology, K Wilson and J Walker, 7th edn
5. Molecular Cloning: A Laboratory Manual (Fourth Edition) Michael R. Green & Joseph Sambrook
6. Genetic Engineering, SmitaRastogi, Neelam Pathak, Oxford University press, 2009.

CBOP-3, BCH-314: (Any one subject) ,

BCH-314(A): Bio-processing and Industrial Biochemistry [48L + 12T]

OR BCH-314(B): Pharmacology and Forensic Biochemistry [48L + 12T]

CBOP-3, BCH-314(A): Bio-processing and Industrial Biochemistry [24L + 6T]

Section I: Bio-processing [24L + 6T]

1. Characteristics of industrial microorganisms
2. Strain improvement, use of auxotrophic mutants
3. Methods and parameters of cultivation of microorganisms , media for industrial fermentation
4. Fermenters, design of fermenters, fermentation process, and maintenance of aseptic conditions, aeration and agitation.
5. Downstream processing, recovery and purification of fermentation products, effluent treatment.
6. Applications of fermentation technology.
7. Manufacturing by fermentative process: beer, Citric acid, Glutamic acid, lipase, Penicillin, L-asparaginase, cephalosporin.

Reference Books

1. Principles of Fermentation technology, PF Stanbury, A Whitaker, SJ Hall (2008)
2. Molecular biology and biotechnology- edited by JM Walker and FB Gingold, Royal society of chemistry 5th edition (2009)
3. Industrial Microbiology – Casida 2nd edition (2016).
4. General Microbiology Stainer R. Y. et al (1987) 5th Ed., Macmillan Press Ltd. London

Section II: Industrial Biochemistry [24L + 6T]

1. Media requirements: Sterilization and role of growth regulators, Requirements of aplant tissue culture laboratory.
2. PTC Techniques: Callus and cell suspension culture, Micropropagation, Conditioning of tissue culture plants (weaning and hardening), Somatic cell hybridization, Haploid (anther) culture, Embryo culture, Protoplast fusion, Somatic embryogenesis, Somaclonal variations, Cybrids and Allopheny, Agrobacterium mediated hairy root culture
3. Active principles in medicinal plants and phytochemistry of the metabolites of medicinal

importance.

Animal tissue culture

1. Media requirements: preparation of medium and sterilization techniques, Advantages and disadvantages of natural and synthetic media.
2. Cell culture methods: Hanging drop, suspension and monolayer culture, Behavior and characteristics of cells in culture, Primary and established cell lines, characteristics of transformed cells, Methods of cell preservation.
3. ATC techniques: Primary cultures and secondary cultures, cloning, heterocaryons, variant cells, contact inhibitions, Organ culture and cell and tissue banking

Reference Books:

1. Principle and practice of Animal tissue culture by SudhaGangal, 2nd edition (2010).
2. Tissue Culture by John Paul, 4th edition (1970).
3. Plant cell tissue and Organ culture by Gamburg Phillips (1995).
4. Plant tissue culture basic and applied T B JhaandB Gosh (2005).
5. Culture of Animal Cells by Ian Freshney 6th edition (2011)

CBOP-3, BCH-314(B): Pharmacology and Forensic Biochemistry [48L + 12T]

Section I: Pharmacology [24L + 6T]

1. Concept of evidence-based medicine, Importance of Biochemistry and pharmacy: Metabolites and anti-metabolites;
2. Drugs - Classification of drugs, routes of drug administration. Receptor interaction, involvement of binding forces in drug receptor interaction, drug action not mediated by receptors
3. Pharmacokinetic considerations: drug absorption, distribution, biotransformations and excretion
4. Pharmacokinetic concepts of bioavailability, apparent volume of distribution (aVd), half life ($t_{1/2}$), and clearance (CL) that are used to decide the doses and rational dosing during the drug treatment.
5. Pharmacodynamics; site and mechanism of drug action, drug receptors and receptor regulation, concepts of agonists, antagonists, partial agonist and inverse agonist drugs
6. Drug interactions and concept of pharmacogenomics/-genetics in drug action, effects and ADRs
7. Adverse drug reactions (ADRs) and role of pharmacovigilance activity in ADR monitoring
8. Drug Development: Challenges, Discovery, use of genomes for drug discovery, stages of drug development.

Section II: Forensic Biochemistry [24L + 6T]

1. Forensic Toxicology: - Introduction and concept of forensic toxicological. Different areas of toxicology, spectrum of toxic dose, risk and safety. Classification of toxic agents, characteristics of exposure, route and site of exposure. Duration of frequency of exposure. Spectrum of undesired effects: Allergic reactions, Idiosyncratic reactions, Immediate versus delayed toxicity, Reversible versus irreversible toxicity, Local versus systemic toxicity. Interaction of chemicals, Tolerance, Dose response. Selective toxicity.
2. Evaluation of Toxicity: Descriptive Animal toxicity tests: Acute lethality, Sub acute, sub chronic and chronic toxicity testing. Teratology and reproduction, Mutagenicity.
3. Biotransformation of toxicants: Phase I and II biotransformation reactions, Detoxication and toxication. Components of Cytochrome P-450 monooxygenase system. Mechanism of phase I and II reactions. Bioactivation, Toxicity of insecticides/drugs i.e. carbamates, organophosphorous, and chlorinated insecticides metals, animal and plant toxins, solvents and vapors.
4. Applications of toxicology: forensic, clinical and occupational health and industrial

hygiene

- Enzymes in forensic biochemistry, role of DNA in analysis, role of enzymes to determine the times since death.

Reference books:

- Haye's principles and methods of Toxicology Ed. A Wallace Hayes, Pub. Raven press, NY, 6th Edition (2014).
- Casarett and Doull's Toxicology ed. John Doull, Curtio D Kleassen and Mary D Aunder, McMillan publisher Co, NY, 3rd edition (2003).
- Appraisal of the safety of chemicals in foods, drugs and cosmetics. Ed. The Editorial Committee of Association of Food and Drug Officials of the United States (1959).
- Toxicology- Mechanisms and analytical methods, Vol I and II, ed Stewart CP and Stolman A, Pub Academic press (1960).
- Veterinary toxicology by RJ Garner edBeilliere, tindall and Cox London, 3rd edition (2007).
- The chemistry and microbiology of pollution (1975) IJ Higgins and RG Burns Acad Press, NY
- Introduction to ecological biochemistry JB Harbone Acad Press, NY 4th edition (2004).

CCPP-3, BCH- 315: Practical, Molecular Biology and Immunological techniques

[96L + 24T]

Molecular Biology

- Melting Temperature
- Spectrophotometric analysis of nucleic acids
- Primer Designing
- DNA amplification (PCR)
- Isolation of plasmid DNA
- Restriction digestion of DNA
- Ligation
- Competent cell preparation
- Transformation
- Agarose gel electrophoresis of DNA and molecular size determination.

Immunological techniques.

- Blood group typing, Rh blood typing
- Ouchterlony double diffusion assay
- Single Radial immunodiffusion
- Immuno electrophoresis
- Rocket immunoelectrophoresis
- ELISA
- WIDAL Test
- Lateral flow immunodiffusion assay
- Separation and purification of Immunoglobulin
- Western Blotting (Demo Experiment)
- Quantitative precipitin assay
- Reverse blood grouping

SEMESTER IV

CCTP-10, BCH-411: Neurochemistry & Endocrinology [48L + 12T]

Section I: Neurochemistry [24L + 6T]

- Brain and behavior, Nerve cells and behavior
- Anatomical organization: Central nervous system, spinal cord, different regions of the brain, peripheral and autonomic nervous system afferent and efferent pathways.

3. Neurotransmitters: Synthesis, storage, uptake degradation and action of neurotransmitters. Acetyl choline, GABA, Serotonin, Dopamine, Glutamate Aspartate, Nitrous Oxide etc., Neuropeptides.
4. Receptors: Types of receptors, properties of receptors, sensory modalities and sensory circuits. Sensory perception, cerebrospinal fluid, blood- brain barrier.
5. Learning and memory: Mechanism of short term memory and long term potentiation. NMDA and AMPA glutamate receptors. Retrograde messengers in synaptic transmission. Role of CAM kinase II, Calcium, Protein kinase, CAMP, NO, Calpain and other proteins in memory and learning process.
6. Circadian rhythms.

Reference books

1. Text book of physiology- Guyton, 12th edition (2010)
2. Principles of neural science Kandel ER, Schwartz JH, Elsevier, N.Holland, NY, 5th edition (1991)
3. Neurobiology, Shepherd GM , Oxford Univ. Press (1993).
4. Nerve and muscle excitation Junge D, Sinauerassoc, Sanderland, mass (1976).
5. Biochemistry , L Stryer, Freeman and Co, NY, 8th edition (2015).
6. Biochemistry, Zubay, Addison Wesley and Co.2nd edition (1994)

Section II: Endocrinology [24L + 6T]

1. General characteristics of hormones: chemistry, structure, synthesis, secretion, transport, metabolism & mechanism of action of hormones of the thyroid, hypothalamus, pituitary, pancreas, adrenals, glands, prostaglandins and gastro intestinal hormones, secondary messengers and their mode of action, calcium signaling, zinc fingers.
2. Disorders related to hormones.
3. Cell membranes and intracellular receptors for hormones.
4. Hormonal inter relationship.
5. Biosynthesis of steroid hormones, cholera toxin, adenylate cyclase and TP, hormone overproduction and target cell insensitivity.
6. EGF, NGF, PDGF, Enkephalin.

Reference books:

1. Vertebrate endocrinology- Noris DO 5th ed (2013).
2. Endocrine physiology- Martin, CR (1985(O xfordUniv press (NY)
3. Physiological chemistry –Harper 17ed Lange medical
4. Biochemistry- Zubay (1983) Addison, Wesley publ. Co.
5. Text book of endocrinology –Williams, 13th edition Saundes Co (2016).
6. Biochemical endocrinology E. Frieden (1983)

CCTP-11, BCH-412: Medical and Physiological Biochemistry [48L + 12T]**Section I: Medical Biochemistry: [24L + 6T]**

1. Mechanism of action at molecular level of selected antibiotics: inhibitors of cell wall, plasma membrane, nucleic acids and protein synthesis. Mechanism of action of anti metabolites, analgesics, hallucinogens, antiviral, antifungal, antiprotozoal and mechanism of resistance to antibiotics and other drugs.
2. Lysosomes and their physiological role: Structure and function of lysosomes, role in animal and plant cells. Physiological role in various types of digestive phenomenon disturbances to lysosomes (lysosomal pathology), lysosomal storage disease.
3. Molecular basis of hemoglobinopathies: concept of hemoglobinopathies, β and α thalassemia's, sickle cell anemia, pathophysiology, biochemistry, types of mutations.
4. Ischemic heart disease/CHD: myocardial infarction and coronary heart diseases (pathophysiology); laboratory findings, enzymes involved.
5. Cancer: carcinogenesis, microevolution process, molecular genetics of cancer, causative

agents, role of viruses.

6. Biochemistry of diseases: Influenza: life cycle, transmission, biochemical mechanism, Malaria: epidemiology, life cycle, biochemical mechanism; Alzheimer: dementia, biochemical mechanism, formation and tangles and plaques.
7. Apoptosis: extrinsic and intrinsic mechanism, role in diseases and physiology.

Reference Books

1. Biochemistry of antimicrobial action (4th ed) TJ Franklin, Chapman hall (1989)
2. Mechanism of microbial diseases, M Schaechter et al, Williams and Wilkins Int. 5th Ed.(2012)
3. Microbiology an application based approach, M.J Pelczar, ECS Chan, N.R.Krieg (2009).
4. Biochemistry, L Stryer (3rd ed), Freeman and Co, 8th edition (2015).
5. Biochemical aspects of human diseases (1983), RL Elkeles, Slackwell scientific publishers, Oxford
6. Biochemistry and diseases, Robert Cohn Carl S Roth (1996).
7. Molecular biology of the cell, third edition, Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, JD Watson, 6th edition (2014).

Section II: Physiological biochemistry [24L + 6T]

1. Liver: anatomy, physiological functions, Liver function tests, Liver disorders:- hepatitis, cirrhosis, Jaundice: etiology and symptoms.
2. Kidney: anatomy, physiological functions, diseases/disorder, diagnostic tests.
3. Respiration: Principles of gaseous exchange during respiration, Bohr effect, transport of oxygen and carbon dioxide in the blood, regulation of respiration.
4. Digestion and Absorption of food: Generalized structure of digestive tract and associated digestive gland. Function of different parts- peristalsis, regulation of saliva, gastric, pancreatic, Intestinal and bile secretion (i.e. digestion), Absorption – (carbohydrate, protein, lipid, minerals and vitamin) transport and excretion of nutrients.
5. Biochemistry of blood clotting ,clotting factors, intrinsic and extrinsic pathways, mechanism of formation of thrombin, fibrin, fibrin clot, role of vitamin K clotting process, lysis of fibrin clot. Conditions that cause excessive bleeding in humans.
6. Regulation of acid-base balance, types and functions of acid-base buffers, clinical abnormalities associated with acid-base imbalance.
7. Water and Mineral metabolism.

Reference Books

1. Biochemistry, L Stryer, Freeman and Co, NY, VI edition (2008).
2. Biochemistry, Zubay, Addison Wesley and Co. (1983).
3. Textbook of Physiology, Guyton, 12th edition (2010).
4. Physiology, Berne and Levy, 7th edition (2017).
5. Harper's Biochemistry- 30th edition (2015).
6. Text book of Biochemistry and Human Biology - Ed. G. P. Talwar (2002).

CBOP-4, BCH-413 (Any one), BCH-413 (A): Evolution and developmental biology OR BCH-413 (B): Clinical Nutrition and Food Technology

CBOP-4, BCH-413 (A): Evolution and developmental biology [48L + 12T]

Section I: Evolution [24L + 6T]

1. Theories of Evolution.-the time scale and some evolutionary principles. Chemical evolution and origin of life. Prototypes of metabolic pathways.
2. Genesis of oxygen generating photosynthesis and aerobic respiration. Methanogenesis evolution of prokaryotes
3. Evolution of protists
4. Origin of eukaryotes

5. Theories regarding origin of mitochondria and chloroplast, the five kingdom classification of living organisms, outline of eukaryote evolution- evolution of primates.
6. Construction of phylogenetic trees- molecular data set based on sequences
7. Evolution of proteins and nucleic acid – elastic analysis.
8. Evolution of introns
9. Evolutionary view of exon domain relationships

Section II: DEVELOPMENTAL BIOLOGY [24L + 6T]

- 1) Basic concepts of development : Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development
- 2) Gametogenesis, fertilization and early development: Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.
- 3) Morphogenesis and organogenesis in animals : Cell aggregation and differentiation in Dictyostelium; axes and pattern formation in Drosophila, amphibia and chick; organogenesis – vulva formation in Caenorhabditis elegans, eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination.
- 4) Programmed cell death, aging and senescence
- 5) Developmental Biology—Cell differentiation, hierarchy of genes, measurement of time during development, nature of differentiation, DNA rearrangements& amplification, genetic control of morphogenesis, plant molecular genetics.

Reference Books:

1. Evolution and Diversity of life, E. Mayer Belknap Press Pub, 1976
2. Population species and evolution (1973), E Mayer Press Pub.
3. Biochemistry ,Lehninger 7th edition, (2012) Worth pub
4. Origin of Eukaryotic cells, Margulis L.(1977)
5. Developmental Biology: Scott F. Gilbert.
- 6 . Evolution and Diversity of life, E. Mayer Belknap Press Pub, 1976
7. Population species and evolution (1973), E Mayer Press Pub.
8. Origin of Eukaryotic cells, Margulis L.(1977)

CBOP-4 , BCH-413 (B): Clinical Nutrition and Food Technology

[48L + 12T]

Section I: Clinical Nutrition: [24L + 6T]

1. Diet and nutrition in India: Assessment of nutritional status
2. Food and Nutritional Security
3. Effects of irradiation, cooking, refining, sprouting and fermentation on nutritional quality of food
4. Food Habits, Food Fadism and Nutrition
5. Interrelationship between dietary lipids and cholesterol metabolism
6. Malnutrition
7. Weight Management and Eating Disorders
8. Nutrition and Anemia
9. Food Allergy
10. Nutrition and metabolic disorders: Diabetic and Obesity
11. Factors affecting digestion and absorption of food

12. Dietary fiber- chemical composition and importance
13. Physiological effects and metabolic adaptation during exercise
14. Nutritional management of inborn errors of metabolism

Reference books:

1. Essentials of food and nutrition M Swaminathan Vol. II, Applied aspects (1974), Ganesh Pub, Madras
2. Human biochemistry – James Orten and Otto Neuhaus, 10th ed , CV Mosby co London
3. Human nutrition and dietetics-Davidson and Passmore

Section II: Food Technology: [24L + 6T]

1. Concepts of food analysis; Rules and regulations of food analysis
2. Monitoring food quality: Hazard Analysis and Critical Control Point, Good manufacturing practices, current good manufacturing practices; Standard operating procedures, good laboratory practices
3. Biochemistry of food spoilage, principles of food preservations , methods of food preservation
4. Proteins from unconventional sources- OCP, SCP etc
5. Starch production, manufacture of natural and synthetic sweeteners and syrups
6. Enzymes in food analysis, alcohol, amino acids, glucose
7. Enzymes in food processing, meat tenderization and fruit juice technology
8. Food additives, starches, sugars, syrups and sweeteners, flavoring agents, colors Food preservatives. Role and mode of action of salts, chelating agents, stabilizers and thickeners; Humectants/polyhydric alcohol, anti-caking agent, firming agent, flour bleaching and maturing agents, antioxidants, nutritional and non-nutritional sweeteners;
9. Food Laws: FSSAI, AGMARK, BIS, FPO, Weights and Measures Act ,CODEX
10. Genetically modified foods

Reference books:

1. Enzymes and food processing- GG Birch, N Blackbrough (1981)
2. Nutrition and food processing- MG Miller , G Tobin, AVI publishing Co, Creem Holm (1980)
3. Introduction to food sciences and technology –GF Stewart and MA Amerine (1973) Academic Press

CBOP-5, BCH-414 : Practical, Any One Subject

BCH-414 (A): Principles Of Downstream Techniques In Bioprocess **OR**
BCH-414 (B): Clinical Biochemistry and Research Methodology

BCH-414 (A): Industrial Biochemistry [96L + 24T]

1. Ethanol production using bio wastes /raw material [Free cells/ immobilized cells]
2. Microbial production of glutamic acid/citric acid
3. Biotransformation (Enzymatic/Immobilized enzyme)
4. Production of wine from grapes.
5. Extraction, isolation, partial purification (if necessary), calculation of percentage yield and performing a confirmatory test for the following:(Any one)
 1. Carbohydrates:
 - a. Cellulose
 - b. Glycogen from Liver
 - c. Pectin from apples/bananas/oranges
6. Lipids:
 - a. Extraction and analysis of lipid.
7. Pigments (Separation of the following pigments on TLC slides):
 - a. Oleoresin Extraction
 - b. Carotenes from carrots
 - c. Chlorophylls from spinach
8. Isolation and Estimation of
 - a. Oxalates from spinach/ *Aloe vera*
 - b. Lycopene from tomatoes.
9. Demonstration of Bioreactor
10. Isolation and purification of Protein (determination of % yield and purity)
11. Essential oil extraction

CBOP-5, BCH-414(B): Clinical Biochemistry and Research Methodology**Section-I, Clinical Biochemistry(Any 10) [48L + 12T]**

1. Estimation of Lipoproteins
2. Estimation of serum amylase
3. Estimation of bilirubin
4. Estimation of blood urea and uric acid
5. Blood sugar determination by Folin-Wu method
6. Estimation of creatine phosphokinase
7. Normal and abnormal constituents of urine
8. Determination of blood cholesterol
9. Determination of glucose by glucose oxidase method
10. Estimation of glycosylated hemoglobin
11. Estimation of LDH and its isozymes
12. Estimation of alkaline and acid phosphatase from serum
13. Estimation of total protein and albumin from serum
14. Determination of SGPT and SGOT

Reference Books:

1. Practical Biochemistry- David Plummer 3rd edition (2015).
2. Practical Biochemistry – J. Jayaraman (2011).
3. Biochemical methods – Sadasivam and Manickam 3rd edition (2007).
4. Biochemistry –Practical Approach – Kieth Wilson and J. Walker 5th edition (2006).
5. Introductory Practical Biochemistry- Randhir Singh and Sawhney (1999).
6. Laboratory handbook on Biochemistry, S Shanmugam, 2010, PHI Pvt Ltd, New Delhi

(2010).

Section-II, Research Methodology [48L + 12T]

1. Preparation of Research Proposal for submitted to the funding agencies. (Submit it as report)
2. Review of Research work being carried out at any five National/ International Research Centers or Institutes/Research institute visit report
3. Use of Excel for calculation and Graph
 - a) Measurement of Central Tendency (Mean, Median, Mode)
 - b) Measurement of Dispersion/variability(Mean Deviation, Standard Deviation, Co efficient of variation)
 - c) Line Graph, Bar graph. Pie chart
5. Tool plagiarism detection
4. Research Paper analysis
 - a) Analysis of data (including graph, table, figure, Method/technique/instrument) (Using MS word of Similar software Brief Report 1 page)
 - b) Presentation of Research Paper (15 minute power point presentation)

CCPP-4, BCH-415: (Project) [96L + 24T]

GUIDELINE TO CARRY OUT PROJECTWORK

1. The main purpose of introduction Project Work at MSc Part II is to make the students familiar with Research Methodology i.e. reference work, experimental work, statistical analysis of experimental data, interpretation of results obtained, writing of project work and compilation of bibliography in proper order. This will not only help train the inquisitive minds of the students, but also inspire them to take up research-oriented higher studies and career.
2. **Duration of Project work: -**
Development on the nature of the research problem and the infrastructure available in the respective Biochemistry Departments or Research Institutes or Industries, the duration of Project Work is recommended as follows:-
 - a. 06 Months (**Equivalent to 96L + 24T**): - The project work will commence immediately after the conclusion of Semester II of M. Sc Part – I.
 - b. Each student shall complete a small research project during his/ her academic year of M. Sc Part- II. However, the initial reference work can be started in M.Sc Part- I and summer vacation.
4. **Nature of Research Project:-**
The following will be considered as the Research Project.
 - a. Experimental based involving laboratory analytical work, or
 - b. Industrial training based provided that the candidate has undergone actual hands on training in instrumental analytical techniques.
5. **Schedule for Submission of project Work:-**
 - a. Experiment work or Industrial training must be completed by October 31.
 - b. The duration of Diwali Vacation and the part of Sem IV up to December 31 shall be utilized for finalizing the written contents of the project work.
 - c. The final copy of the project work (3 Copies) will have to submit to the respective HOD by January end of Sem IV.
6. The project containing about 20-30 pages (A4 size paper with normal margins). Should be divided into the following parts: -
 - a. Certification of completion of Project Work from the HOD.
 - b. Acknowledgement.
 - c. Introduction
 - d. Review of Related Literature

- e. Aims and Objectives
 - f. Signification of research problems selected
 - g. Plan of work
 - h. Material and Methods
 - i. Results
 - j. Discussion
 - k. Bibliography
7. The project should be submitted at the time of University Practical Examination, as the same will be assessed internally.

GUIDELINE FOR THE ASSESMENT OF PROJECT WORK

1. Each student will complete the project (3 copies) and get all the copies certified by the guiding teacher and the Head of Dept.(HOD) by January of Sem IV.
3. One copy of the certified project will be submitted to the HOD; One will be submitted to the guide while the other copy will be retained by the students for his/ her personal record.
4. After the certification of the project, the HOD will invite a PG – Recognized Teacher of Biochemistry Dept of any other College/ Institute/ Research centre for the assessment of **Research Project.**
5. The candidate is required to present the Research Project to the invited examiner followed by Viva- Voce examination based on the project work by the examiner.
6. The following Marking Scheme shall be considered while assessing the project work
Particular of Marks Allotment
 - a) Project Dissertation (Contents Submitted in the bound form).
 - b) Presentation of Project Work before Examiner.
 - c) Viva- voce Exam based in Project work.

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Savitribai Phule Pune University

(Formerly University of Pune)

Two Year Degree Program in Computer Science

(Faculty of Science & Technology)

Revised Syllabi for

M.Sc. (Computer Science) Part-I

(For Colleges Affiliated to Savitribai Phule Pune University)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course: M.Sc. (Computer Science)**Preamble:**

This syllabus is the extension of the existing syllabus which is currently being taught to M.Sc. (Computer Science) of Savitribai Phule Pune University for the last few years, but modified to be placed within the credit based system to be implemented from the academic year 2019-2020. However, there are few changes incorporated in the existing syllabus.

It is believed that the proposed changes as part of the credit based system will bring a qualitative change in the way M.Sc. (Computer Science) is taught, which will offer a more enriched learning experience. It aims to provide technology-oriented students with the knowledge and ability to develop creative solutions, and better understand the effects of future developments of computer systems and technology on people and society.

The syllabus is about developing skills to learn new technology, grasping the concepts and issues behind its use and the use of computers.

Course Structure:

Year/ Sem	Course Type	Course Code	Course Name	Credit	% of Assessment		
					IA	UE	Total
I Year Sem-I	Core Compulsory Theory Paper	CSUT111	Paradigm of Programming Language	4	30	70	100
		CSUT112	Design and Analysis of Algorithms	4	30	70	100
		CSUT113	Database Technologies	4	30	70	100
	Choice Based Optional Paper	CSDT114A	Cloud computing	2	15	35	50
		CSDP114A	Cloud Computing Practical	2	15	35	50
		OR					
		CSDT114B	Artificial Intelligence	2	15	35	50
		CSDP114B	Artificial Intelligence Practical	2	15	35	50
		OR					
		CSDT114C	Web Services	2	15	35	50
		CSDP114C	Web Services Practical	2	15	35	50
		OR					
Core Compulsory Practical Paper	CSUP115	PPL and Database Technologies Practical	4	30	70	100	

Year/ Sem	Course Type	Course Code	Course Name	Credit	% of Assessment		
					IA	UE	Total
I Year Sem-II	Core Compulsory Theory Paper	CSUT121	Advanced Operating System	4	30	70	100
		CSUT122	Mobile Technologies	4	30	70	100
		CSUT123	Software Project Management	4	30	70	100
	Choice Based Optional Paper	CSDT124A	Project	2	15	35	50
		CSDP124A	Project related Assignments	2	15	35	50
		OR					
		CSDT124B	Human Computer Interaction	2	15	35	50
		CSDP124B	Human Computer Interaction Practical	2	15	35	50
		OR					
		CSDT124C	Soft Computing	2	15	35	50
		CSDP124C	Soft Computing Practical	2	15	35	50
		OR					
Core Compulsory Practical Paper	CSUP125	Practical on Advanced OS & Mobile Technologies	4	30	70	100	

Year/ Sem	Course Type	Course Code	Course Name	Credit	% of Assessment		
					IA	UE	Total
II Year Sem-III	Core Compulsory Theory Paper	CSUT231	Software Architecture and Design Pattern	4	30	70	100
		CSUT232	Machine Learning	4	30	70	100
		CSUT233	Evolutionary Algorithms	4	30	70	100
	Choice Based Optional Paper	CSDT234A	Big Data	2	15	35	50
		CSDP234A	Big Data Practical	2	15	35	50
		OR					
		CSDT234B	Web Analytics	2	15	35	50
		CSDP234B	Web Analytics Practical	2	15	35	50
		OR					
		CSDT234C	Project	2	15	35	50
		CSDP234C	Project related Assignments	2	15	35	50
Core Compulsory Practical Paper	CSUP235	Practical on Software Architecture and Design Pattern and Machine Learning	4	30	70	100	

Year/ Sem	Subject	Paper	Title of Paper	Credit	% of Assessment		
					IA	UE	Total
II Year Sem-IV	Core	CSUIT241	Industrial Training /Institutional project	20			

IA :- Internal Assessment, UE :- University Examination

Equivalence of Previous Syllabus:

Old Subject	New Subject
Principles of Programming Languages	Paradigm of Programming Language
Advanced Networking	No Equivalence
Distributed Database Concepts	Database Technologies
Design and Analysis of Algorithms	Design and Analysis of Algorithms
Network Programming	No Equivalence
Digital Image Processing	No Equivalence
Advanced Operating Systems	Advanced Operating Systems
Data Mining and Data Warehousing	Big Data
Project	Project
Programming With DOT NET	No Equivalence
Artificial Intelligence	Artificial Intelligence
Advance Design and Analysis of Algorithms	Evolutionary Algorithms
Software Metrics & Project Management	Software Project Management
Mobile Computing	Mobile Technologies
Soft Computing	Soft Computing
Project	Project
Web Services	Web Services
Database and System Administrator	No Equivalence
Functional Programming	No Equivalence
Business Intelligence	No Equivalence
Industrial Training /Institutional project	Industrial Training /Institutional project
Parallel Computing	No Equivalence
Embedded System	No Equivalence
Software Quality Assurance	No Equivalence
Modeling and Simulation	No Equivalence

Practical paper implementation strategy:

Subject	Platform
PPL	Linux
Database Technologies	Linux
AI	Linux
Web Services	Linux/Windows
Cloud Computing	Linux

Note : Any version of Linux (Fedora/ Redhat/ Ubuntu etc) can be used as per your comfort.

Detailed Syllabus:

Course Code: CSUT111	Course Name: Paradigm of Programming Language	Total Lectures (48 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 30 Marks UE: 70 Marks	No. of Credits 4
Course Prerequisites:	Student should have basic knowledge of: <ul style="list-style-type: none"> • Procedural Language like C • Object-Oriented Languages (C++ and Java) • Concepts of Operating Systems • Basic Data Structures and Algorithms. 	
Course Objectives:	To Prepare student to think about programming languages analytically: <ul style="list-style-type: none"> • Separate syntax from semantics • Compare programming language designs • Understand their strengths and weaknesses • Learn new languages more quickly • Understand basic language implementation techniques • Learn small programs in different programming Languages 	
Chapter	Course Contents	No. of Lectures
1	Introduction <ul style="list-style-type: none"> • The Art of Language Design • The Programming Language Spectrum • Why Study Programming Languages? • Compilation and Interpretation • Programming Environments 	2
2	Names, Scopes, and Bindings <ul style="list-style-type: none"> • The Notion of Binding Time • Object Lifetime and Storage Management • Static Allocation, Stack-Based Allocation, Heap-Based Allocation, Garbage Collection • Scope Rules • Static Scoping, Nested Subroutines, Declaration Order, Dynamic Scoping The meaning of Names in a Scope • Aliases, Overloading, Polymorphism and Related Concepts, the Binding of Referencing Environments • Subroutine Closures, First-Class Values and Unlimited Extent, Object Closures Macro Expansion • 	5

3	<p>Control Flow</p> <ul style="list-style-type: none"> • Expression Evaluation , Precedence and Associativity, Assignments, Initialization, Ordering Within Expressions, Short-Circuit Evaluation • Structured and Unstructured Flow, Structured Alternatives to goto • Sequencing • Selection - Short-Circuited Conditions, Case/Switch Statements Iteration • Iteration - Enumeration-Controlled Loops, Combination Loops, Iterators, Logically Controlled Loops Recursion • Recursion - Iteration and Recursion, Applicative- and Normal-Order Evaluation 	5
4	<p>Data Types</p> <ul style="list-style-type: none"> • Introduction • Primitive Data Types • Numeric Types : Integer, Floating point, Complex , Decimal, Boolean Types, Character Types • Character String Types • Design Issues, Strings and Their Operations, String Length Operations, Evaluation, Implementation of Character String Types • User defined Ordinal types Enumeration types, Designs Evaluation Subrange types, Ada's design Evaluation Implementation of user defined ordinal types • Array types • Design issues, Arrays and indices, Subscript bindings and array categories, Heterogeneous arrays, Array initialization, Array operations, Rectangular and Jagged arrays, Slices, Evaluation, Implementation of Array Types • Associative Arrays • Structure and operations, Implementing associative arrays, • Record types • Definitions of records, References to record fields, Operations on records, Evaluation, Implementation of Record types • Union Types • Design issues, Discriminated versus Free unions, Evaluation, Implementation of Union types 	8

	<ul style="list-style-type: none"> • Pointer and Reference Types • Design issues, Pointer operations, Pointer problems, Dangling pointers, Lost heap dynamic variables, Pointers in C and C++, Reference types, Evaluation • Implementation of pointer and reference types - Representation of pointers and references Solution to dangling pointer problem Heap management 	
5	<p>Subprograms and Implementing Subprograms</p> <ul style="list-style-type: none"> • Introduction • Fundamentals of Subprograms • Design Issues for subprograms • Local Referencing Environments • Parameter-Passing Methods • Parameters That Are • Subprograms • Overloaded Subprograms • Generic Subroutines, Generic Functions in C++, Generic Methods in Java • Design Issues for Functions • User-Defined Overloaded Operators • Coroutines • Implementing Subprograms • The General Semantics of Calls and Returns • Implementing “Simple” Subprograms • Implementing Subprograms with Stack-Dynamic Local Variables • Nested Subprograms • Blocks • Implementing Dynamic Scoping 	5
6	<p>Data Abstraction and Object Orientation</p> <ul style="list-style-type: none"> • Object-Oriented Programming • Encapsulation and Inheritance <p>Modules, Classes, Nesting (Inner Classes), Type Extensions, Extending without Inheritance</p> <ul style="list-style-type: none"> • Initialization and Finalization <p>Choosing a Constructor, References and Values, Execution Order, Garbage Collection</p> <ul style="list-style-type: none"> • Dynamic Method Binding • Virtual- and Non-Virtual Methods, Abstract Classes, Member Lookup, Polymorphism, Object Closures • Multiple Inheritance • Semantic Ambiguities, Replicated Inheritance, 	8

	Shared Inheritance, Mix-In Inheritance	
7	Concurrency <ul style="list-style-type: none"> • Introduction : Multiprocessor Architecture Categories of concurrency, Motivations for studying concurrency • Introduction to Subprogram-level, concurrency Fundamental concepts, Language Design for concurrency, Design Issues • Semaphores - Introduction Cooperation synchronization, Competition Synchronization, Evaluation • Monitors - Introduction, Cooperation synchronization, Competition Synchronization, Evaluation, • Message Passing Introduction- The concept of Synchronous Message Passing • Java Threads - The Thread class –Priorities, Competition Synchronization Cooperation Synchronization, Evaluation 	5
8	Functional Programming in Scala <ul style="list-style-type: none"> • Strings • Numbers • Control Structures • Classes and Properties • Methods • Objects • Functional Programming • List, Array, Map, Set 	10

References:

Sr. No.	Title of the Book	Author/s	Publication
1	Programming Language Pragmatics, 3e	Michel L. Scott	Kaufmann Publishers, An Imprint of Elsevier, USA
2	Concepts of Programming Languages, Eighth Edition	Robert W. Sebesta	Pearson Education
3	Scala Cookbook	Alvin Alexander	O'REILLY publication

Course Code: CSUT112	Course Name: Design and Analysis of Algorithm	Total Lectures (48 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 30 Marks UE: 70 Marks	No. of Credits 4
Course Prerequisites:	<input type="checkbox"/> Basic knowledge of algorithms and programming concepts <input type="checkbox"/> Data Structures and Advanced Data Structures <input type="checkbox"/> Basic Knowledge of Graphs and Algorithms	
Course Objectives:	<ul style="list-style-type: none"> • To design the algorithms • To select the appropriate algorithm by doing necessary analysis of algorithms • To learn basic Algorithm Analysis techniques and understand the use of asymptotic notation • Understand different design strategies • Understand the use of data structures in improving algorithm performance • Understand classical problem and solutions • Learn a variety of useful algorithms • Understand classification of problems • To provide foundation in algorithm design and analysis • To develop ability to understand and design algorithms in context of space and time complexity. 	
Chapter	Course Contents	No. of Lectures
1	Basics of Algorithms <ul style="list-style-type: none"> • Algorithm definition and characteristics • Space complexity • Time complexity, worst case-best case-average case • complexity, asymptotic notation • Recursive and non-recursive algorithms • Sorting algorithms (insertion sort, heap sort, bubble sort) • Sorting in linear time: counting sort, concept of bucket and radix sort • Searching algorithms: Linear, Binary 	8
2	Divide and conquer strategy <ul style="list-style-type: none"> • General method, control abstraction • Binary search • Merge sort, Quick sort • Comparison between Traditional Method of Matrix Multiplication vs. Strassen's Matrix Multiplication 	5

3	Greedy Method <ul style="list-style-type: none"> • Knapsack problem • Job sequencing with deadlines, • Minimum-cost spanning trees: Kruskal and Prim's algorithm • Optimal storage on tapes • Optimal merge patterns • Huffman coding • Shortest Path :Dijkstra's Algorithm 	7
4	Dynamic Programming <ul style="list-style-type: none"> • Principle of optimality • Matrix chain multiplication • 0/1 Knapsack Problem <ul style="list-style-type: none"> i)Merge & Purge ii)Functional Method • Bellman Ford Algorithm • All pairs Shortest Path Floyd- Warshall Algorithm • Longest common subsequence, • String editing, Travelling Salesperson problem 	10
5	Decrease and Conquer <ul style="list-style-type: none"> • Definition of Graph Representation of Graph • By Constant - DFS and BFS • Topological sorting • Connected components and spanning trees • By Variable Size decrease Euclid's algorithm • Articulation Point and Bridge edge 	5
6	Backtracking <ul style="list-style-type: none"> • General method • Fixed Tuple vs. Variable Tuple Formulation • n- Queen's problem • Graph coloring problem • Hamiltonian cycle • Sum of subsets 	5
7	Branch and Bound <ul style="list-style-type: none"> • Introduction • FIFO BB Search, LIFO Search • Definitions of LCBB Search • Bounding Function, Ranking Function • Traveling Salesman problem Using Variable tuple 	5

	<ul style="list-style-type: none"> • Formulation using LCBB • 0/1 knapsack problem using LCBB 	
8	Problem Classification <ul style="list-style-type: none"> • Nondeterministic algorithm • The class of P, NP, NP-hard and NP - Complete problems • Cook's theorem 	3

References:

Sr. No.	Title of the Book	Author/s	Publication
1	Computer algorithms	Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran	Galgotia Publication
2	T. Cormen, C. Leiserson, & R. Rivest	Algorithms	MIT Press
3	A. Aho, J. Hopcroft & J. Ullman	The Design and Analysis of Computer Algorithms	Addison Wesley
4	Donald Knuth	The Art of Computer Programming	Addison Wesley
5	Steven Skiena	The Algorithm Manual	Springer
6	Jungnickel	Graphs, Networks and Algorithms	Springer

Course Code: CSUT113	Course Name: Database Technologies	Total Lectures (48 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 30 Marks UE: 70 Marks	No. of Credits 4
Course Prerequisites:	<ul style="list-style-type: none"> • Knowledge of file system concepts • Strong foundation of Related database Concepts (Basic & Advanced) • A firm foundation of any RDBMS package 	
Course Objectives:	<ul style="list-style-type: none"> • Provide an overview of the concept of NoSQL technology. • Provide an insight to the different types of NoSQL databases • Make the student capable of making a choice of what database technologies to use, based on their application needs. 	
Chapter	Course Contents	No. of Lectures
1	Introduction to NOSQL (Core concepts)	18
	Why NoSQL	
	Aggregate Data Models	
	Data modeling details	
	Distribution Models	
	Consistency	
	Version stamps	
2	Implementation with NOSQL databases	14
	Key-Value Databases (Riak)	
	Document Databases (Mongodb)	
	Column-Family stores (Cassandra)	
	Graph databases (Neo4j)	
3	Schema Migrations	5
4	Polygot Persistence (Multi model types)	5
5	Beyond NoSQL	3
6	Choosing your database	3

References:

Sr. No.	Title of the Book	Author/s	Publication
1	NoSQL Distilled	Pramod Sadalge, Martin Fowler	
2	NoSQL for Dummies	A Willy Brand	
3	http://nosql-database.org		

Note: For Database Technologies implementation of databases/assignments can be done in all, but for university practical examination only MongoDB and Neo4j will be used/considered. Other can be for self learning/demonstration.

Course Code: CSDT114A	Course Name: Cloud Computing	Total Lectures (30 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 15 Marks UE: 35 Marks	No. of Credits 2
Course Prerequisites:	<input type="checkbox"/> Operating System <input type="checkbox"/> Fundamentals of Computer Networks <input type="checkbox"/> Good Understanding of Object Oriented Programming Concepts	
Course Objectives:	<ul style="list-style-type: none"> • To understand the principles and paradigm of Cloud Computing • To appreciate the role of Virtualization Technologies • Ability to design and deploy Cloud Infrastructure • Understand cloud security issues and solutions 	
Chapter	Course Contents	No. of Lectures
1	Introduction to Cloud Computing Overview, Layers and Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Multitenant Technology. Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology. Infrastructure as a Service, Platform as a Service, Software as a Service, Cloud Deployment Models.	8
2	Abstraction and Virtualization Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Provisioning in the Cloud Context Virtualization of CPU, Memory , I/O Devices, Virtual Clusters and Resource management	7

3	Programming, Environments and Applications Features of Cloud and Grid Platforms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, Applications: Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications.	8
4	Security In The Cloud Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security - Identity Management and Access Control, Disaster Recovery in Clouds.	7

References:

Sr. No.	Title of the Book	Author/s	Publication
1	Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center	Brian J.S. Chee and Curtis Franklin	CRC Press, ISBN :9781439806128
2	Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi	Mastering Cloud Computing: Foundations and Applications Programming	McGraw Hill, ISBN: 978 1259029950, 1259029956
3	Kai Hwang, Geoffrey C Fox, Jack G Dongarra	Distributed and Cloud Computing, From Parallel Processing to the Internet of Things	Morgan Kaufmann Publishers, 2012.

CSDP114A: Cloud Computing Practical Assignments

Sr. No	Assignment
1.	Working and Implementation of Infrastructure as a service.
2.	Working and Implementation of Software as a service.
3.	Working and Implementation of Platform as a services.
4.	Practical Implementation of Storage as a Service.
5.	Working of Google drive to make spreadsheet and notes.
6.	Working and Implementation of identity management.
7.	Write a program for web feed.
8.	Execute the step to Demonstrate and implementation of cloud on single sign on.
9.	Practical Implementation of cloud security.
10.	Installing and Developing Application Using Google App Engine.
11.	Implement VMWareESXi Server
12.	Using OpenNebula to manage heterogeneous distributed data center Infrastructure.
13.	Implementation of Cloud Failure Cluster.
14.	Managing and working of cloud xen server.
15.	Working with Aneka and demonstrate how to Managing cloud computing Resources .
16.	Installation and configuration of cloud Hadoop and demonstrate simple query.
17.	Create a sample mobile application using Amazon Web Service (AWS) account as a cloud service. Also provide database connectivity with implemented mobile application.

Course Code: CSDT114B	Course Name: Artificial Intelligence	Total Lectures (30 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 15 Marks UE: 35 Marks	No. of Credits 02
Course Prerequisites:	<input type="checkbox"/> Concepts of Data structures and Design and Analysis of algorithms. <input type="checkbox"/> Strong data analytics skills. <input type="checkbox"/> Strong will to learn machine learning languages.	
Course Objectives:	<input type="checkbox"/> To learn various types of algorithms useful in Artificial Intelligence (AI). <input type="checkbox"/> To convey the ideas in AI research and programming language related to emerging technology. <input type="checkbox"/> To understand the numerous applications and huge possibilities in the field of AI that goes beyond the normal human imagination.	
Chapter	Course Contents	No. of Lectures
1	Introduction to Artificial Intelligence: Introduction and Intelligent systems, What Is AI, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, Applications of AI, Early work in AI and related fields, AI problems and Techniques.	2
2	Searching: -Defining AI problems as a State Space Search: example, Search and Control Strategies, Problem Characteristics, Issues in Design of Search Programs, Production System. Blind Search Techniques : -BFS, DFS, DLS, Iterative Deepening, Search, Bidirectional Search, Uniform cost Search. Heuristic search techniques: -Generate and test ,Hill Climbing, Best First search, Constraint Satisfaction, Mean-End Analysis, A*,AO*.	8

3	<p>Knowledge Representation:</p> <p>Representations and Mappings, Approaches to Knowledge Representation, Knowledge representation method, Propositional Logic, Predicate logic, Representing Simple facts in Logic, Resolution, Forward and backward chaining .</p> <p>Game Playing- Minimax Search Procedures, Adding alpha-beta cutoffs.</p>	8
4	<p>Introduction to AI with Python:</p> <p>Introduction to Python , why python with AI, Features of Python, Basics of Python, Python statements, Methods & Functions using python, Basic and advanced modules & Packages, Python Decorators and generators .Advanced Objects & Data structures.</p>	6
5	<p>Machine Learning:</p> <p>Why Machine learning, Types of Machine Learning: Supervised learning- Classification & Regression. Random Forest, KNN Algorithm. Unsupervised learning-Clustering & Association. Reinforcement learning.</p>	6

References:

Sr. No.	Title of the Book	Author/s	Publication
1	Computational Intelligence	Eberhart	Elsevier Publication
2	Artificial Intelligence: A New Synthesis	Nilsson	Elsevier Publication
3	Artificial Intelligence with Python	PrateekJoshi	Packt Publishing Ltd
4	Reinforcement and Systematic Machine Learning for Decision Making,	Parag Kulkarni	Wiley-IEEE Press Edition
5	Artificial Intelligence	Saroj Kausik	Cengage Learning
6	Introduction to Machine Learning	EthemAlpaydin	PHI 2nd Edition

CSDP114B: Artificial Intelligence Practical

Sr. No.	Assignment
1	Subject teacher should conduct first lab practical on basic programs using python for introducing and using python environment such as, a) Program to print multiplication table for given no. b) Program to check whether the given no is prime or not. c) Program to find factorial of the given no and similar programs.
2	Write a program to implement List Operations(Nested list, Length, Concatenation, Membership ,Iteration ,Indexing and Slicing), List Methods(Add, Append, Extend & Delete)
3	Write a program to Illustrate Different Set Operations.
4	Write a program to implement Simple Chatbot.
5	Write a program to implement Breadth First Search Traversal.
6	Write a program to implement Depth First Search Traversal.
7	Write a program to implement Water Jug Problem.
8	Write a program to implement K -Nearest Neighbor algorithm.
9	Write a program to implement Regression algorithm.
10	Write a program to implement Random Forest Algorithm.

Course Code: CSDT 114C	Course Name: Web Services	Total Lectures (30 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 15 Marks UE: 35 Marks	No. of Credits 2
Course Prerequisites:	<ul style="list-style-type: none"> • Strong knowledge about Java programming. • Good Understanding of Object Oriented Programming concepts. • Must be familiar with XML. 	
Course Objectives:	<ul style="list-style-type: none"> • To understand the details of web services technologies like WSDL,UDDI, SOAP • To learn how to implement and deploy web service client and server • To explore interoperability between different frameworks • To understand the concept of RESTful system. 	
Chapter	Course Contents	No. of Lectures
1	<p>Web Service and SOA fundamentals</p> <p>Introduction to Web Services — The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services.</p> <p>Web Services Architecture — Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication models, basic steps of implementing web services.</p>	6
2	<p>SOAP: Simple Object Access Protocol</p> <p>Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP communication model, Building SOAP Web Services, developing SOAP Web Services using Java, Error handling in SOAP, Advantages and disadvantages of SOAP.</p>	8

3	<p>Unit III : Describing and Discovering Web Services</p> <p>WSDL - WSDL in the world of Web Services, Web Services life cycle, anatomy of WSDL definition document, WSDL bindings, WSDL Tools, limitations of WSDL, Service discovery, role of service discovery in a SOA, service discovery mechanisms,</p> <p>UDDI – UDDI Registries, uses of UDDI Registry, Programming with UDDI, UDDI data structures, support for categorization in UDDI Registries, Publishing API, Publishing information to a UDDI Registry, searching information in a UDDI Registry, deleting information in a UDDI Registry, limitations of UDDI.</p>	8
4	<p>Unit IV : The REST Architectural style :</p> <p>Introducing HTTP, The core architectural elements of a RESTful system, Description and discovery of RESTful web services, Java tools and frameworks for building RESTful web services, JSON message format and tools and frameworks around JSON, Build RESTful web services with JAX-RS APIs, The Description and Discovery of RESTful Web Services, Design guidelines for building RESTful web services, Secure RESTful web services</p>	8

References:

Sr. No.	Title of the Book	Author/s	Publication
1	Building Web Services with Java, 2nd Edition	S. Graham and others	Pearson Edn., 2008.
2	J2EE Web Services	Richard Monson-Haefel	Pearson Education.
3	Java Web Services Programming,	R.Mogha, V.V.Preetham	Wiley India Pvt.Ltd.
4	XML, Web Services, and the Data Revolution	F.P.Coyle	Pearson Education

CSDP114C: Web Services Practical Assignments

Pre-requisites

- Strong knowledge about Java programming / PHP / .Net Framework
- Good Understanding of Object Oriented Programming concepts.
- Must be familiar with XML.

Objectives

- To understand how to develop web services using Java/PHP/.Net

Sr. No.	Assignment
1.	Create 'Dynamic Web Project', which will host your web service functionality to greet the user according to server time and create 'Dynamic Web Project', which will host the client application that will send user name and test the web service.
2.	Create 'Dynamic Web Project', which will host your web service functionality to convert Celsius to Fahrenheit and create 'Dynamic Web Project', which will host the client application that will send Celsius and test the web service.
3.	Create 'Dynamic Web Project', which will host your web service functionality to find the factorial of given number and create 'Dynamic Web Project', which will host the client application that will send positive integer number and test the web service.
4.	Create 'Dynamic Web Project', which will host your web service functionality to validate email id (use regular expression) and create 'Dynamic Web Project', which will host the client application that will send email id and test the web service.
5.	Create 'Dynamic Web Project', which will host your web service functionality to validate user name and password (use database for storing username and password) and create 'Dynamic Web Project', which will host the client application that will send user name and password and test the web service.
6.	Create 'Dynamic Web Project', which will host your web service functionality to select employee details (use database for storing emp details (eno, ename, designation, salary)) and create 'Dynamic Web Project', which will host the client application that will send employee name and display the details.
7.	Create 'Dynamic Web Project', which will host your web service functionality to select Movie details (Movie(mno, mname, release_year) and Actor(ano, aname), 1 : M cardinality) and create 'Dynamic Web Project', which will host the client application that will send actor name and display the details.
8.	Create 'Dynamic Web Project', which will host your web service functionality to validate mobile no (use regular expression: should contain only 10 numeric no) and create 'Dynamic Web Project', which will host the client application that will send mobile no and test the web service.
9.	Create 'Dynamic Web Project', which will host your web service functionality to convert Rupees to Dollar, Pound, Euro,..... and create 'Dynamic Web Project', which will host the client application that will send amount in Rupees & type of conversion and tests the web service.

10.	Create 'Dynamic Web Project', which will host your web service functionality to give the suggestion for given key word and create 'Dynamic Web Project', which will host the client application that tests the web service.
11.	Create 'Dynamic Web Project', which will host your web service functionality to find area and volume of the circle and create 'Dynamic Web Project', which will host the client application that tests the web service.
12.	Create 'Dynamic Web Project', which will host your web service functionality to find number of vowels in the given string and create 'Dynamic Web Project', which will host the client application that tests the web service.
13.	Create 'Dynamic Web Project', which will host your web service functionality to convert decimal number to Binary, Octal, Hexa Decimal and create 'Dynamic Web Project', which will host the client application that will send decimal number & type of conversion and test the web service.
14.	Create 'Dynamic Web Project', which will host your web service functionality to validate user name and password (use database for storing username and password) and create 'Dynamic Web Project', which will host the client application that will send user name and password and test the web service.
15.	Create 'Dynamic Web Project', which will host your web service functionality for returning book price and create 'Dynamic Web Project', which will host the client application that will send Book Name

CSUP115: PPL and Database Technologies Practical

LIST OF SCALA PROGRAMS (PPL)

Control Structures

1. Write a program to calculate average of all numbers between n1 and n2(eg.100 to 300 Read values of n1 and n2 from user)
2. Write a program to calculate factorial of a number.
3. Write a program to read five random numbers and check that random numbers are perfect number or not.
4. Write a program to find second maximum number of four given numbers.
5. Write a program to calculate sum of prime numbers between 1 to 100
6. Write a program to read an integer from user and convert it to binary and octal using user defined functions.

Arrays

1. Write a program to find maximum and minimum of an array
2. Write a program to calculate transpose of a matrix.
3. Write a program to calculate determinant of a matrix,
4. Write a program to check if the matrix is upper triangular or not.
5. Write a program to sort the matrix using insertion sort.
6. Write a program for multiplication of two matrices(Validate number of rows and columns before multiplication and give appropriate message)

String

1. Write a program to count uppercase letters in a string and convert it to lowercase and display the new string.
2. Write a program to read a character from user and count the number of occurrences of that character.
3. Write a program to read two strings. Remove the occurrence of second string in first string.
4. Create array of strings and read a string from user. Display all the elements of array containing given string.

Classes and Objects

1. Define a class CurrentAccount (accNo, name, balance, minBalance). Define appropriate constructors and operations withdraw(), deposit(), viewBalance(). Create an object and perform operations.
2. Define a class Employee (id, name, salary). Define methods accept() and display(). Display details of employee having maximum salary.
3. Create abstract class Order (id, description). Derive two classes PurchaseOrder& SalesOrder with members Vendor and Customer. Create object of each PurchaseOrder and SalesOrder. Display the details of each account.
4. Create abstract class Shape with abstract functions volume() and display(). Extend two classes Cube and Cylinder from it. Calculate volume of each and display it.

5. Create class Project (id, name, location). Define parameterized constructor. Keep a count of each object created and display the details of each project.
6. Define a class Sports (id, name, description, amount). Derive two classes Indoor and Outdoor. Define appropriate constructors and operations. Create an object and perform operations.
7. Design abstract class Employee with computeSal() as abstract function. Create two subclasses Worker and Manager. Salary of worker should be calculated on hourly basis of work and Salary of Manager should be calculated on monthly basis with additional incentives.

List

1. Create Lists using five different methods(Lisp style , Java style, fill, range and tabulate methods)
2. Create two Lists and Merge it and store the sorted in ascending order.
3. Create a list of integers divisible by 3 from List containing numbers from 1 to 50.
4. Create a list of even numbers up to 10 and calculate its product.
5. Write a program to create list with 10 members using function $3n^2+4n+6$
6. Write a program to create a list of 1 to 100 numbers. Create second list from first list selecting numbers multiple of 10.
7. Create a list of 50 members using function $2n+3$. Create second list excluding all elements multiple of 7.

Map

1. Write a user defined functions to convert lowercase letter to uppercase and call the function using Map.
2. Write a program to create map with Rollno and FirstName. Print all student information with same FirstName.

Set

1. Write a program to create two sets and find common elements between them.
2. Write a program to display largest and smallest element of the Set
3. Write a program to merge two sets and calculate product and average of all elements of the Set

Database Technologies: MongoDB Practical Assignment 1

1. Create a database with the name 'Movie'.
2. A 'Film' is a collection of documents with the following fields:
 - a. Film Id
 - b. Title of the film
 - c. Year of release
 - d. Genre / Category (like adventure, action, sci-fi, romantic etc.) A film can belong to more than one genre.
 - e. Actors (First name and Last name)
A film can have more than one actor.
 - f. Director (First name and Last name)
A film can have more than one director.
 - g. Release details (It consists of places of release, dates of release and rating of the film.)
3. An 'Actor' is a collection of documents with the following fields:
 - a. Actor Id
 - b. First name
 - c. Last Name
 - d. Address (Street, City, State, Country, Pin-code)
 - e. Contact Details (Email Id and Phone No)
 - f. Age of an actor.

Queries:

1. Insert at least 10 documents in the collection Film –
 - a. Insert at least one document with film belonging to two genres.
 - b. Insert at least one document with film that is released at more than one place and on two different dates.
 - c. Insert at least three documents with the films released in the same year.
 - d. Insert at least two documents with the films directed by one director.
 - e. Insert at least two documents with films those are acted by a pair 'Madhuri Dixit' and 'Shahrukh Khan'.
2. Insert at least 10 documents in the collection Actor.

Make sure, you are inserting the names of actors who have acted in films, given in the 'Film' collection.
3. Display all the documents inserted in both the collections.
4. Add a value to the rating of the film whose title starts with 'T'.
5. Add an actor named " _____ " in the 'Actor' collection. Also add the details of the film in 'Film' collection in which this actor has acted in.
6. Delete the film " _____ ".
7. Delete an actor named " _____ ".
8. Delete all actors from an 'Actor' collection who have age greater than " _____ ".
9. Update the actor's address where Actor Id is " _____ ".
10. Update the genre of the film directed by " _____ ".

Database Technologies: MongoDB Practical Assignment 2

1. Create a database with name 'Company'.
2. An 'Employee' is a collection of documents with the following fields:
 - a. Employee ID
 - b. First Name
 - c. Last Name
 - d. Email
 - e. Phone No.
 - f. Address (House No, Street, City, State, Country, Pin-code)
 - g. Salary
 - h. Designation
 - i. Experience
 - j. Date of Joining
 - k. Birthdate
3. A 'Transaction' is a collection of documents with the following fields:
 - a. Transaction Id,
 - b. Transaction Date
 - c. Name (First Name of employee who processed the transaction)
 - d. Transaction Details (Item Id, Item Name, Quantity, Price)
 - e. Payment (Type of Payment (Debit/Credit/Cash), Total amount paid, Payment Successful)
 - f. Remark (Remark field can be empty.)

Queries:

1. Insert at least 5 documents in 'Employee' collection.
2. Insert multiple documents (at least 10) into the 'Transaction' collection by passing an array of documents to the db.collection.insert () method.
3. Display all the documents of both the collections in a formatted manner.
4. Update salary of all employees by giving an increment of Rs. 4000.
5. Update the remark for transaction id 201.
6. Update designation of an employee named " _____ " from supervisor to manager.
7. Update designation of an employee having Employee Id as _____.
8. Change the address of an employee having Employee Id as _____.
9. Delete transaction made by " _____ " employee on the given date.
10. Delete all the employees whose first name starts with 'K'.

Database Technologies: MongoDB Practical Assignment 3

This assignment is based on 'Movie' database having collections 'Film' and 'Actor'.

Prerequisite: Read MongoDB Aggregate framework before executing the following assignments.

Note: It is expected that student should fill in the data relevant to the queries given in the assignment. The result set should not be empty.

1. Find the titles of all the films starting with the letter 'R' released during the year 2009 and 2011.
2. Find the list of films acted by an actor "_____".
3. Find all the films released in 90s.
4. Find all films belonging to "Adventure" and "Thriller" genre.
5. Find all the films having 'A' rating.
6. Arrange the film names in ascending order and release year should be in descending order.
7. Sort the actors in ascending order according to their age.
8. Find movies that are comedies or dramas and are released after 2013.
9. Show the latest 2 films acted by an actor "_____".
10. List the titles of films acted by actors "_____" and "_____".
11. Retrieve films with an actor living in Spain.
12. Retrieve films with actor details.

Note: Similarly, additional queries can be executed based on these collections for practice.

Database Technologies: MongoDB Practical Assignment 4

This assignment is based on 'Company' database having collections 'Employee' and 'Transaction'.

Prerequisite: Read MongoDB Aggregate framework before executing the following assignments.

Note: It is expected that student should fill in the data relevant to the queries given in the assignment. The result set should not be empty.

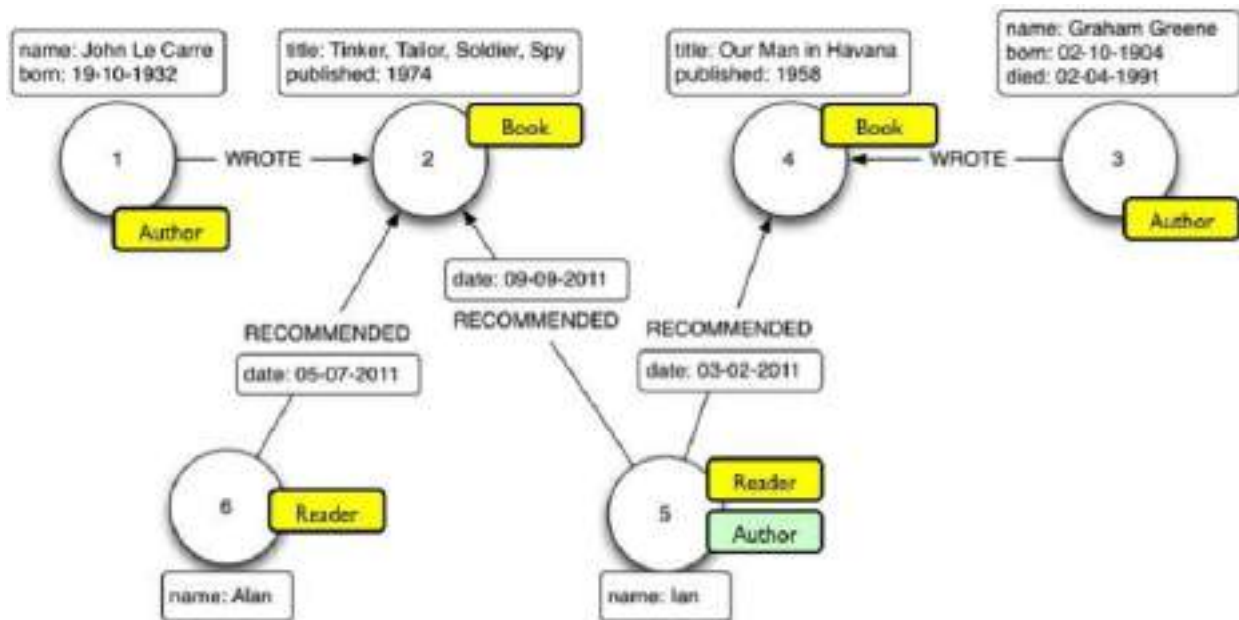
1. Find employees having designation as either 'manager' or 'floor supervisor'.
2. Find an employee whose name ends with " _____ " and print the output in json format.
3. Display the name of an employee whose salary is greater than _____ using a MongoDB cursor.
4. Sort the employees in the descending order of their designation.
5. Count the total number of employees in a collection.
6. Calculate the sum of total amount paid for all the transaction documents.
7. Calculate the sum of total amount paid for each payment type.
8. Find the transaction id of the latest transaction.
9. Find designation of employees who have made transaction of amount greater than Rs. 500.
10. Find the total quantity of a particular item sold using Map Reduce.

Database Technologies: Neo4j Practical Assignment 1

Create the following databases as graph models. Visualize the models after creation, Return properties of nodes, Return the nodes labels, Return the relationships with its properties.

NB: You may assume and add more labels , relationships, properties to the graphs

1. Create a library database , as given below.



There are individual books, readers, and authors that are present in the library data model.. A minimal set of labels are as follows:

Book: This label includes all the books

Person: This label includes authors, translators, reviewers, Readers, Suppliers and so on

Publisher: This label includes the publishers of books in the database

A set of basic relationships are as follows:

PublishedBy: This relationship is used to specify that a book was published by a publisher

Votes: This relationship describes the relation between a user and a book, for example, how a book was rated by a user.

ReviewedBy : This relationship is used to specify that a book was reviewed and remarked by a user.

TranslatedBy: This relationship is used to specify that a book was translated to a language by a user.

IssuedBy: This relationship is used to specify that a book was issued by a user.

ReturnedBy: This relationship is used to specify that a book was returned by a user

Every book has the following properties:

Title: This is the title of the book in string format

Tags: This is an array of string tags useful for searching through the database based on topic, arguments, geographic regions, languages, and so on

Status: the book status , specifying whether its issued or in library.

Condition: book condition, new or old

Cost : Cost of book

Type: book is a Novel, Journal, suspense thriller etc

2. Consider a Song database, with labels as Artists, Song, Recording_company, Recoding_studio, song author etc.

Relationships can be as follows

Artist \longrightarrow [Performs] \longrightarrow Song \longrightarrow [Written by] \longrightarrow Song_author.

Song \longrightarrow [Recorded in] \longrightarrow Recording Studio \longrightarrow [managed by] \longrightarrow recordingCompany

Recording Company \longrightarrow [Finances] \longrightarrow Song

You may add more labels and relationship and their properties, as per assumptions.

3. Consider an Employee database, with a minimal set of labels as follows Employee:

denotes a person as an employee of the organization Department: denotes the

different departments, in which employees work. Skillset: A list of skills acquired by an employee

Projects: A list of projects in which an employee works.

A minimal set of relationships can be as follows: Works_in :

employee works in a department Has_acquired: employee has

acquired a skill Assigned_to : employee assigned to a project

Controlled_by: A project is controlled by a department Project_manager :

Employee is a project_manager of a Project

4. Consider a movie database, with nodes as Actors, Movies, Roles, Producer, Financier, Director.

Assume appropriate relationships between the nodes, include properties for nodes and relationships.

5. Create a Social network database , with labels as Person, Affiliations, Groups, Story, Timeline etc. Some of the relationships can be as follows:

Person \longrightarrow [friend of] \longrightarrow Person \longrightarrow [affiliated to] \longrightarrow affiliations

Person \longrightarrow [belongs to] \longrightarrow Groups, Person \longrightarrow [create] \longrightarrow Story \longrightarrow [refers to] \longrightarrow Person

Person \longrightarrow [creates] \longrightarrow Timeline \longrightarrow [reference for] \longrightarrow Story ,

Timeline \longrightarrow [contains] \longrightarrow Messages

Database Technologies: Neo4j Practical Assignment 2 Simple Queries.

1. Library Database :
 - a) List all people, who have issued a book “.....”
 - b) Count the number of people who have read “”
 - c) Add a property “Number of books issued “ for Mr. Joshi and set its value as the count
 - d) List the names of publishers from pune city.

2. Song Database:
 - a) List the names of songs written by “:.....”
 - b) List the names of record companies who have financed for the song “....”
 - c) List the names of artist performing the song “.....”
 - d) Name the songs recorded by the studio “

3. Employee Database:
 - a) List the names of employees in department “.....”
 - b) List the projects along with their properties, controlled by department “.....”
 - c) List the departments along with the count of employees in it
 - d) List the skillset for an employee “.....”

4. Movie Database:
 - a) Find all actors who have acted in a movie “.....”
 - b) Find all reviewer pairs, one following the other and both reviewing the same movie, and return entire subgraphs.
 - c) Find all actors that acted in a movie together after 2010 and return the actor names and movie node
 - d) Find all movies produced by “

5. Social Network Database:
 - a) Find all friends of “John”, along with the year, since when john knows them.
 - b) List out the affiliations of John.
 - c) Find all friends of john, who are born in the same year as John
 - d) List out the messages posted by John in his timeline, during the year 2015.

Database Technologies: Neo4j Assignment 3 Complex pattern Queries:

1. Library database
 - a) List all readers who have recommended either book “...” or “.....” or “.....”
 - b) List the readers who haven't recommended any book
 - c) List the authors who have written a book that has been read / issued by maximum number of readers.
 - d) List the names of books recommended by “.....” And read by at least one reader
 - e) List the names of books recommended by “.....” and read by maximum number of readers.
 - f) List the names of publishers who haven't published any books written by authors from Pune and Mumbai.
 - g) List the names of voracious readers in our library
2. Song Database:
 - a) List the names of artists who have sung only songs written by “.....”
 - b) List the names of artists who have sung the maximum number of songs recorded by “.....” studio
 - c) List the names of songs financed by “.....”, and sung by “.....”
3. Employee Database:
 - a) List the names of employees having the same skills as employee “.....”
 - b) List the projects controlled by a department “.....” and have employees of the same department working in it.
 - c) List the names of the projects belonging to departments managed by employee “.....”
4. Movie Database:
 - a) List the names of actors that paired in multiple movies together.
 - b) List all pairs of actor–movie subgraphs along with the roles played.
 - c) List all reviewers and the ones they are following directly or via another a third Reviewer
 - d) List the names of movies that have the most number of reviews.
4. Social Network Database:
 - a) List out the people, who have created maximum timeline messages.
 - b) List all friends of John's friend, Tom
 - c) List the people with maximum friends
 - d) List the people who are part of more than 3 groups.

Course Code: CSUT121	Course Name: Advanced Operating System	Total Lectures (48 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 30 Marks UE: 70 Marks	No. of Credits 4
Course Prerequisites:	<ul style="list-style-type: none"> • Working knowledge of C programming. • Basic Computer Architecture concepts. • Basic algorithms and data structure concepts. 	
Course Objectives:	<p>This course teaches Advanced Operating Systems Concepts using Unix/Linux. This course strikes a delicate balance between theory and practical applications In fact, most Units start with the theory and then switches focus on how the concepts are implemented in a C program. This course describes the programming interface to the Unix/Linux system - the system call interface. It is intended for anyone writing C programs that run under Unix/Linux. This course provides an understanding of the functions of Operating Systems. It also provides provide an insight into functional modules of Operating Systems. It discusses the concepts underlying in the design and implementation of Operating Systems.</p>	
Chapter	Course Contents	No. of Lectures
1	Introduction to UNIX/LinuxKernel <ul style="list-style-type: none"> • System Structure, User Perspective, Assumptions about Hardware, Architecture of UNIX Operating System (TextBook-1: Chapter Topics: 1.2, 1.3, 1.5, 2.1) • Concepts of Linux Programming- Files and the Filesystem, Processes, Users and Groups, Permissions, Signals, Interprocess Communication (TextBook-3: Chapter 1- relevant topics) 	04
2	File and Directory I/O <ul style="list-style-type: none"> • Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading and writing disk blocks, inodes, structure of regular file, open, read, write, lseek, close, pipes, dup (TextBook- 1: Chapter Topics: 3.1-3.4, 4.1, 4.2, 5.1-5.3, 5.5-5.7, 5.12, 5.13) • open, creat, file sharing, atomic operations, dup2, sync, fsync, and fdatsync, fcntl, /dev/fd, stat, fstat, lstat, file types, Set-User-ID and Set-Group-ID, file access permissions, ownership of new files and directories, access function, umask function, chmod and fchmod, sticky bit, chown, fchown, and lchown, file size, file truncation, file systems, link, unlink, remove, and rename functions, symbolic links, symlink and readlink functions, file times, utime, mkdir and rmdir, reading directories, chdir, fchdir, and getcwd, device special files (TextBook-2: Chapter Topics: 3.3, 3.4, 3.10-3.14, 3.16, 4.2-4.23) 	15

3	<p>Process Environment, Process Control and Process Relationships</p> <ul style="list-style-type: none"> • Process states and transitions, layout of system memory, the context of a process, saving the context of a process, sleep, process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, changing the size of the process, The Shell, Process Scheduling (TextBook-1: Chapter Topics: 6.1-6.4, 6.6, 7.1-7.8, 8.1) • Process termination, environment list, memory layout of a C program, shared libraries, environment variables, setjmp and longjmp, getrlimit and setrlimit, process identifiers, fork, vfork, exit, wait and waitpid, waitid, wait3 and wait4, race conditions, exec, changing user IDs and group IDs, system function, user identification, process times (TextBook-2: Chapter Topics: 7.3, 7.5-7.7, 7.9-7.11, 8.2-8.11, 8.13, 8.15, 8.16) 	15
4	<p>Memory Management</p> <ul style="list-style-type: none"> • The Process Address Space, Allocating Dynamic Memory, Managing Data Segment, Anonymous Memory Mappings, Advanced Memory Allocation, Debugging Memory Allocations, Stack-Based Allocations, Choosing a Memory Allocation Mechanism, Manipulating Memory, Locking Memory, Opportunistic Allocation (TextBook-3: Chapter 8) • Swapping, Demand Paging (TextBook-1: Chapter Topics: 9.1, 9.2) 	06
5	<p>Signal Handling</p> <ul style="list-style-type: none"> • Signal concepts, signal function, unreliable signals, interrupted system calls, reentrant functions, SIGCLD semantics, reliable-signal technology, kill and raise, alarm and pause, signal sets, sigprocmask, sigpending, sigsetjmp and siglongjmp, sigsuspend, abort, system function revisited, sleep (TextBook-2: Topics: 10.2-10.13, 10.15-10.19) 	08

References:

Sr. No.	Title of the Book	Author/s	Publication
1	The Design of the UNIX Operating System	Maurice J. Bach.	PHI
2	Advanced Programming in the UNIX Environment	Richard Stevens	Addison-Wesley
3	Linux System Programming	Robert Love	O'Reilly

Course Code: CSUT122	Course Name: Mobile Technologies	Total Lectures (48 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 30 Marks UE: 70 Marks	No. of Credits 4
Course Prerequisites:	<input type="checkbox"/> Concepts of Networking <input type="checkbox"/> Conversant with OS internals <input type="checkbox"/> Familiar with the network Protocol stack <input type="checkbox"/> Gain knowledge about different mobile platform and application development <input type="checkbox"/> Brief History of wireless communication	
Course Objectives:	<input type="checkbox"/> To impart basic understanding of the wireless communication systems. <input type="checkbox"/> To expose students to various aspects of mobile and ad-hoc networks. <input type="checkbox"/> Understand the issues relating to Wireless applications <input type="checkbox"/> Understand the Mobile security	
Chapter	Course Contents	No. of Lectures
1	Introduction to Mobile Computing <ul style="list-style-type: none"> • Introduction and need for Mobile computing • Mobility and portability • Mobile and Wireless devices • Mobile Applications • Mobile Operating system – IOS, BlackBery, Windows phone, Plam OS, Symbian OS, PhoneGap 	03
2	Android Fundamentals <ul style="list-style-type: none"> • Introduction to Android - Overview and evolution of Android , Features of Android, Android architecture • Components of an Android Application, Manifest file • Android Activity • Service Lifecycle 	07
3	Android UI Design <ul style="list-style-type: none"> • Basic UI Designing (Form widgets ,Text Fields , Layouts ,[dip, dp, sip, sp] versus px) • Intent(in detail) • All components (e.g Button , Slider, Image view, Toast) Event Handling • Adapters and Widgets • Menu 	07

4	Android Thread and Notification <ul style="list-style-type: none"> • Threads running on UI thread (runOnUiThread) • Worker thread • Handlers & Runnable • AsyncTask (in detail) • Broadcast Receivers • Services and notifications • Toast • Alarms 	07
5	Advanced Android Programming <ul style="list-style-type: none"> • Content Providers – SQLite Programming • JSON Parsing • Accessing Phone Service(Call, SMS, MMS) • Location based services 	05
6	PhoneGap Programming <ul style="list-style-type: none"> • Why Use PhoneGap? • How PhoneGap Works • Designing for the Container • Writing PhoneGap Applications • Building PhoneGap Applications • PhoneGap Limitations • PhoneGap Plug-Ins • Hello, World! Program • PhoneGap APIs –1 Accelerometer: <ul style="list-style-type: none"> • Querying Device Orientation, • Watching a Device’s Orientation, • Creating a Contact, Searching for Contacts, Cloning Contacts, Removing Contacts. 	12
7	iOS Fundamentals <ul style="list-style-type: none"> • Introduction - What is IOS ,IOS Architecture, Frameworks, Application Life Cycle, Features • Swift - Introduction to Swift ,General Concepts of Swift • Xcode - Introduction to Xcode , Navigator, Editor Utility, Tools, Console, Document, Simulator, Instruments • Startup - Application Templates, Introduction to Storyboard , Hello World Application, How ‘Hello World’ Working, Debugging Database, Plist, Preference, Sqlite Web Service, Restful Web Service (JSON & XML) 	08

References:

Sr. No.	Title of the Book	Author/s	Publication
1	A Course in Machine Learning	Hal Daumé III	
2	IOS Apprentice	Matthijs Hollemans	
3	PhoneGap: Beginner's Guide	Giorgio Natili, Purusothaman Ramanujam	PACKT Publication
4	Beginning Android Application Development	Wei-Meng Lee Wiley	

Course Code: CSUT123	Course Name: Software Project Management	Total Lectures (48 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 30 Marks UE: 70 Marks	No. of Credits 4
Course Prerequisites:	<input type="checkbox"/> Software Engineering <input type="checkbox"/> Basic testing concepts	
Course Objectives:	<ul style="list-style-type: none"> • Software Metrics and Project Management covers skills that are required to ensure successful medium and large scale software projects. • It examines Requirements Elicitation, Project Management, Verification & Validation and Management of Large Software Engineering Projects. • Students learn to select and apply project management techniques for process modeling, planning, estimation, process metrics and risk management; perform software verification and validation using inspections, design and execution of system test cases. 	
Chapter	Course Contents	No. of Lectures
1	Introduction to Project Management <ul style="list-style-type: none"> <input type="checkbox"/> What is a Project? <input type="checkbox"/> What is Project management? <input type="checkbox"/> Project phases and project life cycle <input type="checkbox"/> Organizational structure <input type="checkbox"/> Qualities of Project Manager <input type="checkbox"/> WBS 	4
2	Project Management Components <ul style="list-style-type: none"> <input type="checkbox"/> Project Integration Management-Project plan development and execution <input type="checkbox"/> Change controls <input type="checkbox"/> CCB <input type="checkbox"/> Configuration management 	6
3	Scope Management <ul style="list-style-type: none"> <input type="checkbox"/> Strategic planning <input type="checkbox"/> Scope planning, definition <input type="checkbox"/> Verification and control 	4
4	Time management <ul style="list-style-type: none"> <input type="checkbox"/> Activity planning <input type="checkbox"/> Schedule development and control <input type="checkbox"/> GANTT Chart 	2
5	Cost Management <ul style="list-style-type: none"> <input type="checkbox"/> Cost estimation and Control <input type="checkbox"/> COCOMO model <input type="checkbox"/> BASIC COCOMO NUMERICALS 	2
6	Quality Management <ul style="list-style-type: none"> • Quality planning and assurance 	2

7	Human Resource Management <ul style="list-style-type: none"> Organizational planning Staff acquisition 	2
8	Communication Management <ul style="list-style-type: none"> Information distribution Reporting 	2
9	Risk Management <ul style="list-style-type: none"> Risk identification Quantification and control 	2
10	Procurement Management <ul style="list-style-type: none"> Solicitation management and control Contract administration 	2
11	Software Metrics <ul style="list-style-type: none"> The scope of software metrics Size- oriented metrics Function oriented Software metrics data collection Analyzing software data 	6
12	Software Reliability <ul style="list-style-type: none"> Measurement and prediction Resource measurement Productivity, teams and tools 	6
13	Planning a measurement program <ul style="list-style-type: none"> What is metrics plan? Developing goals, questions and metrics Where and When: Mapping measures to activities How: Measurement tools Who: Measurers , analyst, tools revision plans 	4
14	Quality Standards <ul style="list-style-type: none"> CMM levels KPA's PSP/TSP 	4

References:

Sr. No.	Title of the Book	Author/s	Publication
1.	Software Engineering	Roger Pressman	McGraw-Hill
2.	Software Metrics for Project Management and process improvement	Robert B. Grady	Prentice hill

CSDT124A: Project Guidelines

CSDP124A: Project Related Assignments

Assignment 1

Assignment 2

Assignment 3

Assignment 4

Course Code: CSDT124B	Course Name: Human Computer Interaction	Total Lectures (30 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 15 Marks UE: 35 Marks	No. of Credits 2
Course Prerequisites:	<ul style="list-style-type: none"> • Foundations of Human Computer Interaction • Be familiar with the design technologies for individuals and persons with disabilities • Be aware of mobile HCI • Learn the guidelines for user interface. 	
Course Objectives:	<ul style="list-style-type: none"> • Design effective dialog for HCI. • Design effective HCI for individuals and persons with disabilities. • Assess the importance of user feedback. • Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites. • Develop meaningful user interface. 	
Chapter	Course Contents	No. of Lectures
1	FOUNDATIONS OF HCI The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.	6
2	DESIGN & SOFTWARE PROCESS Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design	7
3	MODELS AND THEORIES Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.	5
4	MOBILE HCI Mobile Ecosystem: Platforms, Application frameworks Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	6

5	WEB INTERFACE DESIGN Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow, Case Studies.	6
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References:

Sr. No.	Title of the Book	Author/s	Publication
1	Human Computer Interaction, (Chapter 1 , 2 & 3)	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale	3rd Edition, Pearson Education, 2004
2	Mobile Design and Development (Chapter 4)	Brian Fling	First Edition O'Reilly Media Inc., 2009
3	Designing Web Interfaces (Chapter 5)	Bill Scott and Theresa Neil	First Edition, O'Reilly, 2009

CSDP124B: Human Computer Interaction Practical Assignments

Note: Any tool or technology can be used for implementation e.g., VB, DOTNET, JAVA, PHP, etc.

- 1) Understand the trouble of interacting with Computers - Redesign interfaces of applications. Select any application, like land-line phone application, registration etc and understand the trouble of interacting with that application. Comment on design of that application as good or bad design based on whether interaction principles are matching with users mental model or not. Redesign the interface for mention the change in design and reason.

- 2) Know your client: Select anyone category of user and develop application understanding the user who will be using your system. Comment on the category of user selected and specific features given for the users and identify what kinds of interfaces will they like and why?. Compare with existing system analyze and rate them. Analyze user models and develop user centric interfaces for :
 - a. Children (4-5 years of age): An application to teach math.
Perform analysis of children behavior e.g. their preferences, interests etc

 - b. Teenagers: Design a digital diary for young teens to help them overcome various social pressures they deal with during their teen years. The diary should also be like a self help tool which would help them deal with incidents like bullying, peer pressure, etc.. This is an open project and you can think in any direction to make the children sail through their teen years while trying to discover life around them.
Perform analysis of teenagers e.g. their problems, interests, needs, etc

 - c. Older generation: Folks from the older generation has been very wary of using their credit card on the Internet. They have various concerns when it comes to paying their bills. Also because of their old age, it will be beneficial for them to use the internet and pay their phone, electricity, gas, etc. bills
Analysis of old people e.g. their nature, interests, needs, etc

 - d. Rural people: ATVM for train ticketing in rural area
Perform analysis of rural people e.g. their problems, interests, needs, language etc

 - e. Mentally disabled: Design the interface of a game for mentally disabled children. □
Analysis of mentally disabled e.g. their behavior, problems, interests...

Any tool or technology can be used for implementation e.g., VB, DOTNET, JAVA, PHP, etc.

- 3) Identify 5 different websites catering to one specific goal (eg. Goal – on-line shopping and 5 different websites – ebay, amazon, flipkart, zovi, myntra) and perform a competitive analysis on them to understand how each one caters to the goal, the interactions and flow of the payment system and prepare a report on the same. Consider any 8 HCI principles and prepare the following table evaluating the websites.

Sr. No	Principles	Poor	Average	Good	Good Very	Excellent
1.	Aesthetically pleasing					
2.	..					

- 4) To achieve simplicity one needs to optimize the number of elements on a screen, within limits of clarity. And minimize the alignment points, especially horizontal or columnar
1. Calculate Screen Complexity for existing Graphical User Interface (GUI).
 2. Redesign the Screen by applying various guidelines to lower the complexity of selected Graphical User Interface (GUI) to achieve simplicity

Method for Measuring Complexity:

1. Draw a rectangle around each element on a screen, including captions, controls, headings, data, title, and so on.
2. Count the number of elements and horizontal alignment points (the number of columns in which a field, inscribed by a rectangle, starts).
3. Count the number of elements and vertical alignment points (the number of rows in which an element, inscribed by a rectangle, starts).
4. Calculate number of bits required by horizontal (column) alignment points and number of bits required by vertical (row) alignment points by applying following formula for calculating the measure of complexity.

$$C = -N \sum_{n=1}^m p_n \log_2 p_n$$

C, complexity of the system in bits

N, total number of events (widths or heights)

m, number of event classes (number of unique widths or heights)

pn, probability of occurrence of the nth event class (based on the frequency of events within that class)

5. Calculate overall complexity by adding the number bits required by horizontal alignment points and vertical alignment points.
- 5) Design/Redesign web user interface based on Gestalt theories and comment on the principle applied and justify. Also analyze one image in which Gestalt principle is applied and comment.

Example: Take a look at old IBM logo:



You recognize the letters as an I, a B, and an M, no problem there. But they aren't letters at all; the whole thing is a compilation of bright blue horizontal lines arranged to create the perception of a set of letters. Gestalt Property used here is Closure. Closure means that we "close" objects that are themselves not complete; not only completing the figure in our

perception, but perceiving the figure as having an extra element of aesthetic design; we look for a simple, recognizable pattern.

- 6) Design an application which consists of different types of menus such as Menu bar, Pull-Down Menu, Cascading Menu, Pop-up Menus, Tear-off Menus. Apply and explain general menu design guidelines applied for formatting, ordering, phrasing, selecting choices, and navigating menus for application which is designed.
- 7) Implement different Kinds of Windows such as message boxes, palette Windows, Pop-up Windows, primary window, secondary window, dialog boxes, message box etc. For every window designed for the application explain:
 - Purpose
 - Description
 - Components
 - Kind window
- 8) Identify separate lines of business, e.g., medical, greeting cards, law etc. Design an application using proper guidelines for icons. Comment on design of icons and their relevance in the system.

Icon design is an important process. Meaningful and recognizable icons will speed learning and recall and yield a much more effective system. Poor design will lead to errors, delays, and confusion. Looks different from all other icons.

- Is obvious what it does or represents.
- Is recognizable when no larger than 16 pixels square.
- Looks as good in black and white as in color. Icon Size

Supply in all standard sizes.

- 16 × 16 pixels.
- 16- and 256-color versions. - 32 × 32 pixels
- 16- and 256-color versions. - 48 × 48 pixels
- 16- and 256-color versions.
- Use colors from the system palette.
- Use an odd number of pixels along each side.
- Provides center pixel around which to focus design.
- Minimum sizes for easy selection:
 - With stylus or pen: 15 pixels square.
 - With mouse: 20 pixels square.
 - With finger: 40 pixels square. - Provide as large a hot zone as possible. Choosing Images
- Use existing icons when available.
- Use images for nouns, not verbs.
- Use traditional images.
- Consider user cultural and social norms.

The Design Process of Icons

- Define purpose:

To begin the design process, first define the icon's purpose and use. Have the design team brainstorm about possible ideas, considering real-world metaphors.

- Collect, evaluate, and sketch ideas:

Start by designing on paper, not on the computer. Ask everyone to sketch his or her ideas.

- Draw in black and white: Many icons will be displayed in monochrome. Color is an enhancing property; consider it as such.
- Test for expectation, recognition, and learning. Choosing the objects and actions, and the icons to represent them, is not a precise process, and will not be easy. So, as in any screen design activity, adequate testing and possible refinement of developed images must be built into the design process. Icon recognition and learning should both be measured as part of the normal testing process.
- Test for legibility.

Verify the legibility and clarity of the icons in general. Also, verify the legibility of the icons on the screen backgrounds chosen. White or gray backgrounds may create difficulties. An icon mapped in color, then displayed on a monochrome screen, may not present itself satisfactorily. Be prepared to redraw it in black and white, if necessary.

- Register new icons in the system's registry.

Create and maintain a registry of all system icons. Provide a detailed and distinctive description of all new icons.

Course Code: CSDT124C	Course Name: Soft Computing	Total Lectures (30 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 15 Marks UE: 35 Marks	No. of Credits 2
Course Prerequisites:	<input type="checkbox"/> A strong mathematical background <input type="checkbox"/> Proficiency with algorithms <input type="checkbox"/> Critical thinking and problem solving skills	
Course Objectives:	<input type="checkbox"/> To introduce the ideas of soft computational techniques based on human experience. <input type="checkbox"/> To generate an ability to design, analyze and perform experiments on real life problems using various Neural Learning Algorithms. <input type="checkbox"/> To conceptualize fuzzy logic and its implementation for various real world applications. <input type="checkbox"/> To apply the process of approximate reasoning using Neuro-Fuzzy Modeling. <input type="checkbox"/> To provide the mathematical background to carry out optimization using genetic algorithms.	
Chapter	Course Contents	No. of Lectures
1	Introduction to Soft Computing Neural Networks: Definition, Advantages, Applications, Scope. Fuzzy logic: Definition, Applications. Genetic Algorithms: Definition, Applications.	2
2	Neural Network Fundamental Concept: Artificial Neural Network, Biological Neural Network, Brain vs. Computer-Comparison Between Biological Neuron and Artificial Neuron (Brain vs. Computer), Artificial Neurons, Neural Networks and Architectures: Neuron Abstraction, Neuron Single Functions, Mathematical Preliminaries, Neural Networks Defined, Architectures: Feedforward and Feedback, Salient Properties of Neural Networks Geometry of Binary Threshold Neurons and Their Networks: Pattern Recognition and Data Classification, Convex Sets, Convex Hulls and Linear Separability, Space of Boolean Functions, Binary Neurons are Pattern Dichotomizers, Non-linearly Separable Problems, Capacity of a Simple Threshold Logic Neuron, Revisiting the XOR Problem, Multilayer Networks, How Many Hidden Nodes are Enough? Learning and Memory: An Anecdotal Introduction, Long Term Memory, The Behavioral Approach to Learning, The Molecular Problem of Memory, Learning Algorithms, Error Correction and Gradient	15

	Descent Rules, Learning Objective for TLNs, Pattern Space and Weight Space. Linear Separability, Hebb Network, Perceptron Network. α - Least Mean Square Learning.	
3	Fuzzy Set Theory Brief Review of Conventional Set Theory, Introduction to Fuzzy Sets, Properties of Fuzzy Sets, Operations on Fuzzy Sets, Crisp Relation, Fuzzy Relation, Tolerance and equivalence relation, Fuzzy Tolerance and equivalence relation, Fuzzy Max-Min and Max-Product Composition, Membership Functions, Fuzzification, Defuzzification to crisp sets, λ -Cuts for fuzzy Relations, Fuzzy (Rule-Based) system, Graphical technique of inference, Membership value assignment-Intuition, Inference.	9
4	Genetic Algorithms What are Genetic Algorithms? Why Genetic Algorithms? Traditional Optimization and Search Techniques, Simple GA, Terminologies and Operators in GA, Encoding, Selection, Crossover, Mutation, Search Termination, Constraints in GA	4

References:



Sr. No.	Title of the Book	Author/s	Publication
1	Fuzzy Logic With Engineering Applications	Timothy Ross	Wiley Publication
2	Introduction to Soft Computing	Deepa & Shivanandan	Wiley Publication
3	Genetic Algorithms in Search, Optimization and Machine Learning	David E. Goldberg	Pearson Education
4	Fundamentals of Neural Networks – Architectures, Algorithms, And Applications	Laurene Fausett	Pearson Education
5	Neural Networks	Satish Kumar	Tata McGrawHill

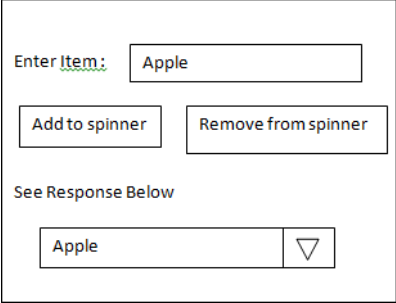
CSDP124C: Soft Computing Practical Assignment



Implement the programs in C/C++/Java/MATLAB

Sr. No	Assignment
1.	Write a program to implement Fuzzy Operations Union Intersection Complement Algebraic sum Algebraic product Cartesian product
2.	Write a program to implement De Morgans law.
3.	Write a program to implement Max-Min Composition and Max-Product Composition.
4.	Write a program to implement lambda cut
5.	Write a program to implement Activation Function.
6.	Write a program to implement Perceptron Learning Rule
7.	Write a program to implement Hebb's Rule
8.	Write a program to implement Feed Forward Network
9.	Write a program for building an Artificial Neural Network by implementing the Back propagation Algorithm and test the same using appropriate data sets.
10.	Write a program for solving linearly separable problem using Perceptron Model.
11.	Write a program to develop supervised learning algorithm
12.	Write a program to study and analyze genetic life cycle

CSUP125: Practical on Advanced OS & Mobile Technologies

Sr. No.	Mobile Technologies Assignments
1.	<p>Java Android Program to demonstrate login form with validation.</p> 
2.	Java Android Program to demonstrate Registration form with validation.
3.	<p>Create the simple calculator shown below also perform appropriate operation</p> 
4.	<p>Create an Android application which examine, that a phone number, which a user has entered is in the given format. * Area code should be one of the following: 040, 041, 050, 0400, 044 * There should 6-8 numbers in telephone number (+ area code).</p>
5.	By using Spinner, Buttons. Write a program to draw following GUI.

	
6.	Create an Android application, which show to the user 5-10 quiz questions. All questions have 4 possible options and one right option exactly. Application counts and shows to the user how many right answers were right and shows the result to user.
7.	Construct an app to display the image on date wise.
8.	Construct image switcher using setFactory().
9.	Construct a bank app to display different menu like windrow, deposite etc.
10.	Create an Android application, where the user can enter player name and points in one view and display it in another view.
11.	Create an Android application, the user can enter 10 students information and stored it in file and display student information in second view and also search the particular student information.
12.	Write an application to accept two numbers from the user, and displays them, but reject input if both numbers are greater than 10 and asks for two new numbers.
13.	Create table Customer (id, name, address, phno). Create Application for Performing the following operation on the table. (using sqlite database) i) Insert New Customer Details. ii) Show All the Customer Details
14.	Create an application that allows the user to enter a number in the textbox named 'getnum'. Check whether the number in the textbox 'getnum' is palindrome or not. Print the message accordingly in the label control named lbldisplay when the user clicks on the button 'check'.
15.	Create Following Table: Emp (emp_no,emp_name,address,phone,salary) Dept (dept_no,dept_name,location) Emp-Dept is related with one-many relationship. Create application for performing the following Operation on the table 1) Add Records into Emp and Dept table. 2) Accept Department name from User and delete

	employee information which belongs to that department.
16.	<p>Perform following numeric operation according to user selection of radio button</p> 
17.	<p>Perform following string operation according to user selection of radio button.</p> 
18.	Java Andorid Program to <u>Perform all arithmetic Operations using Calculators</u>
19.	Java Android Program to <u>Change the Image Displayed on the Screen</u>
20.	Java Android Program to <u>Demonstrate Alert Dialog Box</u>
21.	Java Android Program to <u>Demonstrate the Menu Application</u>
22.	Java Android Program to <u>Demonstrate List View Activity</u> with all operations (Insert, delete, Search).
23.	Java Android Program to <u>Display SMS from the Phone Numbers, which are in Your Contacts</u>
24.	Java Android Program to send email with attachment.
25.	Create an Android application which will ask the user to input his name and a message, display the two items concatenated in a label, and change the format of the label using radio buttons and check boxes for selection, the user can make the label text bold, underlined or italic and change its color .include buttons to display the message in the label, clear the text boxes and label and then exit.
26.	Write a program to search a specific location on Google Map.
27.	Write a program to perform Zoom In, Zoom Out operation and display Satellite view, Terrain view of

	current location on Google Map.
28.	Digital Bio Data PhoneGap Application using HTML5.
29.	Write a PhoneGap application to display push notification.
30.	Write a PhoneGap application to create a contact, Searching for Contacts, Cloning Contacts, Removing Contacts.
31.	Write a IOS application to display "Hello World".
32.	Write aios application to display gesture recognizer.
33.	Write a Swift program to add the last character (given string) at the front and back of a given string. The length of the given string must be 1 or more.
34.	Write a Swift program to create a new string where all the character "a" have been removed except the first and last positions.
35.	Write a Swift program to create a new string made of 2 copies of the first 2 characters of a given string. The string may be any length.
36.	Students design mobile applications for the Android or iOS platforms that uniquely meet clear needs in today's markets. Student design documents include narratives, categorized use cases, screen rows, and database schemata
37.	Handling button events / actions in iOS
38.	Handling image in iOS using UIImageView
39.	Write a iOS application to implement UI elements like ScrollView, TableView, Pickers, Switches
40.	Write a iOS application to Managing camera in iOS
41.	Write a iOS application to Handling audio, video and file in iOS
42.	Write a iOS application to Handling Accelerometer to manage change in position

Advanced OS Assignments

Write a following program in 'C'

1. To create 'n' children. When the children will terminate, display total cumulative time children spent in user and kernel mode.
2. To generate parent process to write unnamed pipe and will read from it.
3. To create a file with hole in it.
4. Takes multiple files as Command Line Arguments and print their inode number.
5. To handle the two-way communication between parent and child using pipe.
6. Print the type of file where file name accepted through Command Line.
7. To demonstrate the use of atexit() function.
8. Open a file goes to sleep for 15 seconds before terminating.
9. To print the size of the file.
10. Read the current directory and display the name of the files, no of files in current directory.
11. Write a C program to implement the following unix/linux command (use fork, pipe and exec system call)


```
ls -l | wc -l
```
12. Write a C program to display all the files from current directory which are created in particular month
13. Write a C program to display all the files from current directory whose size is greater than n Bytes Where n is accept from user.
14. Write a C program to implement the following unix/linux command
 - i. `ls -l > output.txt`
15. Write a C program which display the information of a given file similar to given by the unix / linux command


```
ls -l <file name>
```
16. Write a C program that behaves like a shell (command interpreter). It has its own prompt say "NewShell\$". Any normal shell command is executed from your shell by starting a child process to execute the system program corresponding to the command. It should additionally interpret the following command.
 - i) `count c <filename>` - print number of characters in file
 - ii) `count w <filename>` - print number of words in file
 - iii) `count l <filename>` - print number of lines in file
17. Write a C program that behaves like a shell (command interpreter). It has its own prompt say "NewShell\$". Any normal shell command is executed from your shell by starting a child process to execute the system program corresponding to the command. It should additionally interpret the following command.
 - i) `list f <dirname>` - print name of all files in directory
 - ii) `list n <dirname>` - print number of all entries
 - iii) `list i <dirname>` - print name and inode of all files

18. Write a C program that behaves like a shell (command interpreter). It has its own prompt say "NewShell\$". Any normal shell command is executed from your shell by starting a child process to execute the system program corresponding to the command. It should additionally interpret the following command.
 - i) `typeline +10 <filename>` - print first 10 lines of file
 - ii) `typeline -20 <filename>` - print last 20 lines of file
 - iii) `typeline a <filename>` - print all lines of file

19. Write a C program that behaves like a shell (command interpreter). It has its own prompt say "NewShell\$". Any normal shell command is executed from your shell by starting a child process to execute the system program corresponding to the command. It should
 - i) additionally interpret the following command.
 - ii) `search f <pattern> <filename>` - search first occurrence of pattern in filename
 - iii) `search c <pattern> <filename>` - count no. of occurrences of pattern in filename
 - iv) `search a <pattern> <filename>` - search all occurrences of pattern in filename

20. Write a C program which receives file names as command line arguments and display those filenames in ascending order according to their sizes.
 - i) (e.g \$ `a.out a.txt b.txt c.txt, ...`)

21. Write a C program which create a child process which catch a signal `sighup`, `sigint` and `sigquit`. The Parent process send a `sighup` or `sigint` signal after every 3 seconds, at the end of 30 second parent send `sigquit` signal to child and child terminates my displaying message "My DADDY has Killed me!!!".

22. Write a C program to implement the following unix/linux command (use `fork`, `pipe` and `exec` system call). Your program should block the signal `Ctrl-C` and `Ctrl-\` signal during the execution.
 - i. `ls -l | wc -l`

23. Write a C Program that demonstrates redirection of standard output to a file.

24. Write a program that illustrates how to execute two commands concurrently with a pipe.

25. Write a C program that illustrates suspending and resuming processes using signals.

26. Write a C program that illustrates inters process communication using shared memory.



Savitribai Phule Pune University

(Formerly University of Pune)

Two year M.Sc. Degree Program in Computer Science

(Faculty of Science & Technology)

M.Sc.- II (Computer Science)

Choice Based Credit System Syllabus

To be implemented from Academic Year

2020-2021

Year/ Sem	Course Type	Course Code	Course Name	Credit	% of Assessment			
					IA	UE	Total	
II Year Sem-III	Core Compulsory Theory Paper	CSUT231	Software Architecture and Design Patterns	4	30	70	100	
		CSUT232	Machine Learning	4	30	70	100	
		CSUT233	Web Frameworks	4	30	70	100	
	Choice Based Optional Paper	CSDT234A	Big Data Analytics	2	15	35	50	
		CSDP234A	Big Data Analytics Practical	2	15	35	50	
		OR						
		CSDT234B	Web Analytics	2	15	35	50	
		CSDP234B	Web Analytics Practical	2	15	35	50	
		OR						
		CSDT234C	Project	2	15	35	50	
		CSDP234C	Project related Assignments	2	15	35	50	
Core Compulsory Practical Paper	CSUP235	Practical on CSUT231, CSUT232 and CSUT233	4	30	70	100		

Year/ Sem	Course Type	Course Code	Course Name	Credit	% of Assessment		
					IA	UE	Total
II Year Sem-IV	Core	CSUIT241	Industrial Training /Institutional project	20	150	350	500

IA :- Internal Assessment, UE :- University Examination

CSUT231- Software Architecture and Design Patterns**Total Credits - 4****Pre-requisites**

- Familiarity with UML and OOPs Concepts
- Programming in Java

Course Objectives:

- To introduce students to the basic concepts and techniques of SADP.
- To write java programs using Design Pattern and Frameworks to create reusable and flexible software systems.
- Use of patterns and architectures for solving practical problems.
- To understand about design pattern.
- To understand about the process of deploying web apps using specific Frameworks.

Course Outcomes:

- Recognize the characteristics of patterns that make it useful to solve real-world problems.
- Process available data using python libraries and predict outcomes using Machine Learning algorithms to solve given problem.
- Able to use specific frameworks as per applications need.
- Design java application using design pattern techniques.

Chapter No.	Topics	# Lectures (60 Hrs)
1.	Introduction	2
	1.1 UML The Notation	
	1.2 Process Unified Process / Rational Unified Process inception, elaboration, construction, transition	
	1.3 How various components fit in the life cycle The artifacts at end of each process / discipline	
2.	Software Architecture	4
	2.1 What Software Architecture is and what it isn't.	
	2.2 Why is architecture important?	
	2.3 Architectural structures and views	

3. Architectural Styles	6
3.1 Architectural Styles	
3.2 Pipes and Filters	
3.3 Data Abstraction and Object – Oriented Organization	
3.4 Event-Based, Implicit Invocation	
3.5 Layered Systems	
3.6 Repositories	
3.7 Interpreters	
3.8 Other familiar Architectures	
3.9 Heterogeneous Architectures.	
4. Introduction to Patterns	4
4.1 What is a Pattern & Design Pattern	
4.2 What makes a Pattern (GOF)	
4.3 Describing Design Patterns.	
4.4 Pattern Categories & Relationships between Patterns.	
4.5 Organizing the Catalogue.	
4.6 Patterns and Software Architecture.	
5. Study of Design Patterns	12
5.1 Creational Patterns-singleton, factory method, abstract factory	
5.2 Structural Patterns-adapter, decorator, facade	
5.3 Behavioural Patterns-iterator, observer, strategy, command and state (study of intent, applicability, participants, structure, collaboration , Java Example code , Implementation and consequences)	
6. GRASP(General Responsibility Assignment Software Patterns)	10
6.1 Expert, Creator, High Cohesion, Low Coupling	
6.2 Controller, Polymorphism, Pure Fabrication, Indirection	
6.3 Don't Talk to Strangers	
7. Study of Frameworks	14
7.1 Frameworks as reusable chunks of architecture	
7.2 The framework lifecycle, development using frameworks	
7.3 Spring Core Framework	
7.4 Spring Boot Framework	
7.5 Microservices with Spring	
7.6 Web Architectures: Google Web Tool Kit, Spring , Hibernate etc.	
7.7 Selection of proper framework	
7.8 Comparing Frameworks	
7.9 Advantages of Spring	
7.10 Web based Case Study	
8. Case Study (any one of the web Architecture)	8
8.1 Take a Framework and find Patterns in the Frame work.	

8.2 Benefits of Patterns in the chosen Framework

8.3 How Pattern interact in the selected Framework.

References:

1. Design Patterns – Elements of Reusable Object-oriented Software By E. Gamma, Richard Helm, Ralph Johnson , John Vlissides (GoF)
 2. Pattern – Oriented Software Architecture (POSA) Volume 1. By : Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal.
 3. Software Architecture in Practice. By Len Bass, Paul Clements, Rick Kazman
 4. Applying UML and Patterns By Craig Larman.
 5. Software Architecture- Perspectives on an emerging discipline by Mary shaw and David Garlan
 6. Head First Design Pattern by Kathy Sierra, Bert Bates, Elisabeth Robson, Eric Freeman Publisher: O'Reilly Media, Inc.
 7. Building Microservices-Designing Fine-Grained Systems By Sam Newman Publisher: O'Reilly Media
 8. Design patterns in Java by Douglas Schmidt Publisher O'Reilly
 9. Professional Java Development with the Spring Framework **1st Edition** by Rod Johnson, Alef Arendsen, Thomas Risberg, Colin Sampaleanu ; WROX publication
 10. Mastering Spring 5: An effective guide to build enterprise applications using Java Spring and Spring Boot framework, 2nd Edition by Ranga Rao Karanam ; PACKT publishing
-

CSUT232 Machine Learning**Total Credits - 4****Pre-requisites:**

- Familiarity with Probability Theory, Multivariable Calculus, Linear Algebra
- Programming in Python (NumPy, SciPy, Pandas, Matplotlib, Seaborn, SciKit-Learn, StatsModel)

Course Objectives:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To write python programs using machine learning algorithms for solving practical problems.
- To understand about Machine Learning Library and use cases.
- To understand about the process of deploying ML model.

Course Outcomes:

- Recognize the characteristics of machine learning that make it useful to real-world problems.
- Process available data using python libraries and predict outcomes using Machine Learning algorithms to solve given problem.
- Able to estimate Machine Learning models efficiency using suitable metrics.
- Design application using machine learning techniques.

Chapter No.	Topics	# Lectures (60 Hrs)
1.	Introduction to Machine Learning	7
1.1	Data Science, Artificial Intelligence and Machine Learning Why Learn and What is Learning, What is Machine Learning Traditional Programming Vs. Machine Learning, Machine Learning Process, Types of Data, Key Elements of Machine Learning (Representation, Evaluation and Optimization), Dimensionality Reduction (Feature Reduction)	
1.2	Descriptive and Inferential Statistics: Probability, Distribution, Distance Measures (Euclidean and Manhattan), Correlation and Regression, Hypothesis Testing.	
1.3		

	Creating our own dataset, Importing the dataset, Handling	
1.4	Missing Data, Splitting the dataset into the Training set and Test set, Feature Scaling	
2.	Machine Learning Models	6
2.1	Type of Learning- Supervised, Unsupervised and Semi-Supervised Learning	
2.2	Components of Generalization Error (Bias, Variance, underfitting, overfitting)	
2.3	A Learning System Cycle and Design Cycle	
2.4	Metrics for evaluation viz. accuracy, scalability, squared error, precision and recall, likelihood, posterior probability	
2.5	Classification Accuracy and Performance	
3.	Regression Models	10
3.1	Linear Regression - Simple , Multiple, Polynomial	
3.2	Non-linear Regression – Decision Tree, Support Vector, Random Forest	
4.	Classification Models	10
4.1	K – Nearest Neighbours (KNN)	
4.2	Logistic Regression	
4.3	Naive Bayes Theorem	
4.4	Support Vector Machine	
4.5	Decision Forest Classification	
4.6	Random Tree Classification	
5.	Clustering Models	7
5.1	K-means	
5.2	Hierarchical Clustering (Agglomerative, Divisive), Dendrogram	
5.3	Selecting optimal number of clusters: Within Clusters Sum of Squares (WCSS) by Elbow Method	
6.	Association Rules	5
6.1	Key Terms: Support, Confidence and Lift	
6.2	Apriori Algorithm	
7.	Reinforcement Learning	7
7.1	Upper Confidence Bound	
7.2	Thompson Sampling	
7.3	Q-Learning	

8. Deep Learning**8**

- 8.1** Artificial Neural Network
 - 8.2** Convolution Neural Network
 - 8.3** Recurring Neural Network
-

References:

1. Mitchell, Tom M. "Machine learning. WCB." (1997).
 2. Rogers, Simon, and Mark Girolami. *A first course in machine learning*. CRC Press, 2015.
 3. Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. *The elements of statistical learning*. Vol.1. Springer, Berlin: Springer series in statistics, 2001.
 4. Witten, Ian H., and Eibe Frank. *Data Mining: Practical machine learning tools and techniques*. Morgan Kaufmann, 2005.
 5. Machine learning course material by Andrew Ng, Stanford university
 6. Sutton, Richard S., and Andrew G. Barto. *Reinforcement learning: An introduction*. Vol. 1. No. 1. Cambridge: MIT press, 1998.
 7. Iba, Takashi, et al. "Learning patterns: A pattern language for active learners." *Conference on Pattern Languages of Programs (PLoP)*. 2009.
-

Pre-requisites

- Basic knowledge of Java Script.
- Basics of web application development.
- Knowledge of what is Client and Server side programming.

Course Objectives:

- To introduce students for modern web technologies.
- To learn and use server side programming using Node.js
- To understand asynchronous programming.
- To learn and understand web application in Django a Python Web Framework.

Course Outcomes:

- Students will be ready with the technology which is used widely in Industry as a part of full stack developer.
- Students will know the powerful way to develop the web application in Python.
- Students will understand what really the asynchronous programming.
- Build and deploy robust Django Web App.
- Integrate with Restful web services.

Chapter No.	Topics	# Lectures (60 Hrs)
1.	Java Script Basics	4
	1.1 Java Script data types	
	1.2 Variables, Functions, Events, Regular Expressions	
	1.3 Array and Objects in Java Script	
	1.4 Java Script HTML DOM	
	1.5 Promises and Callbacks	
2.	Introduction to Node JS	3
	2.1 Introduction	
	2.2 What is Node JS and its advantages	
	2.3 Traditional Web Server Model	
	2.4 Node JS Process model	
	2.5 Installation of Node JS	

2.6	Node JS event loop	
3.	Node JS Modules	5
3.1	Functions	
3.2	Buffer	
3.3	Module and Module Types	
3.4	Core Module, Local Module	
3.5	Directories as module	
3.5	Module.exports	
4.	Node Package Manager	4
4.1	What is NPM?	
4.2	Installing package locally	
4.3	Adding dependencies in package.json	
4.4	Installing packages globally	
4.5	Updating packages	
4.6	Managing Dependencies	
5.	Web Server	3
5.1	Creating Web Server	
5.2	Handling HTTP requests	
5.3	Sending Requests	
5.4	HTTP Streaming	
6.	File System	4
6.1	FS Model	
6.2	Files and Directories	
6.6	Streams	
6.4	Reading and Writing Files	
6.5	Reading and Writing Directories	
6.6	Other File Operations	
7.	Events	6
7.1	Asynchronous JS	
7.2	Asynchronous control flow with callbacks	
7.3	Promises	
7.4	EventEmitter Class	
7.5	ASync/Await	
7.6	Returning Event Emitter	
7.7	Inheriting Events	
8.	Working with Databases	6
8.1	Connection String	
8.2	Configuring	
8.3	Working with Select command	

8.4	Various database operations	
8.5	MongoDB	
8.6	Mongoose ODM	
8.7	Mongoose Schema	
8.8	Mongoose Model	
8.9	Querying with Mongoose	
9.	Express JS	7
9.1	REST	
9.2	Introduction to Express JS	
9.3	Routing, Responding	
9.4	Configuration	
9.5	Views	
9.6	Receiving Data	
9.7	Error Handling	
10.	Introduction to Django	4
10.1	What is Django	
10.2	Django and Python	
10.3	Django MVT	
10.4	How to get and install Django	
11.	Getting Started with Django	5
11.1	About 3 core files : model.py, urls.py, views.py	
11.2	Setting up database connections (MySQL/SQLServer)	
11.3	Managing Users & Django admin tools	
11.4	Installing and using 'Out of the Box' Django features	
12.	Django URL Patterns and Views	4
12.1	Designing a good URL Schema	
12.2	Generic Views	
13.	Django Forms	5
13.1	Form Classes	
13.2	Validations	
13.3	Authentication	
13.4	Advanced Form Processing Techniques	
14.1	Django REST Framework	
14.2	Django Piston	

References:

1. Node.js complete reference guid , velentin Bojinov, David Herron, Dioge Resende, packt Publishing Ltd
 2. Mastering Nod.js By Sandro Pasquali , packt Publishing
 3. Smashing Node.js, Java Script Everywhere , Guillermo Rauch, John wiley & Sons
 4. Django for Beginners : Build websites with Python and Django Kindle Edition by William S Vincent
 5. Two Scoops of Django 1.11 : Best Practices for the Django web Framework Book by Danial Roy Greenfeld and Audrey Roy Greenfeld
 6. Web Development with Django CookBook by Aidas Bendoraitis Second Edition PACKT Publishing
-

CSDT234A**Big Data Analytics****Total Credits – 2****Pre-requisites:**

- Basic knowledge of Linux working and its commands.
- One must be able to install and uninstall its packages.
- Programming Languages - Programming Languages like Python, Scala, Java is required because it helps to understand Hadoop programming.

Course Objectives:

1. To understand the Big Data challenges & opportunities, its applications
2. Understanding of concepts of map and reduce and functional programming
3. Gain conceptual understanding of Hadoop Distributed File System.
4. To solve the case studies related to real life situations
5. To bridge the gap between academics and industry needs.

Course Outcomes:

- Recognize the characteristics, applications of big data that make it useful to real-world problems.
- Process available data using big data tools hadoop file system and predict outcomes to solve given problem.
- Study & Design various case studies using big data tools/commands and analyse it.

Chapter No.	Topics	# Lectures (30 Hrs)
1.	Introduction to Big data	
1.1	Big Data :Definition & taxonomy	5
1.2	Sources of Big Data	
1.3	3V's of Big Data (need for Hadoop)	
1.4	Varying data structures	
1.5	Characteristics of Big Data	
1.6	Applications of Big Data	
1.7	Challenges in Big Data	
1.8	Big Data Implications for Industries Big Data Analytics for Telecom/Banking/Retail/HealthCare/IT/Operations	

2. Emerging Database Landscape	3
2.1 Scale-Out Architecture, RDBMS Vs Non-Relational Database	
2.2 Database Workload & its Characteristics	
2.3 Implication of Big Data Scale on Data Processing	
3. Application Architecture & Data Modeling For Big Data And Analytics	5
3.1 Big Data Warehouse & Analytics	
3.2 Big data Warehouse System requirements & Hybrid Architectures	
3.3 Enterprise Data Platform Ecosystem	
3.4 Big Data and Master Data Management	
3.5 Understanding data integration Pattern	
3.6 Big Data Workload Design Approaches	
3.7 Map-Reduce patterns ,Algorithms and Use Cases	
4. The Hadoop Ecosystem	8
4.1 Introduction to Hadoop	
4.2 Hadoop Architecture	
4.3 History of Hadoop-Facebook,Dynamo,Yahoo,Google	
4.4 Hadoop Components :HDFS, Mapreduce	
4.5 Introduction to Pig,Hive ,HBase ,Mahout	
4.6 Installation of single node cluster-installation of java Hadoop configuration	
5. Extracting Value From Big Data	4
5.1 Real Time Analytics	
5.2 In-Memory Data Grid for real Time Analysis	
5.3 Map reduce & Real Time Processing ,Use Cases	
6. Big Data Analytics Methodology	5
6.1 Big Data Analytics Methodology-Analyze & evaluate business cases	
6.2 Develop Business Hypothesis –Analyze outcomes, Build & Prepare Data Sets ,Select & Build Analytical Model ,Design for Big Data scale .Build production ready system ,setting up the Big Data Analytics system ,Gathering data ,measure & monitor	

References:

1. Madhu Jagdeesh,Soumendra Mohanty,Harsha Srivatsa,"Big Data Imperatives: Enterprise Big Data Warehouse,BI Implementations and Analytics",1st Edition, Apress(2013)
 2. Frank J.Ohlorst,"Big Data Analytics:Turning Big Data into Big Money",Wiley Publishers(2012)
 3. Cristian Molaro,Surekha Parekh,Terry Purcell,"DB2 11:The Database for Big Data & Analytics",MC Press,(2013)
 4. Tom White,"Hadoop-The Definitive Guide,Storage and analysis at internet scale",SPD, O'Really.
 5. DT Editorial Services,"Big Data, Black Book-Covers Hadoop2, MapReduce,Hive,YARN, Pig, R and Data Visualization" Dreamtech Press,(2015).
 6. Big Data Case Study by Bernard Marr –Wiley Publications.
-

CSDP234A Big Data Analytics Practical Total Credits – 2 (30Hrs)**NOTE:**

It is expected to form teams and ask students to solve these case studies, discuss and work on solutions. (Refer Book No 6 for solving case studies. In-detail explanation for case studies below is given in the said book)

1. Assignment 1: Case study on Facebook
2. Assignment 2: Case Study on IoT Sensors
3. Assignment 3: Case Study on Telecom Industry
4. Assignment 4: Case Study on Banking
5. Assignment 5: Case study on Amazon
6. Assignment 6: Case Study on General Electric –By TCS
7. Assignment 7 : Case Study on Uber
8. Assignment 8: Case Study on Netflix
9. Assignment 9: CDC(Corona Virus and other Pandemics)

Practical's

Note: Slips should be designed on the basis of following topics at college level. The practical's should be taken on the basis of above case studies.

1. Navigating in Hadoop environment [Operational commands in Hadoop environment like moving, copying files. creating directories etc.
 2. Understand HDFS
 3. Using unix tools
 4. Development in Hadoop environment , using various Hadoop tools/utilities
 5. Develop mapReduce programs [Assignments] - Develop mapReduce functions either in Java or Python
-

CSDT234B- Web Analytics**Total Credits: 2****Objectives:**

1. Understand social media, web and social media analytics, and their potential impact.
2. Determine how to Leverage social media for better services and Understand usability metrics, web and social media metrics.
3. Use various data sources and collect data relating to the metrics and key performance indicators.
4. Identify key performance indicators for a given goal, identify data relating to the metrics and key performance indicators.

Chapter No.	Topics	# Lectures (30 Hrs)
1	Introduction 1.1 What is web Analytics 1.2 Importance of web Analytics 1.3 Web Analytics process 1.4 Types of web analytics 1.5 Web analytics technical requirements 1.6 Web analytics 2.0 framework	2
2	Qualitative Analysis 2.1 Heuristic evaluations: 2.1.1 Conducting a heuristic evaluation 2.1.2. Benefits of heuristic evaluations 2.2 Site Visits: 2.2.1. Conducting a site visit, 2.2.2. Benefits of site visits 2.3 Surveys: 2.3.1. Website surveys 2.3.2. Post-visit surveys 2.3.3. creating and running a survey 2.3.4. Benefits of surveys.	4
3	Web Metrics 3.1 Key metrics 3.2 3.2. Dashboard 3.2.1. Implementation 3.2.2. metrics 3.2.3. Types of metrics 3.3 Conversion	10

	3.3.1. goals,	
	3.3.2. funnels	
3.4	Data sources	
	3.4.1. server log	
	3.4.2. visitors data	
	3.4.3. search engine statistics and conversion funnels	
3.5	Data segmentation	
3.6	Analysis	
3.7	Emerging analytics	
	3.7.1. e commerce	
	3.7.2. mobile analytics	
	3.7.3. A/B testing	
3.8	Social Media Analytics	
	3.8.1. Sentimental Analysis	
	3.8.2. Text Analysis	
3.9	Annotation and Reporting	
	3.9.1. Automated	
	3.9.2. Actionable	
4	Web Analytics 2.0	7
4.1	4.1 Introduction to analytic 2.0	
4.2	Competitive intelligence analysis	
4.3	CI data sources:	
	4.3.1. Toolbar data	
	4.3.2. Panel data	
	4.3.3. ISP data	
	4.3.4. Search engine data	
	4.3.5. Hybrid data	
4.4	Website traffic analysis:	
	4.4.1. Comparing long term traffic trends	
	4.4.2 Analyzing competitive site overlap and opportunities.	
5	Google Analytics:	7
5.1	Audience analysis	
5.2	Acquisition analysis	
5.3	Behaviour analysis	
5.4	Conversion analysis	
5.5	Google website optimizer	
5.6	Implementation technology	
5.7	Privacy issues	

References:

1. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc. 2nd ed.
 2. Kaushik A., Web Analytics 2.0, The Art of Online Accountability and Science of Customer Centricity, Wiley Publishing, Inc. 1st ed.
 3. Kaushik A., Web Analytics: An Hour a Day, 1st ed.
 4. Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley and Sons
-

CSDP234B**Web Analytics Practical****Total Credits – 2 (30 Hrs)****1 Mining Twitter: Exploring Trending Topics, Discovering What People Are Talking About, and More**

Why Is Twitter All the Rage?, Exploring Twitter's API, Fundamental Twitter Terminology, Creating a Twitter API Connection, Exploring Trending Topics, Searching for Tweets, Analysing the 140 Character, Extracting Tweet Entities, Analysing Tweets and Tweet Entities with Frequency Analysis, Computing the Lexical Diversity of Tweets, Examining Patterns in Retweets, Visualizing Frequency Data with Histograms

2 Mining Facebook: Analysing Fan Pages, Examining Friendships, and More

Overview, Exploring Facebook's Social Graph API, Understanding the Social Graph API, Understanding the Open Graph Protocol, Analysing Social Graph Connections, Analysing Facebook Pages, Examining Friendships

3 Mobile Analytic: Analyse the your site on mobile device

In last 30 days, how many new users come from mobile, What was the bounce rate of visitors on mobile device, What was the average session duration?

4 Segment traffic:

Which social channel is sending the most engaged new users, Which page of your Website have been shared most, Which URL has the best engagement matrix.

5 Use Google Analytics to measure the various metrics for E-commerce site amazon.

On-site – It measures the users' behaviour once it is on the website. For example, measurement of your website performance.

Off-site – It is the measurement and analysis irrespective of whether you own or maintain a website. For example, measurement of visibility, comments, potential audience, etc.

**6 Use Google Analytics to measure the various metrics for E-commerce site flipkart
Count**

It is most basic metric of measurement. It is represented as a whole number or a fraction. For example,

Number of visitors = 12999, Number of likes = 3060, etc.

Total sales of merchandise = \$54,396.18.

Ratio

It is typically a count divided by some other count. For example, Page views per visit.

Key Performance Indicator (KPI)

It depends upon the business type and strategy. KPI varies from one business to another.

7 Visitors loyalty:

Analyse the person who visit site again and again is loyal to company because they can become customer

8 Consider the any E-Commerce site and to measure the web analytics.**Content**

It gives you insight about website's content section. You can see how each page is doing, website loading speed, etc.

Page Load Time

More is the load time, the more is bounce rate. Tracking page load time is equally important.

Engagement Rate

It shows how long a person stays on your web page. What all pages he surf. To make your web pages more engaging, include informative content, visuals, fonts and bullets.

9 Text Analytics: Interpreting Twitter Data From college students Tweets. Extracting Tweet Entities, Analysing Tweets and Tweet Entities with Frequency Analysis, Computing the Lexical Diversity of Tweets, Examining Patterns in Retweets, Visualizing Frequency Data with Histograms**10** Consider the any E-Commerce site and to measure the web analytics.**Bounce Rate**

If a person leaves your website within a span of 30 sec, it is considered as a bounce.

The rate at which users spin back is called the bounce rate.

To minimize bounce rate include related posts, clear call-to-action and backlinks in your webpages.

Behavior

Behavior lets you know page views and time spent on website. You can find out how customer behaves once he is on your website.

CSDT234C: Project**Total Credits: 2 (30 Hrs)**

Teaching Scheme

- **Project: 2 hours/week**
- **Batch Size: 5 students**

Workload :

1. One project guide to be assigned to 5 students.
2. 2 hours /week to be allotted for 5 students

Guidelines:

- Students should work in a team of minimum 2 and maximum 3 students.
- Students can choose a project topic without any restriction on technology or domain.
- The student group will work independently throughout the project work including: problem identification, information searching, literature study, design and analysis, implementation, testing, and the final reporting.
- Project guide must conduct project presentations (minimum 2) to monitor the progress of the project groups.
- At the end of the project, the group should prepare a report which should conform to international academic standards. The report should follow the style in academic journals and books, with clear elements such as: abstract, background, aim, design and implementation, testing, conclusion and full references, Tables and figures should be numbered and referenced to in the report.
- The final project presentation with demonstration (UE) will be evaluated by the project guide (appointed by the college) and one external examiner (appointed by the University).

Evaluation guidelines:

IA (15 marks)			UE (35 marks)		
First presentation	Second presentation	Documentation	Project Logic/Presentation	Documentation	Viva
5	5	5	20	5	10

Recommended Documentation contents:**Abstract****Introduction**

- motivation
- problem statement
- purpose/objective and goals
- literature survey
- project scope and limitations

System analysis

- Existing systems
- scope and limitations of existing systems
- project perspective, features
- stakeholders
- Requirement analysis - Functional requirements, performance requirements, security requirements etc.

System Design

- Design constraints
- System Model: UML diagrams
- Data Model
- User interfaces

Implementation details

- Software/hardware specifications

Outputs and Reports

Testing

Test Plan, Black Box Testing or Data Validation Test Cases, White Box Testing or Functional Validation Test cases and results

Conclusion and Recommendations

Future Scope

Bibliography and References

CSDP234C: Project Related Assignments**Total Credits: 2 (30 Hrs)**

Teaching Scheme

- **2 lectures/week**

Workload :

- 2 lectures/week

Guidelines:

- The project assignments are a compulsory part of the project course and should be carried out by each project group.
- Project assignments are to be given by the guide for continuous internal evaluation.
- The project assignments are to be allotted to each group separately by the project guide on the basis of the implementation technology. A suggested list of assignments is given below.
 1. Project Time management: plan (schedule table), Gantt chart, Roles and responsibilities, data collection, Implementation
 2. Simple assignments to evaluate choice of technology
 3. Assignments on UI elements in chosen technology
 4. Assignments on User interfaces in the project
 5. Assignments on event handling in chosen technology
 6. Assignments on Data handling in chosen technology
 7. Online and offline connectivity
 8. Report generation
 9. Deployment considerations
 10. Test cases
- Each student within the group must work actively and contribute to the assignments, project work and report writing.

Evaluation guidelines:

IA (15 marks)		UE (35 marks)	
Attendance	Assignments	Assignments	Viva
5	10	25	10

**CSUP235 Practical on CSUT231, CSUT232 and CSUT233 Total Credits – 4
(60 Hrs)**

Pre-requisites

- Programming in Java
- Programming in Python
- Programming in Nodejs

Course Objectives:

- To write java programs using Design Pattern and Frameworks to create reusable and flexible software systems.
- To understand about the process of deploying web apps using specific Frameworks.
- To write python programs using machine learning algorithms for solving practical problems.
- To understand about the process of deploying ML model.

Course Outcomes:

- Able to use specific frameworks as per applications need.
- Design java application using design pattern techniques.
- Process available data using python libraries and predict outcomes using Machine Learning algorithms to solve given problem.
- Able to estimate Machine Learning models efficiency using suitable metrics.

Software Architecture & Design Pattern List of Assignments
**# Practical's
(20 Hrs)**

1. Write a JAVA Program to implement built-in support (java.util.Observable) Weather station with members temperature, humidity, pressure and methods mesurmentsChanged(), setMesurment(), getTemperature(), getHumidity(), getPressure() Book 6: (Page No.-67)
 2. Write a Java Program to implement I/O Decorator for converting uppercase letters to lower case letters. Book 6: (Page No.-102)
 3. Write a Java Program to implement Factory method for Pizza Store with createPizza(), orderPizza(), prepare(), Bake(), cut(), box(). Use this to create variety of pizza's like NyStyleCheesePizza, ChicagoStyleCheesePizza etc. Book 6:(Page No.-125-130)
 4. Write a Java Program to implement Singleton pattern for multithreading. Book 6:(Page No.-180)
 5. Write a Java Program to implement command pattern to test Remote Control. Book 6: (Page No.-210)
 6. Write a Java Program to implement undo command to test Ceiling fan. Book 6:(Page No.-222)
-

7. Write a Java Program to implement Adapter pattern for Enumeration iterator.
Book 6: (Page No.-250)
8. Write a Java Program to implement Iterator Pattern for Designing Menu like Breakfast, Lunch or Dinner Menu.
Book 6 (page no 326)
9. Write a Java Program to implement State Pattern for Gumball Machine. Create instance variable that holds current state from there, we just need to handle all actions, behaviors and state transition that can happen. For actions we need to implement methods to insert a quarter, remove a quarter, turning the crank and display gumball.
Book 6: (page no 390/391)
10. Write a java program to implement Adapter pattern to design Heart Model to Beat Model.
Book 6: (page no 546/547)
11. Design simple HR Application using Spring Framework Book 9

Machine Learning Practical's
**# Practicals
(20 Hrs)**

1. Write a python program to Prepare Scatter Plot (Use Forge Dataset / Iris Dataset)
2. Write a python program to find all null values in a given data set and remove them.
3. Write a python program the Categorical values in numeric format for a given dataset.
4. Write a python program to implement simple Linear Regression for predicting house price.
5. Write a python program to implement multiple Linear Regression for a given dataset.
6. Write a python program to implement Polynomial Regression for given dataset.
7. Write a python program to Implement Naïve Bayes.
8. Write a python program to Implement Decision Tree whether or not to play tennis.
9. Write a python program to implement linear SVM.
10. Write a python program to find Decision boundary by using a neural network with 10 hidden units on two moons dataset
11. Write a python program to transform data with Principal Component Analysis (PCA)
12. Write a python program to implement k-nearest Neighbors ML algorithm to build prediction model (Use Forge Dataset)
13. Write a python program to implement k-means algorithm on a synthetic dataset.
14. Write a python program to implement *Agglomerative clustering* on a synthetic dataset.

Data Sets for ML

- [UCI Machine Learning Repository](#)
- www.kaggle.com

Web Frameworks Practical's**# Practical's
(20 Hrs)****Note : Install node js and visual studio editor on your machine**

1. Create an HTML form that contain the Student Registration details and write a JavaScript to validate Student first and last name as it should not contain other than alphabets and age should be between 18 to 50.
2. Create an HTML form that contain the Employee Registration details and write a JavaScript to validate DOB, Joining Date, and Salary.
3. Create an HTML form for Login and write a JavaScript to validate email ID using Regular Expression.
4. Create a Node.js file that will convert the output "Hello World!" into upper-case letters:
5. Using nodejs create a web page to read two file names from user and append contents of first file into second file
6. Create a Node.js file that opens the requested file and returns the content to the client. If anything goes wrong, throw a 404 error
7. Create a Node.js file that writes an HTML form, with an upload field
8. Create a Node.js file that demonstrate create database and table in MySQL
9. Create a node.js file that Select all records from the "customers" table, and display the result object on console
10. Create a node.js file that Insert Multiple Records in "student" table, and display the result object on console
11. Create a node.js file that Select all records from the "customers" table, and delete the specified record.
12. Create a Simple Web Server using node js
13. Using node js create a User Login System
14. Using node js create a eLearning System
15. Using node js create a Recipe Book
16. write node js script to interact with the filesystem, and serve a web page from a file
17. Write node js script to build Your Own Node.js Module. Use require ('http') module is a built-in Node module that invokes the functionality of the HTTP library to create a local server. Also use the export statement to make functions in your module available externally. Create a new text file to contain the functions in your module called, "modules.js" and add this function to return today's date and time.
18. Create a js file named main.js for event-driven application. There should be a main loop that listens for events, and then triggers a callback function when one of those events is detected.

19. Write node js application that transfer a file as an attachment on web and enables browser to prompt the user to download file using express js.
20. Create your Django app in which after running the server, you should see on the browser, the text "*Hello! I am learning Django*", which you defined in the index view.
21. Design a Django application that adds web pages with views and templates.
22. Write and run Django code to add data to your site using relational databases with Django's Object Relational Mapper.
23. Develop a basic poll application (app).
 - i. It should consist of two parts:
24. A public site in which user can pick their favourite programming language and vote.
25. An admin site that lets you add, change and delete programming languages.

26. Implement a simple Django application for portfolio management.
27. Create your own blog using Django
28. Build your own To-Do app in Django
29. Create a clone of the "*Hacker News*" website.
30. Develop Online School System using Django
31. Implement your E-commerce Website using Django
32. Implement Login System using Django

M.Sc. Sem IV

CSUIT241 : Industrial Training /Institutional project Total Credits : 20

Teaching Scheme:
2 hours/week

The Industrial Training /Institutional project is equivalent to 5 theory courses of 4 credits each. Marks per 4 credits = 100. The total weightage for Industrial/Institutional training is 500 marks.

Workload :

1. One mentor to be assigned for 2 students.
2. 2 hours /week to be allotted for 2 students

Guidelines:

- Each student must individually complete **minimum 5 months** full time Industrial training / Institutional project in the 4th semester.
- College should assign a student mentor to every student. The mentor will monitor the progress of the student throughout the semester for continuous assessment.
- Student should submit a valid offer letter and synopsis within two weeks of starting the internship.
- There will be continuous assessment of the work done by the student during the internship period.
- Continuous assessment guidelines:
 1. Student should submit a weekly report in the college to the mentor.
 2. The report should contain the following details: Name of student, project title, company name, company mentor, daily activities and results/output, proposed work for next week.
 3. The weekly report should be duly signed by the student and company mentor/ institute guide (CM).
 4. Student Mentor should maintain weekly attendance record for every student.
 5. Two presentations should be conducted for each student (first presentation after first month and second presentation after 3rd month)
 6. Student Mentor should take feedback from the Company mentor regarding overall performance of the student.
- At the end of the internship period, each student should prepare a report which should conform to international academic standards.

- The report should follow the style in academic journals and books, with contents such as: abstract, background, aim, design and implementation, testing, conclusion and full references, Tables and figures should be numbered and referenced to in the report.

Examination and Evaluation guidelines

- The project done during internship period will be evaluated in the following manner:
IA - 150 marks + UE-350 marks.
- The final presentation and documentation will be evaluated by three examiners:
 - Student mentor (appointed by respective college)
 - External examiner (appointed by the University)
 - IT expert (appointed by respective college)

IA (150 marks)				
Weekly Attendance	Weekly Reports	First Presentation	Second Presentation	Documentation
20	40	20	40	30

UE (350 marks)		
Mentor	IT Expert	External Examiner
100	125	125

Recommended Documentation contents:

Title page

Company / Institute certificate

Internship completion certificate

Abstract

Introduction

- motivation
- problem statement
- purpose/objective and goals
- literature survey
- project scope and limitations

System analysis

- Comparative study of Existing systems
- scope and limitations of existing systems
- project perspective, features
- stakeholders
- Requirement analysis - Functional requirements, performance requirements, security requirements etc.

System Design

- Design constraints
- System Model: UML diagrams
- Data Model
- User interfaces

Implementation details

-Software/hardware specifications, etc.

Reports

Testing

Test Plan, Black Box Testing or Data Validation Test Cases, White Box Testing or Functional Validation Test cases and results

Conclusion and Recommendations

Future Scope

Bibliography and References



Savitribai Phule Pune University

(Formerly University of Pune)

Two Year Degree Program in Zoology

(Faculty of Science & Technology)

Revised Syllabi for

M.Sc. (Zoology) Part-I

(for Colleges Affiliated to Savitribai Phule Pune University)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course: M.Sc. (Zoology)

Preamble

Zoology is a major subject of Basic Sciences which deals with all aspects of animal biology. It includes an interesting range of highly diverse topics. The advancements in biological Sciences demands, a zoology student to be a master of many areas in the subject. This Postgraduate degree program has been designed by the Board of Studies in Zoology of SavitribaiPhule Pune University with a tangible understanding of what is needed from zoologists and what zoologists need to pursue as a skilled career. It emulates closely the Benchmark Statement for Biosciences and the guidelines laid down by the University Grants Commission, New Delhi. This Newly designed Curriculum is an appropriate blend of the classical aspects in Zoology which has been the “backbone” knowledge required for all zoologists and the recent and specialized areas. The flexibility in the Curriculum allows the students to choose their areas of interest leading to enhanced employability. Students will be provided sufficient number of hours for their skill development through the Lab Courses and the Project component. The lab courses have differing flavours and priorities to make a good zoologist. This degree offers specialization in areas like Genetics, Animal Physiology and Entomology along with a range of core courses like Biochemistry, Molecular Biology, Comparative Animal Physiology, Developmental Biology, Environmental Biology etc. Various cross cutting issues relating to Environmental biology have been aptly included to develop the students’ sense towards human wellbeing. The field trip/surveys and study tours are included to gives the student an enticing taste of what life is specially outside the walls of the classroom. On successful completion of the programme, the students are expected to understand the key life processes of human and other animal groups, the functioning of molecules, cells, tissues, organs and systems. Also the students will gain increased confidence to use initiative and judgement to make decisions in complex and changeable situations and reflect critically and analytically on personal experience and make informed decisions about further study, training and employment opportunities. The Master of Science (M.Sc.) in Zoology is a Postgraduate program under the Faculty of Science and Technology of SavitribaiPhule Pune University Pune. The curriculum designed

encompasses subjects like Physiology, Entomology, Genetics, Cell Biology, Developmental Biology, Endocrinology, Biochemistry, Molecular Biology, Freshwater Zoology, Environmental Biology etc. Both classical and applied subjects of Zoology have been rightly blended to offer holistic understanding of the subject.

The Choice Based Credit System (CBCS) will be implemented through this curriculum. This curriculum would certainly felicitate students to develop a strong base of the fundamentals and specialize in the desired area of their fondness and abilities. The students pursuing this program would get a privilege to select optional subjects of their choice. A total of 210 hours for theory lectures and 180 hours for laboratory work have been prescribed in each semester including a research project to inculcate the research culture amongst students. This newly designed curriculum will allow students to acquire the skill in handling scientific instruments planning and performing in the laboratory and exercising critical judgement, independent thinking and problem solving skills.

M.Sc. Zoology - Course structure & Distribution of Credits

M.Sc. Zoology, Part –I, Semester-I

Sr. No.	Core Compulsory Theory Paper (CCTP)	Choice Based Optional Paper (CBOP)	Theory/ practical	Credit	Core Compulsory Practical Paper (CCPP)	Credit
1	ZOUT 111 Biochemistry and Biochemical Techniques	-			-	4
2	ZOUT 112 Cell Biology and Developmental Biology	-			-	4
3	ZOUT 113 Genetics and English in Scientific Communication.	-			-	4
4	-	ZODT 114 Theory.	Biostatistics/ Freshwater Zoology	2	-	4
		ZODP 114 Practical	Zoology Practical Paper-1	2		
5	-	-			ZOUP 115 Basic Zoology Lab-I	4
Total Credit of Semester 1						20

M.Sc. Zoology, Part-I, Semester-II

Sr. No.	Core Compulsory Theory Paper (CCTP)	Choice Based Optional Paper (CBOP)	Theory/practical	Credit	Core Compulsory Practical Paper (CCPP)	Credit
1	ZOUT 121 Molecular Biology and Bioinformatics	-			-	4
2	ZOUT 122 Endocrinology and Parasitology	-			-	4
3	ZOUT 123 Comparative Animal Physiology and Environmental Biology.	-			-	4
4	-	ZODT 124 Theory. ----- ZODP 124 Practical	Metabolic pathways / Ichthyology Zoology Practical Paper-2	2 2	-	4
5	-	-			ZOUP 125 Basic Zoology Lab-II	4
Total Credit of Semester 2						20

M.Sc. Zoology, Part-II, Semester - III

Sr. No.	Core Compulsory Theory Paper (CCTP)	Choice Based Optional Paper (CBOP)	Theory/ practical	Credit	Core Compulsory Practical Paper (CCPP)	Credit
1	ZOUT 231 Special Paper (any one) Animal Physiology-I/ Entomology-I/ Genetics-I	-			-	4
2	ZOUT 232 Fundamentals of Systematics and Economic Zoology	-			-	4
3	ZOUT 233 Research Methodology and Insect Physiology and Biochemistry	-			-	4
4	-	ZODT 234 Theory ----- ZODP 234 Practical	Immunology/ Genetic Toxicology/ Zoology Practical Paper-3	2 2	-	4
5	-	-			ZOUP 235 Special Lab I	4

M.Sc. Zoology, Part II, Semester – IV

Sr. No.	Core Compulsory Theory Paper (CCTP)	Choice Based Optional Paper (CBOP)	Theory/practical	Credit	Core Compulsory Practical Paper (CCPP)	Credit
1	ZOUT 241 Special Paper-Any One- Animal Physiology-II/ Entomology-II/ Genetics-II	-			-	4
2	ZOUT 242 Mammalian Reproductive Physiology and Aquaculture				-	4
3	-	ZODT 243 Theory. ----- ZODP 243 Practical	Histology and Histochemistry/ Pest Control Zoology Practical Paper-4	2 2	-	4
4	-	ZODT 244 Theory. ----- ZODP 244 Practical	Pollution Biology. / Apiculture Zoology Practical Paper-5	2 2	-	4
5	-	-			ZOUP 245 (Project)	4
Total Credit of Semester 4						20

Equivalence of Previous Syllabus:

Old Course (2013 Pattern)	New Course (2019 Pattern)
ZY101T: Biochemistry-I	ZOUT 111 Biochemistry and Biochemical Techniques
ZY102T: Cell Biology	ZOUT 112 Cell Biology and Developmental Biology
ZY103T: Genetics	ZOUT 113- Genetics and English in Scientific Communication.
ZY104T: Biostatistics	ZODT 114 Biostatistics
ZY105T: Skills in scientific communication and Writing	ZOUT 113 Genetics and English in Scientific Communication.
ZY106T: Freshwater Zoology	ZODT 114 Freshwater Zoology
ZY101P: Practicals in Biochemistry	ZOUP 115 Basic Zoology Lab-I
ZY102P: Practicals in Cell Biology	
ZY103P: Practicals in Genetics	
ZY105P: Practicals in Skills in scientific communication and writing	
ZY106P: Practicals in Fresh water zoology	
ZY104P: Practicals in Biostatistics	ZODP 114 Zoology Practical-1

Semester-II

Old Course (2013 Pattern)	New Course (2019 Pattern)
ZY201T: Biochemistry-II	ZODT 124 Metabolic pathways
ZY202T: Molecular Biology	ZOUT 121 Molecular Biology and Bioinformatics
ZY203T: Developmental Biology	ZOUT 112 Cell Biology and Developmental Biology
ZY204T: Endocrinology	ZOUT 122 Endocrinology and Parasitology

ZY205T: Comparative Animal Physiology	ZOUT 123 Comparative Animal Physiology & Environmental Biology
ZY206T: Biochemical Techniques/Ichthyology	ZOUT 111 Biochemistry & Biochemical Techniques ZODT 124 Ichthyology
ZY201P: Practicals in Biochemistry-II	ZOUP 125 Basic Zoology Lab-II
ZY202P: Practicals in Molecular Biology	
ZY203P: Practicals in Developmental Biology	
ZY204P: Practicals in Endocrinology	
ZY205P: Practicals in Comparative Animal Physiology	
ZY206P: Practicals in Biochemical Techniques/ Ichthyology	ZODP 124 Zoology Practical-2

Detailed Syllabus with Recommended Books:

Program outcomes (POs): After successfully completing the M.Sc. Zoology program students will be able to:

PO1. Zoology knowledge: Apply the knowledge of Zoology, Life Sciences and allied subjects to the understanding of complex life processes and phenomena.

PO2. Problem analysis: Identify, review research literature, and analyse complex situations of living forms.

PO3. Design/development of solutions: Design processes/strategies that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in real situations.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and ICT tools for understanding of the subject.

PO6. The Postgraduate and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the natural and anthropogenic activities in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. Identify a range of invertebrates and vertebrates and justify their conservation.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the work/research practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex life activities with the scientific community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of Zoology and management principles and apply these to one's own work, as a member and leader in a team.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Following is the syllabus of each course along with the course outcomes:

Course Code and Course Name:

ZOUT 111 Biochemistry and Biochemical Techniques. (4 Credits: 60 Lectures)

Semester I

After successfully completing this course, students will be able to:

CO1: Define basic terms in biochemistry and biochemical techniques.

CO2: Explain the applications of the various biochemical techniques.

CO3: Explain the structure and functions of various biomolecules.

CO4: Explain the importance of tools and techniques in biology.

CO5: Illustrate the importance of pH, buffer and water in living systems.

CO6: Illustrate the principle, working and applications of basic techniques used in biology.

CO7: Draw the structures of various carbohydrates and amino acids.

CO8: Classify enzymes with examples.

Biochemical techniques:

CO1: Explain the importance and applications of techniques in biochemistry.

CO2: Explain the principle and applications of various chromatographic techniques with examples.

CO3: Explain the principle, working, materials used and applications of electrophoresis.

CO4: Describe the concept of light, electromagnetic spectrum and its application in absorption spectroscopy.

CO5: Illustrate the importance of radioactive compounds and radioactivity in biology.

CO6: Demonstrate the principle and working of Warburg's apparatus.

CO7: Demonstrate the principle, working, applications of centrifugation.

CO8: Justify the applications of radioactivity compounds in biology.

CO9: Compare the various separation techniques.

Sr. No.	Name of the topic	Lectures allotted
Biochemistry:		
1.	Basics of chemistry- Structure of atoms, molecules and chemical bonds, Normality, molarity, molality	(02L)
2.	Chemistry of Water : Structure of water and physicochemical properties of water, water as universal solvent, pH and Buffers, Biological Buffer System	(04L)
3.	Carbohydrates: Classification, basic Structures and functions, Biological Significance.	(03L)
4.	Lipids: Classification, structure and function and biological significance.	(03L)
5.	Vitamins: Classification- water-soluble and fat-soluble vitamins, Biological significance.	(02L)
6.	Amino acids: Classification, properties (Physical properties- Optical Isomerization, Absorption in UV light, Ionization; Chemical properties- Reactions with carboxyl group and amino group)	(02L)
7.	Proteins: a. Peptide bond formation, Ramachandran plot. b. Protein structure:-Primary structure, Secondary structure, Tertiary structure and Quaternary structures with examples, Biological significance of proteins.	(05L)
8.	Enzymes: a. Classification, nomenclature and properties b. Enzyme kinetics -one substrate reaction (Michaelis-Menten Equation) c. Factors affecting enzyme activity d. Enzyme inhibition e. Allosteric Enzymes. f. Isozymes (LDH) and coenzymes g. Clinical and industrial significance- Any 3	(09L)
Biochemical Techniques:		
1.	Chromatography: Principle, working and applications of: Adsorption chromatography Partition chromatography, Ion-exchange chromatography, Molecular exclusion chromatography, Affinity chromatography, Gas chromatography, High Performance Liquid Chromatography.	(8L)

2. **Electrophoresis:** Moving boundary electrophoresis, zone electrophoresis, (5L)
different supports used for electrophoresis, electrophoresis of proteins,
electrophoresis of Nucleic acids, isoelectric focussing.
3. **Absorption spectroscopy:** Concepts of light & electromagnetic spectrum, (5L)
Ultraviolet and Visible spectrophotometry, atomic absorption spectrometry and
applications.
4. **Radioactivity:** Properties of radioisotopes, commonly used isotopes, structure & (3L)
working of G.M, counter, isotopic dilution analysis, use of isotopes in biology,
radiation hazards.
6. **Manometry:** Respiratory quotient determination, Principle of Warburg's (2L)
apparatus, working and applications.
7. **Methods for protein sequencing.** (4L)
N-terminal sequencing
C-terminal sequencing.
Methods for DNA sequencing.
Maxam- Gilbert Sequencing
Chain termination method
Dye terminator sequencing
8. **Centrifugation:** Principle, Types of centrifugation- Preparative and (3L)
Analytical.applications of centrifugation.

REFERENCE BOOKS:

- 1.Biochemistry, 3rd Ed. (2005), Voet Donald and Voet Judith G. John,
Publisher: Wiley & sons, New York.
- 2.Biochemistry 6th Ed, (2007) Berg Jeremy, Tymoczko John, StryerLubert,
Publisher: W. H. Freeman, New York.
- 3.Lehninger's Principles of Biochemistry, 4th edition, (2005) Nelson D. L. and
Cox M. M. W. H. Freeman & Co. NY.
- 4.Biochemical Calculations, 2nd Ed., (1997) Segel Irvin H., Publisher: John
Wiley and Sons, New York.
- 5.Enzymes: Biochemistry, Biotechnology & Clinical chemistry, (2001) Palmer
Trevor, Publisher: Horwood Pub. Co., England.
- 6.Biochemistry, Geoffrey Zubay, William C Brown Pub; 4th edition (June 1999)

7.Principles and Techniques of Biochemistry and Molecular Biology, 6th edition (2008), Keith Wilson and John Walker, Publisher–Cambridge University Press.

8.Light Microscopy in Biology: A Practical Approach, 2nd edition (1999), Alan J. Lacey, Publisher–Oxford University Press.

9.Electron Microscopy: Principles and Techniques for Biologists, (1992), Lonnie D. Russell, Publisher-Jones & Bartlett

Course Code and Course Name:

ZOUT 112 Cell Biology and Developmental Biology(4 Credit: 60 Lecture)

Semester I

After successfully completing this course, students will be able to:

Cell Biology:

CO1: Label the various cell parts

CO2: Sketch and label various types of cells and cell organelles.

CO3: Explain carbon as backbone of biomolecules.

CO4: Explain the ultrastructure and functions of various cell organelles.

CO5: Explain the concepts of cell signalling.

CO6: Illustrate the chemistry and organization of cytoskeleton.

CO7: Illustrate the types, development and causes of tumor.

CO8: Diagrammatically represent the cell cycle phases and its regulation.

Developmental Biology:

CO1: Define the terms in developmental biology

CO2: Explain the significance of model organism for developmental studies.

CO3: Explain the types of eggs, concept of fertilization and cleavage pattern.

CO4: Explain the concept of mesoderm induction and pattern formation with examples.

CO5: Describe neural competence and induction.

CO6: Explain the concept of growth and differentiation.

CO7: Illustrate postembryonic development.

CO8: Compare and contrast spermatogenesis and oogenesis.

Sr. No.	Name of the topic	Lectures allotted
1.	Cell theory, general organisation of cell and characteristics of living systems.	(02L)
2.	Overview of chemical nature of the cell and importance of carbon in biologically important molecules.	(02L)
3.	Plasma membrane: Ultrastructure, membrane proteins; membrane transport – channels, carriers and pumps; membrane potential and synaptic transmission.	(04L)
4.	Endomembrane system: (Endoplasmic reticulum, Golgi complex, Lysosomes); protein trafficking – secretory and endocytic pathways.	(04L)
5.	Mitochondria: Structure, genetic system, functions; protein import	(03L)
6.	Nucleus: Ultrastructure – nuclear envelope, nuclear lamina, nuclear pore complex, nucleolus.	(03L)
7.	Cell Cycle: Phases, check points, mechanism of regulation; regulators of cell cycle progression – MPF, cyclins and cyclin dependent kinases (CDKs).	(03L)
8.	Cytoskeleton: Types, chemistry, organisation, associated proteins and their role.	(03L)
9.	Cancer: Types, development, causes; characteristics of cancer cell, tumour viruses, oncogene and tumour suppresser gene.	(03L)
10.	Cell signalling: Signalling molecules and their receptors, cell surface receptors,significance of cell signalling.	(03L)
	Developmental Biology:	
1.	Introduction to developmental biology: Early theories of Developmental biology Concepts of Developmental biology – Growth, cell division, cell differentiation, cell communication, signalling, patterning, induction and competence.	(3L)
2.	Model Organisms: Invertebrate: <i>Drosophila melanogaster</i> , Pisces: Zebra Fish- <i>Danio rerio</i> , Amphibians: <i>Xenopus laevis</i> , Birds: Chicken, Mammals: Mouse.	(3L)
3.	Gametogenesis: Spermatogenesis: spermatogenesis, structure of sperm, regulation of sperm motility, Oogenesis: structure of ovum, previtellogenesis, vitellogenesis and post-vitellogenesis	(2L)
4.	Fertilization: Concept of fertilization, types of fertilization, Species specific sperm attraction, recognition of egg & sperm, acrosome reaction, signal transduction, molecular strategy to avoid polyspermy in fertilization	(4L)

5. **Types of eggs:** Based on amount of distribution of yolk, Cleavage: types and significance. (2L)
6. **Morphogenesis:** Blastulation: Amphioxus, Frog, Chick, Mid Blastula (5L)
Transition,
Comparative study of Gastrulation in Amphioxus, Frog, Chick
Neurulation: Frog, Chick
Organogenesis: Development of the vertebrate eye –formation of eye field, cell differentiation
7. **Pattern formation: Setting up the body axis** (4L)
1. Animal vegetal axis: Amphibians,
2. Dorsal ventral axis: Amphibians
3. Antero-posterior axis: *Drosophila*-role of bicoidnanos hunchback.
8. **Organizers:** (2L)
Spemann and Mangold: Primary embryonic induction, Functions of organizer,
Molecular mechanisms of Amphibian axis formation
9. **Regeneration:** (3L)
Limb regeneration: Salamander, Regeneration in Hydra
10. Apoptosis, aging and senescence. (2L)

REFERENCE BOOKS:

1. Karp Gerald (2010) *Cell Biology*. 6th Edition, John Willey & Sons (Asia) Pte. Ltd.
2. Cooper Geoffrey M. (1997) *The Cell: A Molecular Approach*. ASM Press, Washington D.C., U.S.A.
3. Sadava David E. (1993) *Cell Biology – Organelle Structure and Function*. Jones &Barlett Publishers, Boston, London.
4. Hardin Jeff, Gregory Bertoni and Lewis J. Kleinsmith (2012) *World of the Cell*. 8th Edition, Pearson Education, Inc., San Francisco, U.S.A.
5. Alberts B., A. Johnson, J. Lewis, M. Raff, K. Roberts and P. Walter (2008) *Molecular Biology of the Cell*. 5th Edition, Garland Science, New York, U.S.A.
6. Lodish H., D. Baltimore, A. Berk, L. Zipursky, M. Matsudaira and J. Darnell (1995) *Molecular Cell Biology*. Eds. 3, Scientific American &

- W. H. Freeman, New York.
7. De Robertis E. D. P. and De Robertis E. M. E. (1987) *Cell and Molecular Biology*. 8th Edition, Lea and Febiger, Philadelphia.
 8. Loewy A. G., P. Siekevitz, J. R. Menninger and J. A. N. Gallant (1991) *Cell Structure & Function*. Saunders College Publishing, U.S.A.
 9. Nelson D. L. and Cox M. M. (2008) *Lehninger Principles of Biochemistry*. 5th Edition, W. H. Freeman & Co. NY.
 10. *Developmental Biology*, 9th edition (2010), S.F. Gilbert. Publisher – Sinauer, Associates Inc.
 11. *Principles of Development*, 3rd edition (2007), Lewis Wolpert, Publisher- Oxford, University Press.
 12. *An Introduction to Embryology*, 5th edition (2004), B. I. Balinsky. Publisher – ThomasAsia Pvt. Ltd.
 13. *Developmental Biology*, (2001), R. M. Twyman, Publisher - Bios Scientific, Publishers LTD.
 14. *Analysis of Biological Development*, 2000, Klaus Kalthoff, McGraw-Hill Science/Engineering/Math; 2nd Ed edition.

Course Code and Course Name:

ZOUT 113 Genetics and English in Scientific Communication. (4 Credit: 60 Lecture)

Semester I

After successfully completing this course, students will be able to:

Genetics:

CO1: Define the basic terminologies in genetics.

CO2: Identify genetic disorders based on Karyotypes and traits.

CO3: Explain the concept of Mendelian genetics, gene, gene regulation and multiple alleles.

CO4: Discuss Linkage and crossing with their types and significance.

CO5: Explain the principles of Population genetics.

CO6: Illustrate the modified Mendelian laws of inheritance.

CO7: Justify the inheritance of qualitative and quantitative traits.

CO8: Solve the problems based on gene frequency.

English in Scientific Communication:

CO1: Write the outline of a scientific paper.

CO2: Write the title, abstract, discussion and citations of a given scientific article.

CO3: Prepare a scientific presentation using PowerPoint.

CO4: Explain language as a tool for effective scientific communication.

CO5: Use the formal elements of specific types of scientific writing.

CO6: Critically analyze data from research; incorporate it into assigned writing clearly, concisely, and logically; and attribute the source with proper citation.

CO7: Practice the unique qualities of professional rhetoric and writing style, such as sentence conciseness, clarity, accuracy, honesty, avoiding wordiness or ambiguity, using direct order organization, readability, coherence and transitional devices.

CO8: Justify the importance of plagiarism check and Proof-read given article.

Sr. No.	Name of the topic	Lectures allotted
1.	Recapitulation of Mendelian principles; Practical applications of genetics in brief	(02L)
2.	Classical concept of a gene: Allele, pseudoalleles, multiple alleles (blood groups)	(02L)
3.	Gene interactions and epistasis and their types.	(02L)
4.	Linkage and crossing over: Linkage, linkage groups, types of crossing over, sex linkage, sex limited and sex influenced characters, Recombination, recombination maps in diploids for 2 point and 3 point test cross, (determination of gene order with suitable examples)	(06L)
5.	Quantitative genetics : Polygenic inheritance, heritability and its measurements and Quantitative Traits Locus mapping	(03L)
6.	Principles of Population Genetics: Hardy-Weinberg law and its application for autosomal genes. Calculations of gene frequencies with suitable examples.	(05L)
7.	Somatic cell genetics and its applications.	(02L)
8.	Microbial genetics : Methods of genetic transfers – transformation, conjugation, transduction	(03L)

9. Extra chromosomal inheritance: Inheritance of Mitochondria. (01L)
10. Human genetics: dominant and recessive disorders, physical traits. (04L)
- English in Scientific Communication:**
1. Language as a communication tool; relationship among reading, writing, listening and speaking (2L)
2. Pragmatic competence: co-operative principles and politeness principles (1L)
3. Organisation of English language: sentence structure, basic grammar, sequence and tenses, syntax, paragraphs, paraphrases and précis writing, synonyms and antonyms (3L)
4. Common errors in written and spoken English: tautology, double negative, double positive, superfluous words (2L)
5. Oral presentation: How to prepare a presentation, power point slides, use of communication and IT, voice, speed of delivery, obstacles in effective communication (2L)
6. Drafting of a research project for financial assistance from funding agency, writing of scientific paper using word processor. (2L)
7. Outline of a scientific research paper: (14L)
- 7.1 Hypothesis, theory and concept
- 7.2 Title designing, framing Abstract and Keywords
- 7.3 Introduction: statement of the problem and justification; aim, objectives, need, significance and rationale of the study, review of literature.
- 7.4 Materials and Methods: contents, importance of measurements, reproducibility etc.
- 7.5 Observations and Results: text and data presentation, tables, graphs, histograms, diagrams, photographic plates, legends and captions
- 7.6 Discussion: logical sequence and critical analysis of ideas and evidences, data conclusion
- 7.7 References: finding references from journals, books and databases; Citation - styles of citations
- 7.8 Summary, Acknowledgements
8. Editing and correcting: proof-reading symbols, jargons and abbreviations (3L)
9. Plagiarism: meaning, types, avoiding plagiarism. (1L)

REFERENCE BOOKS:

1. Genetics, 3Rd Edn by Strickberger, Pearson India, 2015, Paperback, 9789332555105
2. Principles of Genetics, Gardner, E.J., Peter & Simmons, M.J. and Snustad, D.P. 8thEdn. John Wiley and Sons, New York, 2006.
3. Concepts of Genetics. William S Klug and Michael R Cummings. 10thEdn. Pearson Education India, 2016.
4. Lewin, Benjamin. Genes IX. John Wiley and Sons, New York, 2008.
5. Genetics By Verma, P.S. And Agrawal, V.K., S.Chand and Co., New Delhi
6. Genetics By Gupta, P.K., Rastogi Publication, Meerut
7. Genetics By Sarin, C., Tata McGraw Hill, New Delhi
8. Genetics: Daniel J Fairbanks, W. Ralph Andersen; Brooks / Cole Publ. co. (1999).
9. iGenetics: A Molecular Approach, 3rdEdn by Peter J Russell, Pearson India, 2016, Paperback, 9789332571624
10. O'Conner M. and F. P. Woodford (1975) Writing Scientific Papers in English. Elsevier-Excerpta Medica-North Holland Publ., Amsterdam.
11. Trelease S. F. (1958) How to Write Scientific and Technical Papers. Williams and Wilkins Co. Baltimore, U.S.A.
12. Day Robert (1996) How to Write and Publish a Scientific Paper. Cambridge University Press.
13. McMillan V. (1997) Writing Papers in the Biological Sciences. Edn. 2, W. H. Freeman, New York.
14. Winkler Anthony C. and Jo Ray McCuen-Metherell (2008) Writing the Research Paper, A Handbook. 7th Edition, Wadsworth Cengage Learning, Boston, M.A., U.S.A.
15. Vijayalakshmi G. and C. Sivapragasam (2008) Research Methods – Tip & Techniques. M.J.P. Publishers, Chennai.
16. Kothari C. R. (2009) *Research Methodology: Methods & Techniques*. 2nd Revised Edition, New Age International Publishers, New Delhi.
17. Levinson Stephen C. (2003) Pragmatics. Cambridge University Press, Cambridge.
18. Yule George (2012) Pragmatics (Oxford Introduction to Language Study

- ELT). Oxford University Press.
19. Quirk Randolph and Greenbaum Sidney (2006) A University Grammar of English. Pearson Education Ltd.
 20. Editors of Merriam Webster (2006) Webster's English Usage Guide. Federal Street Press, Springfield, M. A., U.S.A.
 21. Wren P. C. and H. Martin (2016) High School English Grammar and Composition. Blackie ELT Books (A Division of S. Chand & Co. Pvt. Ltd.), New Delhi, India.
 22. American Psychological Association(2010)Publication Manual of the American Psychological Association. 6th Edition, Washington D.C.
 23. Modern Language Association(2016)MLA Handbook. 8th Edition, The Modern Language Association of America.

Course Code and Course Name:

ZODT 114 Biostatistics (2 Credits= 30 lecturers)

Semester I

After successfully completing this course, students will be able to:

CO1: Explain the application of sampling in biological sciences.

CO2: Explain standard Probability distributions.

CO3: Explain the concept and types of central tendency.

CO4: Explain the concept of correlation and regression with their properties.

CO5: Classify the given data.

CO6: Graphically represent the given data.

CO7: Illustrate the measures of dispersion with examples.

CO8: Solve statistical problems.

Sr. No	Name of the topic	Lectures allotted
1.	Introduction: 1.1 Applications and Uses of Statistics 1.2 Population & sample, Different types of Sample 1.3 Exercise & Problems.	(02L)
2.	Data Classification: 2.1 Some important terms (Class frequency, class- limits, Class-width, class mark) 2.2 Frequency distribution, Cumulative frequency, Graphical representation of data (Histogram, Pie-Diagram, Ogive-Curve.) 2.3 Exercise & Problems	(3L)
3.	Measures of central tendency: 3.1 Concept of central tendency, Types of central tendency (Arithmetic mean, Median and mode) combined mean. 3.2 Partition values (Quartiles, Deciles, and Percentiles), Box plot. 3.3 Exercise & Problems.	(3L)
4.	Measures of dispersion: 4.1 Concept of dispersion, absolute and relative measure of dispersion. 4.2 Different measures of dispersion (Range, Quartile- Deviation, Variance and standard-deviation, Coefficient of Variation) combined variance 4.3 Exercise & Problems.	(4L)
5.	Correlation and Regression: 5.1 Bivariate data, concept of correlation, Types of Correlation, Scatter diagram, Karl Pearson's coefficient of correlation and its properties. 5.2 Concept of regression, Linear regression, regression Coefficients and its properties. 5.3 Exercise & Problems.	(5L)
6.	Probability and probability distribution: 6.1 Some important terms (types of experiment, sample Space and types of sample space, events and types of events.) 6.2 Definition of probability (mathematical and classical) Conditional	(5L)

probability. Concept of random variable Univariate Probability Distribution and its mathematical expectation.

6.3 Some standard probability distributions (binomial, Poisson and normal) their probability distribution, mean, variance, and properties of these distribution.

6.4 Exercise & Problems.

7. Test of hypothesis: (8L)

7.1 Some important terms (hypothesis, types of hypothesis, Test, Critical region, acceptance region, type I error, type II error, level of significance, p-value)

7.2 Test for mean and equality of two population means, Test for proportion and equality of two population proportions.

7.3 chi-square test for goodness of fit, Unpaired and paired t test. F test for equality of two population variances.

7.4 Software used for Statistical analysis

7.5 Exercise & Problems.

Course Code and Course Name:

ZODP 114 Practical Biostatistics.

(2 Credits- 60 Hours)

Semester I

After successfully completing this course, students will be able to:

CO1: Construct frequency distribution chart.

CO2: Graphically represent the given data.

CO3: Solve the statistical problems based on Central Tendency, Dispersion, Correlation and regression.

CO4: Apply computer software for statistical analysis.

CO5: Solve numerical problems on test of hypothesis using biological data.

Sr. No	ZODP 114 Practical Biostatistics	No. of Practicals
1.	Construction of frequency distribution and its graphical representation.	(1P)
2.	Measures of Central Tendency.	(2P)
3.	Measures of Dispersion	(2P)
4.	Correlation and Regression.	(1P)
5.	Computation and application of binomial & Poisson probabilities.	(1P)
6.	Computation and application of normal probabilities.	(2P)
7.	Test for means and proportions	(1P)
8.	Chi-square test of goodness of fit.	(1P)
9.	Paired and unpaired t- test, F-test.	(2P)
10.	Statistical analysis with Computer software packages	(2P)

REFERENCE BOOKS:

1. Principles and Practice of Biostatistics: Dr J.V. Dixit
2. Statistical Methods: Snedecor G.W. & Cochran W.G.
3. Statistical Methods: Dixon W.S. and Massey
4. Biostatistics for the Biological and Health Sciences, 2nd Edition
by Marc M. Triola, Mario F. Triola, Jason Roy, Published by Pearson
Copyright © 2018
5. Biostatistics: Basic Concepts and Methodology for the Health Sciences,
10ed, ISV by Wayne W. Daniel, Wiley Publication.

Course Code and Course Name:

ZODT 114 Freshwater Zoology.

(2 Credits= 30 lecturers)

Semester I

After successfully completing this course, students will be able to:

CO1: Enlist the diagnostic features of shrimps.

CO2: Explain the types of aquatic habitats.

CO3: Discuss the aquatic adaptations of common freshwater forms.

CO4: Explain the adaptations in freshwater Turtles and Crocodiles.

CO5: Illustrate the physicochemical properties of water.

CO6: Demonstrate the effect of pollutants on freshwater bodies

CO7: Justify the presence of zooplanktons and aquatics forms in freshwater bodies.

Sr. No.	Name of the topic	Lectures allotted
1.	Introduction to freshwater habitats. Lotic habitat: Major rivers in India Lentic habitat: Lakes, ponds, wetlands and ephemeral water bodies. Thermal stratification in lakes.	(02L)
2.	Physico-chemical conditions of freshwater and its implications on freshwater biota. Physical conditions: Water current, water colour, turbidity and temperature. Chemical conditions : pH, carbon dioxide, dissolved oxygen, hardness, acidity and alkalinity, nitrate, phosphate and sulphates.	(7L)
3.	General characters of plankton with special emphasis on the characters used in taxonomy and reproduction: Rotifera, Copepoda, Cladocera and Ostracoda.	(4L)
4.	Introduction to minor phyla: Gastrotricha, Bryozoa and Tardigrada (water bears).	(2L)
5.	Diversity and economic importance of freshwater Crustacea and Mollusca.	(2L)
6.	Locomotory and respiratory adaptation in freshwater insect orders: Ephemeroptera, Odonata, Plecoptera, Coleoptera, Diptera and Hemiptera.	(2L)
7.	Diversity and distribution of vertebrates in the freshwater bodies of India. (Excluding fishes)	(2L)
8.	Adaptive physiology of freshwater fauna: Osmotic and ionic, thermal, respiratory, reproductive and life cycle, mechanical, locomotory and sensory adaptations.	(6L)
9.	Anthropogenic impact on freshwater: Waste and pollution, sewage and silage, mining waste, agricultural chemicals, industrial outflows and invasions. Eutrophication : Causes and problems.	(3L)

Course Code and Course Name:**ZODP 114 Practical Freshwater Zoology.****(2 Credits = 60 lectures.)****Semester I**

After successfully completing this course, students will be able to:

CO1: Identify commercially important freshwater fish.

CO2: Identify the aquatic adaptations in common freshwater forms.

CO3: Prepare the culture of *Paramecium* and *Daphnia*.

CO4: Estimate the hardness and chloride content in water samples.

CO5: Analyze the Zooplanktons from local freshwater bodies.

CO6: Evaluate the bio-indicators of pollution in freshwater.

Sr. No.	ZODP 114 Practical Freshwater Zoology	No. of Practicals
1.	Estimation of total carbon dioxide and chloride form given water sample.	(1P)
2.	Estimation of phosphates forms given water sample.	(1P)
3.	Estimation of total nitrate from given water sample.	(1P)
4.	Estimation of calcium and total hardness of given water sample.	(1P)
5.	Estimation of total alkalinity of given water sample.	(1P)
6.	Collection, preservation and identification of zooplankton from freshwater habitat. (Prepare permanent slides and Identify up to genus level using taxonomic key).	(2P)
7.	A qualitative and quantitative analysis of zooplankton from a given freshwater sample using Lackey's drop count method/ Sedgwick rafter counting cell.	(1P)
8.	Identification of economically important freshwater crustaceans and fishes.	(1P)
9.	Study of locomotory and respiratory adaptations in aquatic insects and larvae (<i>Ranatra</i> , <i>Notonecta</i> , <i>Gerris</i> , <i>Bellostoma</i> and <i>Dytiscus</i>).	(1P)
10.	Study of aquatic and semiaquatic adaptations in amphibians and reptiles.	(1P)
11.	Estimation of primary productivity with dark and light bottle method	(1P)
12.	To prepare and maintain a culture of paramecium, Daphnia and Hydra	(2P)
13.	A Compulsory visit to local freshwater body and preparation of report on physicochemical conditions and faunal organisms.	(1P)

REFERENCE BOOKS:

1. Limnology: lake and river ecosystem, Robert G. Wetzel. Academic Press,

- 3rd edition.
2. Treatise of Limnology. Hutchinson G. E. John Willy Publication, New York (3 volumes).
 3. Field Guide to freshwater invertebrates of North America. Thorp and Rogers. Academic press.
 4. Environmental Physiology of Animals. Pat Wilmer, Graham Stone and Ian Johnston. Wiley-Blackwell; 2nd edition.
 5. Current status of freshwater resources of India. Kailash Chandra, Gopi K.C., Rao D.V., Valarmathi K. and Alfred J.R.B. Zoological survey of India, 2017.
 6. Freshwater Ecology: Concepts and Environmental Applications of Limnology. Academic press, 2nd edition.
 7. Freshwater invertebrates of the United States. Robert Pennak. A Wiley-Interscience Publication.
 8. Freshwater Biology. Whipple and Ward. John Wiley & Sons Inc; 2nd edition (December 1959).
 9. Freshwater Invertebrates: Ecology and General Biology. Thorp and Covich. Academic Press, 4th edition.
 10. Limnological Methods. Paul and Welch. Mcgraw –Hill publication.
 11. Limnological analysis. Wetzel Robert G., Springer Publication.

Course Code and Course Name:**ZOUP 115 Basic Zoology Lab-1.****(4 Credits- 120 hours)****Semester I**

Note: A total of 30 practicals are to be conducted. 10 practicals from each module are to be conducted. 1 practical is of 4 clock hour duration.

After successfully completing this course, students will be able to:

CO1: Identify the developmental stages of chick embryo, cell structures and phases of cell division

CO2: Identify the grammatical mistakes from the given paragraph and common errors in written and spoken presentations.

CO3: Write a scientific project and research article along with its proof reading.

CO4: Demonstrate the working of different microscopes, colorimetric and spectrophotometric methods, cell fractionation and ligature in *Drosophila* larvae,

CO5: Determine the gene distance and order, genotype and phenotype ratios and allelic frequencies from the given data.

CO6: Estimate sugar and protein by suitable biochemical method, and isolate protein from biological source.

CO7: Prepare acid and base solutions of desired strength, buffers, bacterial Culture, chick embryo culture and *Drosophila* culture.

CO8: Prepare temporary slide of various cells to demonstrate the cell morphology and cell division, giant chromosome and pedigree analysis chart.

CO9: Calculate % retention and % elution of amino acids on given ion exchanger.

Sr. No.	Name of the Practical	No. of Practicals
Module-I Biochemistry and Biochemical Techniques		
1.	Preparation of Acid & Alkali solutions and acid-base titration (Compulsory)	1P
2.	Principle and working of Colorimetry and spectrophotometry	1P
3.	To prepare Buffers of known pH and molarity and measurement of pH of various samples, Buffering capacity	1P
4.	Units and specific activity of enzymes.	1P
5.	Effect of substrate concentration on enzyme activity (Compulsory)	1P

6	Determine the concentration of Vitamin C by titration method from various sources.	1P
7.	Estimation of Sugar (Glucose) by Folin Wu method. (Compulsory)	1P
8.	Isolate proteins by salting out / by adjusting isoelectric point. (Compulsory)	1P
9.	Estimation of protein by Biuret method method. (Compulsory)	1P
10	Principle and uses of different microscopes	1P
11	Principles of electrophoresis, separation of proteins using Gel electrophoresis. (Compulsory)	1P
12.	To find out the capacity and nature of a given ion-exchanger. Investigate the % retention and %elution of amino acids on a given ion exchanger	1P
13	To study the effect of different solvents for a given dye using thin layer chromatography (Compulsory)	1P
14.	Enzyme isolation and purification by fractionation methods.	2P
Module-II Cell Biology and Developmental Biology		
1	Study of ultrastructure of cell organelles. (Compulsory)	1P
2	Study of different types of cells. (Compulsory)	1P
3	Temporary preparation of human cheek epithelial cells. (Compulsory)	1P
4	Study of different stages of mitosis in suitable material. (Compulsory)	1P
5	Study of meiosis in Grasshopper testes / Onion flower buds / <i>Aloe vera</i> with emphasis on all stages of prophase. (Compulsory)	1P
6	Limits of cleanliness (To check for microbial flora)	2P
7	Cell fractionation – Nuclei, mitochondria observation, nuclear count.	2P
8	Mounting of chick embryos and preparation of permanent mounts (Compulsory)	1P
9	Filter paper ring method for <i>in vitro</i> culturing of chick Embryo & observations.	1P
10	Gross anatomy and histology of chick embryo upto 72 hrs. Brain, heart, lens, ear development. (Compulsory)	1P
11	Study of embryonic and post-embryonic development using frog egg as a model system.	1P
12	Study of life cycle of <i>Drosophila melanogaster</i> . (Compulsory)	1P
13	Study of effect of ligature in <i>Drosophila</i> / House fly larva	1P
14	Study of regeneration in <i>Hydra/ Planaria</i> .	1P

15	Study the early developmental stages in any freshwater snail.	1P
	Module-III Genetics and English in Scientific communication	1P
1	Study of sex linked inheritance in <i>Drosophila sp.</i>	1P
2	Study of monohybrid and Dihybrid ratio in <i>Drosophila sp.</i> (Compulsory)	1P
3	Determination of gene distances and gene order for a given three-point test cross. (Compulsory)	1P
4	Polytene chromosomes of <i>Drosophila or Chironomous</i> -examination of puff and bands. (Compulsory)	1P
5	Estimation of allelic frequencies, heterozygote frequencies in human populations. (Compulsory)	1P
6	Pedigree Analysis: Sex-Linked, Autosomal dominant and recessive.	1P
7	Culturing <i>E.Coli</i> on solid and liquid media	1P
8	English vocabulary, word formation, basic grammar-verb, adverb, adjective, noun, pronoun (Compulsory)	1P
9	Syntax, paraphrasing and précis writing, synonyms, antonyms, abbreviations.	1P
10	Spoken English: pronunciation, diphthong, accent, clarity, speed, punctuation, simplicity and syntax	1P
11	Common errors in written and spoken presentation- Tautology, double negatives and double positives, sequence and tenses, ambiguity, spellings, jargons.	1P
12	Outline of a scientific paper; preparation of a research project.	1P
13	Writing abstracts, conclusion/ summary and acknowledgements, key words and suggest a suitable title to the given abstract/paper (Compulsory)	1P
14	Assigning legends to given graphs, figures and captions to given tables, Deciphering the given pictorals.	1P
15	Study of proof correction symbols; proof- reading the given text & correcting the proofs.	1P
16	How to write materials and methods ,observation section of a research paper.	1P
17	Write discussion section for the given discussion-less research paper and writing Citations/ Bibliography (Compulsory)	1P
18	Oral presentation: Rhythm, style, control, mock presentation of 10 minutes.	1P

M.Sc. Zoology (Semester - 2)

Course Code and Course Name:

ZOUT 121: Molecular Biology and Bioinformatics. (4 Credits = 60 lectures)

Semester II

After successfully completing this course, students will be able to:

CO1: Explain the DNA structure & types, topology, Physical properties; chromatin structure and organization.

CO2: Discuss genome organization, DNA and Protein sequencing with their application in evolutionary studies.

CO3: Explain the mobile DNA elements.

CO4: Explain mechanism of DNA damage and repair.

CO5: Illustrate the process of DNA replication, transcription, translation and their regulations.

CO6: Illustrate the database tools with their significance.

CO7: Schematically represent the processes of central dogma.

CO8: Justify the post translational and post transcriptional modifications.

Sr. No.	Name of the topic	Lectures allotted
1.	DNA structure and topology :-Structure of chromatin, nucleosome, chromatin organization and remodeling, higher order organization - chromosome, centromere, telomere, Histones and its effect on structure and function of chromatin, type of DNA (A,B,Z)	(5L)
2.	Physical properties of DNA: T _m , hypo and hyper chromicity, solubility, mutarotation and buoyancy.	(2L)
3.	Genome organization: C value paradox and genome size, Cot curves, repetitive and non-repetitive DNA sequence and their importance Cot ½ and, kinetic and sequence complicity, satellite DNA.	(2L)
4.	DNA Replication: DNA replication in <i>E. coli</i> , Origin of replication, , types of <i>E. coli</i> DNA polymerases, details of replication process, regulation of replication, connection of replication to cell cycle. Different models of replication for linear and circular DNA replication features of single stranded	(10L)

- phages. Eukaryotic DNA replication, multiplereplicons, eukaryotic DNA polymerases, ARS in yeast, Origin Recognition Complex(ORC), regulation of replication.
5. **DNA damage and repair:** Different types in DNA damages, Different DNA repair systems: Nucleotide excision repair, Base excision repair, mismatch repair, recombination repair, Double strand break repair, transcriptional coupled repair, Nick Translation and SOS Repair (5L)
 6. **Transcription:** Transcriptional Unit in prokaryotes and eukaryotes, role and significance of promoter, enhancer, intron, exon, silencer, Transcriptional factors, mechanism of prokaryotic gene transcription, type and structure of RNA polymerase, post transcriptional processing: Capping, polyadenylation and splicing in eukaryotes and significance, Ribonucleoproteins(SnRNPs&ScRNPs) (8L)
 7. **Gene regulation and expression** in prokaryotes- Lac, arabinose and Trp operon. (3L)
 8. **Protein synthesis:** Genetic Code ribosome structure, activation of amino acids, peptide bond formation and translocation of peptides, post-translational modifications, inhibitors of protein synthesis (6L)
 9. **Mobile DNA elements:** Transposable elements in bacteria, IS elements, composite transposons, replicative, non-replicative transposons, Mu transposition Controlling elements in Tn A and Tn 10 transposition, SINES and LINES. Retroviruses and retrotransposon. (4L)
- Bioinformatics**
1. **Introduction** (2L)
Introduction to Bioinformatics and Bioinformatics web resource (NCBI, EBI, ExPASy, PubMed, OMIA), Applications of Bioinformatics
 2. **Databases – Tools and their uses** (4L)
Biological databases, Primary sequence databases, Nucleic acid sequence databases (GenBank, EMBL-EBI, DDBJ), Protein sequence data bases (UniProtKB, PIR, PDB) Secondary sequence databases, Derived databases - PROSITE, BLOCKS, Pfam/ Prodom, Structure databases and bibliographic databases

- 3. Sequence alignment methods (4L)**
 BLAST, FASTA
 Significance of sequence alignment
 Pairwise sequence alignment (Needleman & Wunsch, Smith & Waterman methods) Multiple sequence alignment (PRAS, CLUSTALW)
- 4. Predictive applications using DNA and protein sequences (5L)**
 Evolutionary studies: Concept of phylogenetic trees, Parsimony and Bayesian approaches, synonymous and non-synonymous substitutions, convergent and parallel evolution, Pharmacogenomics: Discovering a drug: Target identification
 Protein Chips and Functional Proteomics: Different types of protein chip, detecting and quantifying; applications of Proteomics
 Metabolomics: Concept and applications

REFERENCE BOOKS:

1. *Genes IX*, 9th edition (2008), Benjamin Lewin, Publisher - Jones and Barlett Publishers, Inc.
2. *Molecular Biology of the Gene*, 5th Edition (2004), James D. Watson, Tania Baker,
3. Stephen P. Bell, Alexander Gann, Michael Levine, Richard Lodwick. Publisher - Pearson Education, Inc. and Dorling Kindersley Publishing, Inc
4. *Bioinformatics - Concepts, Skills, and Applications*; S.C. Rastogi & others; CBS Publishing; 2003.
5. *Bioinformatics - A practical guide to analysis of Genes & Proteins*; Andreas D Baxevanis & B F Francis; John Wiley; 2000.
6. *Introduction to Bioinformatics*; 1st Edition; T K Attwood, D J parry-Smith; Pearson Education, 11th Reprint; 2005.
7. *Bioinformatics*; 1st Edition; C S V Murthy; Himalaya Publishing House; 2003
8. *Bioinformatics sequence and genome analysis*; David W. Mount; Cold spring harbor laboratory press; 2004
9. *Basic Bioinformatics*; S. Ignacimuthu, S.J.; Narosa Publishing House; 1995

10. An Introduction to Bioinformatics Algorithms; Neil C. Jones and Pavel A. Pevzner; MIT Press, First Indian Reprint; 2005
11. Bioinformatics - Managing Scientific Data; Zoe Lacroix, Terence Critchlow; Morgan Kaufmann Publishers (Elsevier Science); 2003 (for the V unit)
12. Phylogenetics: Theory and Practice of Phylogenetic Systematics; Second edition; Bruce S. Lieberman; Wiley-Blackwell; 2011
13. Molecular Evolution: A Phylogenetic Approach; Roderick D.M. Page, Dr Edward C. Holmes; Well Publishing; 1998
14. Essential Bioinformatics; JinXiong; Cambridge University Press; 2006
15. Proteomics - From Protein Sequence to Function; 12 S. R. Pennington, M. J. Dunn; First edition; Springer publications; 2001
16. Proteomics; Timothy Palzkill; Springer; 2002
17. Metabolomics - A Powerful Tool in Systems Biology; Jens Hřiriis Nielsen, Michael C. Jewett; Springer; 2007
18. Systems Metabolic Engineering; Dr. Christoph Wittmann, Sang Yup. Lee; Springer; 2012
19. Bioinformatics (Bios Instant Notes); Second Edition (Special Indian Edition); T. Charlie Hodgman, Andrew French and David R. Westhead; Garland Science (Taylor and Francis Group); 2010
20. Understanding Bioinformatics; Marketa Zvelebil and Jeremy O. Baum; Garland Science (Taylor and Francis Group); 2008
21. Bioinformatics Computing – The complete practical guide to bioinformatics for life scientists; Bryan Bergeron; Eastern Economy Edition; Prentice-Hall of India Pvt. Ltd., New Delhi; 2003
22. Bioinformatics; Prakash S. Lohar; MJP Publishers, Chennai; 2009
23. A text book of Molecular Biology- J.Pal and S. Ghaskadabi, Oxford Publication- India.
24. Freifelders Essentials of Molecular Biology, Malacinski G.M (2006) (Fourth Edition). Narosa Publishing House, New Delhi.
25. Karp's Cell and Molecular Biology: Concepts and Experiments, 8th Edition by Gerald Karp, Janet Iwasa, et al. 2016, Wiley Publication

Course Code and Course Name:**ZOUT 122 Endocrinology and Parasitology.****(4 Credits= 60 lecturers)****Semester II**

After successfully completing this course, students will be able to:

Endocrinology:

- CO1: Discuss the roles of Pituitary gland and pineal body.
- CO2: Explain hormonal regulation of biomolecules and mineral metabolism.
- CO3: Describe the role of osmoregulatory and gastrointestinal hormones.
- CO4: Explain the role of hormones in moulting, change in body colour of crustaceans; yolk synthesis in amphibians; insect development.
- CO5: Explain the hormonal regulation of metabolism.
- CO6: Illustrate the mechanism of hormone action and role of hormone receptors.
- CO7: Justify hormones as coordination molecules.
- CO8: Justify the significance of biological clocks and rhythms.

Parasitology:

- CO1: Define the terminologies of parasitology.
- CO2: Explain the concepts of animal association with examples.
- CO3: Describe the role of parasites in public health and hygiene.
- CO4: Explain the morphology and life cycle of common parasites.
- CO5: Explain the pathogenicity and control measures of common parasites.
- CO6: Illustrate the process of parasitic infections to human.
- CO7: Justify the importance of control strategies against parasitic infections.
- CO8: Justify the significance of vectors and disease transmission.

Sr. No.	Name of the topic	Lectures allotted
Endocrinology:		
1.	Hormones as chemical messenger, types of hormones-protein and non-protein	(2L)
2.	Hormone receptors; on the plasma membrane, cytoplasm & nucleus	(2L)
3.	Mechanism of hormone action- signal transduction cascade.	(2L)
4.	Hypothalamic hypophysiotropins	(2L)

5. Adenohypophysial hormones: ACTH, PRL, STH and TSH (4L)
6. Control of chromatophores: Pituitary, pineal (2L)
7. Hormonal regulation of carbohydrates, protein & lipid metabolism: pancreatic hormones glucocorticoids (3L)
8. Osmoregulatory hormones: ADH, mineralocorticoids, renin-angiotensin (2L)
9. Gastrointestinal hormones (2L)
10. Control of calcium and phosphate metabolism (2L)
11. Endocrine mechanism in crustacean: X & Y organs, regulation of metabolism, heart, salt and water balance, reproduction, colour change, moulting (3L)
12. **Chronobiology:** Introduction, significance, Clocks, Rhythm and Calendar, The biological timing system: Concepts and methods, Types: Ultradian, circadian and circannual rhythms. (4L)
- Parasitology**
- 1 **Host-Parasite systems:** (7L)
- 1.1 Preadaptation to infectiousness, Myiasis: Classification according to tissue, vectors specific, sub specific, accidental; clinical presentation humans, syndrome, symptoms, diagnostic, control method prevention, treatment.;
Transmission: Types, categories: A. Conspecific: Contact, Transplacental, Transovarian, B. Heterospecific: Mechanical (Indirect & Direct), Biological, Paratenic, Hyper parasitic, Parasitoidal.
- 1.2 Manipulation of Host behaviour, Parasitism & Altruism, parasites & social behavior of hosts, parasitism & life history, parasitic effects benefiting the host.
- 2 **Type study:** (8L)
- Classification geographical distribution, morphology, life-cycle, transmission, pathogenicity, treatment and prophylaxis of:
- 2.1 Protozoa: *Trypanosoma* Sps., *Leishmania* Sps.
- 2.2 Platyhelminthes: *Schistosoma* Sps., *Echinococcus* Sps.
- 2.3 Nematoda: *Ancylostoma* Sps., *Dracunculus* Sps.
- 3 **Genetics & Molecular Biology:** (7L)
- 3.1 *Trypanosoma*: Diploid & Sexual stage, Molecular characteristics of surface coat, Variable surface glycoprotein (VSG) and VSG gene expression.
- 3.2 *Plasmodium*: Diploid & haploid stages, Chromosome polymorphism, gene

encoding Circumsporozoite protein & merozoites S- antigens, surface antigen diversity. Resistance of Malaria to drugs, its mechanism & assessment.

3.3 Platyhelminthes: Inseminative behaviour, parthenogenesis and polyspermy, sex determination, sex linked inheritance in Schistosomes.

4 Serology & immunodiagnostic methods: (6L)

4.1 Serology & antibody synthesis, preparation & demonstration of specific antigens of *Entamoeba*, *Plasmodium*, *Trypanosoma* & *Leishmania*

4.2 Immunodiagnostic assays, Immunodiffusion, haemagglutination test, Radioimmuno assay, ELISA, complement fixation test.

5. Prophylaxis & control: Biologic, Genetic, Chemical, Physical & Other (2L) methods.

REFERENCE BOOKS:

1. Bentley, P.J. (1998). Comparative vertebrate endocrinology, edn.3, Cambridge University Press, London.
2. Bollander, F. (1994). Molecular endocrinology, edn.2, Acad. Press, San Diego.
3. Hadely, M.E. (1996). Endocrinology. Edn.4, Prentice Hall, Upper Saddle Park.
4. Thomdyke, M.C. and Goldsworthy, G.J. (1988). Neurohormones in Invertebrates. Cambridge University Press.
5. Hoar, W.S. and Hickman, C.P., Jr. (1983). A laboratory companion for general and comparative physiology. Edn.3, Prentice Hall, Englewood Cliffs, N.J., USA.
6. Kobayashi, H. Malsumolo, A. and Ishii, S. (Eds.) (1992). Atlas of endocrine organs: vertebrates and invertebrates. Springer Verlag, Berlin.
7. Zarrow, M.X., Yachim, J.M. and McCarthy, J.L. (1964). Experimental endocrinology: a sourcebook of basic techniques. Academic Press, New York
8. Comparative protozoology, Ecology, Physiology, Life history, Anderson, O.R., Springer verlag, Berlin.
9. General Parasitology, Cheng T. C., Academic Press.
10. Modern Parasitology, Cox F.E.G., Eds. Parasitology in focus, facts &

trends, Melhorn h.,Eds., SprigerVerlag, Beriin.

11. Medical Parasitology, Piakarsky G. L., Springer Verlag, Berlin.

12. Modern Parasitology, Cellular immunological & immunological aspects,
Wylor D. J., Eds.,

13. Molecular Parasitology: Protozoan parasites and their
MoleculesWalochnik, J, Duchene M, 2016

Course Code and Course Name:

ZOUT 123 Comparative Animal Physiology & Environmental Biology.

Semester II

(4 Credits= 60 lecturers)

After successfully completing this course, students will be able to:

Comparative Animal Physiology:

CO1: Explain the physiology of processes like digestion, respiration, muscle contraction and excretion.

CO2: Describe the mechanism of thermoregulation in both poikilotherms and homeotherms.

CO3: Explain the mechanism of chemical communication in vertebrates.

CO4: Comment on the structure and functions of various sense organs.

CO5: Illustrate the concept of osmotic regulation in various animals with suitable examples.

CO6: Compare the physiology of regulatory mechanisms in various groups of animals.

CO7: Justify the survival strategies of organism in varied climatic conditions.

CO8: Justify the evolution of various life processes in living forms.

Environmental Biology:

CO1:List the endangered, endemic and extinct animal species of India.

CO2:Identify various types of natural resources, human impact on these resources, and common resource management practices.

CO3:Explain the structure and impact of biogeochemical cycles, ecosystems and energy transformation across trophic levels.

CO4: Describe concepts in population ecology and their significance.

CO5: Discuss environmental hazards and risks and the socio-economic implications.

CO6: Illustrate the impact of climate and anthropogenic factors on biodiversity with reference to India.

CO7: Illustrate the wildlife management practices and their significance.

CO8: Analyze the impact of lifestyle on the environment and animal life.

Topic No.	Name of the topic	Lectures allotted
1.	Digestion: Physiology of digestion.	(03L)
2.	Respiration: Respiratory Surfaces: comparison of ventilation associated with gills and pulmonary respiration. Blood pigment, role in Oxygen transport. O ₂ dissociation curves physiological and ecological significance, CO ₂	(04L)
3.	Muscle contraction: Structure (light & electron microscopic) of the skeletal muscle, proteins of the myofilaments, nature of actin-myosin interaction, sarcoplasmic reticulum and role of Ca ⁺⁺ in contraction	(04L)
4.	Osmotic regulation: Concepts of osmole, osmolarity and tonicity, ionic regulation, Hyper- and hypo-osmotic regulators, ureosmotic animals.	(04L)
5.	Excretion: Basic processes in urine formation, renal function in animals specially the mammalian kidney, Renal pressure system, Comparative biochemistry of nitrogen excretion.	(04L)
6.	Thermoregulation: Biokinetic Zones, tolerance and resistance. Thermobiological terminologies. Compensatory patterns in poikilotherms. Critical temp, and zone of thermal neutrality. Mechanism of thermoregulation in homeotherms.	(04L)
7.	Chemical Communication: Neurosecretion, neurohemal & endocrine organs.	(03L)
8.	Sense organ: classification & functions (details of photoreception as a model). Reflexes, Principles of neural integration.	(04L)
Environmental Biology		
1.	Introduction: Fundamentals of Ecology, Ecosystems: Definition and, concept of ecosystems, energy flow in ecosystems, Nutritional Flux. Development and evolution of the ecosystems. Biogeochemical cycles, Food-chains, ecotone, edge effects, ecological niche, and ecosystem stability.	(5L)
2.	Environmental Microbiology: Microbes - classification and their	(2L)

applications in the environmental sciences. Cultivation and growth of microorganisms. Microorganisms and their association with man, animals and plants. Microbes as anti-microbial agents.

3. Biomes and Habitat Diversity: Classification of biomes, major biotic elements of each biome and their characteristics. Human impact on the natural environment. (2L)
4. Biological diversity of India: Definition and nature, India's biogeographically history, physiography, climate and its impact on biodiversity. Indian forest and vegetation types and diversity of flora and fauna. (4L)
5. Population and Community Ecology (2L)
6. Wetlands Forests and Semi-Arid Habitats of India: Definition and types of wetlands, important wetlands and their conservation issues. Forests and semi-arid habitats and their distribution in India, ecological status of forests and arid lands, and their conservation. (3L)
7. Endangered, Endemic and Extinct Species of India: Threatened species categories of IUCN, threatened species of animals and the reasons, Red data book, Biodiversity hotspots of India. (4L)
8. Wildlife management and conservation. Protected Areas Network in India: Goals of management, Strategies for planning. Factors influencing wildlife management such as habitats, population, behaviour, food-habits, health, etc., tools for data collection and analysis. Human land-use and wildlife management units, important projects for the conservation of wildlife in India, Role of local communities in wildlife management. (6L)
9. Introduction to human animal conflict. (2L)

REFERENCE BOOKS:

1. Comparative animal physiology, Clifford Ladd Prosser, John Wiley & Sons
2. Animal physiology, Richard W. Hill, Gordon A. Wyse. Harper and Row

3. Comparative animal physiology, Philip Carew Withers, Saunders College Pub., 1992
4. Fundamentals of Ecology: E. P. Odum
5. Modern concepts in Ecology: H: D. Kumar
6. Microbes, Man and Animals: The Natural History of Microbial Interactions: Linton, A. H. and Burns, R.G. John Wiley and Sons.
7. Elements of Microbiology: Pelczar, M.J. and Chan ECS, McGraw Hill.
8. General Microbiology: Stainer, R.Y, Adelberg, EA and Ingraham, J.L. . Macmillan Press.
9. Microbial Methods for Environmental Biotechnology: Grainer, J.M. and Lynch, J.M. . Academic Press.
10. Microbiological Methods for Environmental Scientists and Enginners
11. Gaudy, A.F. and Guady, E.T. McGraw Hill.

Course Code and Course Name:

ZODT 124: Metabolic Pathways.(2 Credits= 30 lecturers)

Semester II

CO1: Define basic terminologies of metabolic pathways.

CO2: Explain the laws of thermodynamics, concept of free energy and ATP as currency molecule.

CO3: Describe the Concepts and regulation of metabolism.

CO4: Discuss the oxidation of fatty acids and its significance.

CO5: Illustrate the electron transport chain and oxidative phosphorylation.

CO6: Illustrate the reactions, energetics and regulation of glycolysis, glycogen biosynthesis, TCA cycle, Purine and Pyrimidine metabolism

CO7: Write the general reactions of various metabolic pathways.

CO8: Justify the role of enzymes in metabolism

Sr. No.	Name of the topic	Lectures allotted
1.	Basic law of thermodynamics, internal energy, enthalpy, entropy, concept of free energy, redox potentials, high energy compounds, structure and function of ATP.	(4L)
2.	Concepts of metabolism, Metabolic pathways-Catabolic and anabolic, regulation of metabolic pathways	(2L)
3.	Carbohydrate Metabolism <ol style="list-style-type: none"> 1. Steps of Glycolysis (EMP Pathway). 2. PFK 3. Regulation of Glycolysis. 4. Glycogenesis, Glycogenolysis and Glyconeogenesis 5. Inborn errors of metabolism- Von- Gerkes disease, Tarui's disease, Galactosemia, Maple syrup urine 	(7L)
4.	Electron transport chain and oxidative phosphorylation.	(3L)
5.	Citric acid cycle: Detailed study, energetics, regulation and significance, Role of PDH.	(4L)
6.	Oxidative degradation of amino acids: transamination, oxidative deamination.	(2L)
7.	Biosynthesis of purine and pyrimidine nucleotides	(3L)
8.	A Lipid metabolism: Introduction, oxidation of even chain saturated fatty acids, oxidation of unsaturated fatty acids, oxidation of odd chain fatty acids, omega (ω)-oxidation of fatty acids, Ketogenesis. Transport of Fatty Acids.	(5L)

Course Code and Course Name:

ZODP 124: Practical in Metabolic Pathways.

(2 Credits- 60 Hours)

Semester II

After successfully completing this course, students will be able to:

CO1: Identify the common diseases/conditions caused due to errors in metabolism.

CO2: Explain the principle of Colorimetry and Spectrophotometry.

CO3: Use the basic equipment in biochemistry lab.

CO4: Illustrate the enzyme activity from suitable material.

CO5: Demonstrate the effect of various physical and chemical factors on enzyme activity.

CO6: Demonstrate the absorption studies of biomolecules.

CO7: Estimate the concentration of cholesterol, uric acid, amino acids and starch.

CO8: Separate biomolecules by chromatographic methods.

Sr. No.	ZODP 124: Practical in Metabolic Pathways.	No. of Practicals
1.	Estimation of Starch.(Compulsory)	(1P)
2.	Separation amino acids by paper chromatography	(2P)
3.	Estimation of uric acid in wall Lizard excreta/ Human blood any other suitable material.(Compulsory)	(1P)
4.	To find absorption spectrum of haemoglobin, BSA, Tyrosine.	(1P)
5.	Estimation of Protein by Lowry et al Method.(Compulsory)	(1P)
6.	Estimation of Sugar by DNSA method.	(1P)
7.	Separation of amino acids by TLC (Compulsory)	(1P)
8.	Estimation of free amino acids by Ninhydrin method.(Compulsory)	(1P)
9.	Estimation of cholesterol.	(1P)
10.	Study α -Amylase Activity in Germinating Seeds.	(2P)
11.	Determination of saponification value of a fat.	(1P)
12.	Study the effect of pH and temperature on enzyme activity.	(1P)
13.	Study of human diseases caused due to errors in metabolic pathways with the help of pictures/charts/models/laboratory reports.	(1P)

REFERENCE BOOKS:

1. Biochemistry, 3rd Ed. (2005), Voet Donald and Voet Judith G. John, Publisher: Wiley & sons, New York.
2. Biochemistry 6th Ed, (2007) Berg Jeremy, Tymoczko John, StryerLubert, Publisher: W. H. Freeman, New York.
3. Lehninger's Principles of Biochemistry, 4th edition, (2005) Nelson D. L. and Cox M. M. W. H. Freeman & Co. NY.
4. Biochemical Calculations, 2nd Ed., (2010) Segel Irvin H., Publisher: John Wiley and Sons, New York.
5. Enzymes: Biochemistry, Biotechnology & Clinical chemistry, (2001) Palmer Trevor, Publisher: Horwood Pub. Co., England.
6. Biochemistry, Geoffrey Zubay, William C Brown Pub; 4th edition (June 1999)
7. Principles and Techniques of Biochemistry and Molecular Biology, 6th

- edition (2008), Keith Wilson and John Walker, Publisher–Cambridge University Press.
8. Biochemical Methods, 2018, S.Sadashivam, New Age International Pvt Ltd Publishers; Third edition.
 9. An Introduction to Practical Biochemistry, 2017, David Plummer, McGraw Hill Education; 3th edition.
 10. Medical Biochemistry, 2018- John W Baynes and Marek H. Dominiczak, Publisher- Elsevier; 5th edition.
 11. Harper's Illustrated Biochemistry, 2018, Victor W. Rodwell, David A., Bender, Kathleen M., Botham, Peter J., Kennelly, P. Anthony Weil, McGraw-Hill; Illustrated edition,
 12. Principles of Medical Biochemistry-2016, Gerhard Meisenberg, William H. Simmons, Elsevier; 4th edition.

Course Code and Course Name:

ZODT 124: Ichthyology(2 Credits= 30 lecturers)

Semester II

After successfully completing this course, students will be able to:

- CO1: Identify the common fishes in India.
- CO2: Explain the general characters and evolution of fishes.
- CO3: Explain the fish morphology and anatomical modifications.
- CO4: Illustrate the physiology of reproductive and endocrine organs in fish.
- CO5: Discuss the signs, symptoms and control measures of common diseases in fish.
- CO6: Justify the role of respiratory and excretory organs in survival of fishes.
- CO7: Classify fishes upto order level.
- CO8: Setup aquarium and manage it.

Topic No.	Name of the topic	Lecture allotted
1.	Introduction, general characteristics, evolutionary succession and fossil history of fishes. The early evolution of fishes: Chondrichthian fishes - Sharks, Skates and Rays.	(3L)
2.	Eschmeyer's classification of fishes and diagnostic characters up to orders (one major order from each class).	(4L)
3.	External morphology, body form, appendages, pigmentation, skin and scales.	(1L)
4.	Food and feeding habits, Digestive system and its anatomical modifications.	(2L)
5.	Respiratory mechanism: Respiratory gills and lungs. Accessory respiratory organs: Origin of air breathing organs; skin, buccopharynxopercular cavity and air bladder.	(2L)
6.	Circulatory system: Heart and accessory pumps.	(2L)
7.	Excretion and Osmoregulation: Glomerular and aglomerular kidneys; Nitrogen (ammonia, urea, TMAO) excretions. Water and salt balance in stenohaline and euryhaline fishes. Role of skin and gills.	(3L)
8.	Reproduction: Structure of gonads, gametogenic cycles; spawning.	(2L)
9	Nervous system and Sense organs: Organization of the central and peripheral nervous systems. Olfactory, taste buds, touch receptors, photoreceptors, lateral line and internal ear	(3L)
10	Endocrine system: Pituitary gland, urophysis, adrenal gland, gonads, and thyroid gland.	(2L)
11	Fish pathology: Signs of sickness and effects on fish; Pathological procedure for diagnosis of fish diseases, Symptoms and control measures of viral, bacterial, fungal, protozoan, worm and crustacean diseases.	(2L)
12	Ornamental Fish production and management: World trade of ornamental fishes. Different varieties of exotic and indigenous ornamental fishes. Principles of a balanced aquarium. Fabrication, setting up and maintenance of freshwater aquarium. Water quality management. Water filtration system – biological, mechanical and chemical. Types of filters. Aquarium plants and their propagation methods. Lighting and aeration. Aquarium accessories and decoratives. Aquarium fish feeds. Dry, wet and live	(4L)

feeds. Breeding and rearing of ornamental fishes. Common diseases and their control. Conditioning, packing, transport and quarantine methods. Trade regulations and wild life act in relation to ornamental fishes.

Course Code and Course Name:

ZODP 124: Practical in Ichthyology (2 Credits – 60 hours)

Semester II

Sr. No.	Name of the Practical	No.ofPracticals.
1.	Study of fish evolution with the help of charts/models/Pictures.	(1P)
2.	General external characters, fins and scales (permanent slides & temporary preparations and submission during examination).	(1P)
3.	Classification of fishes (one example from each order); use of diagnostic keys.	(2P)
4.	Length-weight relationship, condition factor, gonado-somatic index of any one fish species.	(1P)
5.	Adaptations of fishes (adhesive organs, accessory respiratory organs, stomachless fishes, spiral valve, electric organs and sense organs.)	(1P)
6.	Study of Weberian ossicles in Heteropneustes/ Labeo.	(1P)
7.	Anatomical observations, demonstration and detailed explanation of fish in general, Digestive, urino-genital system, Endocrine glands of carp/ catfish/ Tilapia.	(1P)
8.	Identification of fish developmental stages: egg, spawn, fry fingerling and adult.	(1P)
9.	Cranial nerves (V, VII, IX & X) and eye ball musculature and innervations in Scoliodon/ carp/ catfish.	(1P)
10.	Histology of digestive, respiratory, excretory, reproductive and endocrine organs.	(1P)
11.	Study of common diseases in fish their diagnosis and control strategies.	(1P)
12.	Setting up of an aquarium and its management and study of breeding behaviour of gourami, Siamese fighting and swordtail.	(2P)
13.	Visit to fish farm/ fish breeding centre/fish market and preparation of detail visit report.	(1P)

REFERENCE BOOKS:

1. Bal D. V. & K. V. Rao (1984). Marine Fisheries. Tata McGraw-Hill, New Delhi.
2. Bone Q., N. B. Marshall & J. H. S. Blaxter (1995). Biology of Fishes, Edn.2, Blackie, Academic % Professional (Chapman & Hall), London.
3. C. Vandujn. Diseases of fishes – Narendra Publishing House, New Delhi.
4. Hoar W. S. & D. J. Randall (1969). Fish Physiology. Vols. I onwards, Academic Press, New York.
5. Jayaram K. C. (1981). The freshwater fishes of India. Pakistan, Bangladesh, Burma and Sri Lanka- A Handbook. Zool. Survey of India, Academic Press, New York.
6. Khanna, S. S. (1984). An Introduction to Fishes. Central Book Depot., Allahabad.
7. Lagler K. E., J. E. Bardach, R. R. Miller D.R.M. Passino (1977). Ichthyology, Edn.2, Wiley, New York.
8. Rahul P. Parihar. Textbook Of Fish Biology & Indian Fisheries
9. Talwar P.K. & A.G. Jhingran (1991). Fish and Fisheries of India and Adjacent Countries, Vols. I & II. Oxford & I.B.H., New York.
10. Wake, M.H. (Ed.) (1979). Hyman's Comparative Vertebrate Anatomy. Edn.3, University of Chicago Press, Chicago
11. Wedemeye G. A. Environmental stress and fish diseases –Narendra. Publishing House.
12. William N. Eschmeyer (2019). Eschmeyer'sCatalog of Fishes (Vol. 1, 2 & 3). Published by the California Academy of Sciences, San Francisco © 1998.

Course Code and Course Name:**ZOUP 125 Basic Zoology Lab-2(4 Credits, 120 hours)****Semester II.**

Note: A total of 30 practicals are to be conducted. 10 practicals from each module are to be conducted. 1 practical is of 4 clock hour duration.

After successfully completing this course, students will be able to:

CO1: Identify the various parasites and parasitic stages of common parasites, nitrogenous wasteproducts of animals, feshwater planktons and slides of endocrine glands.

CO2: Explain the principle and significance of gonadectomy, thyrodectomyand pancreactomy.

CO3: Demonstrate the role of eye stalk and insulin in sugar level in crab.

CO4: Demonstrate the retro cerebral complex in cockroach.

CO5: Demonstrate the RBCs of common vertebrates and effect of various osmolarities.

CO6: Demonstrate the effect of body size, oxygen consumption and Insulin on aquatic animal.

CO7: Determine the bleeding and clotting time, heartbeat of crab, species richness in selected area, physico- chemical properties of soil and water.

CO8: Perform Sterilization of lab equipment, prepare microbial culture, Isolate Bacterial, liver DNA and RNA from given sample, quantify and resolve them using electrophoretic procedures, analyse protein sample by PAGE and SDS PAGE and construct phylogenetic tree using tools inbioinformatics.

Sr. No.	Name of the Practical	No. of Practicals
Module-I Molecular Biology and Bioinformatics		
1.	Lab Safety Techniques and sterilization.	1P
2.	Isolation of bacterial DNA and estimation by UV spectrophotometry (Compulsory)	2P
3.	Isolation of Liver DNA and quantification, Agarose gel electrophoresis of isolated DNA.(Compulsory)	2P
4.	Isolation of RNA and agarose gel electrophoresis.	1P
5.	Concept of biological database, gene and protein search by BLASTA and	1P

	FASTA (Compulsory)	
6	To analyse protein on native PAGE and SDS-polyacrylamide gel electrophoresis.(Compulsory)	2P
7.	Construction of phylogenetics tree for DNA and protein (Compulsory)	1P
8.	Demonstration of DNA amplification by PCR	1P
	Module- II Endocrinology and Parasitology	1P
1	Histology of invertebrate and vertebrate neurosecretory and endocrine structures.(Compulsory)	1P
2	Blood sugar regulation in the crab- role of eye stalk. (Compulsory)	1P
3	Study of retrocerebral complex of the cockroach.	1P
4	Introduction of alloxan diabetes in the mouse/ rat / human. (Compulsory)	1P
5	Gonadectomy in the mouse/ rat.	2P
6	Pancreatectomy in the mouse/ rat.	1P
7	Effect of insulin on blood sugar, hepatic and muscle glycogen of the rat/human. (Compulsory)	1P
8	Thyroidectomy in the rat.	1P
9	Study of life cycle, role as vector & control measures of: Ticks(<i>Argas, Boophilus</i>) Mosquito – any two from- <i>Anopheles/ Aedes/ Culex</i> Any two flies: <i>Tabanus/ Phlebotomus/ Sarcophaga</i> .Cyclops. (Compulsory) (Specimen, Slides or charts may be used.)	2P
10	Ectoparasites&Endoparasites of wild rat, cattle, dog, chick & human including stages in excreta.	2P
11	Study of life cycle of parasitic protozoa: <i>Trypanosoma, Leishmania</i> .(Compulsory)	1P
12	Study of life cycle of helminth parasites: <i>Schistosoma, Echinococcus, Ancylostoma, Dracunculus</i> (Compulsory)	2P
13	Study of Parasites from digestive tract of Cockroach/gut / parasites of hen. (Compulsory)	1P

Module-III Comparative Animal physiology and Environmental Biology

1	Study of nitrogenous waste products of animals from different habitats. (Compulsory)	1P
2	Study of RBCs in different vertebrates and in different physiological conditions.	1P
3	Study of relation of Body size and oxygen consumption in aquatic animals (crab/fish). (Compulsory)	1P
4	Estimation of sugar in rat/crab/human blood. (Compulsory)	1P
5	Determination of bleeding time & clotting time of human blood. (Compulsory)	1P
6	Determination of the heart beat in the crab-effect of temperature & ions.	1P
7	Effect of eye stalk ablation on glucose in the haemolymph of the crab.	1P
8	A visit to aquatic ecosystem and methods for water and plankton collection. (Compulsory)	2P
9	Plankton identification and quantification from river / lake water samples. (Compulsory)	2P
10	Vegetation studies by line, quadrates and belt transect methods and their analysis.	2P
11	Preparation of media for microbial culture, Isolation and culturing of microbes from soil/water samples. (Compulsory)	2P
12	Water analysis for physico-chemical characteristics. (Compulsory)	1P
13	Physico-chemical analysis of soil. (Compulsory)	1P

Note: Latest edition of the recommended books may also be used



Savitribai Phule Pune University

(Formerly University of Pune)

Two Year Degree Program in Zoology

(Faculty of Science & Technology)

Revised Syllabi for

M.Sc. (Zoology) Part-II

(for Colleges Affiliated to Savitribai Phule Pune University)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2020-2021

Title of the Course: M.Sc. (Zoology)**Preamble**

Zoology is a major subject of Basic Sciences which deals with all aspects of animal biology. It includes an interesting range of highly diverse topics. The advancements in biological Sciences demands, a zoology student to be a master of many areas in the subject. This Postgraduate degree program has been designed by the Board of Studies in Zoology of Savitribai Phule Pune University with a tangible understanding of what is needed from zoologists and what zoologists need to pursue as a skilled career. It emulates closely the Benchmark Statement for Biosciences and the guidelines laid down by the University Grants Commission, New Delhi. This Newly designed Curriculum is an appropriate blend of the classical aspects in Zoology which has been the “backbone” knowledge required for all zoologists and the recent and specialized areas. The flexibility in the Curriculum allows the students to choose their areas of interest leading to enhanced employability. Students will be provided sufficient number of hours for their skill development through the Lab Courses and the Project component. The lab courses have differing flavours and priorities to make a good zoologist. This degree offers specialization in areas like Genetics, Animal Physiology and Entomology along with a range of core courses like Biochemistry, Molecular Biology, Comparative Animal Physiology, Developmental Biology, Environmental Biology etc. Various cross cutting issues relating to Environmental biology have been aptly included to develop the students’ sense towards human wellbeing. The field trip/surveys and study tours are included to gives the student an enticing taste of what life is specially outside the walls of the classroom. On successful completion of the programme, the students are expected to understand the key life processes of human and other animal groups, the functioning of molecules, cells, tissues, organs and systems. Also the students will gain increased confidence to use initiative and judgement to make decisions in complex and changeable situations and reflect critically and analytically on personal experience and make informed decisions about further study, training and employment opportunities. The Master of Science (M.Sc.) in Zoology is a Postgraduate program under the Faculty of Science and Technology of Savitribai Phule Pune University Pune. The curriculum designed encompasses subjects like Physiology, Entomology, Genetics, Cell Biology, Developmental Biology, Endocrinology, Biochemistry, Molecular Biology, Freshwater Zoology, Environmental Biology etc. Both classical and applied subjects of Zoology have been rightly blended to offer holistic understanding of the subject.

The Choice Based Credit System (CBCS) will be implemented through this curriculum. This curriculum would certainly felicitate students to develop a strong base of the fundamentals and specialize in the desired area of their fondness and abilities. The students pursuing this program

would get a privilege to select optional subjects of their choice. A total of 210 hours for theory lectures and 180 hours for laboratory work have been prescribed in each semester including a research project (advisable to be start at the first year in consultation with the department staff) to inculcate the research culture amongst students. This newly designed curriculum will allow students to acquire the skill in handling scientific instruments planning and performing in the laboratory and exercising critical judgement, independent thinking and problem solving skills.

M.Sc. Zoology - Course structure & Distribution of Credits

M.Sc. Zoology, Part –I,

Semester-I

Sr. No.	Core Compulsory Theory Paper (CCTP)	Choice Based Optional Paper (CBOP)	Theory/practical	Credit	Core Compulsory Practical Paper (CCPP)	Credit
1	ZOUT 111 Biochemistry and Biochemical Techniques	-			-	4
2	ZOUT 112 Cell Biology and Developmental Biology	-			-	4
3	ZOUT 113 Genetics and English in Scientific Communication.	-			-	4
4	-	ZODT 114 Theory. ----- ----- ZODP 114 Practical	Biostatistics/ Freshwater Zoology Zoology Practical Paper-1	2 2	-	4
5	-	-			ZOUP 115 Basic Zoology Lab-I	4
Total Credit of Semester 1						20

M.Sc. Zoology, Part-I, Semester-II

Sr. No.	Core Compulsory Theory Paper (CCTP)	Choice Based Optional Paper (CBOP)	Theory/ practical	Credit	Core Compulsory Practical Paper (CCPP)	Credit
1	ZOUT 121 Molecular Biology and Bioinformatics	-			-	4
2	ZOUT 122 Endocrinology and Parasitology	-			-	4
3	ZOUT 123 Comparative Animal Physiology and Environmental Biology.	-			-	4
4		ZODT 124 Theory. ----- ZODP 124 Practical	Metabolic pathways / Ichthyology Zoology Practical Paper-2	2 2		4
5	-	-			ZOUP 125 Basic Zoology Lab- II	4
		Total Credit of Semester				20
		2				

M.Sc. Zoology, Part-II, Semester - III

Sr. No.	Core Compulsory Theory Paper (CCTP)	Choice Based Optional Paper (CBOP)	Theory/ practical	Credit	Core Compulsory Practical Paper (CCPP)	Credit
1	ZOUT 231 Special Paper (any one) Animal Physiology-I/ Entomology-I/ Genetics-I	-			-	4
2	ZOUT 232 Fundamentals of Systematics and Economic Zoology	-			-	4
3	ZOUT 233 Research Methodology and Insect Physiology and Biochemistry	-			-	4
4	-	ZODT 234 Theory ----- ZODP 234 Practical	Immunology/ Genetic Toxicology/ Zoology Practical Paper- 3	2 2	-	4
5	-	-			ZOUP 235 Special Lab I	4

M.Sc. Zoology, Part II, Semester – IV

Sr. No.	Core Compulsory Theory Paper (CCTP)	Choice Based Optional Paper (CBOP)	Theory/practical	Credit	Core Compulsory Practical Paper (CCPP)	Credit
1	ZOUT 241 Special Paper-Any One- Animal Physiology-II/ Entomology-II/ Genetics-II	-			-	4
2	ZOUT 242 Mammalian Reproductive Physiology and Aquaculture				-	4
3	-	ZODT 243 Theory	Histology and Histochemistry/ Pest Control	2	-	4
		ZODP 243 Practical	Zoology Practical Paper-4 (Practicals corresponding to ZOUT 241and ZODT 243)	2		
4	-	ZODT 244 Theory	Pollution Biology/ Apiculture	2	-	4
		ZODP 244 Practical	Zoology Practical Paper-5 (Practicals corresponding to ZOUT 242 and ZODT 244)	2		
5	-	-			ZOUP 245 (Project)	4
Total Credit of Semester 4						20

Equivalence of Previous Syllabus:

Semester-I

Old Course (2013 Pattern)	New Course (2019 Pattern)
ZY101T: Biochemistry-I	ZOUT 111 Biochemistry and Biochemical Techniques
ZY102T: Cell Biology	ZOUT 112 Cell Biology and Developmental Biology
ZY103T: Genetics	ZOUT 113- Genetics and English in Scientific Communication.
ZY104T: Biostatistics	ZODT 114 Biostatistics
ZY105T: Skills in scientific communication and Writing	ZOUT 113 Genetics and English in Scientific Communication.
ZY106T: Freshwater Zoology	ZODT 114 Freshwater Zoology
ZY101P: Practicals in Biochemistry	ZOUP 115 Basic Zoology Lab-I
ZY102P: Practicals in Cell Biology	
ZY103P: Practicals in Genetics	
ZY105P: Practicals in Skills in scientific communication and writing	
ZY106P: Practicals in Fresh water zoology	
ZY104P: Practicals in Biostatistics	ZODP 114 Zoology Practical-1
Old Course (2013 Pattern)	
ZY101T: Biochemistry-I	
ZY102T: Cell Biology	
ZY103T: Genetics	
ZY104T: Biostatistics	
ZY105T: Skills in scientific communication and Writing	
ZY106T: Freshwater Zoology	
ZY101P: Practicals in Biochemistry	
ZY102P: Practicals in Cell Biology	
ZY103P: Practicals in Genetics	
ZY105P: Practicals in Skills in scientific communication and writing	
ZY106P: Practicals in Fresh water zoology	
ZY104P: Practicals in Biostatistics	

Semester-II

Old Course (2013 Pattern)	New Course (2019 Pattern)
ZY201T: Biochemistry-II	ZODT 124 Metabolic pathways
ZY202T: Molecular Biology	ZOUT 121 Molecular Biology and Bioinformatics
ZY203T: Developmental Biology	ZOUT 112 Cell Biology and Developmental Biology
ZY204T: Endocrinology	ZOUT 122 Endocrinology and Parasitology
ZY205T: Comparative Animal Physiology	ZOUT 123 Comparative Animal Physiology & Environmental Biology
ZY206T: Biochemical Techniques/Ichthyology	ZOUT 111 Biochemistry & Biochemical Techniques ZODT 124 Ichthyology
ZY201P: Practicals in Biochemistry-II	ZOUP 125 Basic Zoology Lab-II
ZY202P: Practicals in Molecular Biology	
ZY203P: Practicals in Developmental Biology	
ZY204P: Practicals in Endocrinology	
ZY205P: Practicals in Comparative Animal Physiology	

Semester-III

Old Course (2013 Pattern)	New Course (2019 Pattern)
ZY 301T Animal Physiology I (special)	ZOUT 231 Special Paper Animal Physiology-I
ZY 301T Entomology I (special)	ZOUT 231 Special Paper Entomology-I
ZY 301T Genetics I (special)	ZOUT 231 Special Paper Genetics-I
ZY 302T Immunology	ZODT 234 Immunology
ZY 302T Environmental Biology	---
ZY 303T Genetic toxicology	ZODT 234 Genetic toxicology

ZY 303T Aquaculture	ZOUT 242- Aquaculture
ZY 304T Insect Physiology and Biochemistry	ZOUT 233- Insect Physiology and Biochemistry
ZY 305T Research methodology	ZOUT 233- Research methodology
ZY 306T Parasitology	--
ZY 307T Fundamentals of Systematics	ZOUT 232- Fundamentals of Systematics
ZY 308T Insect Ecology	--
ZY 309T Toxicology I	--
ZY 301P Practicals in Animal Physiology I (special)	ZROUP 235 Special Lab I ZODP 234 Practical
ZY 301 P Practicals in Entomology I (special)	
ZY 301 P Practicals in Genetics I (special)	
ZY 302 P Practicals in Immunology	
ZY 302 P Practicals in Environmental Biology	
ZY 303 P Practicals in Genetic toxicology	
ZY 303P Practicals in Aquaculture	
ZY 304P Practicals in Insect Physiology and Biochemistry	
ZY 305P Practicals in Research methodology	
ZY 306P Practicals in Parasitology	
ZY 307P Practicals in Fundamentals of Systematics	
ZY 308P Research Project	
ZY 309P Practicals in Toxicology I	

Semester-IV

Old Course (2013 Pattern)	New Course (2019 Pattern)
ZY 401T Animal Physiology II (special)	ZOUT 241- Animal Physiology II (special)
ZY 401T Entomology II (special)	ZOUT 241- Entomology II (special)
ZY 401T Genetics II (special)	ZOUT 241- Genetics II (special)
ZY 402T Economic Zoology	ZOUT 232- Economic Zoology
ZY 402T Bacteria and phage Genetics	--

ZY 403T Mammalian Reproductive Physiology	ZOUT 242- Mammalian Reproductive Physiology
ZY 403T Biodiversity assessment	--
ZY 404T Histology and Histochemistry	ZODT 243 Histology and Histochemistry
ZY 405T Pollution Biology	ZODT 244 Pollution Biology
ZY 406T Apiculture	ZODT 244 Apiculture
ZY 407T Pest control	ZODT 243 Pest control
ZY 408T Toxicology II	--
ZY 401 P Practical Animal Physiology II	ZODP 243 Practical
ZY 401 P Practical Entomology II	ZODP 244 Practical
ZY 401 P Practical Genetics II	ZODP 244 Practical
ZY 402 P Practical Economic Zoology	ZOUP 245 (Project)
ZY 402 P Practical Bacteria and phage Genetics	ZOUP 245 (Project)
ZY 403 P Practical Mammalian reproductive physiology	ZOUP 245 (Project)
ZY 403 P Practical Biodiversity assessment	ZOUP 245 (Project)
ZY404 P Practical Histology and histochemistry	ZOUP 245 (Project)
ZY405 P Practical Pollution biology	ZOUP 245 (Project)
ZY406 P Practical Apiculture	ZOUP 245 (Project)
ZY308 P Research Project	ZOUP 245 (Project)
ZY 408 P Practicals in Toxicology II	ZOUP 245 (Project)

Detailed Syllabus with Recommended Books:

Program outcomes (POs): After successfully completing the M.Sc. Zoology program students will be able to:

PO1. Zoology knowledge: Apply the knowledge of Zoology, Life Sciences and allied subjects to the understanding of complex life processes and phenomena.

PO2. Problem analysis: Identify, review research literature, and analyse complex situations of living forms.

PO3. Design/development of solutions: Design processes/strategies that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in real situations.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and ICT tools for understanding of the subject.

PO6. The Postgraduate and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the natural and anthropogenic activities in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. Identify a range of invertebrates and vertebrates and justify their conservation.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the work/research practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex life activities with the scientific community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of Zoology and management principles and apply these to one's own work, as a member and leader in a team.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Following is the syllabus of each course along with the course outcomes:

M.Sc. Zoology, Part II, Semester – III

Course Code and Course Name:

ZOUT231: Animal Physiology- I (Special Paper)

(4 Credits: 60 Lectures)

Semester III

After successfully completing this course, students will be able to: CO1:

CO1: Explain the membrane physiology and its dynamics.

CO2: Explain the concept of nutrition and digestion.

CO3: Explain the structure, contraction and types of contraction of muscle.

CO4: Illustrate bioluminescence and animal electricity with examples and its significance

CO5: Correlate the organisms Internal and external environments with homeostasis and biological Clocks.

CO6: Diagrammatically represent the mechanism of respiration, gas exchange and transport of O₂ and CO₂

Sr. No.	Name of the topic	Lectures allotted
1.	External and Internal environment 1.1 External environment: the atmosphere, aquatic & terrestrial environment 1.2 Internal environment: Extracellular and intra cellular environment 1.3 Homeostasis and regulation: tolerance and resistance, acclimatisation and acclimation, regulatory mechanism. 1.4 Biological clock and their regulation: Circadian rhythms lunar and tidal rhythm, circa annual rhythm, photoperiodism.	(08L)
2.	Membrane Physiology 2.1 Membrane structure, membrane permeation, diffusion mediated transport, dynamics of semi permeable membrane. 2.2 Resting membrane potential, diffusion, equilibrium potential, Goldman-Hodkin- Katz potential, conductance, current, capacitance 2.3 Excitable cell membrane: action potential, role of various ion channels, role of Na ⁺ K ⁺ pump, properties of action potentials	(10L)
3.	Physiology of Digestion 3.1 Nutritive requirements (concept of balanced diet), Regulation of hunger, satiety 3.2 Digestion and absorption in the G.I tract: carbohydrate, lipids & protein 3.3 Control and regulation of digestion 3.4 Calorimetry and BMR	(09L)
4.	Respiration 4.1 Internal and external respiration; Anatomy of respiratory system 4.2 Pulmonary respiration: Partial pressure, inspiration and expiration, Lung volume and capacities	(10L)

	4.3 Gas exchange across the pulmonary and systemic capillaries 4.4 Gas transport; O ₂ transport, CO ₂ transport and abnormalities in the blood gas content 4.5 Neuronal control of respiration, role of central and peripheral receptors 4.6 Other functions of respiratory system, waste elimination	
5.	Muscle Physiology 5.1 Structure of skeletal muscle and molecular basis of skeletal muscle contraction, types of contraction, twitch summation and tetanus, relation between muscle length and tension, velocity of contraction 5.2 Chemical basis of muscle contraction 5.3 Innervation of muscles, excitation and contraction coupling 5.4 Skeletal muscle fiber types, contractile machinery of smooth muscle	(09L)
6.	Bioluminescence and Animal electricity 6.1 Bioluminescence: phyletic distribution, structure of luminescent organs, biochemical and molecular mechanism. 6.2 Animal electricity: electro receptors electro organs and their structure and functions	(08L)
7.	Buoyancy 7.1 Definition, density reduction 7.2 Gas floats with examples 7.3 Swim bladder with example	(06L)

REFERENCE BOOKS:

1. Animal Physiology: Adaptation and Environment (1997) Knut Schmidt-Nielsen Publisher: Cambridge University Press.
2. Principles of Animal Physiology (2006), C. D. Moyes and P. M. Schulte. Publisher - Pearson Education Inc. and Dorling Kindersley Publishing Inc.
3. Text book of Medical Physiology 10th edition (2001), A. C. Guyton and J. E. Hall. Publisher - W. B. Saunders Company, Philadelphia. –
4. Principles of Anatomy and Physiology, 11th edition (2006), G. J. Tortora and B. Derrickson. Publisher-John Wiley and Sons Inc.
5. Endocrinology, 5th edition (2008), Mac. E. Hadley. Publisher-Pearson Education Inc. and Dorling Kindersley Publishing Inc.
6. Comparative Vertebrate Endocrinology 3rd edition (1998), P. J. Bentley. Publisher Cambridge University Press.
7. Vertebrate Endocrinology 3rd edition (1997), D. O. Norris. Publisher- Academic Press: An imprint of Elsevier.
8. The World of the Cell, 7th edition, (2005), Wayne M. Becker, Lewis J. Kleinsmith, Jeff Hardin., Publisher - Benjamin Cummings.
9. Principles of Animal Physiology (2nd Edition) (2007) Christopher D. Moyes , Patricia M.

Schulte

10. Animal Physiology, Third Edition (2012) Richard W. Hill, Gordon A. Wyse, Margaret Anderson
11. Functional Anatomy and Physiology of Domestic Animals 4th Edition (2009) William O. Reece Animal Physiology 2nd Edition Richard W. Hill Publisher: Sinauer Associates, Incorporated
12. Eckert's Animal Physiology (2004) Roger Eckert, D.J. Randall, Warren Burggren, Kathleen French Publisher: W.H.Freeman & Co Ltd
13. Principles of Animal Physiology (2013) Christopher D. Moyes, Patricia M. Schulte • Publisher: Pearson Education Limited
14. Environmental Physiology of Animals (2004) Pat Willmer, Graham Stone, Ian Johnston • Publisher: Blackwell Publishing Ltd
15. Introduction to Animal Physiology (1998) Ian Kay Publisher: Bios Scientific Publishers Ltd

Note: Use the latest editions of the recommended books

Course Code and Course Name:**ZOUT 231 : Entomology- I (Special Paper)****4 Credits: 60 Lectures****Semester III****After successfully completing this course, students will be able to:**

CO1: Define entomology and Insects and understand origin and evolution of insects and their relation to other arthropods.

CO2: Give outline of Classification of insects up to family with distinguishing characters and examples of each order and family.

CO3: Explain the structure, chemical composition and functions of Integument and Derivatives of Integument.

CO4: Explain the structure, modifications of insect body regions and their appendages.

CO5: Explain the Comparative anatomical and histological structure of various body systems.

CO6: Explain the location structure and functions of various Endocrine and Exocrine glands.

CO7: Explain the location and structure of Light and Sound producing organs in various insects

Sr. No.	Name of the topic	Lectures allotted
1.	Introduction to Entomology: Definition, Origin, Evolution and Inter-relationship of insects with other arthropods.	(04L)
2.	General outline of Classification and Phylogeny of insects up to family : Apterygote insects (4 orders), Exopterygote insects (16 orders) and Endopterygote insects (9 orders).	(19L)
3.	Integument : Structure, chemical composition and functions. Derivatives of Integument: Cuticular appendages & Processes.	(02L)
4.	Comparative study of : Head and its appendages; Thorax and its appendages ; Abdomen and its appendages.	(09L)
5.	Comparative anatomical and histological study of the following : Digestive system, Respiratory system, Circulatory system, Excretory system, Reproductive system, Nervous system and Sense organs.	(20L)
6.	Endocrine and Exocrine glands and Hormonal action.	(04L)
7.	Light and Sound producing organs.	(02L)

REFERENCE BOOKS:

1. A Text book of Entomology-By H. H. Ross (John Wiley and Sons, Ins. New York,).
2. An Introduction to Entomology- By J. H. Comstock (Ithaca, New York).
3. General & Applied Entomology- By K. K. Nayar, T.N. Anathakrishnan & B.V. David, (Tata McGraw-Hill, New Delhi).

4. General Entomology, 2nd edition- By M.S. Mani Oxford & IBH Publishing Company, New Delhi.
5. Imm's text book of entomology by O. W. Richards and R. G. Davies (Methuen and com, London) vol. I and II
6. Introduction to comparative Entomology- By R. M .Fox and J. W. Fox (Reinhold, New York)
7. Modern Entomology, 2nd edition- By D. B. Tembhare (Himalaya Publication House, Bombay).
8. Principles of insect morphology- By R. E. Snodgrass (Tata Mc-Graw Hill Bombay).
9. The Insect: Structure & Function- By R. F. Chapman (E.L.B.S., & E.U.P. London).

Note: Use the latest editions of the recommended books

Course Code and Course Name:**ZOUT 231 : Genetics- I (Special Paper)****(4 Credits: 60 Lectures)****Semester III**

After successfully completing this course, students will be able to:

CO1: Define the basic terminologies in Genetics

CO2: Elaborate the advantages of model organisms used in genetic studies

CO3: Apply molecular methodologies in genetic analysis

CO4: Estimate gene frequencies

Sr. No.	Name of the topic	Lectures allotted
1.	Model Genetic System: Life cycles, genetic nomenclature and advantages of the following organisms commonly used in genetic studies: 1.1 T phages 1.2 <i>E.coli</i> 1.3 <i>Saccharomyces cerevisiae</i> and <i>Schizosaccharomyces pombe</i> 1.4 <i>C. elegans</i> 1.5 <i>Drosophila</i> 1.6 Zebra fish 1.7 Mouse	6L
2.	Advanced Population Genetics: 2.1 Recapitulation of basic concepts and Hardy-Weinberg law. 2.2 Estimation of gene frequencies in population through mutation, migration and selection, selection-mutation equilibrium, derivation and genetic equations for above. 2.3 Assortative mating, inbreeding and genetic drift.	12L
3.	Quantitative genetics: 3.1 Concept of continuous variation, phenotypic variance and its partitioning into subcomponents. 3.2 Co-variance, correlation and regression, degree of genetic determination, measurement of heritability, quantitative inheritance in humans.	12L
4.	Evolutionary Genetics: 4.1 Genetic polymorphism. 4.2 Selection strategies and effects. 4.3 Genetics of speciation: classical and modern concepts. 4.5 Use of molecular information in understanding phylogenetic relationship.	12L
5.	Applications of Molecular methodologies in genetic analysis: 5.1 Introduction to gene localization on chromosomes. 5.2 Chromosomal Probes and Paints. 5.3 Gene Therapy: <i>Ex vivo</i> and <i>In vivo</i> gene therapy and two examples of gene delivery system. 5.4 Reverse Genetics.	12L

	5.5 History of Human genome project: Strategies, methodologies, and current status.	
6.	Genetics in Toxicology: 6.1 History of genetic toxicology and role of FDA, EPA and its guidelines and regulation. 6.2 Role of model organisms in genetic toxicology studies. 6.3 Screening tests: use of test systems- Bacterial, Yeast, <i>Drosophila</i> and Mammalian system.	06L

REFERENCE BOOKS:

1. An Introduction to Genetic Analysis – A.J.F. Griffiths, J. Doebley, C. Peichel, D.A. Wassarman (12th ed.) W.H. Freeman Publ. 2020.
2. Concepts of Genetics – W.S. Klug and M.R. Cummings (12th ed.) Pearson Publ. 2019.
3. Genetics : A conceptual approach – B.A. Pierce (6th ed.) W.H. Freeman Publ. 2016.
4. Lewin’s GENES XII – J.E. Krebs, E.S. Goldstein, S.T. Kilpatrick. Jones and Bartlett Publ. 2018.
5. Human Molecular Genetics – T. Strachan and A. Read (5th ed.) Garland Science Publ. 2018.
6. Genetics – M.W. Strickberger (3rd ed.) Pearson India Publ. 2015
7. Principles of Genetic Toxicology – D. Brusick. Springer (reprint of Basic Book Publ) 2013.
8. Principles of Genetics – E.J. Gardner, M.J. Simmons, D.P. Snustad (8th ed.) John Wiley & Sons 2006.
9. Genetics: Analysis of Genes and Genomes – D.L. Hartl and E.W. Jones (6th ed.) Jones & Bartlett Publ. 2004.
10. Strickberger’s Evolution – B. Hall (4th ed.) Jones and Bartlett Publ. 2008.

Note: Use the latest editions of the recommended books

Course Code and Course Name:**ZOUT 232 : Fundamentals of Systematics and Economic Zoology (4 Credits: 60 Lectures)****Semester III**

After successfully completing this course, students will be able to: CO1:

Fundamentals of Systematics

CO1: Explain principles, methods of biological classification and diversity in kingdom Animalia.

CO2: Explain the importance of taxonomic keys and taxonomic characters.

CO3: Explain the principles of zoological classification and nomenclature

CO4: Discuss the various taxonomic procedures and molecular phylogenetics & phylogeography.

CO5: Illustrate the methodologies used in systematics.

Economic Zoology

CO1: Illustrate the lac culture, apiculture, prawn culture, vermiculture, Poultry, dairy industry and Piggery.

CO2: Explain the role of insects of economic importance.

CO3: Explain parasitic roundworms of animal and plants.

CO4: Signify the role of parasitic and soil protozoan in human welfare.

CO5: Justify the use of animals in pharmaceutical research.

CO6: Explain coral reef and its significance.

Sr. No.	Name of the topic	Lectures allotted
	Fundamentals of Systematics	
1.	Fundamental of Systematics: Biological classification, Hierarchy of Categories and taxa.	2L
2.	Taxonomic keys: Types of taxonomic keys, their merits and demerits. International code of Zoological nomenclature: Its operative principles, interpretation and application of important rules, zoological nomenclature, formation of names	7L
3.	Taxonomic procedures: taxonomic collection preservation, curation process and identification.	3L
4.	Species concepts: Definition and types (Allopatric, sympatric, parapatric, sibling etc.)	2L
5.	Kingdoms of Life: General outline of kingdoms including Monera & Protista. Broad outline & Diversity in kingdom Animalia (Major and Minor phyla).	5L
6.	Methodologies in systematics: Morphology based taxonomy, Numerical taxonomy, Cyto-taxonomy and chemotaxonomy, Molecular systematic, DNA fingerprinting & Molecular markers for detection/evaluation of polymorphism, RFLP, RAPD etc.	8LL

7.	Molecular phylogenetics and phylogeography.	3L
	Economic Zoology	
1.	Animal husbandry: Poultry, Piggery, Dairy industry and wool industry.	08L
2.	Economic importance of insects: Apiculture, Lac culture, Sericulture, House hold insect and stored grain pest and Agricultural pest.	10 L
3.	Economic importance of amphibian, reptiles and birds.	02 L
4.	Vermiculture industry in India.	01 L
5.	Prawn culture	01 L
6.	Nematodes- parasitic roundworms of animals and plants.	01 L
7.	Helminthes as human and animal parasites.	02 L
8.	Concept of Coral reef and its significance.	01 L
9.	Sponge culture and its importance in industry.	01 L
10.	Parasitic protozoan's and their role in human welfare, soil protozoan's and their role in agriculture.	02 L
11.	Model animals in pharmaceutical industry.	01 L

REFERENCE BOOKS:

Fundamentals of Systematics :

1. Kato., The biology of biodiversity, Springer.
2. Avise J.C., Molecular markers, Natural history and evolution, Chapman and Hill, NY.
3. Wilson A.O., biodiversity, Academic Press, Washington.
4. Principals of systematic Zoology by Ernst Mayr.

Economic Zoology :

1. Economic Zoology: An Introductory Text-Book in Zoology, with Special Reference to Its Applications in Agriculture, Commerce, and Medicine, Herbert Osborn, Ulan Press (August 31, 2012)
2. Economic Zoology-Shukla and Upadhaya, Rastogi Publication, 2017
3. A Textbook of Economic Zoology, Dr Sanjeev Jain, Indian Books and Periodicals 2018.
4. Economic Zoology-Manju Yadav , Discovery Publication 2013
5. Economic Zoology-K.R.Ravindranathan , Om Publications 2013
6. Textbook of Economic Zoology- P.R.Venkitaraman Sudharsana Puubl. Kochi 1983
7. A Handbook on Economic Zoology , Dr Jawaid Ahsan And Dr Subhas Prasad Sinha S. Chand Group.
8. Encyclopedia of Economic Zoology, A.A. Khan. Anmol Publications
9. Economic Zoology by. Manju Yadav, Discovery Publishing House Pvt. Limited. Economic Zoology by Malhotra ,Prakash, Adhyayan Publishers & Distributers
10. Introduction to Economic Zoology, Sarkar, Kundu and Chaki, New Central Book Agency; New edition edition (14 May 2014)

Course Code and Course Name:**ZOUT 233 : Research Methodology and Insect Physiology and Biochemistry****(4 Credits: 60 Lectures)****Semester III**

After successfully completing this course, students will be able to:

Research Methodology

CO1: demonstrate knowledge of research processes (reading, evaluating, and developing)

CO2: perform literature reviews using print and online databases.

CO3: select and define appropriate research problem and parameters to prepare a project proposal.

CO4: identify, explain, compare, and prepare the key elements of a research proposal/report.

CO5: compare and contrast quantitative and qualitative research paradigms

CO6: Use sampling methods, measurement scales and instruments, and appropriate uses of each.

CO7: Justify the rationale for research ethics,

Insect Physiology and Biochemistry

CO1: Explain the structure, Chemistry of integument and sclerotization.

CO2: Describe the process of digestion and metabolism

CO3: Explain the characteristics of haemolymph and types of haemocytes.

CO4: illustrate the structure, physiology and biochemistry of flight muscle.

CO5: Demonstrate the process of excretion, detoxification and water balance

CO6: Justify the role of insect hormones in physiological processes.

Sr. No.	Name of the topic	Lectures allotted
	Research Methodology	
1.	Research: Meaning, Objectives, Types of research, Planning research project – Identifying Research problems, selection of problem – formulation of a problems. Literature review- Collection of literature- Books - Journals. Digital library and search of articles - Key words and search - Internet – Google Scholar – Pub med – Infilbnet – Medline	04L
2.	Data Collection: Meaning, Methods and Tools of Data Collection Hypothesis Sampling, Data Processing, Analysis and Interpretation of Data.	03L
3.	Research Design: Meaning and Objectives, Characteristics of good research design, components of the research design & steps in scientific research process.	02L
4.	Quantitative methods: Biostatistics used for analysis of Biological data	02L

5.	Computer application: bioinformatics, databases and their applications	03L
6.	Tools and techniques: <ul style="list-style-type: none"> • Techniques used Purification and characterization of biomolecules: Recapitulation of centrifugation, chromatography and electrophoresis. • NMR, MALDI-TOF, X-ray crystallography, Circular Dichroism CD • Microscopic techniques including Fluorescence microscopy, Confocal microscopy, Atomic force microscopy and live cell imaging FACS analysis. Real time PCR, DNA microarray, New generation DNA sequencing, Protein Microarray. 	10L
7.	Dissertation structure –Components - Writing Introduction – review of literature – Materials & Methods – Presentation of results – Discussion of Results based on literature – Arriving conclusions – Briefing of Summary – Arrangement and how to quote reference in thesis -Appendix.	02L
8.	Publishing of Articles in National and International Journals - Selection of Journals – ISSN Number – Peer reviewed Journals – Science citation index – impact factor and its importance.	01L
9.	Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights – Reproduction of published material – Plagiarism - Citation and acknowledgement Patent Criteria and procedure of patenting, patenting biological material.	03L
	Insect Physiology and Biochemistry	
10.	Integument: Structure, Chemistry, sclerotization, functions.	03 L
11.	Digestion and absorption of proteins, Carbohydrates and lipids.	03 L
12.	Fat body: Structure, physiology, biochemistry, functions. Integration of carbohydrate, fat and acid metabolism	04 L
13.	Ventilatory mechanisms and their control	03 L
14.	Haemolymph: Physico-chemical characteristics of plasma: types and structure of haemocytes, functions.	03 L
15.	Muscle: structure, physiology and biochemistry of flight muscles	03 L
16.	Excretion and water balance: Structure and function of Malpighian tubules. Water balance and nitrogen excretion.	04 L
17.	Endocrines, neurosecretory hormones, chemistry, function and mechanism of hormone action, moulting and juvenile hormones; chemistry and physiology, other peptide and steroid hormones	04 L
18.	Microsomal and extra-microsomal enzymes insecticide degradation and detoxification.	03 L

REFERENCE BOOKS:

Research Methodology

1. Kothari, C.R. (1985): Research Methodology: Methods and Techniques, Wiley Eastern.
2. Dominowski, R.L. (1980): Research Methods, Prentice Hall Inc., New Jersey.
3. Mishra, R.P. (1980): Research Methodology, Handbook Concept Publishing Company, New Delhi.
4. IIPS (1996): Research Methodology, IIPS, Mumbai.
5. Research and Writings – By-P. Ramdas , A.Wilson srnai M.J.Publisher (2009).
6. Scientific thesis writings and Paper presentations-N.Gurumani. M.J.Publisher (2010).
7. Anderson, Durston&Polle 1970: Thesis and assignment, writing Wiley Eastern Limited

8. G. Vijayalakshmi and C. Sivapragasam. (2008) Research Methods –Tip & Techniques, MJP Publishers, Chennai. WWW.mjppublishers.com
9. Malter K, 1972: Statistical analysis in Biology, Chapman Hall, London.
10. Cohen, L. Lawrence, M., & Morrison, K. (2005). Research Methods in Education (5th edition). Oxford: Oxford University Press.
11. Leedy, P. D. (1980). Practical Research: Planning and design. Washington: Mc Millan Publishing Co., Inc.
12. Singh, Y. K. (2006). Fundamental of Research Methodology and Statistics. New Delhi. New International (P) Limited, Publishers

Insect Physiology and Biochemistry

1. Fundamentals of insect physiology, Blum N.S., John Wiley and sons, NY
2. An introduction to insect physiology, Bursell, e. academic press, NY
3. Insect biochemistry and function Candy D.J. and Kilby D.A. Chapman and hall, London
4. Comprehensive insect physiology, biochemistry and pharmacology, Kerkut G.A and Gilbert L.I., Vol 1 to 13 Pergamon press, Oxford, NY
5. The Insects: Structure and Function. Forth ed., Chapman R. F. (1998), Cambridge University Press, UK.
6. Insect Physiology. Prakash, M. (2008), Discovery Publishing House Pvt. Ltd., New Delhi.
7. Physiological Systems in Insects. Second ed., Klowden, Marc (2007), Elsevier, USA
8. The Principles of Insect Physiology, Seventh ed. Wigglesworth, V.B. (1972), Chapman and Hall, London.

Course Code and Course Name:

ZODT 234 : Immunology

(2 Credits: 30 Lectures)

Semester III

After successfully completing this course, students will be able to:

- CO1: List the primary and secondary immune organs.
- CO2: Explain the concepts of immunity, self-nonsel immune response, autoimmune disease.
- CO3: Explain the theories of antibody synthesis and generation of antibody diversity.
- CO4: Explain the principle and application of the common techniques used in Immunology
- CO5: Illustrate the events and dynamics of inflammation
- CO6: Compare the MHC molecules and diseases associated with HLA.
- CO7: Differentiate between active and passive immunization
- CO8: Compare the three pathways of complement fixation pathway.

Sr. No.	Name of the topic	Lectures allotted
1.	Introduction to Immune system. 1.1. Overview of Immunology 1.2. Innate and Adaptive immunity; Humoral immunity and cell mediated immunity 1.3. Primary and secondary lymphoid organ. Tissue, cells and molecules of the human immune system. 1.4. Immediate response to infection: inflammation, cell migration, acute phase response interferons and NK cell. 1.5. Concept of immunity (self- non self, antigen) and active and passive immunization (natural and artificial)	07L
2.	Antibody structure, antibody classes, subclasses, structure-function relationship, iso, idio and allo types., T cell receptors.	04L
3.	Theories of antibody synthesis, generation of antibody diversity (molecular basis), antibody class switching.	03L
4.	MHC, HLA and disease association, immune deficiencies and disorders. Antigen processing & Immunogenetics.	05L
5.	Immunological Tolerance, Autoimmunity	02L
6.	Hypersensitivity.	01L
7.	Immunological memory, types of vaccines and vaccination	02L
8.	Immunotechniques: Antigen-antibody reaction and complement system and complement fixation test.	02L
9.	Hybridoma principle and application, ELISA, immunofluorescence, immunoelectrophoresis, RIA and monoclonal-polyclonal antibody and its application.	04L

REFERENCE BOOKS:

1. Immunology: Kindt T. J., Goldsby R.A. , Osborne B. A., Kuby J. : freeman WH publications.
2. Essential immunology, IvonRoitt, Blackwell Scientific publication, London.
3. Immunology, Roitt I. V., Butterworth Publishers, USA.

Course Code and Course Name:**ZODT 234 : Genetic Toxicology****(2 Credits: 30 Lectures)****Semester III**

After successfully completing this course, students will be able to:

CO1: Define genotoxicity test systems.

CO2: Describe basic toxicological principles and describe how different chemicals are taken up by, processed in and eliminated from the body

CO3: Inspect physical and chemical genotoxic agents being exposed in his/her environment

CO4: Illustrate physical and chemical genotoxic agents.

CO5: Explain efficiency mechanisms of physical chemical genotoxic agents

CO6: Relate genotoxicity and DNA repair mechanisms and relate types of mutation and DNA repair

CO7: Judge about proper genotoxicity test for mutation types

Sr. No.	Name of the topic	Lectures allotted
1.	Toxicology: Definition and its subdivisions, scope and significance of genetic toxicology	03L
2.	Mutations at molecular, functional and chromosomal levels. Mechanisms of Mutagenesis End point mutations and its function, carcinogenicity and transformation. Biological significance of mutagenesis	07L
3.	Mutagenic agents in human environment. Applications of genetic toxicology to human and environmental monitoring	05L
4.	Methodologies used in detection of mutation, functional, cytogenetic effects. Use of Ames test, mammalian systematics, Drosophila etc.	05L
5.	Screening chemicals for genotoxic properties: Screening tests, hazard assessment, Risk analysis tests. Common assays used for testing mutagenic activity using bacteria, yeasts, insects, plants, animals.	07L
6.	Genetic toxicology and its role in the study of congenital malformations	03L

REFERENCE BOOKS:

1. Chemical mutagens- principles and methods for their detection, Ed. Hollander, A. Vol. 1-5, Plenum press
2. Chemical mutagenesis in mammals and men. Eds. Vogel, F. and Rohtborn, G. Springer Verlag

3. Mutagenic effects of Environmental contaminants, Eds. Sutto, H.E. and Harris, M.I., Academic press
4. Mutation research (section on genetic toxicology testing)
5. Genetic Toxicology: Principles and methods, Parry J.M., Parry E.M. (eds) Springer Publ. (2012)
6. Principles of Genetic Toxicology, Second Edition, David Brusick, Springer Science+Business Media New York

Course Code and Course Name:

ZODP 234 : Zoology Practical Paper-3 (Immunology)

(2 Credits: 60

Hours)

Semester III

Note: A total of 15 practicals are to be conducted. 1 practical is of 4 clock hour duration.

After successfully completing this course, students will be able to:

CO1: Identify the pattern of identity of antigen- antibody reaction.

CO2: Identify the microscopic structure of the lymphoid organs.

CO3: Demonstrate immunoelectrophoresis technique.

CO4: Demonstrate the double diffusion techniques.

CO5: Detect the human blood groups by antigen -antibody reactions

CO6: Prepare the human blood smear to identify various blood cells.

Sr. No.	Name of the topic	Lectures allotted
1.	Double diffusion or Ouchterlony technique (using kit). (Compulsory)	(2P)
2.	Demonstration of Immunoelectrophoresis (using kit). (Compulsory)	(2P)
3.	Separation of e gamma globulins from the serum using native PAGE.	(2P)
4.	Histology of lymphoid organs: skin, spleen, thymus, ileum lymph node and bone marrow. (Compulsory)	(1P)
5.	To study the differential count of WBCs. (Compulsory)	(1P)
6.	Cell counting and viability testing using splenocytes (from goat spleen)	(2P)
7.	To estimate the antigen concentration by rocket electrophoresis (kit using). (Compulsory)	(2P)
8.	To study the immunology of blood transfusion (universal donor, universal recipient, Bombay blood group and erythroblastosis foetalis). (Compulsory)	(1P)
9.	Blood group analysis with reference to cross matching.	(1P)
10.	Demonstration of Various routes of egg inoculations for vaccine production using dye. (amniotic, yolk sac, allantoic and chorio-amniotic)	(1P)
11.	Enzyme detection: acid phosphatase, alkaline phosphatase, esterase	(1P)

Course Code and Course Name:**ZODP 234 : Zoology Practical Paper-3****(2 Credits: 60 Hours)****Semester III**

Note: A total of 15 practicals are to be conducted. 1 practical is of 4 clock hour duration.

Sr. No.	Name of the topic	Lectures allotted
1.	Dominant lethal test in <i>Drosophila</i> (Compulsory)	2 P
2.	Sex linked recessive lethal test in <i>Drosophila</i> (Compulsory)	2 P
3.	Micronucleus test in mouse	2 P
4.	Bone marrow chromosome analysis in mouse	2P
5.	Auxotroph mutation induction in Bacteria	2P
6.	Ame's test (Compulsory)	2P
7.	Study of <i>Drosophila</i> mutants and maintaining <i>Drosophila</i> culture. (Compulsory)	2P
8.	DNA analysis using electrophoretic technique	2P
9.	Temporary stained preparation of blood smear	1p

Course Code and Course Name:+**ZOUP 235 : Special Lab I****(4 Credits: 120****Hours)****Semester III**

Note: A total of 30 practicals are to be conducted. 10 practicals from each module are to be conducted. 1 practical is of 4 clock hour duration.

After successfully completing this course, students will be able to:

Module-I: Animal Physiology-I

CO1: Demonstrate the effect of body size and salinity on oxygen consumption in given animal.

CO2: Demonstrate the effect of starvation on liver and muscle glycogen in given animal

CO3: Demonstrate the effect of exercise on breathing, pulse rate and blood lactate level.

CO4: Demonstrate the effect of pH, temperature and inhibitors on salivary amylase.

CO5: Map the taste buds on human tongue

Module-II: Fundamentals of Systematics and Economic Zoology

CO1: Identify museum specimen/pictures of minor phyla, Invertebrates, Protochordates and Vertebrates.

CO2: Identify animals with the help of taxonomic keys.

CO3: Collect and preserve animal samples using common methods.

CO4: Write scientific report of field/ institutional visit.

CO5: Compare the methods of collection and curation of insects.

CO6: Identify the poultry breeds.

CO7: Identify edible freshwater fish from nearby area.

CO8: Demonstrate the apiculture equipment.

CO9: Demonstrate the methods of prawn culture.

CO10: Compare various fishing tools, crafts and gears.

Module-III: Research Methodology and Insect Physiology and Biochemistry

CO1: Use MS excel in presentation and analysis of data using common statistical tests.

CO2: Suggest a suitable title for a research article.

CO3: Write the abstract, key words, result, discussion, conclusion and citations of references.

CO4: Write a research project to seek funding.

CO5: Conduct a scientific survey.

CO6: Perform protein purification experiment.

CO7: Demonstrate the heart and haemocytes of cockroach.

CO8: Demonstrate the effect of starvation on glycogen in insects.

CO9: Demonstrate the effect of temperature on water loss in cockroach.

CO10: Detect the amino acids in insect haemolymph by chromatographic method.

CO11: Determine the oxygen consumption in dragon fly nymph

CO12: Perform the assay of amylase activity in midgut of insect

Sr. No.	Name of the Practical	No. of Practicals
Module-I: Practical Animal Physiology-I		
1.	Body size and oxygen consumption in aquatic animals (Compulsory)	1P
2.	Estimation of Respiratory Quotient by Warburg's Respirometer	1P
3.	Effect of salinity on oxygen consumption in aquatic animals (Compulsory)	1P
4.	Effect of exercise on breathing rate, pulse rate and blood lactate of man (Compulsory)	1P
5.	Effect of pH, temperature and incubation on human salivary amylase activity. (Compulsory)	1P
6.	Absorption spectra of blood pigment (Compulsory)	1P
7.	Mapping of taste areas on human tongue. (Compulsory)	1P
8.	Carbohydrates in mammalian gut (Compulsory)	1P
9.	Effect of starvation on liver and muscle glycogen in mouse (Compulsory)	1P

10.	Preparation of glycerinated muscle fibers and study of its properties. (Compulsory)	1P
11.	Phosphagen kinase in mouse and crab muscle phosphagen	1P
12.	Effect of load on muscles contraction in frog	1P
13.	LDH isoenzymes isolation and detection using agarose gel electrophoresis in heart / skeletal muscle of rat	1P
14.	Determination of Body Mass Index (BMI)	1P
Module-I: Practical Entomology- I		
1.	Method of collection, preservation & presentation of insects.	(02P)
2.	Study of Taxonomy and diagnostic features up to family of Apterygote, Exopterygote and Endopterygote insects (at least one insect from each order). (Compulsory- 3)	(06P)
3.	Study of generalized insect: Grasshopper/ Cockroach i. Systematic position, Habit, Habitat and Important morphological features. ii. Dissection so as to study: Digestive, Nervous and Reproductive system and Retro-cerebral complex. (Compulsory)	(03P)
4.	Temporary mounting of mouth parts, antenna, legs, wings, spiracles and tympanum of a generalized insect. (Compulsory)	(01P)
5.	Dissection of an insect pest (Plant bug or any insect pest as per local availability and legal permissibility) so as to study taxonomy, diagnostic features and anatomy pertaining to digestive, nervous and reproductive systems.	(03P)
6.	Study of head capsule: Structure of head capsule, head orientations and modifications. Study of types of mouthparts and antennae. (Compulsory- 1)	(02P)
7.	Study of general structure of legs and their modifications. Study of general structure of a wing and its modifications. (Compulsory)	(02P)
8.	Study of abdominal appendages.	(01P)
Module-I: Practical Genetics- I		
1.	Analysis of metric trait and estimation of phenotypic variance.	[1P]
2.	Partitioning of phenotypic variance in genetic and non-genetic components in a simulated population. Estimation of DGD.	[1P]
3.	Detection of polymorphism in a population – Biochemical (Enzyme, protein etc.)	[1P]
4.	To study population cage experiments using <i>Drosophila</i> : a) Genetic Drift b) Artificial selection- Experimental simulation and modeling.	[1p]
5.	Extraction of Genomic DNA (<i>Drosophila</i>).	[2P]
6.	<i>In-silico</i> design of PCR primers for a gene of interest.	[1P]
7.	Chromatography of <i>Drosophila</i> eye colour pigments (wild type and/ or eye colour mutants).	[1p]
8.	Microbial genetics: Basic methodology, colony count and growth curve.	[2P]
9.	Microbial genetics: Isolation of Auxotroph (Estimation of frequency) Replica plate technique.	[2P]
10.	Microbial genetics: Bacterial transformation and blue white selection. Calculation of transformation efficiency.	[1P]
11.	Study of conventions of nomenclature of genes, genotypes and gene products in different model systems.	[2P]
12.	Sex-linked recessive lethal test in <i>Drosophila</i> .	[1P]

Module-II: Practical Fundamentals of Systematics and Economic Zoology		
Practical Fundamentals of Systematics		
1.	To Study specimens of Minor phyla. (Compulsory)	1
2.	Study of museum specimens and slides of invertebrates, (2 examples from each phyla). (Compulsory)	2
3.	Study of museum specimens (protochordates and chordates, 1 or 2 examples of each phyla) (Compulsory)	2
4.	Identification of animals with the help of keys- House fly, Honey bee etc. (Compulsory)	1
5.	Identification of animals with the help of keys- Cockroach, Earthworm.	1
6.	Method of collection, Preservation, and Curing of any insect Specimen (Compulsory)	2
7.	Visits to Scientific Institute like Zoological Survey of India/ Animal Museum and Report writing.	2
Practical Economic Zoology		
1.	Study of Prawn culture on commercial basis.	1P
2.	Study of Apiculture equipments. (Compulsory)	1P
3.	Study of Poultry breeds, feeding utensils in poultry. (Compulsory)	2P
4.	Study of Fishing tools: crafts and gear (Compulsory)	
5.	Study of economic importance of freshwater fishes- <i>Catla</i> , Rohu, <i>Labeo</i> , <i>Mrigala</i> , <i>Notopterus</i> , <i>Mystus</i> sp., <i>Clarius</i> , <i>Channa</i> , <i>Heteropneustes</i> , <i>Reba</i> , <i>Wallago</i> . (Compulsory)	2P
6.	Collection and identification of locally available/cultured fishes.	2P
7.	A visit to piggery/ poultry/ pearl culture centre/ apiculture centre/ sericulture centre and report writing (Compulsory)	1P
Module-III: Practical Research Methodology and Insect Physiology and Biochemistry		
Practical Research Methodology		
1.	Selecting a title for the paper, writing the abstract and key words. (Compulsory)	1P
2.	Writing the Discussion Conclusions and Results: Citation of references (Compulsory)	1P
3.	Importance of scientific surveys, primary data and secondary data in research.	1P
4.	Writing a project proposal to a funding agency (Compulsory)	1P
5.	Use of MS Excel in data presentation.	1P
6.	Examples of some common statistical tests. (Compulsory)	2P
7.	Purification of a biomolecule.	1P
8.	Making a ICT enabled scientific presentation. (Compulsory)	1P
9.	Microscopic techniques.	1P
10.	Presentation of any ONE research paper. (Compulsory)	1P
Practical Insect Physiology and Biochemistry		
1.	Kymographic study of ventilatory movement in beetle	1P
2.	Oxygen consumption in dragon fly nymph (Compulsory)	1P
3.	Study of heart and haemocytes of cockroach (Compulsory)	1P
4.	To determine the trehalase activity in haemolymph of any insect	1P
5.	Amino acid in haemolymph of any insect by chromatographic technique	2P

6.	Study of fat body glycogen of cockroach and effect of starvation (Compulsory)	1P
7.	Effect of temperature on water loss in cockroach (Compulsory)	1P
8.	Von Wisselinghs test for presence of chitin in insect cuticle (Compulsory)	1P

M.Sc. Zoology, Part II, Semester – IV

Course Code and Course Name:

ZOUT 241: Animal Physiology- II (Special Paper)

(4 Credits: 60 Lectures)

Semester IV

After successfully completing this course, students will be able to:

CO1: Explain the composition of blood, types of blood cells, vascular dynamics and clotting.

CO2: Illustrate the anatomy and physiology of heart and cardiac cycle

CO3: Describe the excretory system, nitrogenous wastes and renal regulation

CO4: Illustrate the osmoregulatory mechanism in Invertebrates and Vertebrates

CO5: Discuss the neuronal physiology and various potentials.

CO6: Justify the location and structure of eye, ear and taste buds to their functions.

CO7: Justify energy utilization in physiological and metabolic activities.

Sr. No.	Name of the topic	Lectures allotted
1.	Blood and blood vessels: a) Blood composition and function, Haematopoiesis b) Blood clotting and it's molecular mechanism c) Blood vessels and blood pressure: Blood vessel types, Arteries, role as pressure reservoir and arterial pressure: Aeteriole:role in distribution in cardiac output and maintainance of arterial blood pressure, Capillaries and it's functions, veins:its role as blood reservoir and venous return d) Blood pressure-Hypertension and Hypotension	(08L)
2.	Cardiac Physiology: a) Anatomy of heart	(09L)

	<ul style="list-style-type: none"> b) Electrical activity of the heart pace makers, spread of cardiac coupling, action potential of cardiac cells c) Electrocardiography d) Mechanism events of cardiac cycle, Heart sound e) Neuronal and Hormonal control of heart f) Cardiovascular response of exercise 	
3.	<p>Excretion & Osmoregulation:</p> <ul style="list-style-type: none"> a) Nitrogenous waste- ammonia and its excretion, urea, urea cycle, uric acid and its excretion, products of nucleoprotein metabolism, miscellaneous end product of nitrogen metabolism. b) Organ of excretion and urine formation c) Renal regulation and acid –base balance. d) Maintaining water and electrolyte balance and its regulation in aquatic invertebrates & vertebrate, moist skinned animals, arthropods, terrestrial, vertebrate and marine air breathing vertebrates. 	(09L)
4.	<p>Neuronal Physiology:</p> <ul style="list-style-type: none"> a) Nerve cells : Structure & Function b) Excitation and conduction of nerve fiber: Resting membrane potential, Action potential, all or none law, electronic potential, saltatory conduction c) Ionic basis of excitation and conduction d) Neurotransmitter types and receptors: Metabolism of neurotransmitters, Neuropeptides e) Synapse and Neuronal integration f) Impact of drugs and disease on synaptic transmission 	(8L)
5.	<p>Sensory Physiology:</p> <ul style="list-style-type: none"> a) Receptor types, receptor potential and receptor adaptation b) Eye-structure and physiology of vision c) Ear-Hearing and equilibrium, sound waves and it's characters, structure of ear and physiology of hearing and equilibrium d) Chemical senses : Taste and smell e) Tactile sensation / response 	(09L)
6.	<p>Energy metabolism:</p> <ul style="list-style-type: none"> a) Metabolic rate b) Energy storage: Fat and glycogen c) Effect of O₂ concentration: acclimation to low O₂ level, anaerobic metabolism, lactic acid and glycolysis d) Problem of diving and deep sea hydro thermal vent e) Metabolic rate and body size: mammals, birds, marsupials & monotremes f) Energy cost of locomotion: running, swimming, flying g) Effect of high altitude 	(12L)
7.	<p>Stress & Adaptation:</p> <ul style="list-style-type: none"> a) The Autonomic nervous system & HPA axis coordinate the stress response to an acute threat. b) The HPA axis modulates the immune system. c) Chronic stress causes deleterious effects. d) Plasma glucocorticoid concentration shows seasonal variations. 	(05L)

REFERENCE BOOKS:

1. Principles of animal physiology. (2006), C. D. Moyes and P. M. Schulte. Publisher - Pearson Education Inc. and Dorling Kindersley Publishing Inc.
2. Text book of Medical Physiology. 10th edition (2001),. A. C. Guyton and J. E. Hall. Publisher - W. B. Saunders Company, Philadelphia.
3. Principles of Anatomy and Physiology, 11th edition (2006), G. J. Tortora and B. Derrickson. Publisher-John Wiley and Sons Inc.
4. Endocrinology, 5th edition (2008), Mac. E. Hadley. Publisher-Pearson Education Inc. and Dorling Kindersley Publishing Inc.
5. Comparative Vertebrate Endocrinology. 3rd edition (1998), P. J. Bentley. Publisher-Cambridge University Press.
6. Vertebrate Endocrinology. 3rd edition (1997), D. O. Norris. Publisher- Academic Press: An imprint of Elsevier.
7. The World of the Cell, 7th edition, (2005), Wayne M. Becker, Lewis J. Kleinsmith, Jeff Hardin., Publisher - Benjamin Cummings.
8. Molecular Cell Biology, 6th edition (2007). Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Anthony Bretscher, Hidde Ploegh, Paul Matsudaira, Publisher-W. H. Freeman.
9. Molecular Biology of the Cell, 5th edition (2007). Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. Publisher - Garland Science.
10. An Outline of Energy Metabolism in Man, Gordon L. Atkins, William Heinemann Medical Books Limited, London 1981
11. Stress Physiology in Animals, Paul H.M. Balm, Blackwell; 1 edition (20 August 1999).
12. Sensory Systems: Anatomy, Physiology and Pathophysiology, Aage R. Moller, Academic Press 2003.

Course Code and Course Name:**ZOUT 241: Entomology- II (Special Paper)****(4 Credits: 60 Lectures)****Semester IV**

After successfully completing this course, students will be able to:

CO1: Explain Gametogenesis, Fertilization and oviposition.

CO2: Explain embryonic developmental stages such as Cleavage, Blastoderm and Germ band formation; Gastrulation, Blastokinesis, differentiation of germ layers, Segmentation and Appendages formation and organogenesis.

CO3: Explain post-embryonic developmental stages such as Nymph, Naiad, larva, Pupa and Metamorphosis.

CO4: Explain specialized reproductive mechanisms.

CO5: Explain Hadorn's experiments with imaginal disc, Regeneration and Aging.

CO6: Explain Occurrence, Initiation, Preparations for diapauses and its Controls.

Sr. No.	Name of the topic	Lectures allotted
1.	Gametogenesis : Spermatogenesis, Seminal transfer and spermatophore formation; Oogenesis, Structure and Types of insect eggs. Fertilization and oviposition.	(08L)
2.	Insect embryonic development: Cleavage and Blastoderm formation, Germ band formation, Gastrulation, Embryonic membranes, Blastokinesis, Dorsal closure and dorsal organ, Fate/ differentiation of germ layers, Segmentation, Appendages formation and organogenesis in brief.	(18L)
3.	The post embryonic development: Ecllosion from the egg. The developmental stages: Nymph, Naiad, larva, Pupa, Emergence from the pupa/ cocoon. Metamorphosis and Growth.	(20L)
4.	Specialized reproductive mechanism: Oviparity, viviparity, polyembryony, paedogenesis and parthenogenesis.	(04L)
5.	Hadorn's experiments with imaginal disc, Regeneration and Aging.	(06L)
6.	Diapause: Occurrence, Initiation and Preparations for diapauses. Diapause development and Controls.	(04L)

REFERENCE BOOKS:

1. 'The Insect- structure and Function'- by R.F. Chapman , ELBS, London
2. 'A Text book of Entomology'- by H. H. Ross (John Wiley and Sons, Ins. New York,
3. 'Imms' Text Book of Entomology- by O. W. Richards and R. G. Davies, (Methuen & Cc., London,), Vols. I & II.
4. 'Embryology of Insects and Myriapods'- by O. A. Johanson and F.H. Butt, (McGraw Hill, New York,).
5. 'The ecology of insect populations in theory and practice'- by L.R. Clarks P. W. Geier, R.D. Hughes, R.F. Morris (Methuen, London).
6. 'Developmental system: Insects' Vol. I and II- by S. J. Counce and C.H. Waddington (Academic Press, London,).

Course Code and Course Name:**ZOUT 241: Genetics- II (Special Paper)****(4 Credits: 60 Lectures)****Semester IV**

Sr. No.	Name of the topic	Lectures allotted
1.	Solving problems (Numerical: Probability estimation) of Mendelian and non-mendelian genetics.	02L
2.	Basic Human Genetics: 2.1 History of Human Genetics 2.2 Pedigree- Gathering Family history, pedigree symbols, construction of pedigrees, Autosomal inheritance- Dominant & Recessive, Monogenic traits (Sex Linked inheritance, Sex Limited & Sex-influenced traits, mitochondrial traits), MIM number. 2.3 presentation of molecular genetic data in pedigrees 2.4 Complications to the basic pedigree patterns- non penetrance, variable expressivity, pleiotropy, late onset, dominance problems, genetic heterogeneity, genomic imprinting & uniparental disomy, spontaneous mutations, mosaicism & chimerism, male lethality, X- inactivation. 2.5 Parametric and non-parametric analysis, identifying recombinants & non recombinants in pedigree, two- point mapping- LOD score analysis, genetic & physical map distances, genetic markers.	12L
3.	Clinical Genetics : 3.1 Monogenic diseases- 3.1.1 Cystic Fibrosis 3.1.2 Tay-Sachs syndrome 3.1.3 Marphan syndrome 3.2 Triplet repeat based disorders 3.3 Inborn metabolic errors-	15L

	<p>3.3.1 Disorders of carbohydrate metabolism</p> <p>3.3.2 Disorders of nucleic acid metabolism</p> <p>3.3.3 Disorders of lipid metabolism</p> <p>3.3.4 Lysosomal storage disorders</p> <p>3.3.5 Peroxisomal disorders</p> <p>3.4 Disorders of Hematopoietic systems-</p> <p>3.4.1 Overview of blood cell types & haemoglobin</p> <p>3.4.2 Sickle cell anemia</p> <p>3.4.3 Thalassemia</p> <p>3.4.4 Hemophilia's</p> <p>3.5 Prenatal and pre-implantation diagnosis</p> <p>3.5.1 Indications for prenatal diagnosis</p> <p>3.5.2 Indications for chromosomal testing</p> <p>3.5.3 Non- invasive methods</p> <p>3.5.4 Invasive methods</p>	
4.	Epigenetics: concept and applications	2L
5.	Physical mapping methods: 5.1 Low resolution mapping- cell hybrids, radiation hybrid mapping, synteny homology. 5.2 Restriction maps, clone contig maps, STS map, EST map, DNA sequence map.	3L
6.	Immunogenetics: 6.1 Genetic basis of antibody diversity. 6.2 Regeneration of TCR diversity. 6.3 HLA polymorphism and disease association.	3L
7.	Oncogenetics : 7.1 Concepts of oncogenes and tumor suppressor genes. 7.2 Role of oncogenes. 7.3 Cytogenetic studies.	3L
8.	Behavioural Genetics: 8.1 Rothenbuhler's experiment on genetics of Bee behavior (hygienic and non-hygienic Trait). 8.2 Nature-nurture and behavior- 8.2.1 Genetic experiments to investigate animal behavior- 8.2.1.1 Selection studies. 8.2.1.2 Inbred strain studies. 8.3 Identifying genes for controlling behavior- 8.3.1 Induced mutations 8.3.2 Quantitative trait loci. 8.3.3 Synteny orthology. 8.4 Twin and adoption study designs. 8.5 Environmental influence- shared and non-shared environment. 8.6 Genetics of human behavioural defects- Schizophrenia.	5L
9.	Neurogenetics: 9.1 Genetics of Circadian rhythm (sleep-wake cycle), learning and memory mutants in <i>Drosophila</i> . 9.2 Psychopathology- Alzheimer's disease	3L

10.	<i>Drosophila</i> genetics: 10.1 History of <i>Drosophila</i> genetics. 10.2 Genetic basis of Sex determination and dosage compensation in <i>Drosophila</i> . 10.3 Maternal genes and formation of body axis. 10.4 Segmentation genes. 10.5 Homeotic gene functions. 10.6 Regulation of Hox- gene expression	6L
11.	Bacterial and phage genetics: 11.1 Bacteriophage lambda: morphology and structure of nucleic acids, lytic cycle and lysogeny. 11.2 T even and odd phages: bacteriophage T2, T4 and T7 morphology, nucleic acid structure and life cycle. Special features compared to lambda 11.3 RNA phages: Q beta and MS2, replication and concept of overlapping genes	6L

REFERENCE BOOKS:

1. An Introduction to Genetic Analysis – A.J.F. Griffiths, J. Doebley, C. Peichel, D.A. Wassarman (12th ed.) W.H. Freeman Publ. 2020.
2. *i*-Genetics : A molecular Approach – P.J. Russell. Pearson Publ. 2016.
3. Concepts of Genetics – W.S. Klug and M.R. Cummings (12th ed.) Pearson Publ. 2019.
4. Lewin's GENES XII – J.E. Krebs, E.S. Goldstein, S.T. Kilpatrick. Jones and Bartlett Publ. 2018.
5. Genetics – M.W. Strickberger (3rd ed.) Pearson India Publ. 2015
6. Genetics : The continuity of Life – D.J. Fairbanks and W.R. Andersen. Thomson Brooks / Cole Publ. 1999.
7. Principles of Genetics – E.J. Gardner, M.J. Simmons, D.P. Snustad (8th ed.) John Wiley & Sons 2006.
8. Genetics: Analysis of Genes and Genomes – D.L. Hartl and E.W. Jones (6th ed.) Jones & Bartlett Publ. 2004.
9. Developmental Biology – S.F. Gilbert (10th ed.) Sinauer Associates Inc. 2013.
10. Medical Genetics – L.B. Jorde, J.C. Carey, M.J. Bamshad (5th ed.) Elsevier 2015.
11. Genetics in Medicine (Thomson & Thomson) – R.L. Nussbaum, R.R. McInnes, H.F. Willard (8th ed.) Elsevier 2016.
12. Behavioral Genetics – V.S. Knopik, J.M. Neiderhiser, J.C. DeFries, R. Plomin (7th ed.) Worth Publ. 2016. An Introduction to Genetic Analysis – A.J.F. Griffiths, J. Doebley, C. Peichel, D.A. Wassarman (12th ed.) W.H. Freeman Publ. 2020.

Course Code and Course Name:**ZOUT 242: Mammalian Reproductive Physiology and Aquaculture****(4 Credits: 60 Lectures)****Semester IV**

After successfully completing this course, students will be able to:

Mammalian Reproductive Physiology

CO1: Explain the male and female reproductive systems and sexual dimorphic characteristics

CO2: Explain the sexual cycles with examples

CO3: Illustrate the reproductive dysfunctions.

CO4: Diagrammatically represent the hormonal regulation of reproductive processes like pregnancy, lactation and parturition.

CO5: Prepare the flow chart to demonstrate the hormonal coordination of reproductive Processes

CO6: Justify the artificial control of reproduction.

Aquaculture

CO1: Identify the fish diseases and the causative organisms

CO2: Mention the various composite fish culture with significance of each type.

CO3: Describe the methods of freshwater prawn culture and its management.

CO4: Explain the methods of pearl culture and pearl harvesting.

CO5: Illustrate the preparation and management of fish culture ponds.

CO6: Demonstrate the methods of packaging and transport of fish and brood fish.

CO7: Illustrate techniques of fish harvesting, preservation & processing.

CO8: Compare the techniques used in fishery development.

Sr. No.	Name of the topic	Lectures allotted
	Mammalian Reproductive Physiology	
1.	Reproductive Systems: Anatomy of Male Reproductive System, Accessory organs and their function Spermatogenesis, Function of Sertoli cells, Blood Testisbarriers, inhibin, Leydig cell, Capacitation. Functions of Androgens.	05L

	Anatomy of Female Reproductive System.	
2.	Reproductive patterns: Environmental factors and breeding, continuous and seasonal breeders.	02L
3.	Sexual cycles: puberty, oestrous and menstrual cycles and its hormonal regulation. Ovarian cycle and its hormonal regulation. Cycling of non-pregnant uterus and vagina.	04L
4.	Hormonal regulation: GnRH, pituitary gonadotropins, behavioural effects, testicular hormones, testosterone derivatives, inhibin, ovarian hormones: Pituitary gonadal axis, Oestrogen, progesterone's feedback relationships Prostaglandins and their role in reproduction.	04L
5.	Fertilization, Gamete Transportation Pregnancy: conception and blastocyst formation, implantation and delayed implantation, hormonal regulation in pregnancy.	04L
6.	Placenta: formation, types and functions,	02L
7.	Parturition; birth process, Ferguson reflex, neuroendocrine control, purperium	02L
8.	Lactation: Anatomy and growth of mammary glands, Lactogenesis and galactopoiesis. Hormonal regulation and suckling reflex	02L
9.	Reproductive dysfunctions: Aging and reproduction. Climacteric, anatomical, endocrine and genetic disorders.	01L
10.	Artificial control of reproduction: increasing reproductive potential, artificial insemination, in vitro fertilization and embryo transfer, induced breeding, physical, physiological, surgical, chemical methods of contraception in male, female. Infertility: its causes and treatment, Recent advances in female contraception. Prenatal diagnostic test for genetic disorders-foetal ultra-sonography, Amniocentesis, Chorionic villi sampling,	04L
Aquaculture		
1.	Aquaculture concept and its scope Nutritional value of fish	(1L)
2.	Physicochemical parameter of water for fish culture pH, Calcium, Total Alkalinity, Nitrate, Ammonia, Total hardness of fresh water	(3L)
3.	Construction and management of fish culture pond: Construction of ponds, management of ponds, Predatory and weed fishes and their control, Aquatic weeds and their control, Aquatic insects and their control, fish feeding: natural and artificial.	(3L)
4.	Fish breeding: natural and induced. Natural breeding in pond water, Induced breeding- Pituitary extract, selection of breeders, injection of pituitary extract, spawning, Advantages of induced breeding.	(2L)
5.	Transport of fish seed and Brood fish: causes of mortality in transport, methods for packaging and transport, open systems, closed systems, use of chemicals in live fish transport, anesthetic drugs, antiseptics & antibiotics.	(3L)
6.	Fish culture: Selection of cultivable fish, monoculture, composite culture, culture of Indian major carps, Culture of common carps, culture of cat fishes, paddy cum fish culture, mari culture, cage culture, integrated fish farming	(7L)
7.	Fish preservation, processing and byproducts. Fish preservation techniques, fish biproducts.	(2L)

8.	Fish pathology: bacterial, fungal, protozoan and worm diseases of fish.	(2L)
9.	Fresh water prawn culture (<i>Macrobracium rosenbergii</i>): Seed procurement from natural resources, breeding and larval rearing of fresh water prawn, management of cultural ponds, harvesting and marketing.	(2L)
10.	Pearl Culture: Composition & quality of pearl, collection of oysters, rearing of oysters, insertion of nucleus, pearl formation, harvesting of pearls.	(2L)
11.	Technologies in Fisheries development: Geographic Information System (GIS) technology, Use of Information Communication Technology (ICT) in fishes: production aspects, marketing aspects.	(2L)

References:

Mammalian Reproductive Physiology

1. Austin C.R. and Short R.V., Reproduction in mammals Books 1-5, Univ. of Cambridge
2. Hogarth P.H. biology of Reproduction, Blackie and Son, Glasgow, London.
3. Nalbandov, AV, Reproductive Physiology, Lea and Febiger, Philadelphia
4. Turner and Bagnara. General Endocrinology Sixth Edition, W.B. Saunders Company,

Aquaculture

1. Agustí, S. 1991. Light environment within dense algal populations: cell size influences on self-shading. Journal of Plankton Research, 13(4): 863–871.
2. Ahamad Ali, S. 1982. Relative efficiencies of pelletized feeds compounded with different animal proteins and the effect of protein level on the growth of the prawn *Penaeus indicus*. Proceedings of the Symposium on Coastal Aquaculture, Marine Biological Association of India, 1: 321–328.
3. Biswas, K. P. (2002), **A Text Book of Fish, Fisheries & Technology**, Narendra Publishing House, Delhi.
4. Jain, K.K. 2003, **Induced breeding of carps by hypophysation**. In: Carp and Cat fish breeding & culture CIFE. Publication, Versova. Mumbai.
5. Jyoti, M. K. & Sharma, A. 2006. **Fishes, Aid to collection, preservation and identification** Daya Publishing House, New Delhi.
6. Langur, R.K., 2002. **Management of carp rearing ponds**. 62-65. In: Carp and catfish breeding & culture. C.I.F.E., Versova, Mumbai.
7. Mark, D.L. (1983) **Fish Diseases**. T.F.H. Publication Inc. New Jersey.
8. Sharma, B.D. and Sanjappa, M. 1993., **Flora of India**. Botanical Survey of India, Calcutta. 1-639.
9. Sinha, V.R.P. 1999. **Rural Aquaculture in India**. RAP Publications, 21, Bangkok, Thailand.
10. Srivastava, C.B.L. 2005, **A textbook of Fisheries and Indian Fish**.
11. Tamot/P, Mishra, R, Somdutta (2008). Proceeding of taal, 2007 : In 12th Lake Conference : 318-324.

Course Code and Course Name:**ZODT 243: Histology and Histochemistry****(2 Credits: 30 Lectures)****Semester IV**

After successfully completing this course, students will be able to:

CO1: Explain the fundamental tissues in details.

CO2: Describe the process of histological preparations.

CO3: Illustrate the tools used in histological preparations.

CO4: Justify the use of various stains and dyes used in histochemical detection of biomolecules.

CO5: Justify the importance of Immunohistochemistry.

CO6: Draw the structures of various tissues and label them.

Sr. No.	Name of the topic	Lectures allotted
1.	Scope and importance of Histology and Histochemistry Fundamentals of histology: Epithelial, connective, muscular, nervous and other specialized tissues.	05L
2.	Tools in histology: Principles, design and functioning of microtomes, automated microtomes, ultra-microtome, cryostat, problems and troubleshooting.	04L
3.	Techniques in histology: General principles for the preparation of Tissue for Histological studies. Fixation – Principle, Aims and Objectives of fixatives. Chemical action of fixatives on cells and tissue components Processing of fixed samples, dehydration (procedure and significance), embedding, block making, Temporary and permanent preparations, whole mount preparation	05L
4.	Staining (staining methods histochemical and immunohistological methods) dyes and dye binding reactive groups, mordants and mordanting	02L
5.	Fundamentals of histochemical techniques: Histochemical classification of Carbohydrates and Principle for the Identification of Carbohydrates- glycogen (Periodic acid/Shift method (PAS)	02L
6.	Histochemical localization of Mucopolysaccharides by KMNO ₄ /AB and PAS method.	02L
7.	Histochemical classification of Proteins- Principles and mechanism for the identification of total Proteins and Glycoproteins (Bromophenol Blue & Congo red method). Importance of Enzyme histochemistry. -Localization of enzymes in tissues, Alkaline and Acid phosphates.	04L
8.	Histochemical localization of Nucleic Acids, DNA and RNA (Feulgen reaction &Pyroninmethod).	02L

9.	Application of Histochemical methods for the detection of various types of Carcinoma and Immunofluorescent techniques	02L
10.	Histochemical classification of Lipids. Principle for the demonstration of Lipids in various animal tissues (Copperphthalocyanin method and Sudan Blank- B method)	02L

Reference books: -

1. Text book of Histology Roland lesson DL. WB Saunders Company, Tokyo.
2. Histology: Roland lesson and Thomas Leesan WB Saunders company Co., Canada
3. Histochemistry Vol. I II III A G E pearse Churchill Livingstone NY
4. Histochemistry in Focus, A source book of Technics and Research needs (2007), K.Shyamasundari and K.Hanmantha Rao, MJP Puplichers, Chennai.
5. An introduction to Functional Histology, Bourne, G.H. (1988), Churchil, London.
6. Histochemical Techniqes, Cassilmann, W.G.B (1988), Methuen, London

Course Code and Course Name:

ZODT 243: Pest Control

(2 Credits: 30 Lectures)

Semester IV

After successfully completing this course, students will be able to:

CO1: Explain the Pest, nature of damage caused by pests and pest control.

CO2: Explain medical, veterinary, Household and stored grain pests.

CO3: Explain the Principles and methods of pest control including Biological control measures.

CO4: Explain the Integrated pest management (IPM)

CO5: Explain the Non- insect pest and their control: Rat, Bandicoots, Crabs, Snails, Slugs, Birds and Squirrels.

CO5: Explain the principle and working of pesticide appliances.

Sr. No.	Name of the topic	Lectures allotted
1.	Introduction of the pest control : Pest, pest control, types of pests and their importance and damage caused by pests.	02L
2.	Brief outline of medical and veterinary entomology with reference to important measures to control the vectors. Household and stored grain pest and their control measures.	06L
3.	Principles and methods of pest control: Cultural control measures, Physical control measures, Mechanical Control measures, Chemical control measures. Types and mode of action. Insecticidal formulations and dilutions. Drawbacks of chemical control.	12L

	Biological control measures: History, principles and scope of biological control. Biological agents: important groups of Parasitoids, predators and pathogens. Advantages and Drawbacks of Biological control, Biological Control Management.	
4.	Autocidal control : Chemosterilants and radiations for sterilization, Male sterile Theory, Hormones and Pheromones, Attractants and Repellants. Integrated pest management (IPM) : Principles and application	06L
5.	Non- insect pest and their control: Rat, Bandicoots, Crabs, Snails, Slugs, Birds and Squirrels.	02L
6.	Pesticide- Appliances: Sprayers and Dusters, Hazards of Pesticides and Antidotes.	02L

Reference Books

1. "Pest control- A Survey" By A. Woods. (McGraw-Hill, London, 1974).
2. Pest control" – By W. W. Kilgore and R. L. Doutt (Academic Press, New York, 1967).
3. Integrated Pest Management- By J. L. Apple and R. E. Smith, Plenum Publication Co., New Delhi.
4. An Introduction of Biological Control- By R.V.D. Boarscho, P. S. Y. Messenger and A. P. Gaiter, Plenum Publication Co.
5. Insect Pests and their Control- By Evans J.W., Asiatic Publ., New Delhi.
6. Applied Entomology, Vol- 1, 2nd Edition- By K.P. Srivastava, Kalyani Publishers, New Delhi.

Course Code and Course Name:**ZODP 243: Zoology Practical Paper- 4****(2 Credits: 60 Hours)****Semester IV**

Note: A total of 15 practicals are to be conducted. 10 practicals from module I (Practicals corresponds to ZOUT 241) and 5 practicals from module II (Practicals corresponds to ZODT 243) are to be conducted. 1 practical is of 4 clock hour duration.

After successfully completing this course, students will be able to:

Animal Physiology- II

CO1: Determine the bleeding and clotting time of human blood.

CO2: Demonstrate the invertebrate heart.

CO3: Calculate the heartbeats of *Daphnia/Drosophila* larva.

CO4: Determine serum urea and protein and glucose in human blood and urine.

CO5: Justify the effects of various physical and chemical factors on frog heart and muscle.

Entomology- II

CO1: Identify the histological structure of male and female reproductive system of insect.

CO2: Identify the eggs of different insects.

CO3: Identify the different embryonic stages of insects.

CO4: Identify the different post-embryonic stages of insects.

CO5: demonstrate various body organs, systems and appendages of housefly and butterfly.

Histology and Histochemistry

CO1: Identify the various tissues with the help of permanent slides.

CO2: Demonstrate the effect of fixatives on tissues.

CO3: Detect the biomolecules with histochemical staining methods.

CO4: Sketch and label the microscopic details of tissues.

CO5: Prepare the permanent histological slides.

Pest Control

CO1 : Identify beneficial and harmful insects.

CO2 : Identify and classify insect pest of agricultural, veterinary and public health importance.

CO3 : Know the effects of contact insecticides and fumigants on behavior of insect pests.

CO4 : Determine the LD₅₀

CO5 : Behavior of insects to repellants and attractants.

CO6 : Know the principle and working of pesticide appliances.

CO7 : Identify and know the role of biological controlling agents.

CO8 : Know the non-insect pests.

Sr. No.	Name of the Practical	No. of Practicals
Module- I : Practical Animal Physiology- II		
1.	Determination of bleeding time and clotting time in man (Compulsory)	1P
2.	Study of invertebrate (earthworm and crab) heart	1P
3.	Ionic effects on perfused heart of frog (with the help of ICT tool/ Charts/diagrams.)	1P
4.	Effect of adrenalin and acetylcholine on perfused heart of frog (with the help of ICT tool/ Charts/diagrams.) (Compulsory)	1P
5.	Osmotic stress and volume change in earthworm	1P
6.	Effect of temperature on water loss in cockroach (Compulsory)	1P
7.	Detection and measuring of heart beats (Manually) in Drosophila larva/Daphnia.	1P
8.	Detection of allantoin in mammalian urine (Compulsory)	1P
9.	Study of Glomerular filtration rate by creatinine clearance	1P
10.	Study of Types of heart (Myogenic and Neurogenic)	1P
11.	Estimation of SGOT/SGPT from blood sample (Source of blood: Local recognized pathology laboratory)	1P
12.	Determination of protein, glucose in Urine. (Compulsory)	1P
13.	Determination of protein, glucose in Urine from diabetic patient. (Compulsory)	1P
14.	Qualitative Analysis: 1) Preparation and study of Urine crystals. 2) Estimation of serum urea. (Compulsory)	1P
15.	Normal & abnormal constituents of human urine (Compulsory)	1P
16.	Quantitative estimation of salt gain and salt loss by fresh water Crab.	1P
17.	Total RBC, WBC and Different WBC count- A comparative study of fish, goat and human. (Compulsory)	1P
18.	Estimation of blood Sodium, potassium, Calcium	1P
19.	Estimation of blood alkaline & acid phosphatases	1P
20.	Estimation serum uric acid (Compulsory)	1P
Module- I : Practical Entomology- II		
1.	Histological studies of male reproductive system (Testes, Vas deference, Ejaculatory duct, Accessory gland and spermatogenesis). (Compulsory)	(01P)
2.	Histological studies of female reproductive system (Ovariole, lateral oviduct, common oviduct, Accessory glands, bursa copulatrix, spermatheca). (Compulsory)	(01P)
3.	Study of types of Eggs in insects. (Compulsory)	(01P)
4.	Early embryology of insect: cleavage, blastula, germ band, gastrula, embryo- 1 day old, 2 day old and 3 day old in suitable insect.	(01P)
5.	Study of post embryonic development of insects: Collection and study of types of Nymph, naiads, larvae and pupae. (Compulsory)	(02P)

6.	Dissection of House fly: The digestive system, Nervous system, Male and Female Reproductive System; Temporary mountings of antenna, halter, legs and ovipositor. (Compulsory)	(03P)
7.	Dissection of butterfly: The digestive system, Nervous system, Male and Female Reproductive System, Temporary mountings of antenna, scales and ovipositor. (Compulsory- 2)	(03P)
Module- I : Practical Genetics- II		
1.	Methodology for constructing Human Pedigree.	[1P]
2.	Analysis and construction of typical pedigrees for autosomal dominant and recessive genes, sex linked dominant and recessive genes.	[1P]
3.	Preparation of metaphase chromosomal spreads from any vertebrate model system.	[1P]
4.	G banding and C banding on mouse metaphase spread	[2P]
5.	Study of courtship behavior in wild type and mutant <i>Drosophila</i> .	[1P]
6.	Study of maternal effect mutants : Bicoid and Nanos.	[1P]
7.	Preparation of metaphase chromosomal spread of 3 rd instar larva of <i>Drosophila</i> (from brain Ganglion).	[2P]
8.	Measurement of olfaction activity in <i>Drosophila</i> larvae and Adult Fly [The olfaction trap assay for behavioural genetics and screening].	[1P]
9.	Measurement of Locomotory activity in <i>Drosophila</i> larvae and Adult Fly [flight escape assay for behavioural genetics and screening].	[1P]
10.	Larval mechanosensation assay in <i>Drosophila</i> .	[1P]
11.	Concept of genetic disorder databases and demonstration of use of OMIM.	[1P]
12.	Open field Activity test and Elevated plus maze test for anxiety levels in laboratory mice.	[1P]
Module- II : Practical Histology and Histochemistry		
1.	Study of different types of tissue with help of permanent slides (Compulsory)	(2P)
2.	Preparation of different reagent/stains for histology (Compulsory)	(2P)
3.	Block preparation and sectioning (Compulsory)	(2P)
4.	Effect of fixatives, fixation of tissues	(1P)
5.	Comparative study of effect of fixative on a given tissue	(1P)
6.	Mucopolysaccharide staining, AB pH 1.5, 2.5 (Compulsory)	(1P)
7.	Proteins and lipid staining by Sudan black (Compulsory)	(1P)
8.		
9.	Nucleic acid staining: methyl green, pyronine, feulgen stain (Compulsory)	(1P)
10.	Effect of fixatives on tissue sections- liver	(1P)
Module- II : Practical Pest Control		
1.	Morphological and taxonomic study of insect pest of agricultural importance. (Any 10).	(01)
2.	Study of insect pests of veterinary and public health importance. (Compulsory)	(01)
3.	Study of Household and stored grain pests. (Compulsory)	(01)

4.	Study of effects of contact poison on pests: Chlorinated hydrocarbons, Organophosphates and Carbamate.	(01)
5.	Calculation of LD ₅₀ and effects on behavior. (Compulsory)	(01)
6.	Study of respiratory poisons (fumigants)- Carbon tetrachloride, ethylene dichloride and Nicotine. (Compulsory)	(01)
7.	Study of Pesticide appliances: Sprayers and Dusters.	(01)
8.	Study of Parasitoids, predators and pathogens in biological control.	(01)
9.	Study of Non- insect pests : Rat, Bandicoots, Crabs, Snails, Slugs, Birds and Squirrels.	(01)
10.	Study of insect attractants and repellants (any two). (Compulsory)	(01)

Course Code and Course Name:

ZODT 244: Pollution Biology

(2 Credits: 30 Lectures)

Semester IV

After successfully completing this course, students will be able to:

CO1: Explain the organization of biosphere.

CO2: Explain in details the types of pollution.

CO3: Describe the pollution monitoring strategies.

CO4: Illustrate the bioassay methods.

CO5: Elucidate the methods to study the impact of pollutants.

CO6: Justify the importance of biomedical waste management.

Sr. No.	Name of the topic	Lectures allotted
1.	Biosphere: Introduction, hydrosphere, lithosphere, atmosphere. (2L)	2L
2.	Pollution: Types of pollution (Air, Water, Agricultural), pollutants and effect of pollution on health, on biosphere and on economy. Eutrophication: Definition, Limnology of lake, process of eutrophication (3L)	3L
3.	Noise pollution: Characteristics of sound, source, effects and control measures of noise pollution.	3L
4.	Pesticide pollution: Pesticides and their kinds, possible sources and pathways of pesticide Pollution. Impact of pesticides on living organisms	2L
5.	Radioactive pollution: Types, sources and effects, radioactivity assessments and control.	3L
6.	Bioassay: Purpose of bioassay, selection and test organisms, pollutant bioassay using fish	2L
7.	Pollution monitoring: strategies for water, soil, noise.	2L
8.	Histological, biochemical and physiological methods to study Impact of pollutants on animals.	3L

9.	Bioconcentration, Bioaccumulation and Biomagnifications of pollutants- Causes and Consequences.	3L
10.	Biological methods for assessment of environmental quality.	3L
11.	Biomedical waste – Handling and Management.	2L
12.	Environment protection act 1986	2L

References

1. Ecology, E.P. Odum, Amerind publ.
2. Environmental biology, P.D. Sharma, Rastogi Publ.
3. Environmental pollution, H.M. Dix, John Wiley Publ.
4. Pesticides in aquatic environment, M.A. Q. Khar, Plenum Press.
5. Environmental pollution and its control under international law, R.A. Malviya , Chay Publ.
6. Ecology, Ricklefs, freeman, W.H.
7. Limnology, Welch McGrew Hill Publ.
8. Practical Ecology – K.S. Rao, Ujjain (M.P) Anmol Publ. New Delhi (India)

Course Code and Course Name:

ZODT 244: Apiculture

(2 Credits: 30 Lectures)

Semester IV

After successfully completing this course, students will be able to:

CO1: Explain the basic concepts of apiculture like systematics, colony organization, polymorphism, morphology and foraging.

CO2: Explain the tools and management of apiary.

CO3: Explain the importance of institutions pertinent to apiculture.

CO4: Discuss the setup of beekeeping business.

CO5: Illustrate the bee keeping as occupation.

CO6: Justify the presence of bees to increase the agriculture productivity.

Sr. No.	Name of the topic	Lectures allotted
1.	Biology of Bees : History, Classification and Biology of Honey Bees. Social Organization of Bee Colony.	05L
2.	Rearing of Bees : Introduction to apiculture practices and handling of Beehives. Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth Bee Pasturage Selection of Bee Species for Apiculture Bee Keeping Equipment Methods of Extraction of Honey (Indigenous and Modern)	11L
3.	Diseases and Enemies Bee Diseases and Enemies Control and Preventive measures, Hormones in Apiculture.	06L
4.	Bee Economy : Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc.	03L

5.	Entrepreneurship in Apiculture Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens	05L
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References:

- 1) Bees and Beekeeping D. P. Abrol ,Kalyani Publisher, New Delhi. 51
- 2) A Comprehensive guide to Bees and Beekeeping. D. P. Abrol. Scientific Publisher, New Delhi.
- 3) Honey bees and their management S. B. Withhead. Axis books Publisher, Jodhpur.
- 4) Honey bees: Diseases, Parasites, Pests, Predator and their management. N. Nagaraja and D. Rajagopal , M.J.P Publisher, Chennai.
- 5) A Handbook of Beekeeping Dharamsing and D. P. Singh (Agrobios India (Publisher), Jodhpur.
- 6) Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
- 7) Bisht D.S., Apiculture, ICAR Publication.
- 8) Singh S., Beekeeping in India, Indian council of Agricultural Research, NewDelhi.
- 9) Introduction to disease of bee –Bailey, L
- 10) World of honeybee –Butter C. G.
- 11) Beekeeping in India –Sardar Sing (ICAR).
- 12) The Principle of Insect Physiology-Wigglesworth, V.S.
- 13) Applied Zoology- B. B. Waykar, A. Y. Mahajan, B. C. More . (Prashant Publication Jalgaon)
- 14) D.K. Belsare Beekeeping for livelihood

Course Code and Course Name:**ZODP 244 : Zoology Practical Paper- 5** (*Practicals corresponding to ZOUT 242 and ZODT 244*)**(2 Credits: 60 Hours)****Semester IV**

Note: A total of 15 practicals are to be conducted. 5 practicals from each module (**Module- I :** Practical corresponding to ZOUT 242 MRP, **Module- II :** Practical corresponding to ZOUT 242 Aquaculture and **Module- III :** Practical corresponding to ZODT 244 Pollution Biology/ Apiculture) are to be conducted. 1 practical is of 4 clock hour duration.

After successfully completing this course, students will be able to:

Mammalian Reproductive Physiology

CO1: Identify the histological slides of reproductive organ/tissues.

CO2: Explain the various types of placenta in mammals.

CO3: Comment on merits and demerits of contraceptive devices/methods.

CO4: Illustrate the technique of gonadectomy.

CO5: Perform vaginal smear technique to identify the phases of oestrous cycle.

CO6: Distinguish the male and female anatomical features of reproductive system in mammals.

Aquaculture

CO1: Identify Indian oysters.

CO2: Identify the common freshwater fish used in culture farming.

CO3: Demonstrate the processing and storing methods for fish and prawn.

CO4: Test the freshness of fish/prawn by histological methods.

CO5: Test the freshness of fish/prawn by biochemical methods.

CO6: Prepare the culture of Daphnia and rotifers.

CO7: Estimate the productivity of water bodies.

Pollution Biology

CO1: Identify the bioindicators from given water sample.

CO2: Write a report on eutrophication of water body.

CO3: Determine the LC50 value for the given compound

CO4: Determine the biomass of given sample.

CO5: Analyze pH and salinity of given sample.

CO6: Estimate calcium and magnesium, sulphate from polluted water.

Apiculture

CO1: Identify the honey bees

CO2: explain the bee morphology and behaviour

CO3: Illustrate the bee enemies

CO4: Justify the rearing techniques and bee management

Sr. No.	Name of the Practical	No. of Practicals
	Module- I : Practical Mammalian Reproductive Physiology	
1.	Anatomy of male and female reproductive system in rat/Mouse (Compulsory)	1P
2.	Study of histological slides of male reproductive System-Testis, Vas deferens, Epididymis, Prostate, Seminal vesicle, Cowper's gland (Compulsory)	1P
3.	Study of histological slides of female reproductive System-Ovary, Uterus fallopian tube (Compulsory)	1P
4.	Vaginal smear technique in Rat	1P
5.	Study of placental types (Compulsory)	1P
6.	Study of Uterine smooth muscles	1P
7.	Study of contraceptive devices (Compulsory)	1P
8.	E-Demonstration of Orchiectomy or Vasectomy or Epididymectomy in rat/ Mice	1P
9.	E-Demonstration of Ovariectomy in rat/Mice	1P
10.	Visit to artificial insemination Centre and family planning Centre.	1P
	Module- II : Practical Aquaculture	
1.	To Study Physico-chemical parameters of fresh water –pH, Turbidity, Calcium, Nitrate, Ammonia. (Compulsory)	1P
2.	Determination of total alkalinity and total hardness of fresh water.	1P
3.	Determination of dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD) of fresh water. (Compulsory)	1P
4.	Study of conventional method for testing the soil of fresh water pond.	1P
5.	Study of control methods of aquatic weeds.	1P
6.	Study of induced breeding techniques by using pituitary extract.	1P
7.	Study of Indian major carps, prawns, and oysters. (Compulsory)	1P
8.	Study of fish disease (bacterial, fungal, protozoan), head and lateral line erosion and eye disease. (Compulsory)	1P
9.	Use of Geographic Information Technique (GIS) and Information and communication technology (ICT).	1P
10.	Visit to fish farm/ fish industry. (Compulsory)	1P
	Module- III : Practical Pollution Biology	
1.	Study of bio – indicators of pollution. (Compulsory)	1P
2.	Analysis of CO, CO ₂ , NO pollution level data in collaboration with district pollution dept. of Maharashtra state.	1P
3.	Study of Eutrophic ponds /lakes /river.	1P
4.	Visit to water filtration plant/Pollution. (Compulsory)	1P
5.	Analysis of pH and salinity from water /soil sample.	1P
6.	Determination of LC ₅₀ / LD ₅₀ for insecticide / pollution/molluscicide etc. (Compulsory)	1P
7.	Estimation of Biomass by:- i)Wet weight and ii) Dry weight.	1P
8.	Estimation of calcium and magnesium in polluted water. (Compulsory)	1P

9.	Soil analysis for calcium carbonate. (Compulsory)	1P
10.	Estimation of sulphate in polluted water.	1P
	Module- III : Practical Apiculture	
1.	Study of Honey bee species, Castes and Bee morphology. (Compulsory)	(3P)
2.	Study of Beekeeping equipment: Bee box and tools. (Compulsory)	(2P)
3.	Study of Bee products: Honey, Bees wax, Pollens, Royal Jelly, Propolis and Bee venom. (Compulsory)	(2P)
4.	Study of diseases and enemies of honeybee. (Compulsory)	(2P)
5.	Study of bee flora in the locality and observations on bee foraging Behaviour. (Compulsory)	(1P)
6.	A compulsory visit to an Apiary or Central Bee Research and Training Institute or a Beekeeper to gain a firsthand experience in handling bees.	(2P)

**SAVITRIBAI PHULE PUNE UNIVERSITY,
PUNE**

**CHOICE BASED CREDIT SYSTEM
M.Sc. ELECTRONIC SCIENCE
(implemented from June 2019)**

M. Sc. Electronic Science

Structure of Course

Basic structure/pattern (Framework) of the proposed postgraduate syllabus for the two year integrated course leading to M.Sc. (Electronic Science) in the colleges affiliated to Savitribai Phule Pune University.

Course Structure includes 3 compulsory theory courses of 4 credits each, 1 Elective Theory of 2 credits and 1 compulsory practical course of 4 credits as well for each semester

In addition to this, one optional theory course and one practical course of 2 credits each are to be chosen from the given list for optional course

M.Sc. Electronic Science - Course structure & Credits Distribution

M. Sc. Electronic Science(Semester 1)

Sr. No.	Course code	Title of paper	Number of units	Credits
1	ELUT111	Mathematical Methods in Electronics using C	04	4
2	ELUT112	Analog Circuit Design	04	4
3	ELUT113	Digital System Design	04	4
4	ELDT114	Elective Theory Course 1	02	2
5	ELUP115	Practical Course 2 (Compulsory Course)	12 Practical sessions	4
6	ELDP114	Practical Course 1 (Elective Subject 1)	6 Practical sessions	2
			Total Credits	20

Elective Course 1

Any one theory course of 2 credits with corresponding practical course of 2 credits

- **Basics of optical communication**
- **Fundamentals and applications of PIC microcontrollers**

M. Sc. Electronic Science (Semester 2)

Sr. No.	Course code	Title of paper	Number of units	Credits
1	ELUT121	Applied Electromagnetics, Microwaves and Antennas	04	4
2	ELUT122	Instrumentation and Measurement Techniques	04	4
3	ELUT123	Foundation of Semiconductor Devices	04	4
4	ELDT124	Elective Theory Course 2	02	2
5	ELUP125	Practical Course 4 (Compulsory Course)	12 Practical sessions	4
6	ELDP124	Practical Course 3 (Elective course 2)	6 Practical sessions	2
			Total Credits	20

Elective Course 2

Any one theory course of 2 credits with corresponding practical course of 2 credits

- **Fiber optic communication system**
- **Fundamentals and applications of AVR microcontrollers**

Detail Syllabus with Recommended Books

M.Sc. Electronic Science Part 1

SEMESTER 1

ELUT111: Mathematical Methods in Electronics using C (4 Credits)

Objectives:

1. To get familiar with role of differential equations in applied electronics
2. To know about mathematical tools and techniques for network analysis
3. To learn the methods of analysis for CT and DT signals and systems
4. To learn concept of mathematical modeling of simple electrical circuits
5. To solve mathematical methods using C programming
6. To learn various advanced features, graphics and interfacing
7. To learn concepts of object oriented programming in C++

Unit-1: Electronic Signals and Mathematical Tools for Circuit Analysis (15 hrs)

Signals: periodic, non periodic, Continuous Time (CT) and Discrete Time (DT), special electronic signals (impulse, unit step, sinusoidal, ramp, square wave, staircase) Laplace Transform (LT): definition, LT of standard electronic signals, inverse LT, methods of ILT (partial fraction method), properties of LT (shifting, linear, scaling), initial and final value theorem, Convolution theorem, LT of derivatives and Integrals, solution of DE using LT

Unit 2: Transfer functions and Z transform (15 hrs)

concept of Transient and steady state response of systems using transfer function, poles and zeros of transfer function and their significance, applications to simple passive filters such as Low Pass (LP), High Pass (HP)

Concept of transfer function of CT and DT systems, Laplace transformation of electrical circuits, two port network functions, time and frequency domain response Stability analysis of electronic circuits using Routh Herwitz Criterion and using pole zero analysis

Z-Transform (ZT): definition, inverse ZT (partial fraction and residue method), ZT of standard electronic signals, properties, difference equation and solutions using ZT

Unit-3: Differential Equations(15 hrs)

Differential Equation, Ordinary Differential Equations (ODE), DE and their occurrences in real life

M. Sc. Electronic Science

problems, linear differential equation with constant coefficients, partial DE, Introduction to coordinate systems (rectangular, cylindrical and spherical), method of separation of variables, General outline for solution of wave equation in Cartesian and cylindrical coordinate system, Bessel DE and zeros of Bessel function and their significance, solution of Laplace equation in spherical coordinate system

Unit 4: Advanced C programming(15 hrs)

C fundamentals: Introduction of high-level programming language, operators and its precedence, various data types in C, storage classes in C.

Control statements: Decision-making and forming loop in programs.

Arrays & pointers: handling character, arrays in C, pointers in C, advanced pointers, structure and union.

Functions: user defined function, pointer to functions.

Introduction to Embedded C

Text / Reference Books:

1. Advanced Engineering Mathematics, E. Kreyzig, John Wiley and Sons.
2. Network Analysis, G. K. Mittal, Khanna Publication.
3. Circuits and Networks Analysis and Synthesis, A. Sudhakar, Shyam Mohan and S. Pilli, TMH.
4. Digital Signal Processing, S. Salivahan, A. Vallavraj and C. Gnanpriya, McGraw Hill.
5. Network Analysis, M. E. Van Valkenberg, PHI.
6. Network and Systems, Roy Choudhary, Wiley Eastern.
7. Microwave Devices and Circuits, Samuel Y. Liao, 3rd Edition, PHI, 2002.
8. Computer programming in C, V. Rajaraman, Pearson Education, 2nd edition, 2003.
9. The C programming language, Dennis Ritchie, Pearson Education, 2nd edition, 2003.
10. Object oriented programming in C++, Robert Lafore, Galgotia Publications.
11. Programming with C++, John Hubbard, Schaum Outline Series, Tata McGraw Hill.
12. Programming with C, Byron S. Gottfried, Schaum Outline Series, Tata McGraw Hill.

ELUT112: Analog Circuit Design (4 Credits)

Objectives:

1. To learn the characteristics and working of electronic devices
2. To study the various device models
3. To study the wideband and narrowband amplifiers using BJT
4. To develop skills in analysis and design of analog circuits
5. To study the designs of opamp applications

Unit-1: Basic Semiconductor Devices(15 hrs)

Practical diode characteristics (static and dynamic resistance), temperature effects, switching characteristics, diode breakdown, diode applications in wave shaping circuits

BJT construction and biasing, Operation, CC, CB and CB configurations Construction of JFET, types and its operation, parameters of JFET, JFET characteristics, comparison of BJT and JFET, JFET amplifiers

MOSFET, depletion and enhancement, biasing of MOSFET, applications

Unit-2: Frequency Response of Amplifiers(15 hrs)

BJT models and modeling parameters, equivalent circuits for CE, CB and CC configurations, single stage amplifier, small signal analysis, distortion

Design of single stage RC-coupled amplifier with frequency response (f_1 and f_2) Frequency Response: Low and High frequency equivalent circuit, bode plots, Miller effect, square wave testing, frequency response of multistage amplifiers, different coupling schemes and gain of multistage amplifiers

Unit-3: Tuned Amplifier and Oscillators(15 hrs)

Tuned amplifier design, multistage tuned amplifiers: synchronous and stagger tuning cascade configuration, large signal tuned amplifier

Oscillators: design and analysis of LC and RC oscillators, Hartley, Colpitt's, Miller oscillators, phase shift and Wien-bridge oscillators, crystal oscillators and applications

Unit-4: Operational Amplifiers and their Applications(15 hrs)

Practical consideration in opamp based circuit design, opamp parameters such as dc and low frequency parameters and their significance in design of opamp, closed loop stability analysis

M. Sc. Electronic Science

and frequency compensation.

Inverting and non-inverting amplifiers with design aspects such as input and output impedance, common mode errors and limitations, bandwidth, etc.

Bridge and instrumentation amplifier

Practical design aspect of integrator and differentiators, such as offset error and stability, bandwidth considerations.

Concept and applications of PLL.

Active Filters: transfer functions poles and zeros, Design of active filters - LPF, HPF, BPF and BRF (first and higher orders), Butterworth and Chebyshev filters.

Text / Reference Books:

1. Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar, 3rd Edn, McGraw Hill.
2. Electronic Devices and Circuit Theory, Robert Boylestead, Louis Nashelsky, PHI.
3. Design with Operational Amplifiers and Linear IC, Sergio Franco, 3rd Edn, TMH.
4. Electronic Principles, Malvino and Bates, McGraw Hill.
5. Operational amplifier, G.B.Clayton, Elsevier Sci. Tech.
6. Microelectronic Circuits: Analysis and Design, Mohammad H. Rashid, PWS Publishing Company.
7. Pulse, Digital Switching Circuits, Millman Taub, TMH.
8. Electronic devices, Allen Motershed, PHI.
9. Integrated electronics, Millman Halkies, McGraw Hill.

ELUT113: Digital System Design(4 Credits)

Objectives:

1. To understand sequential and combinational logic design techniques
2. To introduce VERILOG
3. To learn various digital circuits using VERILOG
4. To learn PLD, CPLD, FPGA and their applications

Unit-1: HDL for Digital System Design(15 hrs)

VERILOG: design flow, EDA tools, data types, modules and ports, operators, gate- level modeling, data flow modeling , behavioral modeling, tasks and functions, timing and delays, test bench, types of test bench, comparison between VERILOG and VHDL language

Unit-2: Combinational Logic(15 hrs)

Introduction to combinational circuits, realization of basic combinational functions - magnitude comparator, code converters, multiplexers, demultiplexers, multiplexed display, encoder and decoders, priority encoders, parity generator/checker, arithmetic circuits (adder, subtractor, binary multiplier), parallel adder, look ahead carry generator

VERILOG models and simulation of above combinational circuits

Unit-3: Sequential Logic Design and Circuits(15 hrs)

Introduction to sequential circuits

Flip Flops: types, state table, transition table, excitation tables, timing waveforms, clock generators

Counters: synchronous, asynchronous, design of counters, up/down counter Shift Registers: ring counter, Johnson counter

Finite State Machine (FSM) Design: Mealy and Moore state machines

VERILOG Models and Simulation of above Sequential Circuits and FSMs: stepper motor controller, traffic light control, washing machine control, parking controller, coffee vending machine, LCD controller

Unit-4: PLDs and Memories(15 hrs)

Need of PLD, antifuse, architecture of simple PLD (SPLD)-PAL, PLA, Complex Programmable

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Logic Device (CPLD) and Field Programmable Logic Devices (FPGA) CPLD/FPGA based system design applications - typical combinational and sequential system implementation, estimation of uses of blocks, links, LUTs, etc.

Memories: types, data storage principle, control inputs, and timings, applications, Random Access Memories (RAM), Static Ram (SRAM), standard architecture, 6 transistor cell diagram, sense amplifier, address decoders, timings, Dynamic RAM (DRAM), different DRAM cells, refresh circuits, timings, role of memories in PLD

Text / Reference Books:

1. Verilog HDL; A Guide to Digital Design and Synthesis, Samir Palnitkar, Pearson Education, 2nd edition, 2003.
2. Verilog HDL synthesis; A Practical Primer, J. Bhaskar, Star Galaxy Publishing, 1998.
3. Digital System Design with VERILOG Design, Stephen Brown, Zvonko Vranesic, TMH, 2nd Edn, 2007.
4. Digital design; Principles Practices, Wakerly, PHI.
5. Modern Digital Electronics, R.P Jain, McGraw Hill.
6. Digital systems; Principles and Applications, Tocci, Pearson Education.
7. Digital Logic and Computer Design, Morris Mano, PHI.

ELDT114: BASICS OF FIBER OPTIC COMMUNICATION (2 Credits)

Elective Theory Course 1

Objectives:

1. To understand basics of optical fiber
2. To know about the types of optical fibers
3. To understand fiber optic communication system

Unit – I Fundamentals of optical fiber communication system(15 hrs)

Overview of basics of optical fiber: Total internal reflection. Ray model: Fundamental laws of optics , refraction, Snell's law, critical angle, total internal reflection Ray propagation in step index fiber , Numerical Aperture and acceptance angel , Definition of Skew rays and Meridional rays , Wave model :Phase velocity and group velocity , Modes in optical fiber , V-number & normalized frequency Classification of Optical fiber used in industry: Types of Optical Fiber: SI and GI , SM and MM

Types of losses in Optical fiber: Attenuation, Absorption losses: intrinsic and extrinsic , Linear scattering losses: rayleigh and mie , Fiber bend losses: micro and macro. Dispersion: Intermodal Dispersion in multi mode step index fiber , Intra-modal (Chromatic) Dispersion: material and wave guide dispersion. Dispersion shifted and dispersion flattened fibers

Unit II: Components of Fiber optics communication system (15 hrs)

Advantages & disadvantages , General configuration of Fiber optic communication system , Understand driver circuits used in Optical communication system LED driver circuit: Analog, Digital , LASER driver circuit: analog, digital , Optical receiver block diagram Common source FET preamplifier ,Regenerative repeater

Fiber optic cables : Needs of cabling , Fiber Cables: Slotted core, loose tube and multi-fiber ribbon Splicing and joining of fibre cable ,Connection losses: Extrinsic Parameters: Fresnel reflection, Misalignment, and Other factors, Intrinsic Parameters: NA mismatch, diameter mismatch, Fiber end preparation for loss minimization.

Splices: Fusions Splices ,Mechanical splices: Capillary, V-grooved, Loose tube, Spring groove and elastomeric splices.

Process of Connecting the fibre cable with connectors: Fiber optic connectors: Ferrule, Expanded beam.

TEXT/REFERENCE BOOKS:

- 1 Optical Fiber Communication John M Senior Pearson
- 2 Fiber Optics & Optoelectronics R P Khare Oxford
- 3 Fiber Optic Communication D C Agarwal S Chand
- 4 Optical Fiber & Fiber Optic Communication Subir Kumar Sarkar S Chands

ELDT114: Fundamentals and applications of PIC microcontrollers (2 Credits)

Elective Course I

Unit I: PIC Architecture (15 hrs)

Introduction to PIC microcontrollers, PIC architecture, Concept of pipelining, RISC, I/O ports, timers/counters and other peripherals, memory mapping, Interrupt structure, Comparison of PIC with other microcontrollers and microprocessors

Unit II: Programming and interfacing (15 hrs)

Instruction set; addressing modes, assembly language programming, Programs for bit manipulation, generation of delay and wave forms. PWM control etc. Hardware interface for LEDs, 7segment display, LCD, Keypad interfacing, dc and stepper motor.

TEXT/REFERENCE BOOKS

1. Programming PIC microcontrollers with PIC basic by Chuck Helebuyck
2. PIC microcontrollers-programming in basic by Milan Verle.

SEMESTER II

ELUT121: Applied Electromagnetics, Microwaves and Antennas(4 Credits)

Objectives:

1. To introduce to students the concepts of electromagnetics
2. To understand the theory of transmission lines and wave guides
3. To study various parameters of antennas
4. To study various methods of generation of microwaves

Prerequisite: Physical quantities as vectors, concept of gradient, curl, and divergence, concept of rotation operator, covariant and contra-variant vectors, line, surface and volume – integrals, Gauss and Stokes theorem complex plane, polar form of complex number, complex functions, Cauchy-Riemann conditions, orthogonal functions and relation with Laplace equation

Unit-1: Electromagnetic Waves(15 hrs)

Review of Maxwell's equations and their meaning, continuity equation, electric and magnetic wave equations in time domain and frequency domain, wave propagation in conducting and non-conducting media, skin depth and high frequency propagation, boundary conditions at the interface between two mediums, Poynting theorem and its applications

Unit-2: Transmission Lines(15 hrs)

Types of transmission lines, microstrip lines, two wire transmission line, transmission line equations for voltages and currents, inductance and capacitance per unit length of two wire and coaxial cable transmission line, characteristic impedance, propagation constants, attenuation and phase constants, phase velocity, reflection and transmission coefficients, SWR, line impedance, normalized impedance and admittance, Smith chart construction and applications, single stub and double stub matching, applications to reflection of EM-waves at interfaces for normal incidence

Unit-3: Waveguides and Components(15 hrs)

Concept of waveguides, frequency range, relation to transmission lines

Rectangular Waveguides: TM and TE Modes, concept of cut-off frequency, guide impedance,

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phase velocity, guide wavelength for TE and TM modes, Applications to TE mode in rectangular waveguide, power losses in rectangular waveguide

Circular waveguide introduction only

Optical Fiber: principles of operation and construction, difference between conducting circular waveguide and fiber

Different methods of excitation of TE and TM modes in waveguides Cavity Resonators, Q factor of cavity resonators

Unit-4: Electromagnetic Radiation(15 hrs)

Potentials of electromagnetic fields, retarded potential, radiation from oscillating dipole, concept of near zone and radiation zone, radiation resistance, role of antenna in exciting different TE, TM modes in wave guides

Antenna Parameters: gain, directivity, power, aperture, Friis equation, radiation pattern

Application Areas: antenna temperature, Signal to Noise Ratio (SNR), remote sensing, RADAR equation

Antennas Types: $\lambda/2$ antenna, antenna arrays, horn antennas, parabolic dish antennas, End fire antenna – Yagi Uda, patch antenna, microstrip antennas EMI and EMC

Generation of Microwaves: principle, physical structure and working of - Gunn effect diodes, magnetron oscillator, reflex Klystron oscillator

Note: In the case of antennas and microwave devices, mathematical analysis of equivalent circuits and processes is not expected.

Text / Reference Books:

1. Microwave Devices and Circuits, Samuel Y. Liao, PHI, 3rd Edition, 2002.
2. Principles of Electromagnetics, N. Sadiku, Oxford University Press.
3. Electromagnetics with Applications, Kraus and Fleiseh, McGraw Hill, 5th Edn, 1999.
4. Electromagnetics, J.D. Kraus, 4th Edn, McGraw Hill, 1992.

ELUT122: Instrumentation and Measurement Techniques

Objectives:

1. To understand the configurations and functional descriptions of measuring instruments
2. To understand the basic performance characteristics of instruments
3. To understand the working principles of various types of sensors and transducers and their use in measuring systems
4. To study the techniques involved in various types of instruments
5. To understand the relevance of electronics with other disciplines

Unit-1: Introduction to Measurement and Measurement Systems(15 hrs)

Definition and significance of measurement, classification of instruments and types of measurement applications, elements of an instrument / measurement system, active and passive transducers, analog and digital modes of operation, null and deflection methods, input-output configuration of instruments and measurement systems, methods of correction of instruments and measurement systems Generalized performance characteristics of instruments: static characteristics and static calibration, meaning of static calibration, true value, basic statistics, least-squares calibration curves, calibration accuracy versus installed accuracy, combination of components errors in overall system accuracy calculations, theory validation by experimental testing

Unit-2: Static Dynamic Characteristic of Measurement System(15 hrs)

Static sensitivity, linearity, threshold, noise floor, resolution, hysteresis and dead space, scale readability, span, generalized static stiffness and input impedance, loading effect
Dynamic characteristics: generalized mathematical model of measurement system, operational transfer function, sinusoidal transfer function, zero-order instrument, first order instrument, second order instruments, step response, ramp response, frequency response of first -order instruments and second order instruments
Errors in measurement: Types of Errors - gross, systematic, environmental errors, systemic errors, computational error, personal error etc.

Unit-3: Motion Measurement(15 hrs)

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Methods of transduction, primary sensing elements and transducers, electrical transducers, classification of transducers

Motion and dimensional measurement: fundamental standards, relative displacement-translational and rotational, calibration, resistive potentiometers, resistance strain gauge, differential transformers, variable-inductance and variable-reluctance pickups, eddy current, non contacting transducers, capacitance pickups, piezoelectric transducers, digital displacement transducers (translational and rotary encoders), ultrasonic transducers, detailed discussion of strain gauges, LVDT and synchros

Relative velocity: translational and rotational, calibration, average velocity from measured Δx and Δt , tachometer encoder methods, laser based methods, stroboscopic methods, translational-velocity transducers (moving coil and moving magnet pickups)

Relative acceleration measurements: seismic (absolute) displacement pickups, seismic (absolute) velocity pickups, seismic (absolute) acceleration pickups (accelerometers)

Unit-4: Process Parameter Measurements(15 hrs)

Force, Torque and Shaft power: standards and calibration, basic methods of, bonded strain gauge, differential transformer, piezoelectric, variable reluctance/ FM oscillator digital system, torque measurement on rotating shafts

Pressure and Sound Measurement: standards and calibration, dead weight gauges and manometers, low pressure measurement - Mcleod gauge, Knudsen gauge, viscosity, thermal conductivity, ionization, sound level meter, microphone, capacitor microphone

Flow measurement: Pitot-static tube, Yaw tube, hot wire and hot film anemometers, Laser Doppler anemometer, Gross Volume Flow Rate- rotameter, turbine, ultrasonic flow meter, electromagnetic flow meters

Temperature and Heat Measurement Transducers: standards and calibration, bimetallic thermometers, liquid in glass thermometers, pressure thermometers, RTD, thermocouples, thermistors, semiconductor based temperature sensors, detailed discussion on basics of thermocouples, laws of thermocouples, cold junction compensation; thermistor types, materials used, application circuits, LM35

Radiation Fundamentals: detectors, optical pyrometers, IR imaging systems, heat flux sensing-slug type sensors, Gorden gauge

Text / Reference Books:

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1. Measurement Systems, Applications and Design, Ernest O. Doebelin and Dhanesh N. Manik, 5th Edition, Tata McGrawHill.
2. A Course in Electrical and Electronic Measurements and Instrumentation by A.K. Sawhney, Dhanpat Rai & Co.
3. Electronic Instrumentation, Kalsi, TMH.
4. Modern Electronic Instrumentation and Measurements Techniques, Cooper and Helfrick, PHI.

ELUT123: Foundation of Semiconductor Devices(4 Credits)

Objectives:

1. To introduce crystal structure with reference to semiconductors
2. To introduce quantum and statistical mechanics
3. To understand the characteristics of semiconductor devices
4. To introduce theory of diode, transistor and FETs

Unit-1: Theory of solids(15 hrs)

Crystal structure of solids: Semiconductor materials, types of solids, basics of crystallography, space lattice atomic bonding, unit cell, Miller indices imperfections and impurities in solids, methods for semiconductor crystal growth.

Unit 2: Introduction to Quantum and statistical Mechanics(15 hrs)

Principles of quantum mechanics, Schrodinger wave equation, and Applications of Schrodinger's wave equation for bound state potential problems.

Introduction to quantum theory of solids: Allowed & forbidden energy bands, electrical conduction in solids, extensions to three dimensions, density of states, Statistical mechanics: Statistical laws, Fermi-Dirac probability function, the distribution function and the Fermi energy

Unit-3: Physics of semiconductors(15 hrs)

Semiconductor in equilibrium: Charge carriers in semiconductors, dopant atoms and energy levels, extrinsic semiconductors, Statistics of donors and acceptors, charge neutrality, position of Fermi energy level. Carrier transport phenomena: charge, effective mass, state & carrier distributions, Carrier drift, carrier diffusion, graded impurity distribution, resistivity, Hall effect.

Non-equilibrium excess carriers in semiconductors: Carrier generation and recombination, characteristics of excess carriers, bipolar transport, quasi-Fermi energy levels, excess carrier lifetime, surface effects

Unit-4: Basics of Semiconductor Devices(15 hrs)

Diode: Junction terminologies, Poisson's equation, built-in potential, depletion approximation, diode equation, Qualitative and Quantitative analysis, Reverse-bias breakdown, avalanching, zener process, C-V characteristics, Transient response .

BJT: Terminology, electrostatics and performance parameters, Eber-Moll model, Two port

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model, hybrid – pi model, device models in spice , Modern BJT structures –polysilicon emitter BJT, Heterojunction bipolar transistor (HBT)

FETs: JFET and MESFET - Junction terminologies, characteristics, ac response, spice models

MOSFET: Fundamentals, Capacitance- voltage characteristics, I-V characteristics, Qualitative Theory of Operation, ID - VD Relationship, ac response, spice models.

Text / Reference Books:

1. Semiconductor Physics and Devices Basic Principles, Donald A. Neamen, TMH, 3rd Edition (2003)
2. Semiconductor Device fundamentals, Robert F. Pierret, Pearson Education
3. Solid State Electronics Devices, Streetman, PHI, 5th Edition, (2006)

ELDT124: FIBER OPTIC COMMUNICATION SYSTEM (2 Credits)

Elective Course 2

Objectives:

1. To understand types of optical cables, connectors etc
2. To understand integrated optics and their components
3. To understand design of optical fiber communication system

Unit – I Optical Fiber Cables , connectors and integrated optics(15 hrs)

Optical components & Integrated optics Optical couplers and isolators: types and functions ,Optical switches , Beam splitter, Optical multiplexer and demultiplexer ,Optical wavelength converter , Bragg grating , working of optical amplifier

Understand concept of Integrated optics: Optical Amplifiers-Semiconductor optical amplifier, EDFA, Raman amplifier ,

Concept of Integrated optics Characterization & Applications working principle of Optical Power Meter & OTDR, Optical power meter ,Optical time domain reflectometer ,

Understand application of WDM in Fibre optics communication system ,WDM & DWDM

Fiber Sensors ,List application of various LASER used in industries & medical surgery.

Unit II: Optical System Design: Considerations(15 hrs)

Component Choice, Multiplexing, Point-to- Point Links, System Considerations, Link Power Budget with Examples, Overall Fiber Dispersion In Multi-Mode and Single Mode Fibers, Rise Time Budget with Examples. Transmission Distance, Line Coding in Optical Links, WDM, Necessity, Principles, Types of WDM, Measurement of Attenuation and Dispersion, Eye Pattern.

TEXT/REFERENCE BOOKS:

- 1 Optical Fiber Communication John M Senior Pearson
- 2 Fiber Optics & Optoelectronics R P Khare Oxford
- 3 Fiber Optic Communication D C Agarwal S Chands
- 4 Light wave Communication Systems: A Practical Perspectives Rajappa Papannareddy Penram
- 5 Optical Fiber & Fiber Optic Communication Subir Kumar Sarkar S Chands

ELDT124: Fundamentals and applications of AVR Microcontroller (2 Credits)

Elective Course 2

Objectives:

1. To understand the architecture, assembly language and interfacing of AVR
2. To learn embedded C programming
3. To learn software techniques to embed codes in to the systems

Unit-1: Introduction to AVR Microcontroller (15 hrs)

Architecture (Atmega16), instruction set, addressing modes, memory organization, timers, PWM, I/O ports, ADC, interrupts, serial communication. Basic Assembly Programs: arithmetic, logical, code converter, block data transfer, I/O programming for ADC, timer and I/O ports

Unit-2: Applications of AVR Microcontroller (15 hrs)

Design of General Purpose Target Board: reset, oscillator circuit, derivatives of AVR, Real world interfacing with the microcontrollers and programming in C for interfacing LED, Seven Segment Display, dot matrix display and LCD displays (text and graphic), keyboard and motors (DC, stepper, and servo), I2C and SPI based RTC, EEPROM, DAC and ADC,

Text / Reference Books:

1. AVR Microcontroller and Embedded Systems using Assembly and C, Mazidi and Naimi, Pearson education, 2011.
2. Embedded C Programming and the Atmel AVR, Barnett, Larry D. O’Cull and Sarah A. Cox, Delmar, Cengage Learning, 2007.
3. PIC Microcontroller and Embedded Systems, Mazidi, Mckinlay and Causey, Pearson Education.
4. C Programming for Embedded Systems, Kirk Zurell, Pearson Education.
5. Programming in C, Stephen Kochan, Hayden Books/Macmillan.

ELDP114: PRACTICAL COURSE I(2 Credits)

Elective course 1(Basics of optical communication system)

List of practical's (Any 6)

1. Measurement of Numerical Aperture of optical fiber
2. Measurement of attenuation of given optical fiber
3. Measurement of bending loss of given optical fiber
4. To Plot characteristics of LED
5. To Plot characteristics of LASER diode
6. To Plot characteristics of Photo Diode
7. To Demonstrate various fiber cables
8. To demonstrate fiber end preparation process.
9. To Demonstrate Splicing Techniques
10. To Demonstrate various connectors

ELDP114: Practical Course I(2 Credits)

Elective Course 2 (Any 6)

Practical's on PIC Interfacing

1. Two-digit 7-segment display(multiplexed) interfacing
2. LCD / keyboard Interfacing
3. Bidirectional stepper motor interfacing
4. Real Time Clock display on LCD / HyperTerminal (I2C)
5. Use of internal EEPROM
6. DAC interfacing (square wave, staircase, triangular, sine) use of timer for
7. On-off controller with hysteresis (ADC)
8. Two digit frequency counter or event counter using timer / interrupt
9. Matrix keyboard / Touch screen
10. Graphic LCD interfacing
11. Zigbee communication
12. DC motor control using PWM / intensity control of LED

ELUP115: Practical Course –II (4 Credits)
Compulsory Course(Any 12 Practical's)

A. Practical based on Circuit Design

1. Bootstrap ramp generator for delay triggering
2. Blocking oscillator
3. Tuned amplifier small signal / large signal for IF
4. Transistor based microphone amplifier
5. Voltage controlled current source / sink and current mirror and doubler
6. Comparator and Schmitt trigger with single supply operation
7. Second order Butterworth filters (BP and BR)
8. Waveform generation: quadrature oscillator, Bubba oscillator
9. V to f and f to V using commercially available IC
10. Instrumentation amplifier for a given gain
11. Low current negative power supply using IC555 / dual power supply using single battery
12. PLL characteristics and demonstrate any one application (IC565/CD4046)

B. Practical based on Digital Design

1. Two digit combinational lock
2. Keyboard encoder with latches
3. Traffic light controller
4. Multiplexed display (Bank token / two digit counter)
5. Bidirectional stepper motor control (Sequence Generator)
6. One digit BCD adder and 8-bit adder / subtractor
7. Object counter (use of MMV, counter)
8. Binary-Gray and Gray-Binary code converter

C. Practical Based on VERILOG Programming and Implementation on CPLD or FPGA

1. Combinational Logic
2. Parity Generator and checker
3. Hamming Code Generator
4. Manchester code Generator
5. Sequential Logic
6. Up-down bit binary counter (minimum 4-bit)
7. Universal shift register

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8. Four bit ALU design (structural modelling)
9. Keyboard Scanning
10. Designing of Traffic light Controller
11. Implementation of 8 bit multiplexer
12. LCD controller
13. Code Converter (BCD to seven Segment)
14. Practical based on state machine (Stepper sequence generator/Vending Machine/Washing Machine)
15. Barrel shifter

D. Practical based on C / MATLAB / PSPICE

1. Phase and frequency response from transfer function of a CT system: Low Pass and High Pass
2. Phase and frequency response from transfer function of a DT system: Low Pass and High Pass
3. Transient and steady state response of CT system: LCR series circuit with different inputs
4. Simulation of transfer function using poles and zeros
5. Synthesis of periodic waveform from Fourier coefficients
6. Solution of differential equation with given boundary conditions
7. Analysis of a given dc electrical circuit
8. Effect of locations of poles and zeros on the transfer function and corresponding frequency response

ELDP124: PRACTICAL COURSE I(2 Credits)

Elective course 1 (Fiber optic communication systems)

List of practical's (Any 6)

1. To establish Analog communication optical link
2. To establish Digital communication optical link
3. To Build and test LED drive circuits
4. To Demonstrate OTDR
5. To Demonstrate Optical Power Meter.
6. To Build fibre optics link using PAM technique
7. To Build fiber optics link using TDM technique
8. Following is the list of proposed student activities like:
 - Visit nearby fiber optics industries.
 - Hands on training on fibre connecterization.
 - Arrange visit to BSNL to see live circuits and measurement of parameters
 - Collect information of transatlantic optical network used for communication.
 - Visit any Campus Wide area network which uses optical fiber .
 - Explore use of lasers in medical treatment

List of Major Equipment/Materials

1. OTDR
2. Optical power meter
3. CRO
4. Fusion splicing machine
5. Optical fiber : Glass,Plastic
6. Semiconductor laser

**ELDP124: Practical Course I(2 Credits)
Elective Course 2(Any 6)**

Practical on AVR

1. Interfacing of LED array to generate different sequences,
2. use of timer for delay generation
3. Matrix Keyboard interface with LCD
4. DAC interfacing (sine, staircase, triangular, square wave) use of timer
5. Use of ADC
6. DC motor control using PWM / Intensity control of LED – with CCP
7. Serial EEPROM / EEPROM interface using SPI protocol
8. Real time clock (RTC)
9. Stepper motor Interfacing
10. Dot matrix rolling display

**ELUP125: Practical Course III(4 Credits)
Compulsory Course(Any 12)**

A. Practical based on Instrumentation and Measurement System

1. Design build and test rms to dc converter for voltage measurement of ac signal
2. Displacement measurement using LVDT, signal conditioning and DPM
3. Temperature measurement using PT100, signal conditioning and DPM
4. Temperature measurement using thermocouple with cold junction compensation
5. Design build and test IR transmitter and receiver (TSOP1738 or similar) for object detection
6. To build and test current telemetry (4 to 20 mA)
7. Ultrasonic transmitter and receiver, distance measurement
8. Pressure measurement using strain gauge
9. RPM measurement using various methods
10. Design and calibrate light intensity meter using photodiode or LDR and the necessary signal conditioning and display.
11. Use of strain gauge to measure stress on a cantilever made of material known quantity
12. Hot wire anemometer

B. Practical based on Electromagnetics, Microwaves, Antennas

1. To study the characteristics of Klystron tube
2. To determine the standing wave ratio and reflection coefficient of a given waveguide
3. To plot directivity pattern of a given antenna
4. To determine a characteristics of a microstrip transmission line
5. Design and test Yagi-Uda antenna with power reflectors
6. Measurement of primary-secondary coupling factor of a given transformer using LCR meter (calculation of transformer model parameters expected)

C. Practical on Electromagnetics (C / MATLAB)

1. To plot Equipotential contours and field lines for given charge distribution
2. Use of Smith chart for transmission line pattern and verify using C
3. Use of MATLAB for potential distribution in a region bound by two conductors
4. Use of MATLAB for directivity pattern for simple antennas

SAVITRIBAI PHULE PUNE UNIVERSITY
FACULTY OF SCIENCE AND TECHNOLOGY

**Courses in choice based credit system for Postgraduate Science Programme
to be implemented from Academic year 2019-20 for Electronic Science**

Subject Name	Year	Sem	Course type	Course code	Course name	Credits
Electronic Science	1	1	Core compulsory Theory Paper	ELUT111	Mathematical methods in Electronics using C	4
				ELUT112	Analog Circuit Design	4
				ELUT113	Digital System Design	4
			Choice based optional paper	ELDT114	Elective Theory Course(Any 1) 1. Basics of optical communication 2. Fundamentals and applications of PIC microcontrollers	2
				ELDP114	Elective Practical Course	2
			Core compulsory practical course	ELUP115	Electronic Sc. Practical Paper	4
				Total Credits	20	
Electronic Science	1	2	Core compulsory Theory Paper	ELUT121	Applied Electromagnetic, microwaves and antenna	4
				ELUT122	Instrumentation and measurement techniques	4
				ELUT123	Foundation of semiconductor devices	4
			Choice based optional paper	ELDT124	Elective Theory Course(Any 1) 1. Fiber optic communication systems 2. Fundamentals and applications of AVR microcontrollers	2
				ELDP124	Elective Practical Course	2
			Core compulsory practical course	ELUP125	Electronic Sc. Practical Paper	4
				Total Credits	20	
Electronic Science	2	3	Core compulsory Theory Paper	ELT231	Advanced communication systems	4
				ELT232	Mechatronics and robotics	4
				ELT233	Control systems	4
			Choice based optional	ELT234	Elective Theory Course(Any 1)	2

			paper		1. Wireless communication systems 1 2. Fundamentals of Internet of Things	
				ELP234	Elective Practical Course	2
			Core compulsory practical course	ELP235	Electronic Sc. Practical Paper	4
					Total Credits	20
Electronic Science	2	4	Core compulsory MOOC/skill development Paper	ELP241*	Industrial training	4
				ELT241	PLC Programming and Applications	2 2
				ELP241	Practical course in PLC Programming and Applications	
				ELT242	MOOCs courses	4
			ELT243	Technical writing	4	
			Core compulsory practical course	ELP244	Project/Internship	8
					Total Credits	20
Total credits at M. Sc						80

*students can opt either for industrial training course(4 credits) or Theory course of industrial automation(2 credits) and practical course(2 credits)

Important Note :

- Student has to earn total 80 credits for completion of two years M.Sc. course
 - Student has to earn generally 20 credits per semester
 - Students can flexibly complete maximum of 24 credits in semester III by offering either MOOCs courses(4 credits) or technical writing course (4 credits) mentioned in semester IV. In that case student has to complete only 16 credits during semester IV. This will facilitate more time for training/internship.
 - There is option for students in Semester IV for course of Industrial training (4 credits). Students can opt for Industrial Automation course of Theory(2 credits) and Practical(2 credits)
 - In semester IV, student has to attend college (PG centre) for 2 days in a week. Remaining time of the week he/she can attend project/internship and industrial training
 - Internship can be completed within college, industry or any other research institute
 - Continuous evaluation of industrial training course should be done by respective PG centres in colleges
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SAVITRIBAI PHULE PUNE UNIVERSITY
M. Sc. Part II(Electronic Science)
Core Compulsory Theory course
Semester III: ELT231: Advanced Communication systems

Credits: 4

Teaching allotment: 4 lectures/week

Lectures: 60 lectures

Course Outcomes:

This course provides students in dept knowledge about different types of communication techniques . At the end of this course, student should be able to

CO1	Analyze continuous wave/analog method of communication(AM, FM and PM) considering noise, its generation and demodulation techniques
CO2	Compare different pulse modulation techniques(analog as well as digital)
CO3	Analyze digital modulation techniques and related correction methods
CO4	Distinguish different radio wave propagation techniques
CO5	Understand basic theory of antenna and their types as per applications
CO6	Understand basics of modern communication techniques like satellite communication and mobile communication

Unit 1: CW communication system

Communication systems, Modulation, Bandwidth requirements, External and Internal noise, Noise figure

Theory of Amplitude modulation, Modulation index, side bands and frequency domain, Power distribution, Generation of AM, Suppression of carrier, suppression of unwanted side bands, Extensions of SSB, AM receivers

Theory of frequency and Phase modulation, sidebands and modulation index, Noise and frequency modulation, Generation of FM, FM receivers

Unit 2: Pulse Communication systems

Revision of PAM,PPM. PWM. Pulse code modulation, Delta modulation, Adaptive delta modulation, Time division multiplexing, Frequency division multiplexing, Characteristics Of Data Transmission Circuits - Bandwidth Requirement – Speed - Baud Rate - Noise - Crosstalk – Distortion.

DIGITAL CODES: ASCII Code – EBCDIC Code - Error Detection Codes – Parity Check Codes – Redundant Codes - Error Correction Codes – Retransmission- Forward Error Correcting Code – Hamming Code –

Digital Modulation Techniques – ASK, FSK, PSK, QPSK Modulation/Demodulation Techniques (Only Block Diagram And Operation).

Data link protocols: SDLC, HDLC, XMODEM protocols, ASK, FSK, PSK, QAM, telephone modems, cable modems and DSL

Unit 3: Radio wave propagation and Antennas

Propagation in free space, tropospheric, ionospheric propagation, Surface wave, Low and very low, extremely low frequency propagation

Basic considerations, Wire radiations in space, Terms and definitions, Effects of ground on antennas, Antenna coupling at medium frequencies, Directional high frequency antennas, UHF and Microwave antennas, Wideband and special purpose antennas.

Smart antenna analogy, Cellular radio systems evolution, signal propagation, Smart antenna benefits and drawbacks

Unit 4: Communication Technologies

SATELLITE COMMUNICATION: Satellite system: Kepler's I,II,II laws – orbits – launching orbits – types - Geostationary synchronous satellites - Advantages – Apogee – Perigee - Active and passive satellite - Earth eclipse of satellite. Antenna: Parabolic reflector antenna – cassegrain antenna. Space segment: Power supply- Attitude control- station keeping – Transponders – TT and C subsystem – Antenna subsystem. Earth segment: Block diagram of Transmit receive earth station - Satellite mobile services - Basics of GPS.

MICROWAVE COMMUNICATION: Microwave frequency ranges - microwave devices – Parametric amplifiers –Travelling wave tubes – simple block diagram of microwave transmitter, receiver and microwave link repeater

MOBILE COMMUNICATION: (Qualitative Treatment only) Cellular telephone– fundamental concepts – Simplified Cellular telephone system - frequency reuse – Interference – Co-channel Interference – Adjacent Channel Interference – Improving coverage and capacity in cellular systems - cell splitting – sectoring – Roaming and Handoff – Basics of blue tooth technology.

SATELLITE MULTIPLE ACCESS TECHNIQUES: TDMA, FDMA, CDMA. Digital cellular system – Global system for mobile communications (GSM) –GSM services - GSM System Architecture – Basics of GPRS.

Text / Reference Books

1. Electronic Communication Systems, George Kennedy and Bernard Davis Publ. Tata McGraw Hill.
 2. Antenna theory analysis and design, Constantine A. Balanis
 3. Electronic communications, Dennis Roddy and John Coolen, Pearson Publ.
 4. Communication Electronics Principles and applications, Louis E. Frenzel, Tata McGraw Hill.
 5. Digital data communication, Miller
 6. Introduction to Fiber optics, A. Ghatak and K. Thyagarajan, Cambridge University press.
 7. Advanced Electronic Communication systems, Tomasi W.
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SAVITRIBAI PHULE PUNE UNIVERSITY
M. Sc. Part II(Electronic Science)
Core Compulsory Theory course

Semester III: ELT232: Mechatronics and Robotics

Credits: 4

Lectures: 60 lectures

Teaching allotment: 4 lectures/week

Course Outcomes:

This course provides through understanding of different systems in mechatronics and robotics. At the end of this course, student should be able to

CO1	Identify different components or blocks in any mechatronic system
CO2	Analyze mechatronic systems using system models and dynamic responses using transformation methods
CO3	Distinguish different sensing and actuating mechanisms used in mechatronics and robotic systems
CO4	Compare different control mechanisms used in robotic systems

Unit-1: Introduction

Basics of mechatronic systems: sensors and transducers: digital sensors for motion measurement, torque and tactile sensors, vibration sensors, control systems

Brief history of robots, types of robots– components and structure, kinematic arrangements (configurations), classification of robots based on various methods of classification such as control method, power source, applications and coordinate systems, Application areas of robots

Solid state switches- diodes, thyristors, BJTs and MOSFETs and their applications as switches and driver circuits, solenoids

DC Motor-: types, basic construction and working, brushed and brushless DC motor driver circuits, and speed control

AC motors- basic idea of single phase and three phase motors and their speed control

Stepper motors- types, construction, features, specifications, control of drives.

Unit-2: Systems, responses and transformations

Basic system models: Mechanical (translational and rotational) system building blocks, electrical system building blocks, electrical and mechanical analogies and their use in analysis

Dynamic responses of systems: modeling dynamic systems, terminology of first order and second order system, performance measures for second order system, system identification

Transformations:

Rigid Motions: Rotations – coordinate transformations relating to representation of a point in two different frames, composition law for rotational transformations, rotation about an arbitrary axis, representing an arbitrary rotation using only three independent quantities using axis/angle representation, Euler angle representation and roll-pitch-yaw representation
Homogeneous transformation matrices, skew symmetric matrices, angular velocity and angular acceleration, addition of angular velocities

Unit-3: Mechanical and electrical actuation systems

Mechanical actuation systems: mechanisms and their role in mechatronic systems, translational and rotational motion – degrees of freedom, kinematic chains – examples of links, toggle linkage, slider-crank etc. cams, gears – types, gear trains, gear ratios, uses of rotation-to-translational motion – rack and pinion, ball screw and links, Ratchet and pawl, belt and chain drives, bearings– types and uses, consideration of moment of inertia and torque for motor selection

Electrical actuation systems: Relays and applications with driver circuits,

Unit-4: Dynamics and Robot Control

Dynamics: deriving dynamical equations of a manipulator by deriving Euler–Lagrange equations by forming Lagrangian of a system

Trajectory planning and generation, joint space schemes, Joint space schemes with via points. Cartesian straight line motion and circular motion, trajectory planning for orientation, difficulties in trajectory planning

Independent Joint Control: basic structure of feedback control system, dynamics of PMDC motor, DC motor control system, set-point tracking using PD and PID compensator, Drive-train dynamics, trajectory interpolation

Force control– static force / torque relationships, natural and artificial constraints, stiffness and compliance

Text / Recommended Books:

1. Mechatronics by W.Bolton, 4th Edition, Pearson.
 2. Mechatronics System Design, by DevdasShetty and Richard Kolk, 2nd Edition, Cengage Learning.
 3. Robotics Engineering – An integrated approach. By Richard W. Klafter, Thomas A. Chmielewski and Michael Negin, PHI Learning Pvt. Ltd.
 4. Robot Dynamics and Control, Spong and M. Vidyasagar, Wiley Student Edition
 5. Robotics: Fundamental Concepts and Analysis, Ashitava Ghoshal, Oxford Higher Education
 6. Robotic Engineering: An integrated approach, Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, Prentice-Hall India
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SAVITRIBAI PHULE PUNE UNIVERSITY

M. Sc. Part II(Electronic Science)

Core Compulsory Theory course

Semester III: ELT233: Control System

Credits: 4

Teaching allotment: 4 lectures/week

Lectures: 60 lectures

Course Outcomes:

This course provides application based knowledge of different mathematical methods in design and development of various control systems. At the end of the course, student should be able to

CO1	Compare different control loop systems such as open loop, closed loop, DCS, SCADA etc.
CO2	Analyze the control systems using different mathematical techniques such as transfer function and different stability criterion
CO3	Analyze and Distinguish different types of analog and digital controllers and control modes
CO4	Identify components of control systems
CO5	Design, develop and implement control systems for given applications

Unit-1: Control system basics

Closed loop control and functional elements in it open-loop control, continuous and discrete state control, control strategies such as feedback, feed forward and adaptive control, steady state optional control concept of DCS, evolution of process control, SCADA supervisory control and data acquisition systems, Fuzzy logic direct digital control CDDC

Unit-2: Control system analysis

Mathematical models of systems, concept of transfer function and its use, method of obtaining transfer function, block diagram of control system, rules of block diagram reductions and examples thereof

Concept of stability, Routh stability criterion, Roth- Hurwitz criterion, Root locus steps in drawing root locus, Use of root locus and examples thereof. Frequency response methods of control system analysis, Bode plots method to plot and examples thereof, Nyquist plots, method to plot and examples thereof, process loop tuning and control system evaluation, Open loop transient response method, Zeigler- Nichols method.

Unit-3: Analog and Digital Controllers

Classification of controllers, Controller terms Discontinuous controllers: On-OFF Controller, three position controller

Continuous controllers: Proportional, Integral and Derivative control

Composite control modes: PI, PD and PID controllers. Derivative overrun and integral windup in PID control mode

Design of analog controller circuits for above modes characteristics and applications

Ladder Programming: Basic components such as relays, Design systems using ladder diagram such as conveyer belt monitoring, temperature control systems etc.

DCS hardware and software, distributed process control station (DPCS), SCADA

hardware and software, applications

Unit-4: Control system components and system examples

Principle and characteristics of control valves, synchro-servo motors, Solenoids, actuators, annunciators, alarms, recorders, Standard Graphics Symbols for Process Control and Instrumentation

Control system examples: Speed control system, position control systems, temperature and level control systems, reel drives, tension control system for paper

Text / Reference Books:

1. Process control: Principles and applications, Surekha Bhanot, Oxford University Press 2nd Edition.
 2. Control Engineering Noel. M. Morris, 3rd Edition Mac Graw Hill.
 3. Process control instrumentation technology, C. D Johanson, PHI.
 4. Control system engineering, Nagrath and Gopal, New age international limited.
 5. Control Systems, U.A. Bakshi and V.U. Bakshi, Technical Publications Pune.
 6. Modern Control engineering, Ogata, Prentice Hall, EEE.
 7. Control engineering theory and practice, N.M. Bandhopadhyay, PHI.
 8. Instrument Engineers' Handbook, Vol. 1: Process Measurement and Analysis, Bela G. Liptak, CRC Press.
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SAVITRIBAI PHULE PUNE UNIVERSITY
M. Sc. Part II(Electronic Science)
Elective Theory course

Semester III: ELT234: Fundamentals of Wireless communication system

Credits: 2

Teaching allotment: 2 lectures/week

Lectures: 30 lectures

Course Outcomes:

This Course provides fundamental knowledge of wireless communication systems. At the end of this course, student should be able to

CO1	Compare different wireless techniques such as mobile, radio, satellite etc
CO2	Understand modern wireless techniques
CO3	Distinguish wireless systems on the basis of performance features

Unit 1:Introduction to Wireless Communication System:

Evolution of mobile communications, Mobile Radio System around the world, Types of Wireless communication System, Comparison of Common wireless system, Trend in Cellular radio and personal communication. Second generation Cellular Networks, Third Generation (3G) Wireless Networks , Wireless Local Loop(WLL),Wireless Local Area network(WLAN), Bluetooth and Personal Area Networks, satellite communication including GPS, wireless local loop, cordless phone, paging systems, RFID.

Unit 2: Recent wireless technologies:

multicarrier modulation, OFDM, MIMO system, diversity multiplexing trade-off, MIMO-OFDM system, smart-antenna; beam forming and MIMO, cognitive radio, software defined radio, communication relays, spectrum sharing.

Wireless Systems: GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, GSM speech coding, Concept of spread spectrum, Architecture of IS-95 CDMA system,Air interface, CDMA forward channels, CDMA reverse channels, Soft handoff, CDMA features, Power control in CDMA, Performance of CDMA System, RAKE Receiver, CDMA2000 cellular technology, GPRS system architecture

Reference Books:

- 1 Wireless Communication, Theodore S. Rappaport, Prentice hall
 - 2 Wireless Communications and Networking, Vijay Garg, Elsevier
 - 3 Wireless digital communication, Kamilo Feher, PHI
 - 4 Mobile Communications Engineering, William C. Y. Lee, Mc Graw Hill Publications
 - 5 Mobile and personal Communication system and services by Rajpandya, IEEE press (PHI).
 - 6 Wireless Communications-T.L.Singh-TMH
 - 7 Adhoc Mobile Wireless network, C.K.Toth Pearson.
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SAVITRIBAI PHULE PUNE UNIVERSITY
M. Sc. Part II(Electronic Science)
Elective Theory course

Semester III: ELT234: Fundamentals of Internet of Things

Credits: 2

Teaching allotment: 2 lectures/week

Lectures: 30 lectures

Course outcomes:

This course enables students to know about basics of Internet of things and technologies used for the same. At the end of this course, student should be able to

CO1	Understand framework of Internet of things
CO2	Identify architecture, structure and security as well as privacy aspects in IoT
CO3	Design and configure RFID and WSN networks considering security issues

Unit 1: Introduction

History of IoT, About IoT, Overview and Motivations, Examples of Applications, Internet of Things Definitions and Frameworks : IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities

Unit 2: fundamental IoT mechanisms and key technologies

Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology,

RFID: Introduction, Principle of RFID, Components of an RFID system, Issues EPCGlobal Architecture Framework: EPCIS & ONS, Design issues, Technological challenges, Security challenges, IP for IoT, Web of Things.

Wireless Sensor Networks: History and context, WSN Architecture, the node, Connecting nodes, Networking Nodes, Securing Communication WSN specific IoT applications, challenges: Security, QoS, Configuration, Various integration approaches, Data link layer protocols, routing protocols and infrastructure establishment.

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Text/Reference books:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
 2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer
 3. Parikshit N. Mahalle& Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (ebook).
 4. Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Willy Publications
 5. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2 nd Edition, Willy Publications
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SAVITRIBAI PHULE PUNE UNIVERSITY
M. Sc. Part II(Electronic Science)

Elective Practical Course: Fundamentals of wireless communication system

Semester III: ELP234: Practical course

Credits: 2

Course outcomes:

This practical course inculcates experiential learning habits in students for wireless communication systems. At the end of the course student should be able to

CO1	Demonstrate wireless communication systems using simulation (MATLAB/SCILAB)
CO2	Evaluate and analyze importance of filters in wireless communication systems
CO3	Configure WSN modules for wireless communication
CO4	Analyze GPRS, GPS and RFID systems and antennas

List of experiments (Any 5)

1. To understand QPSK modulation scheme using MATLAB/SCILAB
 2. To understand effects of pulse shaping filters in wireless communication systems using MATLAB/SCILAB
 3. Evaluate the impact of path loss and shadowing in estimation of received signal power in mobile cellular communication using fading channel mobile communication virtual lab.
 4. Configure ZigBee module as an end device and, set up a communication link with two ZigBee modules.
 5. Study of RFID system and its applications.
 6. Using GPS system, study the graphical representation of geographical position using Survey plotting.
 7. Study the GPRS system and use it for sending an e-mail through WI-GPRS trainer.
 8. Study the GSM modem and its different module for phone book, setting up a call, sending SMS and identifying call history using AT commands. 3.
 9. Interfacing of GSM modem with control unit.
 10. Design a patch antenna using IE3D using different parameters.
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SAVITRIBAI PHULE PUNE UNIVERSITY

M. Sc. Part II(Electronic Science)

Elective Practical Course: Fundamentals of Internet of things

Semester III: ELP234: Practical course

Credits: 2

Course outcomes:

This practical course develops practical skills amongst students for use of IoT in various applications. At the end of the course student should be able to

CO1	Install and implement IoT systems using different microcontrollers
CO2	Demonstrate interfacing of LED,Buzzer, button and sensors to microcontrollers
CO3	Design ,develop and implement IoT systems for basic applications such as ON/OFF LED etc
CO4	Understand methodology to design IoT systems

List of experiments (Any 5)

1. To get familiarize with Raspberri pi /arudino and perform necessary installation procedure
 2. To interface LED/buzzer with arudino/raspberri pi and program it to turn ON/OFF for 1 sec after every 2 sec.
 3. To interface push button with arudino/respberri pi and program it to turn ON/OFF LED when push button is pressed or released
 4. To interface sensor with arudino/raspberri pi and program it to to turn ON/OFF LED for sensor detection
 - 5.To interface DHT11 sensor for recording temperature and humidity readings with arudino/raspberri pi
 6. To interface Bluetooth with arudino/raspberri pi and send sensor data to smartphone
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SAVITRIBAI PHULE PUNE UNIVERSITY
M. Sc. Part II(Electronic Science)
Core compulsory Practical Course
Semester III: ELP235: Practical course

Credits: 4

Course outcomes

This course develops abilities in students to design, build and implement different communication circuits as well as mechatronic systems. At the end of this course, student should be able to

CO1	Design and develop AM and FM transmission system
CO2	Design and implement digital modulation systems and pulse modulation techniques
CO3	Set up and implement mechatronic systems such as flow control or servo control using basic components like motors,sensors and actuators
CO4	Design , develop and implement controller circuits for identified applications

Any 10 Practicals from following sections

Advanced communication systems

1. Design of AM transmitter and receiver
2. Design of FM transmitter and receiver
3. Design of Delta modulation
4. Design PCM encoder and decoder system
5. Design of FSK modulator and demodulator
6. Design of telemetry system

Mechatronics and Robotics

1. Study of a DC servo motor
2. Study of BLDC motor, its speed control/position control
3. Study of PMDC motor torque speed characteristics
4. Study of AC servo motor, its speed control/position control
5. Set up a flow control system using suitable flow sensor and actuator
6. Implementation of velocity profile of servo control

SAVITRIBAI PHULE PUNE UNIVERSITY

M. Sc. Part II(Electronic Science)

Core Compulsory Theory course

Semester IV: ELT241: Industrial Training

Credits: 4

Course outcomes:

This course provides students experiential learning method through hands on training. At the end of course student should be able to

CO1	Understand upcoming requirements in industry/institutions
CO2	Adopt to new techniques or upcoming technologies
CO3	Analyze the problem and solve using different techniques
CO4	Requirement of skills in industry environment

Guidelines for evaluation of course

- Teachers of respective PG centres are expected to conduct continuous evaluation of this course.
 - Note that credits of this course should not considered in 24 credits option of Semester III
 - Evaluation of this course is done as follows:
 1. Internal continuous examination which includes
 - a. Seminar/presentation of work done in industry
 - b. Home assignment
 - c. Time to time reporting to the concerned teacher
 - d. Performance report of student from concerned authority from industry/research institute/college(PG center)
 2. University evaluation which includes
 - a. Written test
 - b. Project examination and presentation of work
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SAVITRIBAI PHULE PUNE UNIVERSITY

M. Sc. Part II(Electronic Science)

Elective Theory course

Semester IV: ELT241: PLC Programming and Applications

Credits: 2

Teaching allotment: 2 lectures/week

Lectures: 30 lectures

Course outcomes:

Due to automation in industry, PLC programming is most demanding skill required in upcoming Engineers. This course builds PLC programming ability in students. At the end of this course student should be able to

CO1	Understand basics of Programmable Logic Controllers, their working and their programming
CO2	Design, modify and troubleshoot such control circuits
CO3	program PLCs to automate the systems for different applications

Unit 1. Introduction to PLC

Concept of PLC, Building blocks of PLC, Functions of various blocks, limitations of relays. Advantages of PLCs over electromagnetic relays. Different programming languages, PLC manufacturer etc. . Working of PLC - Basic operation and principles of PLC , Scan Cycle , Memory structures, I/O structure - Programming terminal, power supply
Basic instructions like latch, master control self holding relays. Timer instruction like retentive timers, resetting of timers. - Counter instructions like up counter, down counter, resetting of counters. - Arithmetic Instructions (ADD,SUB,DIV,MUL etc.) - MOV instruction - RTC(Real Time Clock Function) - Watch Dug Timer - Comparison instructions like equal, not equal, greater, greater than equal, less than, less than equal

Unit 2. PLC Programming and applications

Ladder Diagram Programming :

Programming based on basic instructions, timer, counter, and comparison instructions using ladder program.

Applications of PLCs : Object counter - On-off control , Car parking , Sequential starting of motors , Traffic light control ,Motor in forward and reverse direction - Filling of Bottles , Room Automation

Text/Reference Books:

1. Programmable logic controller, Dunning
 2. Programmable Logic Controller by Job Dan Otter; P.H. International, Inc, USA
 3. Introduction to PLCs by Gary Dunning. McGraw Hill
 4. Module on PLCs and their Applications by Rajesh Kumar, NITTTR Chandigarh
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SAVITRIBAI PHULE PUNE UNIVERSITY
M. Sc. Part II(Electronic Science)
Elective Practical course
Semester IV: ELP241: PLC Programming and Applications

Course outcomes:

At the end of this course student should be able to

CO1	Explain the use of industrial grade components in automation
CO2	Understand relay logic diagram and its use in different applications

List of Experiments: (Any 5)

1. To Identify Components/sub-components of a PLC, Learning functions of different modules of a PLC system available in laboratory
 2. To understand programming a PLC (a) using a Hand held programmer (b) using computer interface
 3. To understand ladder diagram and instruction list syntax
 4. To program and implement basic logic operations, AND, OR, NOT functions
 5. Sequence control system e.g. in lifting a device for packaging and counting
 6. Use of PLC for any one application of the following (Object counter - On-off control , Car parking , Sequential starting of motors , Traffic light control ,Motor in forward and reverse direction - Filling of Bottles , Room Automation)
 7. Industrial visit report/Workshop /hands on training on PLC programming
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M. Sc. Part II(Electronic Science)
Core Compulsory Theory course
Semester IV: EL242: MOOCs Courses

Credits: 4
Lectures: 60 lectures

Course outcomes:

MOOCs courses provide students new and modern learning platform for topics which are not in curriculum or on advanced topics in respective subjects. At the end of these course student should be able to

CO1	manage their own time in order to develop their intrinsic motivation and commitment to the course
CO2	Ensure that the duration of the course is no longer than 8 weeks and remain in and complete shorter MOOCs
CO3	transfer credits from MOOCs into institutional degree programs
CO4	Foster self-directed learning environments to expand students' autonomy, encourage them to complete their weekly assignments, and provide opportunities for students with limited computer and language skills.

- Student has to complete MOOCs course of total 60 hours(4 credits)
- Evaluation is based on Certificate/course completion document and CIE

MOOCs courses

For registration to MOOCs Courses, the students shall follow NPTEL Site <http://nptel.ac.in/> as per the NPTEL policy and norms. The students can register for these courses through NPTEL directly as per the course offering in Odd/Even Semesters at NPTEL. These NPTEL courses (recommended by the University) may be cleared during the Semester III and Semester IV of M. Sc. Electronic Science(not necessary one course in each semester). After successful completion of these Moocs courses the students, shall, provide their successful completion NPTEL status/certificates to the University (COE) through their college of study only.

Name of the Course	Name of instructor/teacher	Credits	Resource
User-centric Computing for Human-Computer Interaction	Prof. Samit Bhattacharya	04	IIT Guwahati
Neural Networks for Signal Processing I	Prof. Shayan Srinivasa Garani	04	IISc Bangalore
Deep Learning	Prof. P.K. Biswas	04	IIT Kharagpur
Numerical Methods And Simulation Techniques For Scientists And Engineers	Dr. Saurabh Basu	04	IIT Guwahati
Introduction to Industry 4.0 and Industrial Internet of Things	Prof. Sudip Misra	04	IIT Kharagpur
VLSI Circuits	Prof. S. Srinivasan	04	IIT Madras
Biomedical signal processing	Prof. Sudipta Mukhopadhyay	04	IIT Kharagpur
Electric Vehicles: Part 1	Amit Kumar Jain	02	IIT Dehli
Introduction to hybrid and electric vehicles	—	02	IIT Guwahati

References

1. www.nptel.com
 2. www.moocs.org
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SAVITRIBAI PHULE PUNE UNIVERSITY
M. Sc. Part II(Electronic Science)
Core Compulsory Theory course
Semester IV: ELDT243: Technical Communication

Credits: 4

Course Outcomes :

This course strengthens technical writing and presentation skills of students. At the end of the, student should be able to

CO1	Utilize the technical writing for the purposes of Technical Communication and its exposure in various dimensions.
CO2	Understand the nature and objective of Technical Communication relevant for the work place
CO3	Imbibe inputs by presentation skills to enhance confidence in face of diverse readers.
CO4	Evaluate and present gist of the books in the form of book review
CO5	Prepare documents for thorough understanding of applications and promote their technical competence

Unit -1 Fundamentals of Technical Communication

Technical Communication: Features; Distinction between General and Technical Communication; Language as a tool of Communication; Dimensions of Communication: Reading & comprehension; Technical writing: sentences; Paragraph; Technical style: Definition, types & Methods; The flow of Communication: Downward; upward, Lateral or Horizontal; Barriers to Communication.

Unit – 2 Forms of Technical Communication:

Technical Report: Definition & importance; Thesis/Project writing: structure & importance; synopsis writing: Methods; Technical research Paper writing: Methods & style; Seminar & Conference paper writing; Key-Note Speech: Introduction & Summarization; Expert Technical Lecture: Theme clarity; Analysis & Findings; 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration.

Unit – 3 Technical Presentation:

Strategies & Techniques Presentation: Forms; interpersonal Communication; Class room presentation; style; method; Individual conferencing: essentials: Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation; Overcoming Stage Fear: Confident speaking; Audience Analysis & retention of audience interest; Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections.

Unit - 4 Technical Communication Skills:

Interview skills; Group Discussion: Objective & Method; Seminar/Conferences Presentation skills: Focus; Content; Style; Argumentation skills: Devices: Analysis; Cohesion & Emphasis; Critical thinking; Exposition narration & Description; effective business communication competence: Grammatical; Discourse competence: combination of

expression & conclusion; Socio-linguistic competence: Strategic competence: Solution of communication problems with verbal and non verbal means.

Reference Books

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.
 2. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
 3. Practical Communication: Process and Practice by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2014, Delhi.
 4. Modern Technical Writing by Sherman, Theodore A (et.al); Apprenice Hall; New Jersey; U.S.
 5. A Text Book of Scientific and Technical Writing by S.D. Sharma; Vikas Publication, Delhi.
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SAVITRIBAI PHULE PUNE UNIVERSITY

M. Sc. Part II Electronic Science

Core compulsory Practical Course

Semester IV: ELDP244:Project/Internship

Credits: 08

Course Outcomes:

Internships are educational and career development opportunities, providing practical experience in a field or discipline. They are structured, short-term, supervised placements often focused around particular tasks or projects with defined timescales. An internship may be compensated, non-compensated or some time may be paid. The internship has to be meaningful and mutually beneficial to the intern and the organization. After completion of this course student should be able to

CO1	Gain experience in writing Technical reports/projects
CO2	Expose to the responsibilities and ethics in industrial environment
CO3	Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control.
CO4	Attain academic, professional and/or personal development
CO5	Develop as future employers/entrepreneurs
CO6	Understand the social, economic and administrative considerations that influence the working environment of industrial organizations
CO7	Understand the psychology of the workers and their habits, attitudes and approach to problem solving

- **Internship/Project credits**

Number of credits allotted to:08

It should include

1. Timely attendance report of student at project/internships
2. Progress report signed by industrial author/project guide
3. Presentations
4. Project report preparation
5. Demonstrations
6. Voce Viva

SAVITRIBAI PHULE PUNE UNIVERSITY
REVISED BBA PROGRAMME STRUCTURE CBCS 2019 PATTERN
BACHELOR OF BUSINESS ADMINISTRATION (BBA)
THREE YEAR FULL TIME COURSE

BBA I YEAR CURRICULUM APPLICABLE W.E.F. AY 2019-20

BBA II YEAR CURRICULUM APPLICABLE W.E.F. AY 2020-21

BBA III YEAR CURRICULUM APPLICABLE W.E.F. AY 2021-22

BBA PROGRAMME CONTENT

1. PREAMBLE
2. Objectives Of The Programme
3. Introduction To The Programme
4. Eligibility
5. Duration Of The Programme
6. Highlights Of The New Curriculum
7. Choice Based Credit System (CBCS)
8. Additional Credits
9. Guidelines For Successful Implementation Of CBCS
10. Teaching Instructions
11. Equivalence, Transitory Provision, Transcript And Standard Of Passing
12. Details On Course Content
13. List Of The Courses
14. Annexure (I) Course Content
15. Annexure(II) Contents Of Skill-Based Courses
16. Acknowledgement

SAVITRIBAI PHULE PUNE UNIVERSITY
FACULTY OF COMMERCE AND MANAGEMENT

**Structure for Three Years Bachelor of Business Administration- BBA Degree Programme
(Choice Based Credit System - CBCS) with effect from June 2019.**

1. Preamble:

The programme structure of BBA is designed to create detailed understanding and awareness of various business systems. This course will cultivate desired business acumen amongst the students. This programme is designed with specific objectives of developing various skills, aptitude and awareness amongst the students in tune with the prevailing business systems that govern different types of business organizations. The course structure is divided into three parts that are interlinked in a systematic manner. This is to maintain consistency and a continuous flow in the teaching-learning process and method of evaluation for each topic.

The present programme will enable the students to foster entrepreneurial attitude, ability to think independently and take rational decisions at various levels of management. It aims to develop a professional and managerial acumen and leadership qualities amongst the youth. Moreover, it incorporates various skills like time management skills, presentation skills, geo-political awareness and business awareness that are required for managerial effectiveness. This programme predominantly endeavours for holistic development of students by providing training in soft skills, computer skills, various Add on Courses and interdisciplinary subjects which are included under the Choice Based Credit System (CBCS).

2. Programme Objectives:

BBA is a professional programme aimed at inculcating managerial and entrepreneurial attitude and skills amongst the learners. This programme is designed to provide basic understanding about Management Education and prepare the students to avail the opportunities available in the Management Profession .It also helps them to become successful business leaders by creating self-employment opportunities. It is basically a development programme for enhancing leadership qualities and encouraging the students to build the required business acumen.

Following are the objectives:

1. To develop precise understanding about business environment and organizations.
2. To develop leadership aptitude among the students in order to work independently and in organized groups.
3. To inculcate among the students the qualities of a dynamic manager, capable of taking various decisions and communicating effectively to different groups of people.
4. To understand and gain knowledge of various financial institutions and agencies.

3. Introduction to the Programme:

The degree shall be titled as **Bachelor of Business Administration (B.B.A.)** under the Faculty of Commerce and Management. The implementation of Choice Based Credit System for First Year B.B.A. is w.e.f. the academic year 2019-2020, Second Year B.B.A. w.e.f. 2020-2021 and Third Year B.B.A. w.e.f. 2021-2022.

4. Eligibility:

- A candidate from any stream, should have passed 12th Std. Examination (H.S.C.10+2) with minimum 40% of marks and English as a passing subject.

OR

- Three Years Diploma Course from Board of Technical Education, conducted by Government of Maharashtra or its equivalent, after S.S.C. i.e. 10th Standard.

OR

- Two Years Diploma Course in Pharmacy from Board of Technical Education, conducted by Government of Maharashtra or its equivalent, after H.S.C. i.e. 12th Standard.

OR

- Completed MCVC program

5. Duration of the Programme:

The Bachelor of Business Administration (BBA) is a full time three (3) years programme and it is divided in six (6) Semesters.

6. Highlights of the New Curriculum:

The New Curriculum intends to add immense value to all stakeholders. These requirements will be addressed effectively in numerous ways by:

- Enhancing the brand value of the Commerce and Management Programme of Savitribai Phule Pune University.
- Providing much needed flexibility to individual Institutes to carve a niche for themselves. A thorough revamp of course through essential computer skills which are necessary for developing proficiency in the selected special subject.
- Emphasizing student-centric teaching and learning process.
- Focusing on 'Concurrent Evaluation' i.e. continuous evaluation throughout the programme.

- Stressing on ‘Experiential Learning’ aspect through Concurrent Evaluation pattern with focus on group activity, field work, self-study, projects, Industry Exposure Programmes, etc.
- Incorporating specializations in the syllabus from Second Year in order to provide in-depth knowledge of the electives chosen by the students.
- Providing opportunity to students to choose courses from other electives to explore cross functionality.
- Emphasizing on Research, Inter-personal skills, Analytical skills, Entrepreneurial skills, and Global aspects of Managerial careers throughout the curriculum.

7. Choice Based Credit System (CBCS):

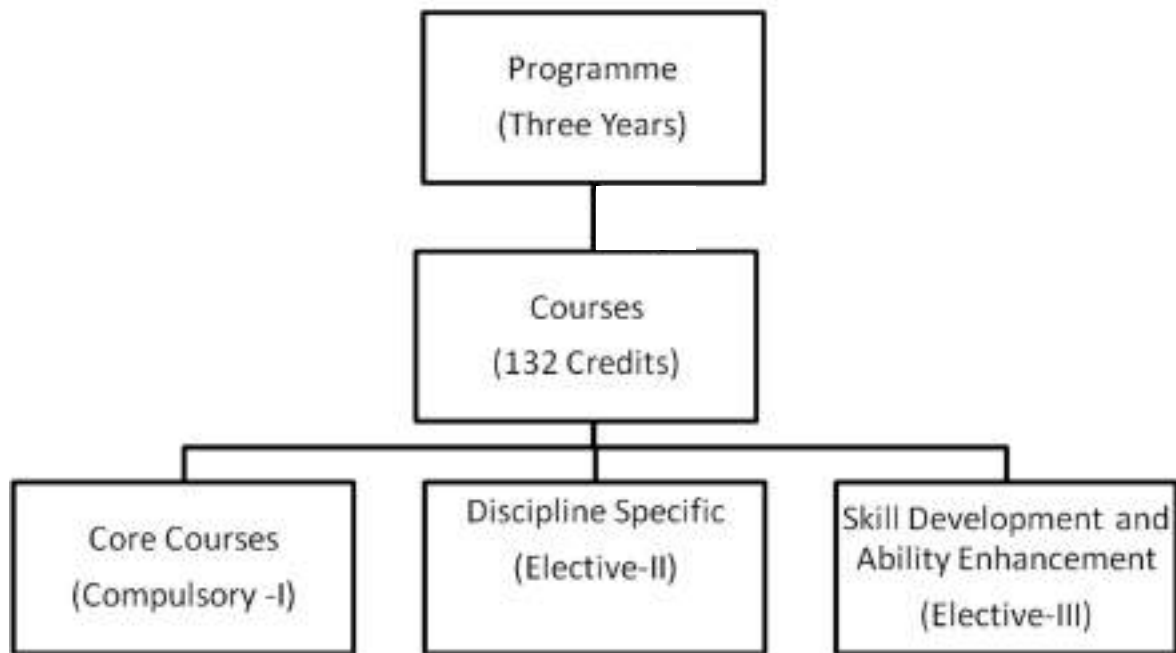
The CBCS provides an opportunity for the students to choose courses from prescribed curriculum comprising of core, elective/minor or skill based courses. The courses can be evaluated by a Grading System, which is considered to be better than the conventional marking system. Thus a uniform Grading System has become a necessity in the entire Higher Education field in India. This will benefit the students to move across institutions within India and across countries. This uniform grading system will also enable the potential employers to assess the performance of the candidates. The UGC has formulated some guidelines in order to bring uniformity in the evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on students performance in examinations which are mentioned below:

7.1 Course: A “Course” is a component of programme, i.e. in the new system, papers will be referred to as courses. Each course is identified by a unique course code. While designing curriculum, courses can have defined weightages. These weightages are called as credits. Each course, in addition to having a syllabus, has learning objectives and outcomes. A course may be designed to comprise lectures/ tutorials/ laboratory work/ field work/ project work/vocational training /viva-voce etc. or a combination of some /any of these.

7.2 Credit: The definition of “Credits” can be based on various parameters. These may be the learning hours put in, learning outcomes and contact hours, the quantum of content/syllabus prescribed for the course. The credit system requires that a student progresses in the academic programmes not in terms of time (years or semesters), but in terms of courses.

7.3 Outline of the CBCS: Bachelor of Business Administration- BBA Degree Programme 2019 pattern.

Outline of the Choice Based Credit System (2019 Pattern)



7.3 I. Core Course: Core courses are the foundation courses of management education. They are compulsory for all the students. Core courses are of two types: Generic Core and Subject Core.

1. Generic Core (GC): This is the course which is mandatory and has to be studied by the student as a core part to fulfill the requirements of a degree in the said discipline of study. Therefore, Generic Core courses are mandatory and fundamental in nature. These courses cannot be substituted by any other courses. Such courses are also known as Hard Core Courses. Generic Core courses in Semester I and II provide foundations of Management and Administration. Generic Core courses in Semester III and IV focus on Functional Areas whereas, Generic Core courses in the Semester V and VI are integrative and provide insights about different fields of business.

2. Subject Core (SC): These are also known as Soft Core Courses. These may be subject-specific/specialized/advanced/supportive to the discipline subject of study, which provides an extended scope and enable exposure to some other disciplines that help in nurturing the candidate's proficiency, domain knowledge, skills, etc. Practical /Tutorial work is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation,which will help the students to understand core subject in better manner.

7.4 II. Elective Courses :

1. Discipline Specific Elective (DSE) Course: Elective course is a course which can be chosen from a pool of courses. Elective Courses which may be offered by the main discipline/subject of study is referred as **Discipline Specific Elective**. DSE Courses develop generic proficiencies amongst the students.

The Institute has the flexibility to offer courses based on Targeted Industry Linkages – sectoral requirements and networking at the college level. A student can select any one specialization from the five areas which are mentioned below.The student will study eight (8) courses in second and third year. DSE courses helps to develop discipline/domain knowledge and nurture candidate's proficiency/skill.

Bachelor of Business Administration Degree offers the following Electives :

- A) Marketing Management (MM)
- B) Financial Management (FM)
- C) Human Resources Management (HRM)
- D) Services Management (SM)
- E) Agri Business Management (ABM)

Dissertation/Project for DSE courses: An elective course designed to acquire special/advanced knowledge, as a supplement study/support study to a project work, with an advisory support of a teacher/faculty member is called dissertation/project.

7.5 III.A. Skill Enhancement Courses (SEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instructions. Open Course contents are mentioned in Annexure II.

Duration of each course will be of 30 hours for 2Credits. Institutes can select various courses as per the interest of their students and the availability of various facilities.

A. List of Skill Enhancement Courses:

- A] Basic Managerial Skills
- B] Communication Skills for Managers
- C] Tally and Computer Based Accounting
- D] Certificate Course in Analysis and Presentation of Data
- E] Introductory Course in Disaster Management
- F] Personality and Soft Skills Development
- G] International Etiquettes and Mannerism
- H] Foreign Language
- H1] Advance Foreign Language
- I] Yoga and Meditation
- J] Ground and Sports Management
- K] Value Education and Gender Equality
- L] UGC / SPPU Approved online courses
- O] College Course Under Specific Scheme

III.B. Ability Enhancement Compulsory Courses (AECC) i.e. Environmental Science.

Duration: 30 hours and Credits: 2

Types of courses :

M. Basic Course in Environmental Awareness OR N. Advanced Course in Environmental Awareness

8. Note: Additional Credits.

The students are also eligible to earn additional Credits for NCC, NSS, Sports, P.T etc. apart from the Courses mentioned in the programme which will be considered separately as per the guidelines and notifications displayed by the respective authorities of the SPPU. The credits will be offered to the students as per Credit calculations of the respective units.

9. Guidelines for successful implementation of CBCS:

9.1. Credit Point may be considered under two parts –

a) One part consisting of the hours actually spent in the class room / practical / field work instructions and the other part consisting of notional hours spent by the Learner for self-study in the library, peer interactions, case study, writing of journals and assignments, projects etc. for the completion of that course.

Every course offered shall have three components associated with the teaching-learning process viz.

- a) Lecture –L : Classroom sessions delivered by faculty in an interactive mode.
- b) Tutorial and Practical (T &P) - : Sessions consisting of participatory discussions/ self-study/ desk work/ brief seminar-presentations by students and such other novel methods that help the students absorb and assimilate the contents delivered in the Lecture sessions in an effective manner.
- c) Practical sessions /Project Work consisting of Hands-on experience / Field Studies / Case-studies that equip students to acquire the much required skill component.

9.2. The success of the CBCS requires certain commitments from both; the students and the teachers.

9.2.1. The student should be regular and punctual to his/her classes, sincere in carrying out the assignments/classroom activities etc. and should maintain consistency in his/her tempo of learning. He/She should make maximum use of the library, internet and other available facilities.

9.2.2. The teachers are expected to be alert and punctual. They should strictly adhere to the schedules of teaching, conducting tests, seminars, evaluation and notification of results. All teachers should notify the tentative schedule of teaching and tests of the entire semester, including the dates of tests, dates of score notification and all other schedules, which can be planned in advance.

9.2.3. The teachers are expected to adhere to an unbiased and objective evaluation and marking of concurrent evaluation scores (internal examinations). This practice will not only boost the confidence of the students, but it will also ensure that merit is given due credit. Transparency, objectivity and quality are the key factors required for a good CBCS to sustain.

The course content is to be looked upon as the bare minimum requirement to be fulfilled. Emphasis shall be laid on the contemporary aspects and going beyond the content. The teaching / learning as well as evaluation are to be interpreted in a broader perspective.

10. Teaching instructions:

10.1 Medium of instructions - Medium of instruction shall be English only.

10.2 Teaching Workload:As per prescribed guidelines under the Commerce and Management faculty.

10.3 Method of Evaluation:

1) Internal Assessment (2) Projects Examination (3)University Examination (SPPU)

10.3.1. Instructions for teachers for Internal Assessment:

The purpose of internal evaluation is to assess the depth of knowledge, understanding and awareness about a particular subject. In order to have a rational and objective assessment of the learners, a teacher is expected to use different evaluation methods.

Continuous Assessment (CA): The concerned subject teacher is responsible for conduction and evaluation aspects with respect to Continuous Assessment. As soon as the course begins, the course teacher is expected to announce the mechanisms under which CA would take place. Journals/Lectures/Library-notes/Seminar-presentations/Assignments/Extension Work/An Open-Book Test (book to be decided by the concerned teacher)/Internal examinations/Classroom instructions through audio visual aids/Case-studies/Role-plays/Industrial Visits/Seminars/Presentations/Guest Lectures/Shared teaching/Flip classes/Simulation/Experiential Learning/Social Outreach/Internships/Certificate Courses /Online Certifications/Group Discussion/Business Fest/Webinars etc. may be used as the tools/mechanism for CA.

A subject teacher has the autonomy to devise a mechanism for evaluating the students as per the guidelines.

The class work will carry 30 marks in each course. Internal Evaluation includes continuous evaluation of a student by adopting variety of techniques.

Tutorials / Practicals for Core Credit : Tutorials Courses will carry 20 marks as a part of evaluation in addition to the Internal Assessment. A small project work consisting of Hands-on

experience / Field Studies / Mini-Research Project (by an individual student or a group of students)/ Assignments/Case-studies etc. that equip the students to acquire the much required skills can be assigned.

It is obligatory for a teacher to announce the performance of the students. It is also mandatory to declare the CA score gained by all the students on the noticeboard duly signed by the concerned teacher of the course and the HOD/Principal/Director well before the commencement of the SPPU examination.

10.3.2 Business Exposure and Project (Semester III&IV)- There will be viva voce examination of 50 marks and a written Examination carrying 50 marks for the students. The students are expected to visit the industry and collect the relevant and required data pertaining to the subject and prepare a report likewise. These Industry Visits and interviews shall be arranged under the supervision of the subject teacher.

A student shall complete a computer course relevant to specialization subject, the fees / Expenses towards computer course will be borne by the students. **The evaluation will be conducted at SPPU level through Viva Voce.**

Projects: For course on Project work in Semester V & VI, there will be Written Report of 50 marks. Appropriate allocation of project work (Internship / Hands on experience) should be arranged by the students under the guidance of the teacher and all the expenses will be borne by the students. Course wise guidelines are mentioned in the course content. **The evaluation will be conducted at SPPU level through Viva Voce.**

Online Course Credit- If a student completes relevant online course approved by SPPU /UGC or other competent authority, within the particular academic period, then he/she is entitled to earn 2 Credits for the same, provided the duration of the course should be more than 4 weeks or it should be of 30 hours. These 2 (two) Credits can be given only after he/she submits the Passing Certificate of the said course undertaken.

10.3.3 External Examination: - SPPU will schedule the written Examination for the course at the end of each Semester.

Guidelines for Setting External Examination Question Papers:

- 1) English will be the only Medium of Answer for students to appear the examinations of SPPU.
- 2) The question papers shall be set by the respective members of the Paper-Setting Committee duly appointed by the University in a manner where due weightage is given to the course syllabus-wise.
- 3) The question paper shall be balanced in respect of various topics outlined in the syllabus.
- 4) The question papers shall have a combination of long, short answers and MCQ type questions.
- 5) The University papers will mostly be divided in three parts. 25% weightage will be given to Objective type questions, 30% weightage will be given to short answers and remaining 45% weightage will be given to long answers type questions. For better understanding of the Course-wise Paper Pattern please refer to the Annexure-II.

11. Equivalence, Transitory Provision, Transcript and Standard of Passing:

The University will conduct examinations for the students of the old course for next three academic years from the date of implementation of the new course. The candidates of old course will be given three chances to clear their subjects as per the old course pattern, and there-after they will have to appear for the subjects under new course pattern as per the equivalence given to the old course.

(For Details Refer: Separate notifications issued by the Board of Examinations.)

Standard of Passing – The programme will be a full-time course and the duration of the programme will be of three years divided into six semesters. A candidate is required to obtain 40% marks in Internal Assessment, Projects and semester-end SPPU examination. There will be separate passing for evaluation of Internal, practical, projects and external SPPU examination.

(University terms (Backlog) and Standard of Passing- For details Refer, Separate notifications issued by the Board of Examinations).

12. Details on Course structure –The courses are divided in three parts:

- 1. List of Core Courses**
- 2. List of Specialization Courses**
- 3. List of Skill Courses.**

1. Core Courses – It is mandatory for the students to complete the courses mentioned in the list.

2. Specialisation Courses – Five electives / options are offered to the students. They will have to select any one course in Semester III as an Elective Subject. The chosen elective will be continued till the end of the course. In all, 8 courses/subjects will be studied by the student by the end of his/her BBA programme. The list of Specialisation courses is separately mentioned.

3. Skill Courses –The list of 16 Skill Enhancement Courses is provided. The college can select courses as mentioned in the structure to suit the requirements of the students. Each course will carry 2 credits having duration of 30 hours. The courses mentioned in the list will be updated as per the requirements of the business environment. The Board Of Studies will make the necessary changes in the list. These courses can also be replaced by approved online courses. It is mandatory for every Institute to conduct the Compulsory Ability Enhancement Course in Semester III. The Institute can select basic or advanced courses.

12. List of Courses offered

BBA -Bachelor of Business Administration Updated Programme Structure CBCS - Pattern 2019

FYBBA Semester I

Group I	Course Details Generic Core (GC) and Subject Core (SC) (Compulsory)			Internal Evaluation		External Evaluation
	Course Code	Course Title	Credits	Core Course	Concurrent Evaluation	Tutorial /Practical
	First Year Semester I					
101	Principles of Management	3	GC	30	-	70
102	Business Communication Skills	4	SC	30	20	50
103	Business Accounting	3	GC	30	-	70

104	Business Economics – Micro	3	GC	30	-	70
105	Business Mathematics	3	GC	30	-	70
106	Business Demography	4	SC	30	20	50
	Total Credits for the Semester I	20				
	GC (12)+SC(8)=20					
	First Year Semester II					
201	Business Organization and System	4	SC	30	20	50
202	Principles of Marketing	3	GC	30	-	70
203	Principles of Finance	3	GC	30	-	70
204	Basics of Cost Accounting	3	GC	30	-	70
205	Business Statistics	3	GC	30	-	70
206	Fundamentals of Computers	4	SC	30	20	50
	Credits for the semester II	20				
	GC (12)+SC(8) =20					
	Second Year Semester III					
301	Principles of Human Resource Management	3	GC	30	-	70
302	Supply Chain Management	3	GC	30	-	70
303	Global Competencies & Personality Development	3	GC	30	-	70
304	Fundamentals of Rural Development	3	GC	30	-	70
	Credits For Semester III- CC 12	12				

Second Year Semester IV						
401	Entrepreneurship and Small Business Management	3	GC	30	-	70
402	Productions and Operations Management	3	GC	30	-	70
403	Decision Making and Risk Management	3	GC	30	-	70
404	International Business Management	3	GC	30	-	70
	Total credits CC12	12				
Third Year Semester V						
501	Research Methodology	3	GC	30	-	70
502	Database Administration and Data Mining	3	GC	30	-	70
503	Business Ethics	3	GC	30	-	70
504	Management of Corporate Social Responsibility	3	GC	30	-	70
	Total credits CC – 12	12				
Third Year Semester VI						
601	Essentials of E - Commerce	3	GC	30	-	70
602	Management Information System	3	GC	30	-	70
603	Business Project Management	3	GC	30	-	70
604	Management Of Innovations & Sustainability	3	GC	30	-	70
	Total credits CC – 12					
Total Credits From GC and SC						

	(Sem) I 20 + (Sem) II 20 (Sem) III12 +(Sem) IV12 (Sem) V12 and (Sem) IV12 =88					
Group II	<u>List of Discipline Specific Elective (DSE)Courses</u> (Select any One group of Electives from the Five)					
(A) OR	Marketing Management (MM)					
	Course Titles	Credits	Semester	Concurrent Evaluation	Tutorial /Practical	SPPU Evaluation
A305	Consumer Behaviour & Sales Management	4	III	30	20	50
A306	Retail Management + Business Exposure	4	III		50	50
A405	Advertising & Promotion Management	4	IV	30	20	50
A406	Digital Marketing + (prescribed computer course or online course)	4	IV		50	50
A505	Marketing Environment Analysis and Strategies	4	V	30	20	50
A506	Legal Aspects in Marketing Management + Project & Viva (50 marks)	6	V		50	50
A605	International Brand Management	4	VI	30	20	50
A606	Cases in Marketing + Project 50 marks theory + Project& Viva 50 marks (Internship)	6	VI		50	50
	Total Credits	36				

(B) OR	(B) Financial Management (FM)					
	Course Titles	Credits	Semester	Concurrent Evaluation	Tutorial /Practical	SPPU Evalu ation
B305	Management Accounting	4	III	30	20	50
B306	Banking & Finance +Business Exposure	4	III		50	50
B405	Business Taxation	4	IV	30	20	50
B406	Financial Services +Computer course (prescribed course or online course)	4	IV		50	50
B505	Analysis of Financial Statements	4	V	30	20	50
B506	Legal Aspects of Finance & Security Laws + Project & Viva (50 marks)	6	V		50	50
B605	Financial Management	4	VI	30	20	50
B606	Cases in Finance + Project 50 marks theory + Project& Viva 50 marks (Internship)	6	VI		50	50
	Total Credits	36				
(C) OR	(C) Human Resources Management (HRM)					
	Course Titles	Credits	Semester	Concurrent Evaluation	Tutorial /Practical	SPPU Evalu ation
C305	Organisational Behaviour	4	III	30	20	50

C306	Legal Aspects in Human Resource +Business Exposure	4	III		50	50
C405	Human Resource Management Functions & Practices	4	IV	30	20	50
C406	Employee Recruitment & Record Management + Computer course (prescribed course or Online course)	4	IV		50	50
C505	Cross Cultural HR & Industrial Relations	4	V	30	20	50
C506	Cases in Human Resource Management +Project & Viva (50 marks)	6	V		50	50
C605	Global Human Resource Management	4	VI	30	20	50
C606	Recent Trends & HR Accounting + Project 50 marks theory + Project& Viva 50 marks (Internship)	6	VI		50	50
	Total Credits	36				
(D) OR	(D)Services Management (SM)					
	Course Titles	Credits	Semester	Concurrent Evaluation	Tutorial /Practical	SPPU Evalu ation
D305	Fundamentals of Services Management.	4	III	30	20	50

D306	Principles & Functions of Services Management+Business Exposure Project	4	III		50	50
D405	Banking & Insurance Management	4	IV	30	20	50
D406	Social Services and NGO Management + Computer Course (prescribed course or Online course)	4	IV		50	50
D505	Health Care Management	5	V	30	20	50
D506	Permissions & Legal Aspects In Services + Project & Viva (50 marks)	5	V		50	50
D605	Global Tourism & Hospitality Management	5	VI	30	20	50
D606	Recent Trends in Services and Project 50 marks theory + Project& Viva 50 marks (Internship)	5	VI		50	50
	Total Credits	36				
(E)	(E)Agri Business Management (ABM)					
	Course Titles	Credits	Semester	Concurrent Evaluation	Tutorial /Practical	SPPU Evaluation
E305	Agriculture and Indian Economy	4	III	30	20	50

E306	Rural Development - Principles and Practice +Business Exposure	4	III	-	50	50
E405	Rural Marketing	4	IV	30	20	50
E406	Banking Operations and Finance + Computer Course (prescribed course or Online Course)	4	IV	-	50	50
E505	Warehouse Management	5	V	30	20	50
E506	Permissions & Legal Aspects In Agriculture + Project & Viva (50 marks)	5	V	-	50	50
E605	Agricultural Exports	5	VI	30	20	50
E606	Tourism Development in Rural India + project 50 marks theory + Project& Viva 50 marks (Internship)	5	VI	-	50	50
	Total Credits	36				
Group III	Skill Enhancement Course (30 hours)- and for 2 credits Ability Enhancement Compulsory Courses (AECC)					
	Courses	Credits	Semester	Concurrent Evaluation + Tutorial /Practical	SPPU Evaluation	
107	Skill Enhancement Course	2	I	50	Grade	
207	Skill Enhancement Course	2	II	50	Grade	
307	Compulsory Course in Environment (AECC),	2	III	50	Grade	

	(Select any one course from the List)				
407	Skill Enhancement Course	2	IV	50	Grade
	Total Credits	8			
(III)	List of Skill Enhancement Course (30 hours)- for 2 credits & Ability Enhancement Compulsory Courses (AECC),				
Course Code	Course Title	Credits	Core Course	Internal Evaluation	SPPU
A	Basic Managerial Skills	2	SEC	50	Grade
B	Communication Skills for Managers	2	SEC	50	Grade
C	Tally and Computer Based Accounting	2	SEC	50	Grade
D	Certificate Course in Analysis and Presentation of Data	2	SEC	50	Grade
E	Introductory Course in Disaster Management	2	SEC	50	Grade
F	Personality and Soft Skills Development	2	SEC	50	Grade
G	International Etiquette and Mannerisms	2	SEC	50	Grade
H	Foreign Language	2	SEC	50	Grade
H1	Foreign Language (Advanced)	2	SEC	50	Grade
I	Yoga and Meditation	2	SEC	50	Grade
J	Ground and Sports Management	2	SEC	50	Grade

K	Value Education and Gender Equality	2	SEC	50	Grade
L	UGC / SPPU Approved online courses (Minimum 4 weeks or 30 Hours)	2	SEC	Online Examination and Certification	-
O	College Course Under Specific Scheme.	2	SEC	50	Grade
AECC	Ability Enhancement Compulsory Courses (AECC), i.e., Environmental Science. Duration: 30 hours and Credits: 2 (Select Any One Course)				
Course Code	Course Title	Credits	Semester	Internal Evaluation	SPPU
1M	Basic Course in Environmental Awareness	2	III	50	Grade
2N	Advanced Course in Environmental Awareness	2	III	50	Grade

Note : All the stakeholders are requested to refer to the updated course content.

Course Content Annexures are attached separately – Faculty members and students should refer to the semester-wise updated course content.

14. Annexure (I) Course Content

15. Annexure(II) Contents of Skill-Based Courses

16. Acknowledement: The course focus of BBA Programme (CBCS-2019 Pattern) has always been raising the academic standards, excellence and holistic development of students. Hon. Prof. Dr. Nitin Karmalkar, Vice Chancellor, Hon. Dr. N. S. Umarani, Pro-Vice Chancellor, Hon. Dr. Parag Kalkar, Dean, and Associate Dean Dr. Yashodhan Mithare, Faculty of Commerce and Management have given insights in designing the BBA Programme.

Dr. Sanjay Kaptan ,Head ,Savkar Chair has shared his immense knowledge and expertise for designing the structure. Also, the Industry expert panel has added insights in course titles of the BBA Programme. Dr. Tanuja Devi co-ordinated the BBA Restructuring Committee. This synergy of contributors is very crucial in fine tuning of the BBA Programme in its present form.

**Savitribai Phule Pune University
FY BBA Semester I (CBCS) Pattern 2019**

The subject wise Revised Syllabus for F.Y. BBA Program

Principles of Management

Course Code 101 - GC

Credit -3

Depth of the course- Reasonable working knowledge

Program Objectives

- To understand basic concept regarding org. Business Administration
- To examining how various management principles
- To develop managerial skills among the students
-

Unit No.	Unit Title	Contents	Purpose & Skills to be develop
1	Nature of management	1.1 Meaning & Importance, Functions 1.2 Role of Managers 1.3 Management as an Art, Science, Profession and a Social System 1.4 Concept of Management, Administration, Organization & Universality of Management	Basic aspects of management thinking & Develop ability of managerial thinking and cultivate business acumen
2	Evolution of management thoughts	2.1 Concept of Managerial Thoughts 2.2 Contribution of Frederick Taylor, Elton Mayo, Henry Fayol and Peter Drucker 2.3 Indian Management ethos (Indian) and different Styles for example (J.R.D Tata, Dhirubhai Ambani, N. R. Narayana Murthy, Verghese Kurien)...	To understand different approaches to management thoughts and philosophy & Ability to understand approaches to philosophy of management thinking

3.	Major managerial Functions	<p>3.1 Forecasting: Meaning, Need Types, Methods, Advantages, merits ,Disadvantages</p> <p>3.2 Planning: Meaning, Need Types ,methods, Advantages, merits, Disadvantages</p> <p>3.3 Organizing: Meaning, Concept, Delegation of Authority: Meaning, Importance Decentralization: Concepts, Meaning And, Importance</p> <p>3.4 Decision Making: Types, Process, and Techniques Directions nature and principles and</p> <p>3.5 Motivation: Meaning, Importance, Nature, Principles, and Theories</p> <p>3.6 Controlling :Meaning, Needs, Process, Techniques</p>	<p>To understand the importance of functions of management and their roles</p> <p>&</p> <p>Ability to organize various programmes and events</p>
4.	Recent trends in Management	<p>4.1 Management of change , management of crises, Total Quality Management (TQM): Meaning, Merits, Demerits ,stress management .(Principles ,concepts merits)</p> <p>4.2 Knowledge Management: Meaning, Merits, Demerits</p> <p>4.3 Outsourcing: Meaning, Merits, Demerits</p>	<p>To know what are the themes in modern management and changes in the business</p> <p>&</p> <p>To learn about new systems and trends in modern management</p>

Teaching Methodology

Teaching Hours	Innovative methods to be used	Project	Expected Outcome
13	Study the role and functions of different managers	How an organizations manages its activities and functions	To develop managerial effectiveness through managerial thinking Knowledge of effective

13	Empirical management thoughts	Preparing charts of management thinkers and profile presentations on major management thinkers	Learning about the management philosophy over the period of time
12	Situation analysis , Business games Case study	Implementing planning process in an org ,analysis of different decision and failure of different org and decision	How to plan and organize an activity and motivate the group
12	Developing applications of management of change and crises Installing quality management system for a group Case study on majors to reduce stress	Develop a program for management of change and case study on resistance to change and preparing the checklist Developing quality manual Project on stress reduction methods	To Develop understanding regarding new systems of management

Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	I Quiz on concept importance of mgt II Presentation on role of management in society and organization III GD on importance of management as profession	25% MCQ Short notes 35% Long answers 40%	Decision making and leadership skills
Unit – II	I Presentation on contribution of management thinkers II case study on different approaches to mgt III posters on contributions of Indian management thinkers to management discipline		
Unit – III	MCQ on managerial functions II situation analysis how management fails or succeed III presentations on different types of decisions and case study on factors affecting decision making		

Unit – IV	MCQ on various new trends in management II case study on application of total quality management in an organization and compare two different intuitions. III Case study on management of change and crises IV situation analysis of determinants of stress		
Total –	30	70	

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Management Concepts and Strategies	J.S. Chandan	Vikas Publishing House Pvt. Ltd.	New Delhi
2	Principles of Management	Harold Koontz , Heinz Wehrich , A. RamachandraArysri	McGraw hill companies	New Delhi
3	Management A Global and Entrepreneurial Perspective	Heinz Wehrich , Mark V. Cannice , Harold Koontz	McGraw hill companies	McGraw hill companies
4	Management – 2008 Edition	Robert Kreitner , MamataMohapatra	Biztantra – Management For Flat World	New Delhi
5	Introduction to Management	John R. Schermerhorn	Wiley India Pvt. Ltd.	New Delhi
6	Principles of Management	P.C. Tripathi , P.N. reddy	McGraw hill companies	New Delhi
7	Management Text and Cases	R. SatyaRaju , A. Parthasarthy	PHI learning Pvt. Ltd	New Delhi
8	Management (Multi-Dimensional Approach)	H. R. Appannaiah , G. Dinakar , H.A. Bhaskara	Himalaya Publishing House	Mumbai

Savitribai Phule Pune University
FY BBA Semester I (CBCS) Pattern 2019
Business Communication Skills
Course Code: 102 SC
Credit 4

Depth of the syllabus - Reasonable knowledge of the communication

Program objectives

- 1 To understand what is the role of communication in personal and business world
2. To understand system and communication and their utility
3. To develop proficiency in how to write business letters and other communications required in business

Unit No.	Unit Title	Contents	Purpose& Skills to be develop
1	Concept of Communication and Introduction to Communication	Role of Communication in social and economic system Need for effective communication, meaning and definition, Principles of effective communication, Barriers to communication and over coming	To understand the basic purpose of communication. & Ability to understand and comprehend the meaning of different forms of communication
2	Methods and types of Communication	Methods of Communications]: Linguistics, Non- Linguistics and Para- Linguistics, Art of Listening Written communication, Forms of written communication. Qualities, difficulties in written communication, Constraints in developing effective written communication Types or Channels of Communication: Internal- Vertical, Horizontal, Consensus, Grapevine External- Inward, Outward ,Merits and Limitations of methods & types of communication	To understand how to write effective messages and different types of communication, & Ability to write meaningful and concise and effective messages
3.	Business Correspondence	Concept ,need and functions of Business .Correspondence , Types of Business letters ,Layout Drafting of business ,	To understand how to make effective Business Correspondence &

		Business Correspondence : Sales , Orders sales circulars and business promotion and resignation letter , leave , application letters ,Complaint , Credit verification, Correspondence with bank, Job application , and Reference check	Ability to write precise business letters and understanding about business correspondence
4.	Analysis of different Media of Communication	Fax communication ,voice mail ,emails ,tele conferencing , communication through social media	1.To understand how modern technology effects businesses and media based communication is working in present context. 2. Effects of new media on business is affecting on interpersonal relations and groups & Ability to use different formats of social communication and technology based communication effectively

Teaching Methods

Teaching Hours	Innovative methods to be used	AV Applications	Project	Expected Outcome
Unit I - 11	Role Play	Films on communication	Life without communication	Ability to understand implication of effective communication

Unit II - 13	Paraphrasing \,praise writing complete the sentence and interpretation of given sentences	Films on understanding written communication	How to write effective message , Story writing	To develop an appropriate understanding role and utility of written communication in life
Unit III- 13	Demonstrations of layout of good business letters analysis of good business letters of different forms Drafting of good business letters	Analysis of real life business situations	Writing letters for different situations Case study of Analysis different correspondence	To develop proficiency for different purposes for different organizations
Unit IV - 11	Demonstrations hands on experience	Analysis of implications and utility of different forms of social media , case study	Projects	To develop proficiency in effectives uses of various media of communication To communicate interact effectively by using different forms of social media
Total 48				

Evaluation methods

Internal Evaluation	External Evaluation	Tutorial /Project - Internal
Method of evaluation I MCQ on concept factures and definition	25%MCQ Short notes 35% Long answers 40%	Business communication skills (102) - Credit 1 - Marks 20

Presentation \- on application of communication in day to day business		Tentative areas for tutorials – (Select any 2 topics) <ol style="list-style-type: none"> 1. Collections of various formal letters and its critical study 2. Assignment on précis writing 3. Presentation on oral communication skills 4. Public speaking 5. Common mistakes in business communication
I Group Discussions on appropriate methods of communication at different situations II – Case study on written communication- Errors in message building and interpretation of message		20 marks (Internal) Guidelines for Tutorials The faculty must design the tutorials in tune with theory subject and shall conduct presentation in the class on the given topics. The evaluation of students must be on the following grounds. (20 marks) <ol style="list-style-type: none"> 1. Understanding of the subject 2. Content 3. Selections of the topic and application of the theory 4. Overall confidence & Presentation skills
I Developing appropriate formats Drafting of appropriate Business letters II- cautions in uses of metaphors and idioms and phrases		
I GD on selecting right media II preparation of charts on different media of communication III – case study on usages of social media Communication etiquettes’		
Marks 30	Marks-50	

Note: Students should be well informed about the tutorials and sufficient time must be given to the students to fulfil the requirements of the tutorials.

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Business Communication	Meenakshi Raman , Prakash Singh	Oxford	New Delhi
2	Business Communication	HomaiPradhan , N.S. Pradhan	Himalaya Publishing House	Mumbai
3	Business Communication	R.K. Madhukar	Vikas Publishing House	New Delhi
4	Business Communication and personality Development	BiswajitDas .ipswwtaSatpathy	Excel Books	New Delhi
5	Business Communication – Concepts , Cases and applications	P.D Chaturvedi , MukeshChaturvedi	Dorling Kindersley	New Delhi
6	Business Communication – Connecting at work	HorySankarMukerjee	Oxford	New Delhi
7	Business Communication Today	Courtland L. Bovee , John V. Thill , AbhaChatterjee	Pearson	New Delhi
8	Hand Book of internal Communication	Eileen Scholes	Infinity Books	New Delhi

Web reference

Sr. no	Lectures	Films	Animation	PPTs	Articles	Sources
	By R. Chandran IIT Kanpur	Film byJ. Balkru	A film on communication barrier	By Matt Setter	1. Importance of communication skills essay 2Importance of communication and effective communication	1. UK Essay 2. Zen growth

Savitribai Phule Pune University
FY BBA Semester I (CBCS) Pattern 2019
Business Accounting
Code No. 103 GC
Credit – 3

Depth of the syllabus - Reasonable working knowledge

Program objectives

To develop right understanding regarding role and importance of monetary and financial transactions in business

To cultivate right approach towards classifications of different transactions and their implications

TO develop proficiency preparation of basic financial as to how to write basis accounting statement - Trading and P&L

Unit No.	Unit Title	Contents	Purpose& Skills to be develop
1	Financial Accounting-	Definition and Scope, objectives, Accounting concepts, principles and conventions. Classification of accounts	To understand role and importance of accounting in Business and how accountingconcept can be implemented in business & Computation ability in business ability to distinguished between various accounting concepts and practices
2	Accounting Transactions and Final Accounts	Problems on Voucher system; Accounting Process, Journals, Ledger, Cash Book , subsidiary books ,Trial Balance preparation of Final Accounts of Sole Proprietorship(Trading and Profit & Loss Account and Balance Sheet)	To understand how to record different financial transactions and their financial implications & Ability to write different accounting tractions and prepare basic financial tractions
3.	.Bank Reconciliation Statements	Meaning, importance and preparation of Bank Reconciliation Statement	To understand the kind of accounting relationship between customer and bank & Ability to write necessary set of entries in books of accounts and in cash book and compare them with bank statement to understand their implications and effect

4	Computerized Accounting	Role of computers and Financial application, Accounting Software packages	Ability to understand growing importance of software and to know how to use software and to write books of accounts & Ability to use software like tally for writing of accounts
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Teaching Methodology

Teaching Hours	Innovative methods to be used	AV Applications	Project	Expected Outcome
11	Applying accounting concepts in real life business Ability to distinguish between accounting transactions and real life business	Role of accounting in business	Importance of accounting of business and nonprofit organizations	To learn about importance of acc. In business
15	Using practical situations for writing Transactions And applying accounting concepts different situations	Writing ledger and cash book	Developing model of Journals and model books of accounts Preparing flow chart of accordance of different transactions	Ability to distinguish between different transactions and its nature
12	Interpretation of bank passbook and its statement Comparative analysis of bank pass book and statement and their interpretation	Lesson on How to write bank reconciliations. Statement from YouTube	Preparing BR. With imaginary data	Ability to prepare and interpret bank reconciliation statement

10	NIL	To Understand how various transactions are recorded while using software and what cautions are need to be taken while recording transactions.	Film on silent features of tally accounting As business software	Appling software basic financial statement and converting row financial data into well written financial data
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Evaluation Method

Unit No	Internal Evaluation	External Evaluation	Suggested Add on Course
I	MCQ on various aspects of accounting Presentations on accounting and its importance in business	25%MCQ Short notes 35% Long answers 40%	Tally and computer based accounting
II	Practical problems on how to write different accounting tractions and maintaining books of accounts		
III	Practical problems on Bank Reconciliation		
IV	Demonstrations and hands on of experience regarding application of Tally and other accounting software		
	30	70	

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Advance Accounting Vou- I	S.N. Maheshwari& S.K. Maheshwari	Vikas Publication	New Delhi
2	Advance Accounting Vou- I	M.C. Shukla , T.C. Grewal , S.C Gupta	S. Chand	New Delhi
3	Accountancy (Vol- I)	S. Kr. Paul	Central Educational Enterprises (P). Ltd.	Kolkata
4	Accounting (text and Cases)	Robert N. Anthony , David F. Hawkins , Kenneth A. Merchant	McGraw Hill Companies	New Delhi
5	Advanced Accountancy(Volume – I)	R.L. Gupta , M. Radhaswamy	Sultan Chand & Sons	New Delhi

Savitribai Phule Pune University
FY BBA Semester I (CBCS) Pattern 2019
Business Economics – Micro
Course Code: 104 GC
Credit - 3

Depth of the syllabus - Reasonable knowledge of the Business Economics

Program Objectives -

1. To understand role of economics as it influences society and business
2. To study how different decisions are taken in relation to price demand and supply
3. To develop right understanding regarding Monopoly, perfect competition, revenue Etc

Unit No.	Unit Title	Contents	Purpose & Skills to be develop
1	Concept of Business economics.	Importance of economics in life, scope, forms of economy economic activities, economic problems , circular flow of economy Meaning and definition of business economics, scope of Business Economics Importance of economics in life, forms of economy, central problems of economics, market forces in solving economic problems, 5 sector flow of income and expenditure	Role and purpose of economics in society and economic & Ability to think in prudent manner
2	Demand and supply analysis	Concept of demand supply Concept of demand, determinants of demand, individual demand, market demand, Law of demand, elasticity of demand, types of elasticity of demand. Practical implementation of elasticity of demand. Methods of measuring elasticity of demand. Concept of supply, determinants of supply, elasticity of supply.	1.To understand how the concept of demand and supply works in particular economy 2.To study implications of different aspects of demand and supply & Ability to examine implications of changes in demand and supply on economics and ability to select right alternatives in a given situation

3.	Revenue and cost analysis	<p>Concept and types of revenue Importance of revenue , methods of calculation of revenue Interrelationship between marginal , total, and average revenue Concept of cost definition and importance of cost ,typology of cost analysis of cost</p>	<p>1.To understand role and function of revenue in different economic decision 2. To examine what factors determine revenue and cost & Ability to comprehend the concept of cost and calculation of revenue and cost and Production.</p>
4	Pricing under various market conditions	<p>Concept of market and competition Meaning of market, types of markets - perfect competition, Monopoly, monopolistic competition, duopoly, and oligopoly. Price and output determination in different market conditions. Concept of Total Revenue, Average Revenue and Marginal Revenue, Methods of measuring TR, AR and MR, interrelationship between TR, AR and MR</p>	<p>To understand concept of market and different forces affecting completion of market under different economic circumstances & Ability to understand market forces governing economic situations</p>

Teaching Methodology

Teaching hours	Innovative methods to be used	AV Applications	Project	Expected Outcome
10	Situation analysis evaluation of different alternatives selection of right options	Film on role of economics in life	Understands the importance of economics in life	To understand different facets of economics and importance of prudent thinking
13	Case studies on Market Situation analysis and Market analysis	Films on fluctuations in economy and market and their impact on social life	Case studies on demand and supply analysis , Examining market trends and their impact on market supply	To understand variation in demand and supply. How it affects the different economic situations and various factors of production

13	Case studies , analysis of a particular economic decisions comparative analysis of revenue and cost decisions	Animation and graphics on cost and revenue ascertainment	Examination of various cost sheet and revenue statement	1.To understand how the revenue is calculated for different situations and factors determined revenue. 2. To know the system of determination and factors consider in cost determination
12	Preparation of graphics for different market situations Analysis of market different market forces affecting demand and supply of various products	Films on monopoly and its effect Films on perfect competitions	Case studies Empirical analysis and projection of market trends	To understand how pricing determination is affected by different market players and forces and its impact on market and society

Unit	Internal Evaluation	External Evaluation
I	I- MCQ on concept meaning II- presentation on role of economic in society III- Presentations on life without economic	25%MCQ Short notes 35% Long answers 40%
II	I - MCQ II- Practical problems on various demand and supply as they influence market III - model illustrations explaining practical illustrations practical demand and supply	
III	I practical problems on computation of revenue II illustrations on explaining different types of revenue Case study on impact on change in cost structure	
IV	I MCQ on monopoly and perfect competition II real life situations on monopolistic pricing III Illustrations on impact of variations in equilibrium of firm on pricing under different circumstance	
	30	70

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Business Economics	Andrew Gillespie	Oxford Press	New Delhi
2	Business Economics	Rob Dransfield	Vikas Publishing House	Noida – New Delhi
3	Business Economics – Theory and Applications	Dr. D.D. Chaturvedi , Dr. S. L. Gupta	International Book House Pvt. Ltd.	New Delhi
4	Economics for management – Text and Cases	S,K. Sarangi	Himalaya Publishing House	Mumbai
5	Economics Principles and Applications	N. Gregory Mankiw	Cengage Learning India Pvt. Ltd.	New Delhi

Savitribai Phule Pune University
FY BBA Semester I (CBCS) Pattern 2019
Business Mathematics
Course Code – 105 GC
Credit 3

Depth of knowledge - Reasonable working knowledge

Program objectives

To develop appropriate understanding as how to use mathematic like computation interest, profit etc

To cultivate right understanding regaining numerical aptitude

To develop logical approach towards analytical approach data

Unit No.	Unit Title	Contents	Purpose & Skills to be develop
1	Numerical Methods for Business Managers	<ul style="list-style-type: none"> • Commission ,brokerage and premium , • Banking and taxation and Calendar , • Simple and compound interest 	<p>To understand how to apply the concept of interest and methods of calculation of interest & To develop Mathematical competence for various interest related transactions and other activities</p>
2	Numerical Methods for Business Managers	<ul style="list-style-type: none"> • Profit and loss • Percentages , • Ratio and proportion , • Averages 	Ability to examine concept of discount in different business situations
3.	Numerical Methods for Business Managers	<ul style="list-style-type: none"> • Matrix and Determinant • Permutation And Combination 	Ability to apply the various concepts in business situations

4	Numerical Methods for Business Managers	<ul style="list-style-type: none"> • Data interpretation , • Linear Programming Problem 	Ability to develop the skills for data interpretation and inferences.
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Teaching Methodology

Teaching Hours	Projects and classroom practice
13	Impact of interest of profits and how loan helps business solvency
12	To develop appropriate model for estimation of profit. Applying ratio to interpreted and evaluate Financial data collection of 5 years reports of various companies for analysis
12	Problems related with combination and permutation
11	Analyzing for different situations with multiple number of parameters

Evaluation methods

Internal Evaluation	External Evaluation
I Basic mathematical aspects reading Interest , II. Practical problems	20% MCQ , and 40% marks for 3 marks each problem 40% are for 4 marks each problem
Computations on various financial transactions and other transactions	
Data interpretation	
30 marks	70 marks

Suggested References

	Title	Author	Publisher
1	Arithmetic for business students	Harvey,J.H.	Cassell,London
2	Business Mathematics	Dr. AmarnathDikshit&Dr.Jinendra Kumar Jain.	
3	Business Mathematics –	PadmalochanHazarika	Sultan chand& sons, Delhi
4	Business Mathematics	Bari	New Literature publishing company, Mumbai
5	Operations Research	V.K. Kapoor	Sultan chand& sons
6	Operations Research	Dr. S. D. Sharma	Sultan Chand & Sons.
7	Operations Research	Dr. J. K. Sharma –	Sultan Chand & Sons.
8	Business mathematics	Dr.AnwarShaikh, Prof.R.G.Gurav, Prof.Tawade, Prof. Vaibhav Joshi	Success Publication,Pune

Savitribai Phule Pune University
FY BBA Semester I (CBCS) Pattern 2019

Business Demography
Code: 106 SC
Credit 4

Depth of the course - Reasonable working knowledge

Program objectives

1. To give proper understanding regarding concept of demography in modern economic setup
2. To study how population and structure changes affecting quality of life and business
3. To develop clarity of concept regarding social economic process and urbanization and its impact on society

Unit No.	Unit Title	Contents	Purpose Skills to be develop
1	Concept of demography	Meaning, importance and need of demography. Studies Study of demography. As an essential discipline of social economic change ,Scope and components of Demography Factors affecting mortality, fertility rate, Methods to calculate fertility and mortality rate.	Growing importance of modern economics and society. To Develop Rational understanding of demography, analysis and effects on society
2	Distribution of population and population growth	Density and population distribution Concept of over and under population Method of assessment of population growth	To understand how population growth influences aspects on society To develop understanding regarding growth process and social economic changes

3.	Population as resources	Importance of human resource as development of the nation Concept of literacy and its importance in modern society Concept of sex ratio age and sex pyramid Concept of working and dependent population	To understand importance in modern and socio economic statues and to learn about role of literacy in economic development Ability to examine implications of changes in population
4	Urbanization and its implications	Concept of urbanization factors affecting urbanization. and rural population , Features and importance Urbanization. Behavioural and demographic Structure and various factors responsible for urbanization	To understand the various determinants of urbanization and migration Ability to understand how urbanization affects the resource allocation and resource planning

Teaching Methodology

Teaching hours	Innovative methods to be used	AV Applications	Project	Expected Outcome
12	Analysis of censes reports Examining the tends in population curve	Films on population explosion	Mapping of various components of Demography Case study on impact on changes in demographic structure	Ability to understand the components of demography. Factors governing of a particular economics and government. Socio economic changes as a outcome of demographic changes
12	Analysis of trends in variation population and its impact on budget ,economic planning and social development	A film on population explosion A film on topography	A study of demographic changes in India Difference provinces in India	Ability to examine how demographic changes - influences different aspects of policy formulation and social development

12	Designing of population pyramid Developing charts of implications of changes in sex ratio of economy on society	Project on examining population change as a determinant A film on relation on literary and development	NIL	To learn about implications of changes in population and structure of population on economy and society
12	Prepare charts and Study of urbanization taken place from last two decades With its effects on business	Case studies on urbanization and sustainability and problems of over exploitation of resources	Study of particular factor of production in district or state and their effects on various sectors	Equal and unequal Distribution of resources and factors of production and its impact on society

Evaluation Methods

Subject	Internal Evaluation	External Evaluation	Tutorial /Project (Internal)
Unit – I	I MCQ on meaning concept and applications of demography II profile preparation on regional III Interpretation of data	25% MCQ Short notes 35% Long answers 40%	Business Demography (106) Credit 1 - Marks 20 Tentative outline for tutorials – (Select any 2 topics) 1Collecting information on changes took place in local and regional Demography 2.Issues related migration Gender equalities/ inequalities and its effect on business 3.Government regulations and its effects on business Relation of Demography and economic development The evaluation of students must be on the following grounds. (20 marks) 1. Understanding of the subject 2. Content
Unit – II	MCQ on density of population various aspects of population II Application based questions on measuring assessment of population of method III analysis of particular aspect of censuses report		
Unit – III	Presentation on HR Development in growth II Presentation on role of literacy on growth III Interpretation of statistical data		
Unit – IV	I GD on effects of urbanization on society		

	II quiz on Urbanization on society III Poster or exhibitions on urbanization of society		3. Selections of the topic and application of the theory 4. Overall confidence & Presentation skills Note: Students should be well informed about the tutorials and sufficient time must be given to the students to fulfill the requirements of the tutorials.
Total –	30	50	20 marks

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
	The Methods and uses of anthropological Demography	Alaka M. Basu	Columbia university press	
	The demographic dividend – A new perspective on the Economic consequences of Population Change	David E. Bloom, David Canning		
	The Continuing Demographic Transition	G.W. Jones ,R.M.Douglas		
	Demographics :A casebook for business and Government	Hallie .JKintner ,,Thomas W.Merrick		
	Population , Ethnicity and Nation Building	By Calvin C.Goldscheider		
	Population Dynamics :A new Economic Approach	C.Y. Cyrus Chu	Oxford	

Savitribai Phule Pune University
FY BBA Semester II (CBCS) Pattern 2019
Business Organizations and Systems
Course Code 201
Credit 4

Depth of the program – Fundamental Knowledge

Objective of the Program:

- 1) To understand role and functions of modern business
- 2) To develop right understanding regarding business environment
- 3) To study how a business institution functions in a given economic set up

Unit No.	Unit Title	Contents	Purpose and Skills to be developed
1	Nature and evolution of business	Concept of business and its characteristics, Objectives of business and prerequisites of a successful business, Development and evolution of Trade, commerce and industry, Recent Trends in Modern Business i.e. BPO, KPO, Entrepreneur & Homepreneur and online trading, digital marketing and payment methods	To understand the purpose of business, To learn how a business unit works and serves the society, historical progress of business as an economic entity, socio economic changes have led to economic development, To study the new trends in commerce.
2	Forms of Business Organization	Forms of business organization and its selection, Meaning, characteristics, advantages and Limitations of Sole proprietorship, Partnership Firm, Limited Liability partnership Firms and private company, Joint Stock Company, virtual business organizations, boundary less organizations, OPC (One Person company)	To understand the significance of different forms of business organizations their types, function, merits and limitations.

3.	Setting up of a business enterprise	Identification of ideas and opportunities, Influencing factors while setting up of business enterprise, Feasibility report of a business enterprise, Size and location of a business enterprise. licensing and basic legal formalities to start a new business enterprise	To know how to search business ideas, how to pre business feasibility report, how to identify ideal business location and deciding optimal size for a new business unit, identification of capital sources for new business unit and basic documentation required for business enterprise.
4.	Study of Domestic and Foreign Trade	Levels of Distribution Channels and their role Domestic Trade: Concept of Domestic Trade, Wholesaling and Retailing Foreign Trade: Concept of Export and Import; Export and Import Procedure	To learn about how a retail trade works in business system, different forms of retail trade and their contribution in the economy To give a brief introduction to stages of internationalization.

Teaching methodology

No of lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
12	Study of a business unit in given environment , Interview of a sole trader to know how he started the unit,	Film shows on ideation of business enterprise Film shows of feasibility report Film on 'Market Development'	Profile of a departmental store works, Observation of function of a KPO/ BPO or online trading	Understand how a business functions , Understanding the idea of business as an economic entity, To understand modern commerce performs new business initiatives.
12	Analysis of partnership firm related documents, Film show on 'Role of sole trader in economy', Film on promotion and formation of company	Film show on 'Role of sole trader in economy' Film/ animation on admission and retirement Film/ animation / Expert lectures on LLP/ Private Company	Report writing on 'Examining the style and functions of different types of sole traders, Project on Analysis of LLP and private company related documents.	Knowledge of selection and appropriateness of a form of business organization , Learning functioning of different types of Sole proprietorship, How a partnership firm is formed,

		Film on promotion and formation of company	Project on Process of formation of a company and role of promoters in formation	partnership deed, admission and retirement of a partner, Documentation process of LLP and private limited company and process of registration, Documentation process of joint stock company and process of registration
11	Film shows on ideation of business enterprise, Guest lecture on how to write a business report, Analysis of market, business units and initial size of successful business unit	Film shows on ideation of business enterprise Film shows of feasibility report Film on 'Market Development'	Preparation of a business report and presentation of the same in a business plan competition	Understanding of basic knowledge about how to start a business enterprise, Understanding the determinants of a selection of a business idea, Understanding the factors governing the selection of size of business.
10	Films and presentations of various forms of retail trade and new trends in retail trade Audiovisual aids giving example of stages of internationalization with reference to different multinational and transnational companies	Presentations on Retail trade and contribution in economic growth	Project report on various types of supply chain and retailing methods	Understanding the nature of retail trade and how a retail trade works in business system, different forms of retail trade and their contribution in the economy. Understanding brief introduction to stages of internationalization.

Internal Evaluation

Tutorials/Presentations	Topics for Assignments (Select any 2)
CCT – 1 Credit	I) Recent trends in modern businesses
20 Marks	ii) Various legal formalities for starting a business

	iii) Case Study Solution Report – Importance of location and competitors analysis iv) Project submission Presentation – Homepreneuership, BPO, KPO and One person company. The evaluation of students must be on the following grounds. (20 marks) 1. Understanding of the subject 2. Content 3. Selections of the topic and application of the theory 4. Overall confidence & Presentation skills Note: Students should be well informed about the tutorials and sufficient time must be given to the students to fulfil the requirements of the tutorials.	
Internal Examination 30 Marks	Internal Evaluation – Role Plays, Case Studies, Situation analysis, MCQ’s , Long question papers etc	Suggested Add on Course Basic managerial skills
	Total	: 50 marks

Suggested References

Sr. No.	Title of the Book	Author/s	Publication	Place
	Business Organization and Management	Vijay Kumar Kaul	Pearson	New Delhi
	Business organization	Dr. Khushpat S. Jain	Himalaya Publishing House	Mumbai

	Modern Business Organisation and Management – Systems Approach	S.A. Sherlekar , V.s. Sherlekar	Himalaya Publishing House	Mumbai
	Business Organization	Rajendra P. Maheshwari , J.P. Mahajan	International Book House	New Delhi
	Business Organisation and management	Neeruvashitha , namitaRajput	Kitab Mahal	Allahabad
	New Course in Organization of Commerce	A.N. Rangparia ,Chopde, Negwekar and 8 more	Sheth	Mumbai
	Students' guide to Business Organisation	Dr. neeruVasishth	Taxmann	New Delhi
	Business Organisation and Management	Jagdish Prakash	Kitab Mahal	Allahabad

Savitribai Phule Pune University
Question Paper Pattern (2019) for FY BBA (University examination)
Subject - Business Organizations and Systems
Code no 201

	Compulsory /Choice	Name of the Question	Marks	Total Marks
1	Compulsory Question	Objective Type Question- Multiple Choice Questions	4	15 Marks
		Fill in the blanks	3	
		Define the terms and Match the pairs	8	
2	Solve any 2 out of 4	Long Answer Question	2*10 marks	20 Marks
3	Solve any 3 out of 5	Short Notes	3*5 marks	15 Marks
	Total			50 Marks

Savitribai Phule Pune University
FY BBA Semester II (CBCS) Pattern 2019
Principles of Marketing
Course code 202
Credit 3

Depth of the syllabus - Reasonable knowledge of the Marketing

Objectives –

1. To develop write understanding regarding marketing environment in the country
2. To develop appropriate conceptual understanding as to develop basic marketing concept
3. To develop new understanding regarding services , rural marketing and new trends in marketing

Unit No.	Unit Title	Contents	Purpose and Skills to be developed
1	Concepts and functions of marketing	Marketing concepts, its objectives ,importance and functions of marketing Various Approaches of marketing Challenges and opportunity of marketing manager in international market	Role and importance of marketing manager To understand the silent features of Indian and international Marketing Management Ability to learn how marketing functions in a given environment To understand various tasks performed by marketing managers in different environment
2	Marketing Environment and marketing segmentation	Marketing environment – meaning Internal and external factors influencing marketing environment , Political ,social economical international , technological multi-cultural environment Segmentation: concepts, importance and its types of segmentation.	To know about changing various factors which affects the marketing system. To study the profiles of change in technology, economic policy and demography of Indian market . To study the types of segmentation To develop write understanding of profile of Indian market

3.	Constituents of marketing mix	<p>Marketing Mix- Meaning scope and importance of marketing mix Product mix concept of a product , product characteristics Intrinsic and extrinsic, PLC. Price mix - meaning ,element , importance of price mix ,factors , influencing pricing , pricing methods Place mix , Promotion mix Place mix meaning and concepts of channel of distribution or intermediaries , Promotion mix meaning, definitions , importance and limitations of advertisement People mix meaning & concepts, elements, importance. Process mix -stages, meaning& importance. Physical evidence- meaning, importance & components.</p>	<p>To have right understanding of marketing mix as they influences as marketing mix.</p> <p>To develop understanding regarding various aspects of price promotion physical distribution place, people, process & physical evidence affecting a success of a market.</p>
4.	Classifications and types of markets	<p>Conventional classification of markets. Services marketing its main features importance, growth functions. Rural marketing features and its contribution to Indian economy ,problems and measures to improve Recent trends in Marketing- 1.Green Marketing concepts 2.,Digital Marketing, 3.Virtual Marketing, 4.Hybrid Marketing</p>	<p>To understand different types of markets there role and functions To examine marketing activities are performed and contribute to the economy.</p> <p>To learn about types of market in developing economy and society.</p>

Teaching Methodology

Teaching Hours	Innovative methods to be used	AV Applications	Project	Expected Outcome
Unit I -12	Role Play Development of profiles of Indian Market analysis of a Indian market ,roles and applications in	Films and animations on various marketing Applications	Preparing profiles of marketing functions in different organizations Developing a sketch of various marketing managers working in different companies	Knowledge about functioning of modern Indian Markets Understanding the marketing process and

				planning in international prospects
Unit II – 12	Project on impact of technology on market , analysis of marketing economic policy as they influence Indian markets	Films on marketing environment in Indian and expert lectures on Indian economic system as they influence on markets	Project on technological changes ,reports on new trends in market Profile of marketing policies	To improve understanding regarding marketing environment and segmentation in Indian context.
Unit III- 14	Analysis of successful product launches a Study of select product failures Analysis of various marketing champions	Films on product launch selection of marketing media product life cycle Case study on marketing mix.	Profile of event for new product launch Analysis of advertising campaigns for a launch of a product Profile in India	To cultivate an appropriate Product development process launching and pricing of the product To examine the effect of marketing mix and consumer
Unit IV - 10	Project on role of marketing economy Profile sketch of improving and developing a cases in rural market	Films on problems of rural market role of rural economy and growth of services marketing.	Case study on marketing of services ,problems of rural markets ,developing appropriate strategies for rural market.	Developing a right and complete understanding different types of market in developing economy and how marketing services improve quality of life.

Evaluation Method

Unit – I	MCQ – on concept of Marketing role and importance II practical applications on different approaches to marketing profile study of role and functions of marketing at different organizations.	25% MCQ 35% short notes 40% long answers
Unit – II	I MCQ on different facets of marketing environments II analyses of different constituents of marketing environment Through case study III – MCQ on Marketing segmentation	20% MCQ 40% short notes 40% long answers
Unit – III	I – MCQ on different aspect of Market mix II case study on role of product mix in marketing mix III analysis of market mix Price and place mix as criteria	20% MCQ 40% short notes 40% long answers
Unit – IV	MCQ- on classification and types of Market II analysis of profile of different rural markets and rural consumers in India III analysis of marketing of services in Indi	30% MCQ 30% Short notes 40% long answers
Total –	30	70

Suggested References

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Marketing Management	Philip Kotler &even lane keller	Pearson India	South Asia
2.	Marketing Management	V. S. Ramaswamy , S. Namakumari	Macmillan	New Delhi
3.	Marketing In India Text and cases	S. Neelamrgham	Vikas Publication	New Delhi
4.	Textbook of Marketing	Keith Blois	Oxford	New Delhi

5.	Marketing - Cases Insights	Paul Baines , Chris Fill , Kelly page Piyush K. Sinha	Oxford	New Delhi
6.	Foundational Of marketing	John Fahy& David Jobber	Tata McGraw Hill	New Delhi

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Q.No	Compulsory /Choice	Name of the Question	Marks	Total Marks
1	Compulsory Question	Objective Type Question- Multiple Choice Questions	5	20 Marks
		Fill in the blanks	5	
		Define the terms and Match the pairs	10	
2	Solve any 3 out of 5	Long Answer Question	3*10 marks	30 Marks
3	Solve any 4 out of 6	Short Notes	4*5 marks	20 Marks
	Total			70 Marks

Savitribai Phule Pune University
FY BBA Semester II (CBCS) Pattern 2019
Principles of Finance
Course code 203
Credit 3

Depth of the syllabus – Depth Reasonable working knowledge

Objectives

1. To cultivate right approach towards money , finance , and their role in business
2. To develop right understanding regarding various sources of finance and their role and utility in business
3. To develop basic skills as to concept of capital structure and concept of capital structure

Unit No.	Unit Title	Contents	Purpose and Skills to be developed
1	Unit 1 Basic concepts in finance	Definition - Nature and scope of finance function, Financial Management - Meaning – Approaches: - Traditional, Modern, Role of finance manager.	To understand role and importance in business Ability to understand implication of finance on business
2	Unit 2. Sources of Finance	External: - Shares, Debentures, Public Deposits, Borrowing from banks: - meaning, types, advantages and limitations of these sources, Internal: - Reserves and surplus, Bonus shares Retained earnings,.	To understand role and need of source of finance How different determinants of size and type of business Sources of business finance To learn about imp features and their applications considering their requirements in business
3.	Unit 3. Capital Structure	Meaning criteria for determining capital structure, Factors affecting capital structure, Capitalization:- Meaning, over capitalization and Under Capitalization - meaning, causes, consequences, remedies	To Understand how basic financial structure is designed To know what are the constituents a financially sound business units Analytical ability to understand implications of various constituents of capital units

4	Recent Trends in business finance:-	Meaning and nature of Venture Capital, Leasing, Microfinance, Mutual Fund	To understand new and emerging trends in business finance Ability to understand about current issues related with new trends in business finance
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Teaching Methodology

Unit & teaching Hours	Innovative methods to be used	AV Applications	Project	Expected Outcome
I – (14)	Presentation on how finance helps in org .business successfully Presentation on identifying different needs of finance activities	Short films on Finance and business activities	Estimation on financial needs of small and tiny business needs Assessing financial feasibility of a business venture	To develop Competence to apply various concept in finance for decision making to
II-(13)	Poster presentation on comparative analysis of sources of finance Financial institution who provides sources of finance	Films on different institutions meeting different needs of finance	Developing a suitable financial needs assessment chart developing a checklist for developing source of finance	To develop rational understanding regarding role and utility of different sources of finance
III-(11)	Comparative analysis of different determinants of capital structure Determining need for optimal rational capital structure Implications of over and under capital methods	Films on over and under capitalization on business unit Film on a sound capital structure	A report on assessing capital needs of a business need Evaluating a balance sheet Whether the firm is over or under capitalized	To understand importance of rational and sound financial structure To understand role of capital as a determinant business success
IV –(10)	Presentation emerging trends in business Micro finance and mutual funds Profile presentation on various mutual funds and venture capital financiers in India	Films on contemporary trends in mutual fund in India Films on venture capital and micro finance institutions in India	A report on contribution of mutual funds in economy Role of leasing industry in business finance	To have right understanding how modern business is changing and what are the new trends in business finance

Evaluation Method

Unit	Internal Evaluation (30Marks)	Suggested Add on Course
Unit – I	MCQ on role and importance of finance and business ,Discuss/debate on implications of finance on business success , Presentations on assessing financial need and financial needs in business	Basic course in Financial markets
Unit – II	Comparative analysis of various sources of finance -Selecting a right source of finance for different business and projects, MCQ on various sources of finance.	
Unit – III	MCQ on determinants of capital structure ,Cases study on over and under capital structure Designing on over and under capital structure ,Practical problems on estimating capital requirements of a firm	
Unit – IV	MCQ on Concepts ,applications on Capital, Leasing, Microfinance, Mutual Fund ,Presentations on utility of venture capital and leasing in business , Profile of successful micro financing institutions	

Suggested References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Financial management – Theory and Practice	Prasanna Chandra	McGraw Hill Education	New Delhi
2	Financial Management	I.M. Pandey	Vikas Publishing House Pvt. Ltd.	New Delhi
3	Financial Management	Rajiv Srivastava , Anil Misra	Oxford – University Press	New Delhi
4	Financial Management	P.V. Kulkarni , B.G. Satyaprasad	Himalaya Publishing House	Mumbai
5	Fundamentals of Financial management	James C. Van Horne , John M. Wachowicz , JR	Prentice Hall of India Pvt. Lit.	New Delhi
6	Financial management Comprehensive Text Book with Case Studies	Ravi M. Kishore	Taxmann’s	New Delhi
7	Financial management – recent Trends In Practical Application	Chandra Hariharanlyer	International Book House Pvt. Ltd.	Mumbai

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Q.1. (A) Write true or false	5M
Q.1. (B) Fill in the blanks	5M
Q.2 Write short notes (Any 3)	15M
Solve Any 3	
Q.3 Long question	15M
Q.4 Long question	15M
Q.5 Long question	15M
Q.6 Long question	15M
Q.7 Long question	15M

Savitribai Phule Pune University
FY BBA Semester II (CBCS) Pattern 2019
Basics of Cost Accounting
Course code 204
Credit 3

Depth of the syllabus – Reasonable working knowledge

Objectives

1. To develop rational understanding regarding concept of cost expenditure in business
2. To develop understanding how overheads influence the cost structure of cost
3. To develop skills for computation of total cost for a particular product

Unit No.	Unit Title	Contents	Purpose and Skills to be developed
1	Basic concept in cost –	Concept of Cost, Costing, Cost Accounting & Cost Accountancy , Origin, Objectives and Features of Cost Accounting , Difference between Financial and Cost Accounting, Conceptual analysis of Cost Unit & Cost Centre	To understand importance of costing in decision making Ability to understand importance of costing and role of costing
2	Elements of cost and Cost Sheet	Material, Labour and other Expenses, Classification of Cost & Types of Costs, Preparation of Cost Sheet	To understand how to prepare a cost statement and analyze implication of elements of cost on total cost Ability to examine different aspects of cost as they influence total cost structure and sales price. Ability to prepare comprehensive cost sheet.
3.	Overheads	Meaning and Definitions, Classification of Overheads, Collection, allocation, apportionment and reapportionment of overheads 3.4 Under and over absorption – Definition and Reasons	To understand concept of overhead as it contributes to total cost of a product or service Ability to ascertain ability to distinguish different types of overheads as it influences the total cost in a given situation

4.	Contact and process cost and Methods of costing	Contract Costing – Meaning and features of contract costing, works certified and uncertified, escalation clause, cost plus contract, work in progress, profit on incomplete contract , Process Costing - Meaning, Features of process costing, preparation of process costing including Normal and Abnormal Loss/Gains,	<p>To understand role of contract costing in ascertaining cost of a particular project or activity</p> <p>To know how cost is ascertained for different types of processes</p> <p>To develop ability to ascertain cost of a particular contract under different circumstances.</p> <p>To learn how cost of a particular process is ascertained especially in case of single or multiple process as well as for joint products.</p>
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Unit & teaching Hours	Innovative methods to be used	AV Applications	Project	Expected Outcome
Unit I -12	Demonstration of costing as basic decision input	Film on costing	Preparing a statement of cost , understanding different aspects cost and financial accounting	How to use cost of concept
Unit II - 12	NA	Videos on methods of determination of cost	Analysis of cost statement of different types of manufacturing units	Development of basic ability to think about cost as an ingredient of price mechanism
Unit III- 14	Practical problems on computation of overhead and relationship between different overheads as they affect the total cost structure.	Video on ‘Role of different overheads in total cost structure’	To ascertain different components of overheads and identify how overheads brings difference in total cost	To develop competence, to prepare comprehensive cost sheet and understand implication of overheads on total cost structure

Unit IV - 10	To learn about contract and process cost and to learn practical aspects of the above	Videos on contract and process cost	Project on development contact cost system for a particular project. Analysis of various elements of cost associated with multi process products in manufacturing units.	Development of reasonable working knowledge of methods of ascertainment of cot of a contract or process.
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Teaching Methodology

Unit	Internal Evaluation (30 Marks)
Unit – I	I Filling the banks and match the pairs related with different concepts of cost ,II presentations on cost accounting in different org III cases study on role of cost accounting in profit determinations
Unit – II	I. Application based questions on –different components elements of cost ,preparing charts on different types of cost sheet
Unit – III	I. Application based questions on classification of overheads , II MCQ on concept of overheads ,III practical questions on reapportionment on classification of overheads ,Preparation of chars on classification of overheads
Unit – IV	MCQ on contact and process cost , II interpretations based questions on different types of cost III Practical based questions on contact based costing

Suggested References

Sr. No.	Title of the Book	Author/s	Publication	Place
	Cost Accounting and Financial Management	M.Y. Khan , P.K. Jain	McGraw Hill	New Delhi
	Cost accounting Theory and practice	Bhabatosh Banerjee	PHL Learning Pvt. Ltd.	New Delhi
	Cost Accounting -	Dr. P.C. Tulsian	S. Chand	New Delhi
	Costing Adviser	P.v.Rathnam , P. Lalitha	Kitab Mahal	Allahabad
	Cost Accounting – A managerial Emphasis	Charles T. Horngren , Srikant M. Datar , Madhav V. Rajan	Pearson	New Delhi
	Advanced Cost and Management Accounting	V. K. saxena , C. D. Vashist	Sultan Chand & Sons	New Delhi
	Cost Accounting	Jawahar Lal Seema Srivastava	McGraw Hill education	New Delhi

Savitribai Phule Pune University
Question Paper Pattern (2019) for FY BBA
University Examination
Sub: Basics of cost accounting
Code No.204

Compulsory /Choice	Name of the Question	Marks	Total Marks
Compulsory Question	Objective Type Question- Multiple Choice Questions	5	15 Marks
	Fill in the blanks	5	
	Define the terms and Match the pairs	5	
Solve any 4 out of 5	Short Notes /short questions	4*5 marks	20 Marks
Q4. Solve	Problems on Cost sheet	1*15 marks	15 Marks
	Problems on Contract costing and process costing	3*10	20 Marks

Savitribai Phule Pune University
FY BBA Semester II (CBCS) Pattern 2019
Business Statistics
Course code 205
Credit 3

Course Depth: Reasonable working knowledge

Objectives:

1. To understand role and importance of statistics in various business situations
2. To develop skills related with basic statistical technique
3. Develop right understanding regarding regression, correlation and data interpretation

Unit No.	Unit Title	Contents	No of Hours
1	Frequency Distribution	1.1 Raw data, variable, discrete variable, continuous variable, constant, attribute with illustration. 1.2 Classification- Concept and definition of classification, objectives of classification, types of classification. 1.3 Frequency Distribution- Discrete and Continuous frequency distribution, Cumulative frequency and Cumulative frequency distribution. 1.4 Graphs & Diagram- Histogram, Ogive curve, Pie-Diagram, Bar Diagram, Multiple bar Diagram, Sub-divided bar diagram	8
2	Measure of Central Tendency	2.1 Concept and meaning of Measure of Central Tendency, Objectives of Measure of Central Tendency, Requirements of good Measure of Central Tendency. 2.2 Types of Measure of Central Tendency, Arithmetic Mean (A.M), Median, Mode for discrete and Continuous frequency distribution, Merits & Demerits of A.M., Median , Mode, Numerical Problem. 2.3 Determination of Mode and Median graphically. 2.4 Empirical relation between mean, median and mode. 2.5. Combined Mean 2.6. Numerical Problems.	8

3	Measure of Dispersion	3.1 Concept and meaning of Measure of dispersion, Requirements of good Measure of dispersion. 3.2 Types of Measure of Dispersion- Absolute & Relative Measure dispersion (Range, Standard Deviation (S.D.), Variance, Quartile Deviation, Coefficient of Range, Coefficient of Quartile Deviation, and Coefficient of Variation (C.V). 3.4. Combined Standard Deviation 3.5 Numerical Problems	10
4	Correlation & Regression	4.1. Concept and meaning of Correlation, Types of correlation. 4.2. Methods to study Correlation:- Scatter Diagram, Karl Pearson correlation coefficient, Spearman Rank Correlation Coefficient (with Repeated Ranks) 4.3 Numerical Problems on Correlation 4.4 Regression- Concept and meaning of regression, lines of regression equation of Y on X and X on Y. 4.5 Regression coefficients, properties of regression coefficients, 4.6 Numerical problems on Regression	12
5	Index Numbers	5.1 Concept and meaning of Index Number, Notations 5.2 Construction of Price Index Number, Problems in the construction of Index Number, Cost of Living Index Number (CLI), Family Budget Index Number 5.3 Uses of Index Number 5.4. Numerical Problems.	10

Suggested References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Business Statistics	Girish Phatak	Tech – Max	Pune
2	Statistics for Business	Dr. S. K. Khandelwal	International Book House	New Delhi
3	Fundamentals of Business Statistics	J.K. Sharma	Pearson	New Delhi
4	Business Statistics	G.C. Beri	The McGraw-Hill companies	New Delhi
5	Statistics Theory and Practice	R.S. N. PillaiBagavathi	S. Chand	New Delhi
6	Statistics for Managerial decision Making	Dr. S. K. Khandelwal	International Book House	New Delhi
7	Business Statistics For Contemporary Decision Making	Ken Black	Wiley India Edition	New Delhi

8	Fundamentals of statistics	S.C. Gupta	Himalaya Publication House	Mumbai
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Savitribai Phule Pune University
Question Paper Pattern (2019) for FY BBA
University Examination
Sub: Business Statistics
Code No.205

MAXMARKS:-70

Instructions:

- I. All question are compulsory
- II. Figures to the right indicate full marks.
- III. Notations & abbreviations have their usual meaning
- IV. Simple calculator is allowed

Q1.A) Fill in the blanks [2 X 5=10]

B) State whether the following statements are True OR False: [2 X 3=6]

Q2. Attempt any four of the following (Four out of Six) [4 X4=16]

Q3. . Attempt any four of the following (Four out of Six) [4 X4=16]

Q4. . Attempt any four of the following (Four out of Six) [4 X4=16]

Q5 Attempt any one of the following (One out of Two) [1 X 6=6]

Savitribai Phule Pune University
FY BBA Semester II (CBCS) Pattern 2019
Fundamentals of Computers
Course code 206
Credit 4

Depth of the course - Reasonable working knowledge

Objectives:

1. To develop concept of information and their role in modern businesses
2. To develop rational approach as to how computers can be used in data process analysis in business
3. To develop understanding regarding cautions to be taken security, safety and security while using net based service

Unit No.	Unit Title	Contents	Purpose and Skills to be developed
1	Introduction to Computers	Introduction, Characteristics of Computers, Block diagram of computer, Booting Process, Types of Programming Languages-Machine Languages, Assembly Languages, High Level Languages, Data Organization, Drives, Files, Directories, Storage Devices, Primary Memory, RAM , ROM, Secondary Storage Devices - FD, CD, HDD, Pen drive I/O Device- Monitor and types of monitor, Printer and types of printer, Scanners, Digitizers, Plotters Number Systems-Introduction to Binary, Octal, Hexadecimal system Types of computers	To understand role and importance of computers in business processes To develop understanding regarding role of computers in business operations.

2	Basics of Computer Networks & Internet	<p>Definition-Operating System, Functions of O.S., Types of O. S. – Single user O.S., Multiuser O.S., Overview of Windows O. S., Android O. S., IOS</p> <p>Definition, Goals, Applications, Components, Topology, Types of Topology, Types of Networks, LAN, MAN, WAN,</p>	<p>To understand the importance of operating system</p> <p>To understand structure and modeling of computer networking and data communication in business process.</p> <p>To develop understanding regarding usage, functionality and services provided by operating system in business processes.</p> <p>To develop understanding regarding need, structure and working of computer networking in business operations.</p>
3.	Introduction to Spreadsheet Software and Presentation Software	<p>MS-Excel Various Functions such as Sum, average, count, max, min, Graph / Charts in Ms Excel MS–PowerPoint: Animation Effects, Transition Effects, Slide Show Setting</p>	<p>To learn the process for usage of different computer application in business processes. To develop skills and ability to handle different applications in business process.</p>
4	Introduction to Internet & cyber security	<p>WWW, Internet, Internet Service Providers(ISP), Services Provided by the Internet: e-mail, search engine, Information security overview – Background and current scenario Types of Attacks , Goals of security ,Overview of security threats ,Weak / Strong passwords and password cracking Insecure Network connections, Digital signature</p>	<p>To understand cautions and stapes to be taken and net based services. Ability to handle various software and programmes with due cautions and care.</p>

Teaching Methodology

Teaching hours	Innovative methods to be used	AV Applications	Project	Expected Outcome
11	Demonstrations and hands-on experience Practical exposure regarding usages of computers	Films on role of computers in business decision making	Role of computers in simplifications of business activities Projects on importance of computers in business data analysis.	Proficiency in applying computers in business activities like data processing Tabulation ,data analysis And presentation of data
12	Demonstration and on experience exposure regarding set up of networks like client server architecture, LAN etc.	Films on role of networking in business communication, environment and process	Role of networking system in simplifications of business activities. Projects on importance of Computer network in business Processes.	Proficiency in set up of Different structure computer network in business environment.
11	Demonstration and on experience regarding usage of MS-Excel, MS-Power Point.	Films on Spreadsheets and Presentation	Role of Spreadsheets in simplifications of business activities Projects on importance of spread sheets in business data analysis and processing.	Proficiency in handling of different applications, preparation of power point Presentation.
11	Demonstrations hands on experience and care to be taken while using computers and charts and checklist.	Films on cyber security	Case studies on implications on cyber-attacks and Loss due to improper cyber activities.	Proficiency in usages in processing and transmission of data through computers and internet.

Evaluation	<u>Internal 30 Marks</u> <u>External - 50 Marks</u>
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Suggested References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Introduction to Computer Security	Matt Bishop ,	Pearson	New Delhi
2	Computer Organization	G.V. Anjaneyulu	Himalaya Publishing House	Mumbai
3	Fundamentals of Computers	V. Rajaraman	PHI Learning	New Delhi
4	Computer fundamentals	Pradeep K. Sinha	BPB Publications	New Delhi

Savitribai Phule Pune University
FY BBA Semester II (CBCS) Pattern 2019
Course Title: Fundamentals of Computers
Course Code 206
Credit 1

Supplementary Guidelines for conducting BBA CBCS

Demo Lecture for the following topics by the teachers. The students are supposed to submit a written assignment and Presentations on the given topics.

The evaluation of students must be on the following grounds. (20 marks)

1. Understanding of the subject
2. Content
3. Selections of the topic and application of the theory
4. Overall confidence & Presentation skills

Note:

Students should be well informed about the tutorials and sufficient time must be given to the students to fulfill the requirements of the tutorials.

1. Prepare a Power point presentation on “Mobile Shoppe”.
2. Prepare a Power point presentation on “New Product Launch”.
3. Prepare a Power point presentation on “Monsoon Sale Dhamaka”.
4. Using any spreadsheet package creates worksheet to calculate the balance of customer from bank after depositing and withdrawing some amount.

(take 10 suitable records)

Account No.	Withdraw	Deposits	Balance

Calculate and display the following

- Maximum Balance - Minimum Balance
- Average Balance - Total No. of Accounts

5. Using any popular spreadsheet package, prepare a worksheet to calculate the monthly total salary of an Employee if basic salary is given (take 10 suitable records).

Name of Employee	Basic Salary	HRA	DA	IT	PF	Net

Total Salary=Basic Salary+DA+HRA HRA=15%of Basic Salary
 DA=10% of Basic Salary PF=8.33% of Basic Salary
 IT=30% of Basic Salary Net Salary=Basic+DA+HRA-(IT+PF)

6. Apply for New Passport using e-Seva.
7. Use of Internet for Railway Ticket Booking.
8. Online application for Driving License.

Savitribai Phule Pune University
SY BBA Semester III (CBCS) Pattern 2019
Principles of Human Resource Management
Course Code– GC - 301
Credits - 3

Depth of the Course: Fundamental knowledge

Course Objectives:

1. To introduce the basic concepts of Human Resource Management.
2. To cultivate right approach towards Human Resource and their role in business.
3. To create awareness about the various trends in HRM among the students.

Unit No.	Unit Title	Contents	Purpose & Skills to be develop
1	Introduction to HRM	Introduction to HRM- Meaning, Definition, Features, Scope, Objectives, Importance, Principles of HRM, Evolution of HRM, Functions of HRM, Challenges of HRM, Role of HR Manager, Difference between HRM& Personnel Management, Challenges before HRM	<ol style="list-style-type: none"> 1. To understand the basic concept of HRM and develop knowledge about the various functions of HRM. 2. To understand the different roles the HR performs in an organisation
2	Job Analysis & Planning for Human Resources	Job Analysis- Meaning, Definition, Objectives, Benefits, Methods, Job Analysis Components- Job Description, Job Specification, Job Evaluation Human Resource Planning(HRP)- Meaning, Definition, Objectives, Process, Factors Influencing the Estimation of Human Resource in Organisation, Advantages & Limitations/Barriers of HRP. Caselets on Job Analysis & Human Resource Planning	<ol style="list-style-type: none"> 1. To make the students understand how Job Analysis & Human Resource Planning play an important role in the Organisation. 2. To develop an understanding of the different methods of Job Evaluation & Process of HRP in Specific Organisational functioning.
3	Career Planning , Employee Morale & Job Satisfaction	Career Planning- Meaning, Definition, Objectives, Process, Benefits and Stages. Employee Morale & Job Satisfaction- Employee Morale- Meaning, Definition, causes of low Morale, Job Satisfaction- Meaning, Definition, Factors contributing to Job Satisfaction, Measures to increase Job Satisfaction, Advantages of Job Satisfaction	<ol style="list-style-type: none"> 1. To cultivate the knowledge about Career Planning, Employee Morale & Job Satisfaction among students. 2. To provide knowledge to the students regarding Career Planning which will help/motivate them to

		Caselets on Career Planning, Employee Morale & Job Satisfaction.	climb-up the Career Ladder through higher performance in the organisation. 3. To study the factors contributing to Job Satisfaction and its benefit in the Organisation.
4	HRM in Changing Environment & Trends in HRM	Work force Diversity, Technological Changes & HRM, International HRM, E- Human Resource Management, Human Resource Information System (HRIS), HRM in Virtual Organisations, Work from Home, Out-Sourcing, Changing Role of HRM.	<ol style="list-style-type: none"> 1. To make the students aware about Changing Environment of HRM. 2. To understand the different HRM trends.

Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical –as applicable	Innovative methods to be used	Expected Outcome
Unit 1 (13 hrs)	Interactive teaching methods to be adopted. Role-Play on Challenges before HRM & Ice breaking sessions can be conducted for effective learning. Student Presentations.	<ol style="list-style-type: none"> 1. Describe the basic concept of HRM. 2. Develop knowledge about the functions and different roles of HR Manager. 3. Understand the challenges before HRM
Unit 2 (13 hrs)	Job Analysis Report. Caselets solution sessions and discussion on the same.	<ol style="list-style-type: none"> 1. Understanding the importance of Job Analysis & Human Resource Planning in the Organisation. 2. Develop the Problem- solving and decision making skills.
Unit 3 (13 hrs)	Employee Morale & Job Satisfaction Survey-its basic analysis & Presentation. Caselets solution sessions and its discussion.	<ol style="list-style-type: none"> 1. Development of basic ability to think about Employee Morale and Job Satisfaction. 2. Development of problem-solving and decision-making skills.

Unit 4 (9 hrs)	Student Presentations. Lab Activity.	<ol style="list-style-type: none"> 1. Understand the Changing Environment of HRM and its effects. 2. The students must learn the recent HRM trends with the help of Lab Activities.
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Evaluation

Unit Number	Internal Evaluation		External Evaluation
	Evaluation of students on the basis of	Marks	
I	1. Role Play.	30	25% MCQ 35% short notes 40% long answers
II	1. Report. 2. Caselet Solution & Discussion		
III	1. Survey Analysis & Presentation. 2. Caselet Solution & Discussion.		
IV	1. Lab Activity 2. Presentation		
Total –		30	70

Suggested References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Human Resource Management	L. M. Prasad	Sultan Chand & Company Ltd.	New Delhi
2	Human Resource Management	K. Ashwathappa	Tata McGraw Hill	New Delhi
3	Personnel Management	C. B. Mamoria	Himalaya Publishing House	Mumbai
4	Personnel & Human Resource Management	A. M. Sharma	Himalaya Publishing House	Mumbai
5	Human Resource Management	S. S. Khanka	Sultan Chand & Company Ltd.	New Delhi

S.Y. BBA Semester III (CBCS) Pattern 2019

Supply Chain Management

Course Code: GC - 302

Credits -3

Depth of the Course- Reasonable working knowledge.

Course Objectives:

1. To enable the students to have a comprehensive understanding of Supply Chain Management.
2. To understand key concepts and issues of Logistics and Inventory Management.
3. To understand Warehousing and its role in Space Management.

Unit No.	Unit Title	Contents	Purpose & Skills to be develop
1	Introduction to Supply Chain Management (SCM)	Concept, Objectives and Functions of Supply Chain Management, Supply Chain Strategy, Global Supply Chain Management, Value Chain and Value Delivery Systems for SCM, Bull-Whip Effect, Concept, Importance and Objectives of Green Supply Chain Management.	<ul style="list-style-type: none">• To understand the functions of Supply Chain Management.• To know what is Bull-Whip Effect.• To understand the concept of Green Supply Chain Management.
2	Manufacturing and Warehousing	Manufacturing Scheduling, Manufacturing Flow System, Work- Flow Automation, Material Handling System Design and Decision.Warehousing and Store Keeping, Strategies of Warehousing and Storekeeping, Space Management.	<ul style="list-style-type: none">• To know the process of Work Flow Automation.• To understand Space Management.• To acquaint the students with different Strategies of Warehousing.
3	Logistics Management and IT in Supply Chain Management	Logistics Management, Integrated Logistics Management, Logistics Planning and Strategy, Inventory Management and its Role in Customer Service. Information and Communication Technology	<ul style="list-style-type: none">• To learn the methods of Logistics Planning.• To know the role of Inventory Management in Customer Service.

		in SCM, Role of IT in SCM, Current IT Trends in SCM, RFID, Barcoding. Retail SCM, Problems and Prospects.	<ul style="list-style-type: none"> To understand the role of Information Technology in SCM.
4	Key Operation Aspects in Supply Chain	Supply Chain Network Design, Distribution Network in Supply Chains, Channel Design, Factors Influencing Design, Role and Importance of Distributors in SCM, Role of Human Resources in SCM. Issues in Workforce Management and Relationship Management with Suppliers, Customers and Employees, Linkage between HRM and SCM.	<ul style="list-style-type: none"> To learn the Supply Chain Network Design. To know the Role of Distributors in SCM. To understand Relationship Management with Customers and Employees

Teaching Methodology:

Unit No.	No. of lectures	Innovative Methods to be used		Expected Outcome
1	12	Visit any industry and list out the activities which come under Supply Chain Management Role play of Bull-Whip Effect. Group discussion on Green Supply Chain Management.	Prepare a chart on Manufacturing Flow System	<ul style="list-style-type: none"> The students must understand the functions of Supply Chain Management. The students must gain practical knowledge of Bull-Whip Effect
2	10	Take students out to different Plant Locations to make them understand the Work-Flow Automation Visit a company and List out Space Management techniques used by them.	Prepare a write-up on storekeeping with a live example .	<ul style="list-style-type: none"> The students must understand the importance of Space Management. The students must understand different types of Plant layout and their SCM

3	13	<p>With the help of case study teach different methods of Logistic Management in an industry.</p> <p>Analysis of role of Inventory Management in Customer Service.</p> <p>List out the functions of IT in SCM</p>	A mini presentation on Current IT Trends in SCM	The student must learn different methods of Logistic Management. The students must understand the role of Information Technology in SCM
4	13	<p>Group discussion Role of Human Resources in SCM.</p> <p>Describe the Functions of Quality Circles in an industry</p>	Prepare a research based report on Issues in Workforce Management and Relationship Management with Suppliers,	<p>To understand the various Operation Aspects in Supply Chain</p> <p>To understand the linkage between HRM and SCM</p>

Evaluation Methods:

Unit No	Internal Evaluation	External Evaluation
1	<p>1 MCQ on concept meaning, classification of SCM</p> <p>2 Open Book Test</p> <p>3 Presentation on Value Chain and Value Delivery Systems for SCM.</p>	<p>25% MCQ</p> <p>35% Short notes</p> <p>40% Long answers</p>
2	<p>1 Presentations on Different Material Handling System Design used by companies.</p> <p>2 Case Study on actual factors affecting Store Keeping.</p> <p>3 Chart making on Manufacturing Flow System.</p>	
3	<p>1 MCQ on Logistics Management</p> <p>2 Situation Analysis- Problems and Prospects of Retail in</p>	

	SCM. 3 Presentations on Role of IT in Supply Chain Management	
4	1 Case study on: Issues in Workforce Management 2 Situation Analysis of actual factors affecting Distributors in SCM	
Total	30	70

Suggested References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Supply Chain Management for Global Competitiveness	B.S.Sahay.	Macmillan India Limited	India
2	Supply Chain Management	Sunil Chopra, Peter Meindl & D.V. Kalra.	Pearson Education	UK
3	The Supply Chain Handbook	James A. Tompkins, Dale A. Harmelink.	Tompkins Press	UK
4	Supply Chain Logistics Management	Donald Bowersox, David Closs and M. Bixby Cooper	McGraw-Hill Education;	India
5	Supply Chain Management: Text and Cases	Vinod V Sople	Pearson Education	UK
6	Logistical Management	Donald J.Bowersox & David J.Closs.	Tata McGraw-Hill	New Delhi
7	Designing and Managing the Supply Chain	David Simchi-Levi.	Tata McGraw-Hill Editions	New Delhi

Savitribai Phule Pune University
SY BBA Semester III (CBCS) Pattern 2019
Global Competencies and Personality Development
Course Code-GC- 303
Credits – 03

Depth of the course: Reasonable knowledge about Competencies and Personality Development.

Course objectives:

1. To build self-confidence, enhance self-esteem, and improve overall personality of the students.
2. To enhance global and cultural competencies of the students.
3. To groom the students for appropriate behaviour in social and professional circles.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Introduction to Personality and its Development	<ul style="list-style-type: none"> • Definition and nature of personality • Characteristics of good personality • Determinants of personality development • Theories of personality development <ol style="list-style-type: none"> i. Psychoanalytical Theory by Sigmund Freud ii. Trait Theory by Allport and Big Five model iii. Social Cognition Theory by Albert Bandura 	<ul style="list-style-type: none"> • To study the nature and meaning of personality. • To understand various factors affecting personality development of an individual. • To learn various theories of personality development.
2	Global Competence and Self Development	<ul style="list-style-type: none"> • Meaning and need of global competence. • Characteristics of globally competent individual (life-long learning, understanding cultural differences, adaptability, comfortable with change, 	<p>To understand the concept of Global Competence. To decipher the characteristics of globally competent individual and encourage students to develop that characteristics among themselves. To develop self- esteem and self-confidence of the students.</p>

		<p>problem-solving ability, critical and comparative thinking).</p> <ul style="list-style-type: none"> • Building self-esteem and self confidence • SWOC Analysis and Personal Goal Setting 	<p>To introduce the concept of SWOC Analysis and encourage the students for personal Goal setting by providing theoretical as well as practical knowledge.</p>
3	Development of Social and Interpersonal Skills	<ul style="list-style-type: none"> • Effective communication skills, Preparation for self-introduction. • Working on attitude i.e. Aggressive, assertive and submissive • Development of leadership skills and introduction to Leadership styles. • Team Building; develop ability to work under pressure, flexibility at workplace. • Social empathy, building blocks of social empathy and development of social empathy. • Social Responsibilities • Workplace ethics 	<ul style="list-style-type: none"> • To explain various techniques for effective communication. • To train students for impressive self- introduction. • To introduce various methods for positive attitude development. • To explain various styles and qualities of leaders and encourage students for effective leadership. • To understand the structure of team and to develop ability to work under pressure and flexibility at workplace. • To develop social empathy and explain social responsibilities of the individual. • To introduce various workplace ethics.
4	Projecting a Positive Social Image	<ul style="list-style-type: none"> • Definition and importance of social image • Grooming basics and use of body language • Time management • Public-speaking • Proper e-mail and telephone etiquettes • International and social etiquettes • Social graces and table manners 	<ul style="list-style-type: none"> • To explain the importance of positive social image of the individual. • To introduce basics of grooming and effective use of body language. • To explain the importance of the time management. • To develop ability of effective public speaking. • To train the students for writing e-mails and explain various telephone etiquettes. • To study various social and international etiquettes and table manners.

Teaching Methodology:

Teaching Hours	Innovative methods to be used	Expected Outcome
Unit 1-12	Selected video films on the theories of personality. Interactive sessions. Reading of reference books, magazines and articles and preparing notes by students.	To learn various theories of personality development.
Unit 2-11	Flipping the classroom- students will gather information by using various tools and techniques available. Activities for SWOC and goal setting, Expert Talk can be organized.	To understand the concept of Global Competence. SWOC Analysis by students and encourage the students for personal Goal setting by providing theoretical as well as practical knowledge.
Unit 3-13	Collaboration-few selected students can take responsibility to guide other students through the role play as a mentors, supervisors for the students. It also teaches students empathy, negotiation skills, teamwork, and problem-solving skills. Work together as a team- Project work can be given to the students in groups.	<ul style="list-style-type: none"> • To understand the structure of team as well as to develop ability to work under pressure and flexibility at work place. • To develop social empathy and explain social responsibilities of an individual.
Unit 4-12	Classes outside the classroom to understand social etiquettes, visit to corporate offices, seminars and conferences, public speech event etc. Activity of e-mail writing can be given to the students.	<ul style="list-style-type: none"> • The students should groom themselves and effective use of body language. • To develop the skills of managing the time. • To develop ability of effective public speaking. • To train the students for writing e-mails.

Evaluation:

Unit No.	Internal Evaluation	External Evaluation
Unit – I	Presentation on Theories of Personality Prepare a chart on successful personalities	

Unit – II	Open book test. Assignments	Fill in the blanks True and False Short answer question - 25% Short notes-35% Long answer questions- 40%
Unit – III	Small project on Effective Communication, Social Empathy and Team Building in a group with time limitation Prepare a small handbook on workplace ethics of by visiting some organization or on the basis of collected information through newspapers, corporate magazines and internet.	
Unit – IV	Power point presentation on international etiquettes, Writing of an e-mail.	
Total –	30	70

Suggested references:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Personality development.	Swami Vivekananda	Adhyaksha Advaita Ashram	India
2	Personality Development and Communication skills.	C Rajya Lakshmi Kalyani, D S Vittal, AnithaRaju,	Himalaya Publishing House.	New Delhi,India
3	Effective Life Management.	Swami Amartyananda	Advaita Ashrama	India
4	Personality Development and Soft Skills.	BarunMitra	Oxford University Press	New Delhi,India
5	Soft Skills- Personality Development for Life Success.	Prashant Sharma	BPB Publication	New Delhi, India
6	Theories of Personality 4th Edition.	Hall CS, Lindsey G and Campbell J B	Wiley	New York

Savitribai Phule Pune University
SY BBA Semester III (CBCS) Pattern 2019
Fundamentals of Rural Development
SY BBA Course Code: GC - 304
Credit: 3

Depth of the Course: Functional Knowledge about Rural Development

Course Objectives:

1. To understand the development issues related to rural society.
2. To find the employment opportunities for rural youth.
3. To create interest among the rural youth to participate in rural development programmes and schemes for sustainable development.
4. To discourage seasonal and permanent migration to urban areas.

Unit No.	Unit Title	Contents	Purpose and Skills to be develop
1	Introduction to Rural Development	1.1 Concept of Rural Development- Meaning and Definition. 1.2 Scope and Importance of Rural Development. 1.3 Approaches of Rural Development. 1.4 Need of Rural Development.	<ul style="list-style-type: none"> • To provide sound knowledge about rural development.
2	Rural Development Planning & Management	2.1 Rural Development Planning –District Rural Development Agency (DRDA)- Organisation Structure 2.2 Functions of DRDA 2.3 NGO's and Rural Development 2.4 Self Help Groups (SHG's) formation	<ul style="list-style-type: none"> • The unit will help to gain knowledge regarding working in various Government and NGO's transformation.

3	Agriculture Enterprise & Agro-based industries.	3.1 Agricultural Entrepreneur- Meaning, Definition and Importance. 3.2 Agri-business Enterprises-Issues and prospectus 3.3 Micro-financing 3.4 Food and Agricultural Marketing and Management of agro products. 3.5 Agro-based industries	<ul style="list-style-type: none"> • It gives opportunities to students to develop good communication skills, gain knowledge of local languages, ability to handle masses and leadership skills. • They should develop problem-solving skills and the ability of working with clients with diverse interests. • Creation of interest of thereby planning for n farming.
4	Information Technology and Rural Development	4.1 Rural Development and Internet. 4.2 Information & Communication Technology (ICT) for Rural Development 4.3 IT –Enable Services for an e-village 4.4 Challenges of Rural Development	<ul style="list-style-type: none"> • To develop IT Skills. • To develop awareness regarding the challenges of Rural Development.

Teaching Methodology:

Teaching Hours Theory + Tutorials /Project Practical	Innovative methods to be used	Expected Outcome
Unit 1 (8 hrs)	<ol style="list-style-type: none"> 1. Presentations. 2. Group Discussion on scope and importance of rural development. 	<ol style="list-style-type: none"> 1. Describes the importance of rural development 2. Better understanding of need for rural development
Unit 2 (14 hrs)	<ol style="list-style-type: none"> 1. Debate/ Group discussion on “Role of SHG groups and their effectiveness”. 1. Caselets solution sessions and discussion on same. 	<ol style="list-style-type: none"> 1. Describes determinants of Rural Development Planning 2. Develop the knowledge & ability of the students about the concepts of NGO’s and Rural Development 3. Development of understanding of Functions of DRDA
Unit 3 (14 hrs)	<ol style="list-style-type: none"> 1. Visit to Bhimthadijatra to understand concept of agropreneuership 2. Visit to financial institutions to understand Micro financing 3. Caselets solution sessions and discussion on same. 	<ol style="list-style-type: none"> 1. Describes determinants of agropreneuership 2. Understanding of problems associated with rural entrepreneurship. 3. Understanding the implementation of marketing initiatives

Unit 4 (12 hrs)	<ol style="list-style-type: none"> 1. Role Play on role of internet and rural development. 2. Chart presentation on(ICT) for Rural Development 3. Project competition on IT –Enable Services for an e-village 4. Caselets solution sessions and discussion on same. 5. Students should collect the information about any one scheme of rural development and analyse it. 	<ol style="list-style-type: none"> 1. Understanding role of internet in rural development. 2. Develop the knowledge & ability of the students about the concepts ICT and e-development in villages. 3. Understanding challenges of rural development. 4. Candidates willing to for further research work, also suitable for the project.
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Evaluation

Unit Number	Internal Evaluation		External Evaluation
	Evaluation of students on the basis of	Marks	
I	1. Power point presentations on sub points	30	25% MCQ 35% short notes 40% long answers Fill in the blanks True and False Short answer question -25% Short notes -35% Long answer questions -40%
II	<ol style="list-style-type: none"> 1. Debate/ Group Discussion Activities. 2. Caselets Solution & Discussion 		
III	1. Visit to Bhimthadijatra and other rural initiatives		
IV	<ol style="list-style-type: none"> 1. Role Play. 2. Caselets Solution & Discussion 		
Total –		30	70

Suggested references:

Sr.No.	Title of the Book	Author	Publication	Place
1	Fundamentals of Rural Development	Mary Tahir & Tahir Hussain	I.K International Publishing House	India
2	Rural Development : Concept and Recent Approaches	A .Thomson William A.J.Christopher	Rawat Publications	Jaipur,India
3	Rural Poverty in India	Sib Nath Bhattacharya	Ashish Publishing House	New Delhi
4	Rural Development; Principles, Policies and Management	Katar Singh	SAGE Publication	India
5	Economic Policy and Development	B.L.Mathur	RBSA Publishers	Jaipur,India
6	Indian Economy	V.K.Puri S.K.Sharma	Himalaya Publishing House	Mumbai

Savitribai Phule Pune University
SY BBA Semester III (CBCS) Pattern 2019

Discipline Specific Electives (DSE- A- MM)
Consumer Behaviour & Sales Management
SY BBA Course Code- A 305 MM
Credits 3+1=4

Depth of the Course-Reasonable Knowledge & Insights in Consumer Behaviour & Sales Management.

Course Objectives:

1. To develop significant understanding of Consumer behaviour in Marketing.
2. To understand the relationship between consumer behaviour & Sales Management.
3. To develop conceptual based approach towards decision making aspects & its implementation considering consumer behaviour in Sales Management.

Unit No	Unit Title	Contents	Purpose & Skills to be develop
1.	Introduction and Determinants of Consumer Behaviour	<p>Basics: Meaning of Customers & Consumers, Consumer Roles, Consumerism & De-marketing.</p> <p>Culture & Sub- Culture: Meaning, Characteristics & Relevance to Marketing Decisions.</p> <p>Social Class: Meaning, Measurement, Effect on Lifestyles.</p> <p>Social Groups: Meaning & Group Properties & Reference Groups.</p> <p>Family: Family Life Cycle & Purchasing Decisions.</p> <p>Marketing Mix: Influence of marketing mix variables.</p> <p>Personality & Self Concept: Meaning of Personality, Influence on Purchase Decisions.</p> <p>Motivation & Involvement: Types of Buying Motives, Motive Hierarchy, Dimensions of Involvement.</p> <p>Learning & Memory: Meaning & Principal Elements of Learning, Characteristics of Memory Systems, Recall.</p>	<ul style="list-style-type: none"> • To know the Role & Importance of Consumer Behaviour. • Ability to learn how Consumer Behaviour impacts the Sales of an Organization. • To understand how consumer behaviour is influenced by different environment. • To know about determinants of consumer behaviour affects the marketing system. • To understand the overall effect of concepts upon the consumer behaviour • To develop strategy to influence consumer behaviour.

		Attitudes: Meaning & Characteristics, Strategies for Changing Attitudes, Intentions Behaviours.	
2	Consumer Decision Making Process	<p>Problem Recognition: Types of consumer decisions, types of Problem Recognition, Utilizing problem recognition information</p> <p>Search & Evaluation: Types of information, Sources of Information Search, Search, Experience and Credence Aspects - Marketing Implications</p> <p>Situational Influences on Purchase Decisions</p> <p>Purchasing Process: Why do people shop? Store & Non-store Purchasing Processes, Purchasing Patterns.</p> <p>Post-purchase Evaluation & Behaviour: Consumer Satisfaction, Dissatisfaction, Customer Delight, Consumer Complaint Behaviour, Post- Purchase Dissonance.</p>	<ul style="list-style-type: none"> • To develop the conceptual decision making insights. • To have the right understanding of situations as they influence the consumer behaviour. • To develop the habit of taking calculated risks towards decision making process.
3	Basics to Sales Management & its Organization	<p>Sales Management: Definition and meaning, Objectives, Sales Research, Sales Forecasting methods,</p> <p>Sales Planning and control: Goal setting, Performance measurement, diagnosis and corrective actions.</p> <p>Sales Organization: Need for Sales Organizations, their structure, Sales Managers Functions and responsibilities, Planning for major customers and sales Budget, Specific Characteristics of a successful salesman.</p>	<ul style="list-style-type: none"> • To provide the basic understanding of the processes followed in sales management • To understand the importance of sales organizations & its impact upon the performance of the organizations.
4	Training, Managing & Motivating the Sales Force	<p>A. Recruiting, Selection and Training of Sales force: Procedures and criteria extensively used as selection tools for recruiting and testing sales ability. Sales Force Job Analysis and Description</p> <p>B. Areas of sales Training: Company Specific Knowledge, product knowledge Industry and Market Trend Knowledge, customers and technology – Relationship Selling Process and Customer education. Value added Selling</p> <p>C. Motivating the Sales Team: Motivation Programs – Sales Meetings, Sales Contests, Sales Compensating, (Monetary</p>	<ul style="list-style-type: none"> • To provide an understanding of the tools and techniques necessary to effectively Manage & Control the sales function - organization - sales individual. • To understand the importance of target based marketing to achieve desired results for sales organization.

		compensation, incentive programs as motivators, Non-Monetary compensation – fine tuning of compensation package. Supervising, D. Evaluating Sales Force Performance and Controlling Sales activities: Sales Records and Reporting Systems, Improving Sales Productivity, Ethical and Legal Issues in Sales Management.	
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Teaching Methodology

Teaching Hours Theory + Tutorials /Project	Innovative methods to be used	Tutorials /Project for 1 credit –	Expected Outcome
Unit I – 10Hrs	Group wise presentation to understand the nuances of Consumer behaviour.	Assignments to practice the basic concepts in consumer behaviour.	To have an adequate understanding of consumer behaviour, its scope, objectives, opportunities and its challenges.
Unit II– 14Hrs	Unguided session based upon the Case Studies, in which strategies are adopted by organizations.	Suggesting an adequate strategy to organizations based upon the analysis of the case study .	To help students develop an understanding towards Strategy building & its effectiveness.
Unit III– 14 Hrs	Group discussion amongst the students for developing innovative sales strategy to be followed by organizations.	Discussion & Analysis of success or failure factors behind the strategies implemented.	To find out alternatives for Dynamic organization to ensure their success in highly competitive sales environment.
Unit IV – 10Hrs	Skit, Role Play, Presentation to propose relevant solutions to overcome dynamic challenges for sales organizations.	Suggestion & implementation of creative strategies designed to cope against distorting challenges of sales environment through role play or skit .	Developing Design Thinking approach to explore opportunities while combating against challenges in highly competitive Sales environment.

Evaluation

Subject	Internal Evaluation	External Evaluation
Unit – I	MCQ on Consumer Behavioural Concepts Analysis of Marketing Mix, Motivation & Attitude.	25% MCQ 35% short notes 40% long answers Fill in the blanks True and False Short answer question -25% Short notes -35% Long answer questions -40%
Unit – II	MCQ on Problem Recognition, Search & Evaluation, Purchase Process, Post Purchase evaluation & Behaviour through short answers.	
Unit – III	MCQ on Sales Mgmt, Sales Planning & Control, Sales Organization. Short answers to evaluate the Sales strategy formation & its implementation.	
Unit – IV	MCQs and short answers	
Total –	20+30	50

Suggested References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Consumer Behaviour & Sales Management	Still, Cundiff & Govani,	Pearson Education	New Delhi/Mumbai
2	Consumer Behaviour & Sales Management	Havaldar & Cavale	TMGH	Pune
3	Consumer behavior & Sales Mgmt	SL Gupta	Excel books	Pune
4	Consumer behavior & Sales Mgmt	David L.	Tata McGraw Hill	Mumbai
5	Consumer behavior & Sales Mgmt	Batra, Kazmi	Excel books	Mumbai
6	Sales Management,	Bill Donaldson	Palgrave Publications	UK
7	Consumer Behavior - An Indian perspective	Dr. S.L Gupta, Sumitra Pal	Sultan Chand and Sons	New Delhi

Savitribai Phule Pune University
SY BBA Semester III (CBCS) Pattern 2019
Discipline Specific Electives (DSE- A- MM)
Retail Management
Course Code- DSE A 306 MM
Credits 2+2=4

Depth of the course- Reasonable knowledge of Retail Management

Course Objectives

- 1.To provide basic understanding of forces that shape retail industry
2. To provide understanding of retail operations and strategy
3. To provide understanding of opportunities and challenges in retail industry

Unit No.	Unit Title	Contents	Purpose & Skills to be develop
1	Introduction to Retailing	Structure of retail industry, types of retailers, market segments and channels, market trends, retail life cycle.	Retailing aims to develop students' understanding of retail strategy, retail operations management, innovation in retail, and the key issues impacting growth in retail firms
2	Retailing Strategy	Identifying and Understanding Customers, Customer segmentation, Selecting Target Market, Identifying Market Segments, selecting site locations, Strategic positioning and execution. Establishing and Maintaining Retail Image, Creating In-store Dynamics (Layouts & Plans)	To explore the strategic options available to retailers. To analysis the factors impacting store design and location selection.

3	Managing the Retail Business	Implementing Retail Marketing Plan, Brief Human Resource Requirements, Developing Product and Branding Strategies, Developing Merchandise Plans, Merchandising Strategy,	To study store operations, merchandising and customer management.
4	Future of Retailing	Introduction to recent trends and Technological Advancements in retailing. Omni Channel Retailing, shopping with AR (Augmented reality), Pop up shops, social shopping, private label brands.	To get conversant with the latest tool used in retail industry. To understand the innovative channels to reach out the target customers to sustain in new markets.

Teaching Methodology

Teaching Hours Theory + /Project	Innovative methods to be used		Expected Outcome
Unit I – 10Hrs	Group presentation to understand the perspectives of students of retail industry.	Assignments for practice of basic concepts in retail management.	To have a clear understanding of the retail concepts, its scope, objectives, opportunities and challenges.
Unit II – 14Hrs	Presentation to understand the lay out and customer flow on the floor.	Take an example of a retail store of any MNC to study in store dynamics.	To help students understand the planning process behind a retail business.
Unit III – 14Hrs	Discussion of examples of innovative methods adopted by companies to execute their retail strategy	On the same project find the reasons for the success or failure while analysing the execution strategies adopted by the organization.	Giving insights to the challenges while implementing a plan, in context of retail management.
Unit IV – 10Hrs	Demonstration of current trends in retail sector. Brain storming sessions to propose solutions to recent challenges in retail sector.	Application of the innovative methods and their possible outcomes, opportunities and challenges, for the above implemented project.	Developing critical thinking ability to explore various angles while facing challenges in the retail sector.

Evaluation

Subject	Exposure project Evaluation	External Evaluation
Unit – I	Students are expected to visit Minimum 5 Retail Business Outlets covering all categories like Food & Beverages, Clothing & Apparel, Daily Essentials, Automobile & Electronics Retail and Medicines, etc. Students shall prepare project report on the points like: Store layout, Product display, logistics and SWOC analysis, etc. and Viva-voce will be conducted on the submitted project report.	25% MCQ 35% short notes 40% long answers Fill in the blanks True and False Short answer question -25% Short notes -35% Long answer questions -40%
Unit – II		
Unit – III		
Unit – IV		
Total –	50	50

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Retail Management	Chetan Bajaj, Rajnish Tuli	Oxford University Press	New Delhi, India
2	22 immutable laws of Marketing	Al Ries, Jack Trout	Profile Books Ltd.	UK
3	Retail Management	Gibson	Pearson Publication	UK
4	Fundamentals of Retailing	KVS Madaan	Mc Graw Hill	USA
5	Retail Marketing	Swapna Pradhan	TMGH	India
6	Retailing Management	Michael Levy & Barton Weitz	TMGH	India
7	Retail Marketing Management	David Gilbert	Pearson Publication	UK
8	Managing Retailing	Piyush Kumar Sinha & Dwarika Prasad Uniyal	Oxford University Press	New Delhi, India

Savitribai Phule Pune University
S.Y. BBA Semester III (CBCS) Pattern 2019
Discipline Specific Electives (DSE- B- FM)
Course Title – Management Accounting
Course Code- B 305 FM
Credit 3+1=4

Depth of the Course- Functional knowledge of Management Accounting

Course Objectives: -

1. To impart basic knowledge of management accounting.
2. To understand the implications of various financial ratios in decision making.
3. Application and use of various tools of management accounting in the business.

Unit No.	Unit Title	Contents	Purpose & Skills to be develop
1	Introduction	Management Accounting- Definition, Objectives, Scope, Functions, Advantages, Limitations. Distinction between Financial Accounting and Management Accounting. Distinction between Cost Accounting and Management Accounting	To understand the concept and meaning of management accounting. To understand difference between financial accounting, cost accounting and management accounting. To develop decision making skill of the managers with the use of various management accounting tools.
2	Analysis and interpretation of Financial statement	Introduction of Schedule III as per Company Act 2013, (Statement of Profit & Loss, Statement of Balance sheet format) Methods of Analysis- Comparative statements, Common size statements, Trend percentage or trend ratios (Horizontal Analysis), Fund flow Statement. Introduction of ratio Analysis- meaning, necessity & advantages of ratio analysis. Types of Ratio- Liquidity Ratios, Leverage Ratios, Activity Ratios, profitability Ratios	To study schedule III as per Company Act 2013 and understand the format of Statement of Profit & Loss & Statement of Balance sheet of company. To study different methods of analysis. Application of various methods of analysis. Analytical skill for comparing financial position of any business will be developed.

		(Introduction and Problems on following ratios only) Current ratio, Quick ratio, Gross profit ratio, Net profit ratio, Operating expenses ratio, Debt equity ratio, Debtors turnover ratio Stock turnover ratio	
3	Marginal Costing	Marginal Costing- Meaning, definition of marginal cost and marginal costing, Advantages and limitations of marginal costing, Contribution, Profit volume ratio (P/V Ratio), Breakeven Point (BEP), Margin of Safety, problems on contribution, P/Ratio, BEP and MOS	To understand the concept of contribution and breakeven point in business and its application while estimating profitability level. Decision making skill will be developed.
4	Budget & Budgetary control	Budget and budgetary Control-Meaning, Definition, Nature of budget and budgetary control, Types of budget- as per time, functions and variability, Objectives of budget and budgetary control, Steps in budgetary control, advantages and disadvantages of budgetary control, Problems on cash budget.	To understand the concept of contribution and breakeven point in business and its application while estimating profitability level. Decision making skill will be developed. To study the concept of budget and its various types. On the basis of past data, future growth and plans, estimated cash inflow and cash outflow can be prepared. Estimated requirement of funds in future and its application in business can be calculated.

Teaching Methodology

Teaching + Tutorials Hours	Innovative methods to be used	Tutorials /Project for 1 credit	Expected Outcome
Unit 1- 8	PPT, Group discussion	NA	To understand the concept and meaning of management accounting. To understand difference between financial accounting, cost accounting and management accounting.
Unit 2- 14	PPT, Video, Case study , Group discussion	<ul style="list-style-type: none"> ➤ Financial Analysis of any company of three years using trend percentage, comparative statement, ratio analysis. ➤ Financial Analysis of two different companies using trend percentage, comparative statement, ratio analysis. 	To understand different methods of analysis and classification of various ratios and its application.
Unit 3- 13	PPT, Video, Case study , Group discussion	NA	To calculate contribution and breakeven point to reach profitability level of any business.
Unit 4- 13	PPT, Video, Case study , Group discussion	<ul style="list-style-type: none"> ➤ To prepare budget of any activity or event to be organized in the college. 	To learn how to make various types of budgets as per need and requirement of business.

Evaluation

Subject Management Accounting	Internal Evaluation	External Paper Pattern (50 Marks)
Unit – I	MCQ/ long question/ short notes	Q.1 A Fill in the blanks 5M) Q.1 B Write Short Notes (Any 2) (10M) Q.2 Long Answer (15M) OR Q.2 Problems on ratio analysis Q.3 Problem on marginal costing (10M) Q.4 Problem on Cash budget(10M) OR Q.4 Long Answer
Unit – II	MCQ/Long questions/ problem/ short notes	
Unit – III	MCQ/Long questions/ problem/ short notes	
Unit – IV	MCQ/Long questions/ problem/ short notes	
Total –	30+ 20 marks for project= 50 Marks	

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Management Accounting	L.M.Pandey	Vikas Publishing House	Delhi
2	Management Accounting	S.K.R.Paul	New Book Central Agency	
3	Accounting for Management	S.N.Maheshwari, S.K.Maheshwari, Sharad K. Maheshwari	Vikas Publishing House	Delhi
4	Management Accounting	M.Y.Khan, P.K.Khan,	Mcgraw Hill Education	Delhi
5	Management Accounting	AnthonyA.Atkinson, Robert S.Kaplan, Ella Mac Matsumura,G. Arun Kumar, S.mark. Young	Pearson Education	Delhi

Savitribai Phule Pune University
S.Y. BBA Semester III (CBCS) Pattern 2019
Discipline Specific Electives (DES- B- FM)
Course Title – Banking & Finance
Course Code- B 306 FM
Credits 2+2= 4

Depth of the course- Functional knowledge of banking Operations and various Regulatory Authorities in India.

Course Objectives

1. Study of banking function and its operations.
2. To study the functioning of Regulatory Authorities in India.
3. To study recent technology in banking industry.

Unit No.	Unit Title	Contents	Purpose & Skills to be develop
1	Introduction	Introduction- Origin, meaning and definition of bank, evolution of banking in India, structure of banking system in India	Overview of evolution and banking structure in India
2	Functions of Banks	Functions of Banks- 1. Primary functions- Accepting deposits and granting loans 2. Secondary functions- Public utility services and agency services	Students will understand various functions and activities of banks.
3	Regulatory Authorities in India	Reserve Bank of India (RBI) – Role and functions of RBI, Credit control measures, Qualitative and quantitative credit control Insurance Development Authority (IRDA)- Objectives, Powers and functions of IRDA SEBI- Objectives, power and functions of SEBI	Knowledge of functioning and powers various Regulatory Authorities in India.
4	Technology in banking	Need and importance of technology in banking. ATM, Debit card, Credit card, Tele banking, Net banking, mobile banking, RTGS, NEFT, Swift (Society for	Use of technology in banking and study of security measures while using E- banking

		worldwide interbank financial telecommunication) cyber security in E- banking	
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Teaching Methodology

Teaching Hours Theory + Project -Practical	Innovative methods to be used		Expected Outcome
Unit 1- 10 Lectures	PPT, Video, Group discussion,	Applicable(Project)	Students will understand structure of banking system in India.
Unit 2- 12 Lectures	PPT, Video, Group discussion	Bank Visit	Students will understand functions and operations of banks.
Unit 3- 13 Lectures	PPT, Video, Group discussion	Applicable(Project)	Students will get basic knowledge of function of various regulatory Authorities in India
Unit 4- 13 Lectures	PPT, Video, Group discussion	Applicable(Guest lecture)	Knowledge of how to use new technology in banking operations along with its cyber security.

Evaluation

Subject Management Accounting	<p>Guidelines regarding Exposure project (50 marks) Students need to prepare Exposure project on the following topics- (Any 3)</p> <ol style="list-style-type: none"> 1. Guest lecture/ workshop on any topic mentioned in the syllabus. 2. Visit to any bank and observe banking functions and operations. (group project) 3. PPT on any topic from the syllabus. <p>Conducting survey/ project based on the following themes-</p> <ul style="list-style-type: none"> ▪ Study of different types of banks & their performance ▪ Comparative study of performance of nationalized banks, co- operative banks & foreign banks. ▪ Conducting customer survey of banks customers of any specific bank. ▪ Awareness & conducting financial literacy among different stake holders of the society (e.g. students, house wives, rural area etc.)- Student can conduct a survey by framing a small questionnaire. <p>Note: Colleges can change the project topics according to their convenience.</p>	<p>External Evaluation 25% MCQ 35% Short Notes 40% Long Answers</p>
	SPPU Project viva= 50 marks	Theory paper = 50 marks

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Principles and Practices of Banking	Srinivasan D.and others	Macmillan India Pvt Ltd	Delhi
2	Banking and Insurance	O.P.Agarwal	Himalaya	Delhi
3	The Indian Financial System	Vasant Desai	Himalaya	Delhi
4	Financial services and Markets	Dr. S.Gurusamy	Thomas	Delhi
5	Banking Law and Practice in India	Maheshwari	Kalyani publisher	Delhi

Savitribai Phule Pune University
SY BBA Semester III (CBCS) Pattern 2019
Discipline Specific Electives (DES- C- HRM)
Organisational Behaviour (OB)
Course Code: DSE- C -305 HRM
Credits: 3+1=4

Depth of the Course-Comprehensive Knowledge of Organisational Behaviour

Course Objectives:

1. To describe the major theories, concepts, models and frameworks in the field of Organisational Behaviour.
2. To explain determinants of Organisational Behaviour at Individual, Group and Organisational Level.
3. To give knowledge about approaches to line-up individual, groups & managerial behaviour in order to achieve organisational goals.

Unit No.	Unit Title	Contents	Purpose & Skills to be develop
1	Introduction to Organisational Behaviour (OB)	Meaning, Definition, Nature, Scope, Importance, Key Elements of OB, Disciplines that contribute to the OB field, Models of OB, Challenges for OB	<ol style="list-style-type: none"> 1. To understand and explain how and why Organisational Behaviour study is important to students. 2. To make use of the models of Organisational Behaviour in Specific Organisational Settings.
2	Individual Determinants of Organisational Behaviour	<p>Individual Behaviour- Influencing factors- Personal, Psychological, Organisational System & Resources & Environmental Factors.</p> <p>Personality- Meaning, Definition, Key Determinants of Personality, Types of Personality, Theories of Personality</p> <p>Value & Attitude- Meaning, Definition and Types.</p> <p>Motivation- Meaning, Definition, Importance, Types, Theories- Maslow's Need Hierarchy Theory, McGregor's Theory X & Theory Y, Herzberg's Two- Factor Theory</p> <p>Caselets on Personality, Motivation, Value & Attitude</p>	<ol style="list-style-type: none"> 1. To explain determinants of Organisational Behaviour at Individual Level. 2. To make use of the Theories of Personality by adding new perspective for overall development of the Organisation. 3. To make students understand how Values and Attitudes play a vital role in the Organisation. 4. To make use of Theories of Motivation to motivate employees to achieve higher performance in Organisation.

3	Group Interaction & Organisational Behaviour	<p>Group Dynamics- Meaning, Definition, Types, Reasons for forming Groups, Theories of Group Formation, Stages in Group Development, Group Behaviour, Group Cohesiveness</p> <p>Conflict - Meaning, Definition, Traditional & Modern View of Conflict, Organisational Performance & Conflict, Frustration Model, Conflict Management- Competing, Collaborating, Compromising, Avoiding, Accommodating.</p> <p>Leadership- Meaning, Definition, Leader V/S Manager, Styles of Leadership</p> <p>Caselets on Group Dynamics, Conflict Management & Leadership</p>	<ol style="list-style-type: none"> 1. To explain determinants of Organisational Behaviour at Group Level. 2. To understand the Group Behaviour by learning Theories of Group Formation. 3. To enable students to understand the relation between Organisational Performance & Conflict. 4. To explicate students, the different styles of Leadership.
4	Dynamics of Organisation	<p>Organisational Culture- Meaning, Definition, Levels, Formation & Sustaining Organisational Culture</p> <p>Organisational Change- Meaning, Definition, Types, Forces for Change in Organisation, Resistance to Change, Management of Change</p> <p>Caselets on Organisational Culture & Change Management</p>	<ol style="list-style-type: none"> 1. To explain determinants of Organisational Behaviour at Organisational Level. 2. To identify the factors that create and sustain Organisation's Culture. 3. To identify and manage the forces that act as stimulants to change.
5	Project/ Tutorial	<p>Students can prepare project on any topic which they have learnt under this subject.</p>	<ol style="list-style-type: none"> 1. To develop better understanding of theoretical concepts by undergoing the project.

Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical	Innovative methods to be used	Tutorials /Project for 1 credit	Expected Outcome
Unit 1 (10 hrs)	3. Presentations. 4. Group Discussion on Models of OB.	----	3. Describes importance of Organisational Behaviour. 4. Better understanding of Models of Organisational Behaviour.
Unit 2 (14 hrs)	2. Role Play on different types of Personality. 3. Debate/ Group discussion on Motivation (Monetary Motivation v/s Non-Monetary Motivation). 4. Caselets solution sessions and discussion on same.	----	1. Describes determinants of Organisational Behaviour at Individual Level. 2. Develop the knowledge & ability of the students about the concepts of Personality, Motivation, Value & Attitude. 3. Development of Problem-solving and decision making skills of students.
Unit 3 (14 hrs)	4. Role Play on Stages in Group Formation & Group Cohesiveness. 5. Role Play on Conflict Management. 6. Debate/ Group Discussion on Leader v/s Manager. 7. Caselets solution sessions and discussion on same.	----	4. Describes determinants of Organisational Behaviour at Group Level. 5. Develop the knowledge & ability of the students with respect to the concepts of Group Dynamics, Conflict Management & Leadership. 6. Development of Problem solving and decision making skills.
Unit 4 (10 hrs)	5. Role Play on Resistance to Change. 6. Caselets solution sessions and discussion on same.	----	4. Describes determinants of Organisational Behaviour at Organisational Level. 5. Develop the knowledge & ability of the students about the concepts of Organisational Culture & Change. 6. Development of Problem solving and decision making skills.

Exposure	<ol style="list-style-type: none"> 1. Preparation of Google Form for Questionnaire of Project, Collection of data and Submission of Project. 2. Power Point Presentation. 	Project evaluation of the students on the basis of Project Submission & Presentation of Project	<ol style="list-style-type: none"> 1. Better understanding of theoretical concepts, improvement of communication skills, confidence and stage-daring by presenting the project with the help of PPT.
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Evaluation

Unit Number	Internal Evaluation		External Evaluation
	Evaluation of students on the basis of	Marks	
I	1. Role Play, Debate/ Group Discussion Activities.	30	25% MCQ 35% short notes 40% long answers
II	1. Role Play, Debate/ Group Discussion Activities. 2. Caselet Solution & Discussion		
III	1. Role Play, Debate/ Group Discussion Activities. 2. Caselet Solution & Discussion.		
IV	1. Role Play. 2. Caselet Solution & Discussion		
Project	1. Project Submission. 2. Presentation.		
Total –		50	50

Suggested references:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Organisational Behaviour: Text, Cases, Games	K. Aswathappa	Himalaya Publishing House	Mumbai
2	Organisational Behaviour	Stephen P. Robbins Timothy A. Judge Neharika Vohra	Pearson Education, Inc	New Delhi
3	Organisational Behaviour	S. S. Khanna	S. Chand & Company Ltd.	New Delhi
4	Organisational Behaviour: Text & Cases	Suja R, Nair	Himalaya Publishing House	Mumbai
5	Organisational Behaviour	Jit S. Chandan	Vikas Publishing House Pvt. Ltd.	New Delhi

Savitribai Phule Pune University
SY BBA Semester III (CBCS) Pattern 2019
Legal Aspects in Human Resources DSE - C 306 (HRM)
Course Code: DSE - C 306 (HRM)
Credits: 2+2=4

Depth of the course- Functional Knowledge

Course Objectives:

1. To study and explain rights of employees at work place.
2. To understand the Applications of different Legal Aspects in HR.

Unit No.	Unit Title	Contents	Purpose & Skills to be develop
1	Introduction	Employer, employee, Rights of an employee at work place. HR Policy- Meaning and its importance. Legal issues related to HR in the Organisation	<ol style="list-style-type: none"> 1. To study and explain rights of employees at work place. 2. To understand the legal issues related to HR in an organisation.
2	Wage & Salary Administration and The Workmen's Compensation Act, 1923	Wage & Salary Administration- Meaning & Definition of Wage & Salary, Objectives of Wage & Salary Administration, Wage Differentials, Factors affecting Wage & Salary Levels The Workmen's Compensation Act,1923- Introduction,Main Features of the Act, Definitions, Provisions under the Act.	<ol style="list-style-type: none"> 1. To understand the basic concepts of Wage & Salary Administration. 2. To understand the Applications of The Workmen's Compensation Act, 1923.
3	The Payment of Gratuity Act,1972 and Sexual Harassment of Women at Workplace (Prevention,	The Payment of Gratuity Act,1972 Introduction, Scope and Application, Definitions and Provisions under this Act.	<ol style="list-style-type: none"> 1. To gain knowledge & Applications of The Payment of Gratuity Act,1972 2. To understand the Applications of Sexual Harassment of Women at

	Prohibition and Redressal) Act 2013	Sexual Harassment of Women at Workplace (Prevention , Prohibition And Redressal) Act 2013 Introduction, Main Features of the Act, Provisions, Vishaka Guidelines	Workplace (Prevention , Prohibition And Redressal) Act 2013
4	Business Exposure in HR		<ol style="list-style-type: none"> 1. To introduce the students to the general HR practices in the organisation. 2. To enhance the awareness of the students towards different Acts and its application.

Teaching Methodology

Teaching Hours Theory + Project	Innovative methods to be used	Project in Legal Aspects 2 Credits	Expected Outcome
Unit 1 (6 hrs)	1. Presentations	<ol style="list-style-type: none"> 1. Students are required to visit and collect data from HR department of any small/ medium or large scale industry individually or in groups and study HR policies, Legal issues, calculations of Wage Differentials. 2. Students can visit regional gratuity office to understand its functioning. 	<ol style="list-style-type: none"> 1. Better understanding of the rights of employees at workplace. 2. Describes understanding of the legal issues related to HR in organisation.
Unit 2 (12 hrs)	<ol style="list-style-type: none"> 1. Exercise on Wage Differentials 2. Caselets solution sessions and discussion on same. 3. Group Discussion on The Workmen's Compensation Act,1923 		<ol style="list-style-type: none"> 1. Develop the knowledge & ability of the students about the concepts Wage & Salary Administration. 2. Better understanding of Workmen's Compensation Act,1923.

Unit 3 (12 hrs) & Project work	1. Exercise on Calculation of Gratuity. 2. Caselets solution sessions and discussion on same. 3. Role play on Sexual Harassment of Women at Workplace (Prevention , Prohibition And Redressal) Act 2013	3. Students are required to prepare Project on collected data. Note – Colleges can change the topics for projects as per the requirements of the course.	1. Better understanding of The Payment of Gratuity Act,1972 2. Better understanding of Sexual Harassment of Women at Workplace (Prevention , Prohibition And Redressal) Act 2013
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Evaluation

Subject	Internal Evaluation	External Evaluation
Unit – I	--	25% MCQ
Unit – II	Project 30 marks & Viva 20 marks	35% short notes
Unit – III		40% long answers
Project VIVA		(50 marks)
Total –	50 marks	--
Total –	50 marks	50 marks

Suggested References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Labour & Industrial Laws	S.N.Mishra	Central law publication	Allahabad
2	Industrial and Labour Laws	S. P. Jain, Simmi Agarwal	Dhanpat Rai & Co. (P) LTD.	New Delhi
3	Sexual Harassment of Women at Workplace (Prevention, Prohibition And Redressal) Act 2013	-	Professional book publishers	Delhi
4	Labour and Industrial laws	H L Kumar	Universal Publication	Delhi
5	Labour and Industrial laws	P.K. Padhi	PHI learning Private Ltd	Delhi

Savitribai Phule Pune University
SY BBA Semester III (CBCS) Pattern 2019
Discipline Specific Electives (DSE- D- SM)
Fundamentals of Services Management

Course Code: D-305 SM

Credits: 3+1=4

Depth of the Course: Basics and Overall Perspective of Service Management

Course Objectives:

1. To introduce services as a Business Function.
2. To develop practical insights in enhancing business processes of Service sector.
3. To give the students an exposure to a systematic service framework.
4. To enhance service leadership skills.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
I	Understanding Various Aspects of Services	<p>Introduction to services: Concept, Scope, Classification & characteristics of services, Service as key differentiator for manufacturing industries. Functions of Service Management. Changing dynamics & challenges of service sector.</p> <p>Growth in service sector :- Importance, Growth & Development of service sector in India.</p>	<p>Purpose: -</p> <ul style="list-style-type: none"> -To understand the basic concept of services. -To highlight upon new revolution in services. -To understand recent trends & new developments in Service Sector. <p>Skills to be developed: -Positive approach towards service sector, Identifying opportunities in services.</p>
II	Service Mix Elements- Introduction	<p>Product: - The service products, Service Product Life-Cycle and its Strategies.</p> <p>Place: -Managing Distribution Channels in Service Industry, Factors affecting</p>	<p>Purpose: -</p> <ul style="list-style-type: none"> - To understand various elements of service mix. - To gain practical knowledge of various tools of sales promotion in service sector. - Understanding of difference between products and service sector.

		<p>choice of channel, Strategies for distribution.</p> <p>Promotion: - Objectives, Selection Criteria, Developing the promotion mix, Sales promotion tools.</p> <p>Physical Evidence: - Introduction, Elements, Role of physical evidence, Managing physical evidence as a strategy.</p>	<p>Skills to be developed: - Professionalism in the area of services.</p>
III	Service Environment	<p>Micro & Macro Service Environment: PESTEL Analysis of Service Sector, Six Market Model.</p> <p>Market Analysis & Segmentation: - Planning process, Rethinking the customer service function, Focusing & positioning target customers.</p> <p>Service Design:- Introduction , Building a service blueprint and its benefits.</p>	<p>Purpose: -</p> <ul style="list-style-type: none"> - To learn various models of service market analysis. - To understand the service environment. <p>Skills to be developed: -</p> <ul style="list-style-type: none"> - Developing Analytical ability for proper market analysis. - Innovation & creativity.
IV	Research in Service Industry	<ul style="list-style-type: none"> - Environmental changes leading to service boom. - Impact of globalisation on service Sector: An Overview - New Economic policy & its impact on service sector. - Preparation of small report based on service market analysis. 	<p>Purpose: -</p> <ul style="list-style-type: none"> -Overview of changing dynamics & challenges of service sector. - To gain knowledge of New economic policy & its impact on service sector. <p>Skills to be developed: -</p> <p>Enhancement of service leadership skills through practical learning.</p>

Teaching Methodology: (Pedagogy for Course Delivery): -

Teaching Hours	Innovative Methods to be used	Practical for 1 credit	Expected outcome
12	Interactive Sessions followed by feedback, You Tube Videos for better understanding.	Preparing small reports on field visit experience as assigned by subject faculty	Learning will be more practical based on theory, thereby aid students in better understanding.
12	Visits to various service oriented units(organisations) to gain practical knowledge w.r.t service elements and its effective implementation.	Asking students to prepare report on any of the service organisation of their own choice w.r.t Service elements.	Development of interest in service sector and implementation of various concepts in practice.
12	Preparation of PPT and Use of PPT based on field work for service Market analysis by Using different models like PESTEL, Six Market Model etc.	Assigning students with tasks based on current situation and its impact on service sector.	Ability to collect relevant data and its analysis and interpretation.
12	Arranging Sessions of experts from service industry (Guest lecture series)	Maintaining record of every session by the students for evaluation by the teachers	Awareness of actual scenario w.r.t. service operations and its management.

Evaluation: -Internal (30+20=50) and External – 50 Marks

Subject : Service Management (305)	Internal Evaluation	External Evaluation
Unit – I	Various aspects like assignment, presentation, GD etc. as decided by college authorities(30 marks)	25% MCQ 35% Short Notes 40% Long Answers
Unit – II	Class tests , PPT	
Unit – III	Notes preparation	
Unit – IV	Field visit / project report for 20 marks	
4	30+20=50 marks	50 marks

Suggested References: -

Sr.No	Title Of the Book	Author/s	Publication	Place
1.	Service Marketing Operations & Management	Vinnie J. Juhari, Kirti Dutta	Oxford University Press	Delhi
2.	Service Marketing Management: An Indian Perspective	Dr. B. Balaji	S. Chand & Co.	Delhi
3.	Service Management: Strategy & Leadership in Service business	Richard Normann	Wiley & Sons,Ltd	NewYork
4.	Service Management: The New Paradigm in Retailing	Jay Kandmpully	Springer	New York

Savitribai Phule Pune University
SY BBA Semester III (CBCS) Pattern 2019
Principles & Functions of Services Management- DSE - D-306 SM
Course code DSE - D-306 SM
Credits: 2+2=4

Depth of the Course: Understanding Core Aspects of Service Management

Course Objectives:

1. To recognise & understand different types of service based organizations.
2. To understand the importance of ITES in service sector.
3. To enhance knowledge of global trends in outsourcing.
4. To understand factors crucial to service delivery & recovery.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
I	Understanding Consumer/Customer Behaviour	<p>Customer expectation, strategies for managing customer expectation, 4C's of customer service mix.</p> <p>-Creating the right service philosophy: - Customer service pre & post transaction elements, Meeting the service challenges.</p> <p>-Fundamentals of Customer satisfaction: -Factors influencing customer satisfaction, Understanding the customer services, Customer Loyalty and delight.</p> <p>-Managing demand & supply of services: - Managing demand, Patterns & determinants of demand, Strategies of managing demand, waiting line strategies.</p>	<p>Purpose -: -</p> <p>-Learning & understanding the concept of customer satisfaction.</p> <p>-Understanding efficient management of demand & supply of services.</p> <p>Skills to be developed: -</p> <p>-Development of Behavioural Skills.</p> <p>- Management Skills such as facing Risk, challenges, etc.</p>
II	ITES Introduction	<p>-Outsourcing: -Meaning of outsourcing, factors driving the need of outsourcing, skills to manage</p>	<p>Purpose: -</p> <p>- Learning significance of ITES.</p>

		outsourcing, types & stages of outsourcing, global trends in outsourcing & role of India in outsourcing. - KPO/BPO :- Introduction, significance, third party service providers, future of KPO/BPO, challenges faced.	-Understanding the working & challenges faced by KPO/BPO. - Availing opportunities available in outsourcing. Skills to be developed: - -Adaptability to New /Recent trends and Flexibility.
III	Delivering Quality Services and Value Process	-Service based components of quality, perceived quality, Implementing TQM in service sector & its effect. -Service performance failure – concept of service failure & recovery, customer response to service failure & recovery, service recovery following customer complaints, solving problems & preventing recurrence. Creating service value and defining its benefits. - Service Value Chain: Introduction, significance. -Case studies related to service value chain in Banking & Insurance, Hospital & Health Care, Travel & Tourism, Hotel& Catering.	Purpose: - -To understand the importance of quality in service chain. -To learn the concept of service failure & techniques of recovery from it. Skills to be developed: - - Development of service providing abilities and skills. Purpose: - -Learning various service providing sectors through case study. -Understanding key factors for success & failure of service sectors. Skills to be developed: - -Problem Solving Ability, Case study analysis.
IV	Business Exposure in services		To help students understand the core aspects of service management with reference to different service industries.

Teaching Methodology: -

Teaching and Project Hours	Innovative Methods to be used	Business Exposure for 2 credits (50 Marks)	Expected outcome
6	Interactive Sessions followed by feedback, You Tube Videos for better understanding.	Visit to Five different Service sector organisations as mentioned in syllabus is mandatory.	Learning will be more practical based on theory, thereby aid students in better understanding.
12	Visits to various service oriented units (organisations) to gain practical knowledge w.r.t service elements and its effective implementation.	Preparing reports by selecting different service sector organisations based on visits in consultation with subject expert.	Development of interest in service sector and implementation of various concepts in practice.
12	Use of PPT Use of Microsoft word and Excel for project preparation	Students are required to prepare consolidated report of all five visits and appear for viva-voce.	Ability to collect relevant data and its analysis and interpretation.
(2 credits)	Arranging Sessions of experts from service industry (Guest lecture series)	Maintaining record of every session by the students for evaluation by the teachers	Awareness of actual scenario w.r.t. service operations and its management.

Evaluation: - Internal 50 and External 50

Subject : Service Management (306)	Internal Evaluation	External Evaluation 50 marks Paper
Unit – I	Exposure Report and Viva-Voce (50 marks)	(Based on Theory) 25% MCQ or Objective type, 35% short notes ,40% long answers
Unit – II	-Project report 30 marks and Viva 20marks and total 50 marks	
Unit – III		
Unit – IV		
Total = 4 credits	50 Marks	50 Marks

Suggested References: -

Sr. No.	Title Of the Book	Author/s	Publication	Place
1.	I) Competitive Advantage	Porter,Michael E.	The Free Press	New York
	ii) Service Marketing and Management	Dr. B. Balaji	S. Chand & Co.	Delhi
	iii) Service Sector Management: An Indian Perspective	C.Bhattacharjee	Google Book library	Online source
2.	i)Management of Service Organisations	SassersR..P.	Allyn and Bacon	Boston
3	ii) Service Marketing	Hellen	W.Macmilan India Ltd.	New Delhi

Savitribai Phule Pune University
SY BBA Semester III (CBCS) Pattern 2019
Course Title: Agriculture and Indian Economy- DSE - E 305 ABM
Course Code DSE – DSE - E 305 ABM
Credits: 3+1=4

Depth of the Course: Functional Knowledge about Indian Agriculture and rural India

Course Objectives-

- 1.To understand importance of agriculture in Indian economy.
- 2.To impart knowledge in the field of agriculture marketing.
- 3.To understand various problems and prospects Indian agriculture.

Unit No.	Unit Title	Contents	Purpose and Skills to be developed
I	Agriculture and economic Development	1.1 Importance and role of Agriculture in Indian economy 1.2 Green revolution 1.3 Interdependence between agriculture and industry. 1.4 Trends in agriculture production and productivity.	For the rural development and industrialization which helps to maximize the production and also essential to economic progress.
II	Agricultural Credit	2.1 Co-Operative credit system; NANBARD 2.2 Role of commercial bank, Self-Help Group- meaning and Impact 2.3 Agriculture Finance 2.4 Agricultural credit: Challenges, Opportunities, Strategies,	To know the functioning of NABARD and micro-credit institutions for augmenting flow of credit to self-employed and rural sector.

III	Agricultural Marketing and Prices	<p>3.1 Agricultural Market, Marketing policy 3.2 Regulated market, Marketing channels 3.3 Behaviour of agricultural prices 3.4 Objectives of agricultural price policy.</p>	<p>To achieve a correct balance between the demand and supply of money. Candidate should know the structure and objectives of regulated market.</p>
IV	Agricultural Growth in India	<p>4.1 Recent trends in agricultural growth in India. 4.2 Inter-regional variations in growth of output and productivity 4.3 Cropping Pattern shifts 4.4 Problems and prospects of Indian agriculture. 4.5 International trade in agricultural commodities.</p>	<p>For the liberalized agro-industries policy with maintain sustained growth in productivity and gainful employment. To know the problems of Indian agriculture to accelerate the future growth and prospectus of economy. To know the issues related to import and exports of agriculture commodities.</p>

Teaching Methodology-

Teaching Hours Theory +Tutorials/Project Practical	Innovation methods	Tutorials For 1 Credit	Expected outcome
4 credit Unit 1 – 12 hours Unit 2 – 11 hours Unit 3 – 12 hours Unit 4 – 13 hours	<ul style="list-style-type: none"> • Discussion method • Guest lecture method • Workshop/Seminar • Website visits • Preparing Charts on agri development in India and comparison within the state 	Students can collect information on <ul style="list-style-type: none"> • Tutorial on Green Revolution • Study of local agricultural market. And conducting surveys on Difficulties faced by the farmers, supply chain management, shortage and surplus of Farm products • Data Collection on behaviour of agricultural prices 	<ul style="list-style-type: none"> • Concept clarity regarding Agriculture and Indian Economy • Easy understanding of interdependence between industry and agriculture

Evaluation

Topics	Internal evaluation 30+20 = 50	External evaluation 50 marks	Suggested add on course
UNIT 1	<ul style="list-style-type: none"> • Assignment • Practical survey of agricultural market • Oral expression of agricultural development in India 	25% MCQ 35% short notes 40% long answers (50 marks) --	<ul style="list-style-type: none"> • Certificate course on Indian Agricultural Developments • Certificate course on Agricultural Management
UNIT 2			
UNIT 3			

UNIT 4	<ul style="list-style-type: none"> • Oral presentation by using (charts/Placards/Newspaper cutting/colourful images) • Group presentation on agri based Indian economy 		<ul style="list-style-type: none"> • Agriculture income and Indian economy.
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Suggested references:

Sr.No.	Title of the Book	Author	Publication	Place
1	Agricultural Economics	Bilgrami S.A.	Himalaya Publishing House	Delhi
2	Indian Economy	Dhingra,I.C	Sultan Chand	Delhi
3	Indian Agricultural Development since Independence	Dantwala M.L. et.al	Oxford & IBH	New Delhi
4	Trade Liberalization and Indian Agriculture	Gulati A. and t. Kelly	Oxford University Press	New Delhi
5	Agriculture Price Policy in India	Kahlon A. S. and Tyagi D. S.	Allied Publisher	New Delhi
6	Agricultural growth, Rural poverty and Environmental Degradation in India	Rao C.H.Hanmantha	Oxford University press	New Delhi
7	Banking Reforms and Agricultural Finance in India	Akhtar S.M.andSidhiqi N.A.,	-	-
8	Reserve Bank of India-Hand book of statistics on Indian economy			

Savitribai Phule Pune University
SY BBA Semester III (CBCS) Pattern 2019
Rural Development: Principles and Practice DSE - E 306 (ABM)
Course Code DSE - E 306 (ABM)
Credits: 2+2=4

Depth of the course: Functional Knowledge about rural development

Course Objectives:

1. To develop appropriate attitude and values required of a rural manager.
2. To develop conceptual and exploratory skills to work for rural development

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Basic elements of Rural Development	Meaning of Rural Development, Need for Rural and its importance. Features of Rural Economy. Size and Structure of Rural Economy, Rural versus Urban development, Growth versus Development. Rural Poverty and Rural Income.	<ol style="list-style-type: none"> 1. To study and explain various concepts of Rural Development 2. To understand sectoral Development of rural India
2	Rural Development Policies in India	Need for Rural Development Policy, Goals of Rural Development Policy. Characteristics of Growth and equality orientation Program, Poverty and Unemployment eradication programs. Cooperative Sector and Rural Development, Features of Co-operative Sector and advantages and limitations of Co-operative Sector.	<ol style="list-style-type: none"> 1. To understand the basic rural developmental policies in India. 2. To understand the various programs of rural Development and initiatives taken the Government.
3	Role of Agriculture and Sustainable development.	Role of Agricultural and Non-Agricultural sector in rural development. Impact of globalization on rural development. Need, Advantages and limitations of globalization	<ol style="list-style-type: none"> 1. To develop the insights for equal development and opportunities 2. To understand the linkages and dependency on each other.

		Sustainable development - Various initiatives taken by Government for agriculture and industry linkages, rural and urban linkages, advantages and effects, Challenges and opportunities for linkages. Initiatives for rural sustainable development. Gandhian Model of Rural Development	
4	Business Exposure in Agri Business Management		

Teaching Methodology

Teaching Hours Theory + Project	Innovative methods to be used	Project for 2 credits Project and Viva for 50 marks	Expected Outcome
Unit 1 (6 hrs)	1. Presentations	1. Students are required to visit and collect data on various aspects of rural development. 2. Visit to nearby villages and identify problems faced by them. 3. Collecting data about various Government initiatives and creating awareness in rural areas. 4. This course requires the students to read a number of syllabus related articles, both old and recent. 5. Visit and interview an Agri-exporter to understand the opportunities in Agri-business	1. Better understanding to need for rural development. 2. Describes need for equal distribution of resources. .
Unit 2 (12 hrs)	1. Exercise on Differentiating aspects 2. Discussion on same. 3. Group Discussion on Government initiatives.		1. Develop the knowledge & ability of the students about the concept mentioned in the syllabus.
Unit 3 (12 hrs)	1.Charts will be prepared on Global agri development. 2.Case lets solution sessions and discussion on same.		Importance of sustainable agriculture and Learning agricultural ecosystem
Business Exposure			1. Project outcome Better understanding of theoretical concepts by visit of students in agri- product Industries. Agri-export Houses.

			2. To expose students while engaging in experiential learning to internalize rural environment institutions and initiatives
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Evaluation

Subject	Internal Evaluation	External Evaluation
Unit – I	--	25% MCQ 35% short notes 40% long answers (50 marks)
Unit – II	--	
Unit – III	--	
Project VIVA	Project 30 marks VIVA 20 marks	--
Total –	50 marks	50 marks

Suggested references:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Agricultural Economics,	.Bilgrami S.A.R.	Himalaya Publishing House, (1996)	Delhi.
2	“Indian Economy”	Dhingra,I.C	sultan chan.	Delhi
3	Agricultural growth, Rural poverty and Environmental Degradation in India	Rao C.H.Hanmantha (1975)	Oxford University press ,	New Delhi
4	Agriculture Price Policy in India ,	Kahlon A. S. and Tyagi D. S.((1983)	Allied Publisher	New Delhi
5	Trade Liberalization and Indian Agriculture,	Gulati A. and t. Kelly(1999)	Oxford University Press ,	New Delhi
6.	Rural Development: Principles, Policies and Management	Katar Singh	Publication Year: 2009 DOI: http://dx.doi.org/10.4135/9788132108399	Online Book

Savitribai Phule Pune University
SY BBA Semester IV (CBCS) Pattern 2019
Subject: Entrepreneurship and Small Business Management- GC-401
Course Code – 401
Credits – 3

Depth of the Course: Basic and functional knowledge of entrepreneurship and small business management

Course Objectives:

1. To understand the concept and process of Entrepreneurship.
2. To Acquire Entrepreneurial spirit and resourcefulness.
3. To get acquainted with the concept of Small Business Management.
4. To understand the role and contribution of Entrepreneurs and Small Businesses in the growth and development of individual and the nation.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Entrepreneurial Perspective	<ul style="list-style-type: none"> • Concept of Entrepreneur, Manager, Intrapreneur • Entrepreneur and Entrepreneurship • Meaning, Definition, Evolution. • Types of Entrepreneurs, Qualities and Functions of Entrepreneur. • Factors influencing Entrepreneurship: Psychological, Social, Economical and Environmental factors. • Role of Entrepreneur in growth and development of the small business. • Problem of Unemployment and Importance of wealth creation. 	<p>Purpose :-</p> <ul style="list-style-type: none"> • Learning & understanding the concept of Entrepreneur and process of Entrepreneurship. • Highlighting the role of entrepreneurs in growth and development. • Understanding importance of Entrepreneurial as career <p>Skills to be developed :-</p> <ul style="list-style-type: none"> • Inculcating Entrepreneurial skills and abilities. -

2	Business Opportunity Identification	<ul style="list-style-type: none"> • -Definition of business, industry & commerce and their interrelationship in today’s environment. • Opportunity Search: • Divergent Thinking Mode: Meaning Objectives • Tools and Techniques: Environmental scanning for business opportunity Identification. • Opportunity Selection: • Convergent Thinking Mode: Meaning, Objectives ,Tools And Techniques: Market Survey 	<p>Purpose :-</p> <ul style="list-style-type: none"> • Environmental Scanning for identification of Business opportunities. • Learning various tools and techniques of opportunity search and its appropriate selection. <p>Skills to be developed :-</p> <ul style="list-style-type: none"> • Development of Divergent and Convergent thinking abilities.
3	Management of MSMEs and Sick Enterprises :	<ul style="list-style-type: none"> • Meaning, Objectives and Functions of MSMEs • Challenges of MSMEs, Preventing Sickness in Enterprises – Specific Management Problems; Industrial Sickness in India – Symptoms, process and Rehabilitation of Sick Units. - Financial Assistance for Small • Enterprise: Institutional: • a)Bank Loan • b) Angel Funding c) Venture Funding • d) Self Employment Schemes of Government of Maharashtra. • e) Government Financial Institutions: Khadi and Village Industries Board (KVIB), Rajiv Gandhi UdyamiMitraYojana (RUGMY) • f) Prime Minister Employment Generation Programme (PMEGP). 	<p>Purpose :-</p> <ul style="list-style-type: none"> • To understand the concept of MSME and its challenges. • Creating awareness about financial assistance of various institutions <p>Skills to be developed :-</p> <ul style="list-style-type: none"> • Learning about fund raising for small businesses. • Knowledge about self-employment schemes. • Development of practical approach towards new businesses.
4	Study of Women-founded Start-ups in India and Entrepreneurs’ biography	<ul style="list-style-type: none"> • -UpasanaTaku, Anisha Singh, Sabina Chopra. • Azim H. Premji, Ratan Tata, DR. Shiva Nadar. 	<p>Purpose :-</p> <ul style="list-style-type: none"> • Understanding key factors for success & failure <p>Skills to be developed :-</p> <ul style="list-style-type: none"> • Problem Solving Ability • Qualities/Skills can be acquired from these business leaders to become successful.

Teaching Methodology (Pedagogy for Course Delivery) :-

Teaching Hours	Innovative Methods to be used	Expected outcome
Unit 1 -12 Hours	Interactive Sessions followed by feedback, Role Play for various types of entrepreneur.	It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.
Unit 2 -12 Hours	Group Discussion and Brain Storming sessions for generation of innovative ideas. Theory lectures for conceptual understanding.	Development of interest and positive approach towards entrepreneurship and new start ups.
Unit 3 -12 Hours	Use of PPT for better understanding of various financial institutions and Schemes	Ability to collect relevant data and its analysis and interpretation.
Unit 4 -12 Hours	Arranging Sessions of experts from service industry (Guest lecture series), Presentations by students for self-learning.	Understanding key aspects of success and failure of businesses.

Evaluation :- Internal Marks 30

Subject :	Internal Evaluation	External Evaluation
Unit – I	Evaluation of the students on the basis of various criteria of assessment as prescribed by college	70 Marks Final Examination based on pattern of question papers as prescribed by SPPU.
Unit – II		
Unit – III		
Unit – IV		
Total =4	30 Marks	70 Marks

Suggested References :-

Sr. No	Title Of the Book	Author/s	Publication	Place
1	Entrepreneurship Development and Small Business Enterprises	Poornima M. Charantimath	Pearson, 2014.	Delhi
2	Management of Small Scale Industries	Desai Vasant	Himalaya Publishing House	Delhi
3	The Dynamics of Entrepreneurial Development and Management,	Desai Vasant	Himalaya Publishing House, 2015	Delhi

Savitribai Phule Pune University
Question paper Pattern 2019 for SY BBA
University Examination Sub: Entrepreneurship and Small Business Management
Course Code - 401

Q. No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	20 Marks
		Match the Pairs	5	
		Answer in one sentence	5	
		Fill in the blanks	5	
2	Solve any 3 out of 5	Long Answer Question	3*10 Marks	30 Marks
3	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			70 Marks

Savitribai Phule Pune University
SY BBA Semester IV (CBCS) Pattern 2019
Course: Production and Operation Management- 402 GC
Course Code -402 GC
Credits - 3

Depth of Course: Reasonable Working knowledge.

Course Objectives:

1. To understand the key concepts of Production and Operation Management.
2. To understand the various manufacturing methods and role in managing business.
3. To create awareness about the various safety measures and ergonomics in industries.

Unit No.	Unit Title	Contents	Purpose & Skills to be develop
1	Introduction	<ul style="list-style-type: none"> • Introduction to Production and Operation Management – Meaning, Nature, Scope, • Objectives, Importance, Functions of Production and Operation Management, • Variety of business, Methods of manufacturing, Plant layout, Service layout, • Safety considerations and environmental aspects. 	<ul style="list-style-type: none"> • To understand the basic concept of Production and Operation Management and various methods of manufacturing. • To understand the different layout and safety considerations used for production management.
2	Production Design, Planning , Control	<ul style="list-style-type: none"> • Production Design: Meaning, Objectives, product policy, Techniques of product development. • Production Planning - Meaning, Definition, Objectives, Scheduling, Routing, Dispatch, follow up. • Production Control –Meaning, Objectives, Factors affecting production control. • Caselets on design, planning and control. 	<ul style="list-style-type: none"> • To make the students understand how product developed, planned and controlled in manufacturing.

3	Productivity and Ergonomics	<ul style="list-style-type: none"> • Productivity and Quality Control- Meaning, Definition, Importance, • Measurement techniques, Quality control, Quality circles, TQM. • Ergonomics: Definition, Importance, Bio-Mechanical factors, safety equipment and device. 	<ul style="list-style-type: none"> • To understand the concept of productivity and quality management. • To provide knowledge to the students regarding Ergonomics and safety measures.
4	Maintenance Management	<ul style="list-style-type: none"> • Maintenance Management : Introduction , Meaning, Types, • Planning, Scheduling, Techniques. • Modern Scientific maintenance methods , • Automation and computer integrated manufacturing. 	<ul style="list-style-type: none"> • To make the students aware about Changing Environment, Production and operation maintenance methods.

Teaching Methodology

Teaching Hours Theory	Innovative methods to be used	Expected Outcome
Unit 1 - 12 Hours	Interactive teaching methods to be adopted. Role-Play.	<ol style="list-style-type: none"> 1. Describe the basic concept of production and operation management. 2. Understanding the manufacturing methods and various plant layouts used in industries.
Unit 2 - 12 Hours	Production Design , Planning and Control Caselets solution sessions and discussion on the same.	<ol style="list-style-type: none"> 1. Understanding the importance of product design, production planning and Control. 2. Develop the Problem- solving and decision making skills.
Unit 3 - 12 Hours	Student Presentation. Caselets solution sessions and its discussion.	<ol style="list-style-type: none"> 1. To understand the peoples efficiency in their working condition
Unit 4 - 12 Hours	Student Presentations.	<ol style="list-style-type: none"> 1. Understand the Changing Environment, maintenance methods of production and operation .

Evaluation

Unit Number	Internal Evaluation		External Evaluation
	Evaluation of students on the basis of	Marks	
I	2. Role Play.	30	25% MCQ 35% short notes 40% long answers
II	3. Caselet Solution & Discussion		
III	3. Students Presentation. 4. Caselet Solution & Discussion.		
IV	1.Presentation		
Total –		30 Marks	70 Marks

Suggested References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Production and Operation Management	L. C. Jhamb	Everest Publishing House	New Delhi
2	Production and Operation Management	Chase	Irwin Professional Publishing	U. S.
3	Production and Operation Management (With skill development- caselets and cases)	N.Suresh	Newage International publication	New Delhi
4	Operation Management	B.Mahadevan	Pearson Education India	New Delhi

Savitribai Phule Pune University
Question paper Pattern 2019 for SY BBA
University Examination Sub: Production Operations Management
Course Code - 402

Q. No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	20 Marks
		Match the Pairs	5	
		Answer in one sentence	5	
		Fill in the blanks	5	
2	Solve any 3 out of 5	Long Answer Question	3*10 Marks	30 Marks
3	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			70 Marks

Savitribai Phule Pune University
SY BBA Semester IV (CBCS) Pattern 2019
Course: Decision Making and Risk Management- 403 GC
Course Code – 403 GC
Credits – 3

Depth of the Course: Functional Working Knowledge

Course Objectives:

1. To learn the key topics in decision making and risk management so that they can improve decision making and reduce risk in their management activities and organizations.
2. Find the best alternative in a decision with multiple objectives and uncertainty.
3. Describe the process of making a decision.
4. Analyze an organization's decision making system.
5. Develop a risk management process.

Unit No	Unit Title	Contents	Purpose and Skills to be Developed
1	Introduction to Decision making and Risk Management	<ul style="list-style-type: none">• Decision Making and Risk Management – Introduction, Concept, Problem definition and framing.• Rational Models of decision making, Other models - Myers Briggs, Bounded Rationality model, Retrospective decision model, OODA Loop Model, Ladder of Inference etc.	<ul style="list-style-type: none">• To understand the role and scope of Decision making and Risk management in organisations.

		<ul style="list-style-type: none"> • Types of Decisions, Steps in Decision making process, Creative decision making process. • Why rational models fail ?, Traps and cognitive barriers that lead to sub-optimal decisions 	
2	Decision making Tools and Models	<ul style="list-style-type: none"> • Decision Making - Groupthink versus the wisdom of crowds, Avoiding decision-making traps. • Intuition: pros and cons, Decisions making for corporate management, execution, and operation of projects, Role of technology in decision making and data analysis. • EQ (Emotional Intelligence) versus IQ as essential decision making traits to manage risks • Dealing with conflict and Risk - Resistance to change, Key elements of EQ: personal and social competencies, Dissonant decision making leadership and brain chemistry • Qualitative and Quantitative risk analysis tools /methods – Introduction, Concept. <p>Decision Models in strategic management, Decision making systems.</p>	<ul style="list-style-type: none"> • To understand the importance of Decision making tools and models in business.
3	Role of Decision Making and leadership	<ul style="list-style-type: none"> • Definitions of leadership and followership, Motivational theory; common motives of leaders and followers. • Identifying resources that affect your power and influence; use and misuse of power, Role of competition and conflict in leadership roles. • Charisma, heroes, bullies and jerks – aspects to be considered in decision making and leadership. • Decision making and Leadership - Values as underpinnings of leadership. 	<ul style="list-style-type: none"> • To understand the role of leadership and its allied aspects while making decisions.

4	Organizational Values in Decision Making and Risk Management	<ul style="list-style-type: none"> • Importance of Team composition, Understanding your own value system and how it influences choices, political views, personal and organizational decisions • Organizational values –examples of values for well-known corporations. Importance of shared values in decision making and avoiding risks. • Vision statements as organizing templates for where organizations or individuals are aiming., Examples of individual and corporate vision statements • Developing and communicating your own view of what needs changing or what is possible to avoid risks. • Risk communication, Risk Sharing, Strategic and integral planning of projects, 	<ul style="list-style-type: none"> • To understand the role and importance of organizational values in Decision making and Risk Management
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Teaching Methodology

Teaching Hours Theory	Innovative Methods to be used/ AV Applications	Expected Outcome
Unit 1 - 12 Hours	Case Studies/ Videos/ Discussions on various models of Decision making and Risk management.	To understand the role and scope of Decision making and Risk management in organisations.
Unit 2 - 12 Hours	Case Studies/ Videos/ Discussions on Decision making tools and techniques.	To understand the importance of Decision making tools and models in business.
Unit 3 - 12 Hours	Case Studies/ Videos/ Discussions on Leadership tools and techniques.	To understand the role of leadership and its allied aspects while making decisions.

Unit 4 - 12 Hours	Case Studies/ Videos/Discussions on Organizational values and its importance in decision making and risk management.	To understand the role and importance of organizational values in Decision making and Risk Management
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Suggested References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Decision and Risk Analysis for Construction Management	Melvin W. Lifson, Edward F. Shaifer	John Wiley & Sons 1st.	U.S.
2	Credit appraisal, risk analysis and decision making	D.D. Mukherjee,	Snowwhite Publications 9 th Edition.	India
3	Managing Project Risk and Uncertainty	Chris Chapman and Stephen Ward,	Wiley Publications.	Newyork
4	Process Systems Risk management	Ian Cameron, Raghu Raman	Elseveir Academics Press	
5	Fundamentals of Risk Measurements	Chris Marrison	Tata McGraw Hill	New Delhi
6	Hand book of Environmental Risk Assessment and Management	Calow P	Blackwell Science Ltd	Oxford, UK

Savitribai Phule Pune University
Question paper Pattern 2019 for SY BBA
University Examination Sub: Decision Making and Risk Management
Course Code - 403

Q. No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	20 Marks
		Match the Pairs	5	
		Answer in one sentence	5	
		Fill in the blanks	5	
2	Solve any 3 out of 5	Long Answer Question	3*10 Marks	30 Marks

3	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			70 Marks

Savitribai Phule Pune University
SY BBA Semester IV (CBCS) Pattern 2019
Course: International Business Management- 404 GC
Course Code – 404 GC
Credits – 3

Depth of the Course: Functional Working Knowledge

Course Objectives:

1. To acquaint the students with emerging trends and issues in International Business.
2. To study the impact of International Business Environment on foreign market operations.
3. To analyze International trade models.
4. To analyze the International Investment and its risks associated.
5. To understand financial aspects in world economies, their need and functionality

Unit No	Unit Title	Contents	Purpose and Skills to be Developed
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1	Introduction to International Business	<ul style="list-style-type: none"> • Meaning, Nature and Scope of International Business • Globalization – Effects on Economy, Advantages and Challenges • International Trade Theories and its applications – Reasons for international trade Ricardo’s Theory, Hecksher Ohlin Theory, Michael Porter’s Diamond model. 	<ul style="list-style-type: none"> • Understand the Role and Scope of International Business. • Understand the concepts and role of International trade theories.
2	International Business Environment	<ul style="list-style-type: none"> • International Corporations – Meaning, Scope and Nature • Role and Importance of Multi National Corporations in International Business. • Foreign Direct Investment – Meaning, Concept, Importance. • Legal Aspects of FDI from Indian Context. • Cultural and Demographic Environment – Meaning and Importance in International Business 	<ul style="list-style-type: none"> • Role of International Business and its importance at National and International Level. • International Business study in Business Environment.
3	International Finance	<ul style="list-style-type: none"> • Meaning of Exchange Rate • Determination of exchange rate – Fixed, flexible and managed. • Concept of Spot Rate, Forward rate and Futures • Balance of Trade and Balance of Payments – Introduction, Concept and Importance. • Documentation in International Trade and EXIM Finance. • Financing Techniques and Export Promotion Schemes • World Bank and International Monetary Fund – Objectives and Functions 	<ul style="list-style-type: none"> • Understanding terms of trade in the International Market. • Understanding various Finance and Trade techniques at International level. • Understand the Global Finance Institutions functioning.
4	International Economic Zones and Foreign Trade	<ul style="list-style-type: none"> • World Trade Organization (WTO) – Evolution and Functions • Regional Trading Agreements, India and Trade Agreements, Regional Integration. • Global Sourcing – Introduction, Concept, Challenges, 	<ul style="list-style-type: none"> • Understand the functions of International Organizations. • Understand the opportunities and risks for India with respect to financial globalization.

		<p>Advantages (Indian Context)</p> <ul style="list-style-type: none"> • Composition and Direction of India’s Foreign Trade since 2000. • Case Studies in International Business with reference to Indian Economy on – <ul style="list-style-type: none"> ➤ International Marketing ➤ International Finance ➤ International Human Resource Management ➤ International Strategic Management ➤ Ethics in International Business 	<ul style="list-style-type: none"> • Understand the world economy and factors affecting it through Case Studies.
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Teaching Methodology

Teaching Hours Theory	Innovative Methods to be used/ AV Applications	Expected Outcome
Unit 1 - 12 Hours	Films/Videos of International trade/ Business practices adopted by different countries. Videos on financial ministers of different countries explaining the International trade scenario	To understand the basics of International Business concept and its role.
Unit 2 - 12 Hours	Films/Videos on International Trade theories and its importance. Case Studies on various International trade theories and its impact.	To understand the various International trade theories’ use and experiments on the world trade.
Unit 3 - 12 Hours	Case Studies on International trade and its concept. Case studies on MNC’s and Foreign Direct Investment Policies. Case studies/Videos on the importance of balance of payments and	To understand the International trade concepts and various key concepts affecting the terms of trade. To understand how a country can gain through International trade practices.

	International money standards concept. Case studies/videos on Cultures and Demographics of different countries.	
Unit 4 - 12 Hours	Case Studies/ Quiz/ Discussion on policies adopted by International trade organizations. Case Study/Debate on Financial globalization and its impact. Films/videos/Case study/ Discussion on the 2008 world crisis/recession. Films/Videos on the India's Foreign Trade Policies. Case studies and discussions on free trade and protection policies. Case studies and discussions on Regional Trade Agreements.	Understand the concept of currency exchange rate in the International market. To understand the role and contribution of International trade organizations. Understand the concept of financial globalization and its benefits and adversities. To understand various free trade and protection policies implementation and its role. Understand the Regional Integration and Regional groups' concept in International trade.

Evaluation

Unit Number	Internal Evaluation		External Evaluation
	Evaluation of students on the basis of	Marks	
I	3. Role Play. MCQs ,Presentations	30	25% MCQ 35% short notes 40% long answers
II	4. Caselet Solution & Discussion		
III	5. Students Presentation. 6. Caselet Solution & Discussion.		
IV	1.Presentation		
Total –		30	70

Suggested References:

Sr. No.	Title of the Book	Author/s	Publication	Place
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1	International Economics –,	Francis Cherunilam	Tata McGrawHill.1999	New Delhi
2	International Economics –	Salvatore D.L.	Prentice Hall. 7th Edn.2001	U. S.
3	International Economics –	Sodersten Bo,	Macmillan Press Ltd.1981	New Delhi
4	International Economics	Dr. D. M. Mithani2000	Macmillan Press Ltd.1981	New Delhi
5	International Economics	M. L. Jhingan	Vrinda Publications, Delhi 2006	New Delhi
6	International Business	K Aswathappa	Tata McGrawHill.1999	New Delhi

Savitribai Phule Pune University
Question paper Pattern 2019 for SY BBA
University Examination Sub: International Business Management
Course Code - 404

Q. No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	20 Marks

		Match the Pairs	5	
		Answer in one sentence	5	
		Fill in the blanks	5	
2	Solve any 3 out of 5	Long Answer Question	3*10 Marks	30 Marks
3	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			70 Marks

Savitribai Phule Pune University
SY BBA Semester IV (CBCS) Pattern 2019
Course: Advertising and Promotion Management- DSE- 405 A-MM
Course Code - 405 A-MM
Credits – (3+1)=4

Depth of Course: Reasonable Working knowledge.

Course Objectives:

1. To develop knowledge and understanding of importance of advertising.
2. To understand different sales promotion techniques.
3. To know about promotion management.

4. To understand the process of online advertising.

Unit No.	Unit Title	Contents	Purpose & Skills to be develop
1	Introduction and Advertising Effectiveness.	<ul style="list-style-type: none"> • Meanings, Definition, Functions, Criticism, Ethics, Social issues. • Strategic advertising decisions -advertising budget, advertising framework planning and organisation. • Advertising agency- Definition, functions, types structure. • Advertising effectiveness – objectives of measuring advertising effectiveness, difficulties and evaluation of advertising effectiveness. 	<ul style="list-style-type: none"> • To understand the basic concept of advertising and social issues, ethics. • To understand how to measure the effectiveness of advertising.
2	Copy and medias decisions	<ul style="list-style-type: none"> • Advertising copy- objectives, elements, types of copy, advertising layouts, components, layout format. • Copy creations, pre-testing methods and measurements. • Media decisions – advertising media, media planning , media research , media selection . 	<ul style="list-style-type: none"> • To provide the knowledge regarding copy creations and media selection.
3	Promotion Management	<ul style="list-style-type: none"> • Promotion – Meaning, Definition, Objectives, factors affecting promotion, growth, techniques, Media technology used for promotions. • Strategic Promotion – strategic and promotion, cross promotion, surrogate promotion. 	<ul style="list-style-type: none"> • To make the student aware about promotion techniques.
4	Online advertising	<ul style="list-style-type: none"> • Online advertising – pre-requisites of online advertising, Internet Advertising Today, purpose, types, advantages, social media advertising. 	<ul style="list-style-type: none"> • To cultivate the knowledge regarding online advertising and various types.

Teaching Methodology:

Teaching Hours Theory + Tutorials /Project	Innovative methods to be used	Projects	Teaching Outcome
Unit 1 -10 Hours	Understanding concept of advertising and its effectiveness. Read, Watch and analyse the advertise effectiveness	A report on advertising policies used by any one company.	To learn the effectiveness of advertising on performance and profit.
Unit 2 -14 Hours	Case lets solutions and discussion on the same.	Make a PPT on different modes advertising layouts, components, layout format.	Understanding the copy creations, medias planning and media selection.
Unit 3 - 14 Hours	Students' presentation on sales promotion, techniques, caselets solution, group discussion.	A mini project on types promotion techniques	To understand the effectiveness of promotion.
Unit 4 - 10 Hours	Presentation and display on online advertising .discussion on the same.	Draw a flow chart of online advertising	To understand the advantages of online advertising.
And Tutorial -			

Evaluation

Unit Number	Internal Evaluation		External Evaluation
	Evaluation of students on the basis of	Marks	
I	<ul style="list-style-type: none"> • Role Play. 	30	25% MCQ 35% short notes 40% long answers
II	<ul style="list-style-type: none"> • Caselet Solution & Discussion 		
III	<ul style="list-style-type: none"> • Students Presentation. • Caselet Solution & Discussion. 		
IV	<ul style="list-style-type: none"> • Presentation and viva – 20 		

Total –	50 Marks	50 Marks
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Suggested References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Marketing management	Philip kotler , kellerjha-	Pearson education	New Delhi
2	Advertising and Promotion	Belch and Belch	Tata MC Graw Hill	New Delhi
3	Advertising Management	<i>Rajeev batra and davidaaker</i>	Pearson education	New Delhi
4	Sales Promotion	M.N.Mishra	Himalaya publishing house	New Delhi
5	Advertising and IMC (principles and practices)	William.D. Wells and sandra, pearson	Pearson education	New Delhi

Savitribai Phule Pune University
Question paper Pattern 2019 for SY BBA
University Examination Sub: Advertising and Promotion Management
Course Code – 405 A
Credit - 4 (3+1)

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
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1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Savitribai Phule Pune University
SY BBA Semester IV (CBCS) Pattern 2019
Course: Digital Marketing- DSE 406 A- MM
Course Code – 406 A-MM
Credit –(2+ 2) = 4

Depth of the Course: Reasonable Knowledge and Insights in Digital Marketing.

Course Objectives:

1. To provide students with the Knowledge about business advantages of the digital marketing and its importance for marketing success.
2. To help students become In demand professional by being acquainted through various Digital channels & their ways of Integration.
3. To get Basic Knowledge of Google Analytics for measuring effects of Digital Marketing & getting Insights of Future trends that will affect the future development of the digital marketing.

Unit No	Unit Title	Contents	Purpose & Skills to be develop
1.	Introduction to Digital Marketing	<ul style="list-style-type: none">• Concept and meaning of Digital Marketing, Digital Marketing Process• Meaning of Visibility, Increasing Visibility, Types of visibility, and Examples of visibility.• Concept of Engagement, Visitors Engagement, its importance and examples of engagement.• Bringing Targeted Traffic• Inbound and outbound marketing• Converting Traffic into Leads, Types of Conversion, Understanding Conversion Process• Tools of Digital Marketing	<ul style="list-style-type: none">• To understand the role & Importance of Digital Marketing.• To learn how Digital Marketing impacts the Sales of an Organization• To understand the overall effect of Digital Marketing upon the sales of an Organization.• To develop digital strategy to influence consumer behaviour.
2	Digital Marketing Planning and Structure	<ul style="list-style-type: none">• Creating initial digital marketing plan, Target group analysis, Inbound vs Outbound Marketing,• Content Marketing, Understanding Traffic, Understanding Leads, Strategic Flow for Marketing Activities.• WWW, Domains, Buying a Domain, Website Language & Technology, Core Objective of Website and Flow,• One Page Website, Strategic Design of Home Page, Optimization of Web sites, Design of WordPress web, SEO Optimization, Introduction to Web analytics, Web analytics – levels	<ul style="list-style-type: none">• To develop the conceptual insights for Digital Marketing.• To develop the right understanding of the situations as they are influenced under Digital Marketing.

3	Social Media Marketing	<ul style="list-style-type: none"> • Introduction of Social Media Marketing, Procedure and Fundamentals of – • Facebook Marketing, • Google AdWords, YouTube Marketing, • Email Marketing - Content Writing 	<ul style="list-style-type: none"> • To understand the role of Facebook, Google Ad words, YouTube and Email in digital marketing. • To understand the importance of Digital Platforms & its impact upon the performance of the organizations in complex & varied environment.
4	Computer Laboratory Work	<p>Digital marketing (also known as data-driven marketing) is an umbrella term for the marketing of products or services using digital technologies, mainly on the Internet, but also including mobile phones, display advertising, and any other digital medium. (UI and UX)</p> <p>PPC Advertising With Google Ad-words Create Search Campaigns Creating Display Campaign Optimising Display Campaign Remarketing Google Ad-words Social Media Marketing like</p> <ul style="list-style-type: none"> • Creating Search Engine Campaign Ads • Creating Display Campaign • Optimising Display Campaign • Creating Facebook Advertising Campaign and other social media campaign • Create Remarketing Campaign • PR, Digital Marketing, Event Management, Advertising, Packaging, Product Design, Trade Shows, Sponsorship etc. Usurers Interfere and Usurers Experience • Use of Marketing Communication tools effectively • Prepare the MARCOM strategy 	<ul style="list-style-type: none"> • To have the hands on the designing of website and use of it • To know the optimum use of various social media platforms.

Teaching Methodology :

Teaching Hours Theory + Project	Innovative methods to be used		Expected Outcome
Unit I –10 Hours	Group wise presentation to understand Digital Marketing concept.	Individual Assignments to practice the basic concepts in Digital Marketing.	To have an adequate understanding of Digital Marketing, its scope, objectives, opportunities and its challenges.
Unit II–14 Hours	Case Study based session in which strategies are adopted by organizations.	Inviting Suggestions through an effective strategy to organizations based upon the analysis of the Case Study.	To help students develop an understanding towards Digital Strategy building & its effectiveness.
Unit III–14 Hours	Group discussion amongst the students for developing innovative Digital sales strategy to be followed by organizations in digital era.	Discussion & Analysis of success or failure factors behind the strategies implemented digitally.	To find out alternatives for Dynamic organization to ensure their success in highly competitive sales environment.
Unit IV-10 Hours		Designing digital media campaign using appropriate mix of Facebook, Google Ad words, Youtube and Email.	To use the digital tools effectively for marketing
Computer training Project		Anyone of the above	

Evaluation :

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Practical Examination to be conducted in Computer Lab.Good combination of Oral+ Written Exam + Actual Practical Work can be conducted.	25% MCQ 35% short notes 40% long answers 25% MCQ	Basics & Tools of Digital Marketing.
Unit – II			
Unit – III			Hands on Web site creation, SEO, etc
Unit – IV			

Total –	50 Marks	50 Marks	
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Suggested References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Digital Branding	Daniel Rowles	Kogan Page	New Delhi/Mumbai
2	Digital Marketing	Dave Chaffey	Pearson	Pune/ Mumbai
3	Marketing 4.0	Philip Kotler/Herman Kartajaya	Pearson	Pune/ Mumbai
4	Digital Marketing Strategy	Simon Kingsnorth	Kogan Page	Mumbai
5	Digital Marketing	Dave Chaffey/Fiona Ellis	Pearson	Mumbai
6	Social Media Marketing All-In-One for Dummies,	Jan Zimmerman and Deborah		

A 406 - Guidelines for Computer Training Courses

2 credits for project report and evaluation will be for Project and Viva for 50 marks.

Objectives of Computer Enabling Activities:

- To familiarize Computer Applications used in particular department and understanding jargons of that respective field.
- To understand various concepts and steps relating to designing of Computer Technologies and its applications in various fields.

Method of Conducting Practical Training.

Requirement – High Speed Internet or Wi-Fi , computer and screen. For the specialisation courses, teachers are requested to search and download the free demo modules available on the internet.

- Teachers will run the software through dummy entries and will explain the process to the students.
- Students are expected to learn from online demo modules and its utility in the business or actual life situations.

Expected Outcome: This will help the students to understand how the computers are used in business for collection of information, generating source of information, post entries, various information required to take decisions, data collection , identification of particular source of information and how the information is further processed. Reports are generated based on the filled data.

Project Guidelines for Students:

Students can search information after learning through demo. Students will prepare project report based on data collected (Online or off-line). They will have to prepare requirement sheets of various industries and will analyse computer enabled activities. The students will study various difficulties faced and identify probable solutions for the same.

Digital marketing (also known as data-driven marketing) is an umbrella term for the marketing of products or services using digital technologies, mainly on the Internet, which also includes mobile phones, display advertising, and any other digital medium. (UI and UX)

PPC Advertising With Google Adwords

Create Search Campaigns

Creating Display Campaign

Optimising Display Campaign

Remarketing Google Adwords

Social Media Marketing like

- Creating Search Engine Campaign Ads
- Creating Display Campaign
- Optimising Display Campaign
- Creating Facebook Advertising Campaign and other social media campaign
- Create Remarketing Campaign

- PR, Digital Marketing, Event Management, Advertising, Packaging, Product Design, Trade Shows, Sponsorship etc. Usurers Interfere and Usurers Experience
- Use of Marketing Communication tools effectively
- Prepare the MARCOM strategy

Savitribai Phule Pune University
Question paper Pattern 2019 for SY BBA
University Examination Sub: Digital Marketing
Course Code – 406 A
Credit - 4 (2+2)

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks

3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Savitribai Phule Pune University
SY BBA Semester III (CBCS) Pattern 2019
Course: Business Taxation- 405- B-FM
Course code 405 –B-FM
Credits: (3+1) = 4

Depth of the Course: Understanding Core Aspects of Business Taxation.

Course Objectives:

1. To understand different concepts & definitions under Income Tax Act 1961.
2. To understand the importance of Taxation to the students.
3. To update the students with the latest development in the subject of Taxation.

4. To acquire knowledge about the submission of Income tax returns.
5. To prepare students competent enough to take up to employment in tax planner.
6. To develop ability to calculate taxable income of the person as per Income Tax Act 1961.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
I	Introduction to Income Tax act 1961.	<ul style="list-style-type: none"> • Income Tax Act -1961 (Meaning, Concepts and Definitions) • History of Income Tax in India, Fundamental concepts and definitions under Income Tax Act 1961, • Canons of Taxation, • Objectives of Income Tax, • Taxation structure in India, • Concept and definitions- Income, Person, Assessee, Assessment year, Previous year, Residential Status of an Assessee. Permanent Account Number (PAN)- Uses & Benefits. 	<ul style="list-style-type: none"> • To understand the basic concepts of Income tax act. • To know & study the tax structure of India. • Understanding the historical background of Indian Income tax structure.
II	Heads of Income and computation of total income as per Income Tax 1961.	<p>Different heads of Income: -</p> <p>a) Income from Salary: Salient features, meaning of salary, allowances and tax Liability- Perquisites and their Valuation Deduction from salary. (Theory and basic practical cases)</p> <p>b) Income from House Property: Basis of Chargeability- Annual Value- Self occupied and let out property- Deductions allowed. (Theory and Basic Practical Cases).</p> <p>c) Profits and Gains of Business and Profession: Definitions, Deductions expressly allowed and disallowed.</p> <p>d) Capital Gains: Chargeability- Meaning and concept of Short term and long term capital gains-permissible deductions (Only Theory).</p>	<ul style="list-style-type: none"> • To understand & study different heads of income under income tax act 1961. • To know various exemptions & deductions under Income tax act 1961. • To know the tax compliances of business & Individual person.

		e) Income from Other Sources Chargeability- Meaning and concept –Inclusion and deduction.(only Theory).	
III	Computation of Total Taxable Income & Filing of Online ITR.	<ul style="list-style-type: none"> • Meaning and concept, Gross Total Income - deduction u/s-80 and Tax Liability for respective Assessment year. • Form 26 AS- Uses • Various types of ITR, • Procedure to file various online ITRs. • Refund of Tax. 	<ul style="list-style-type: none"> • To understand the computation of total taxable income. • To know & understand the procedure of online ITR filing.
IV	Other important aspects of Income tax act 1961	<ul style="list-style-type: none"> • Tax deducted at source (TDS), (TDS section 192-194) • Tax Collection at Sources (TCS) • Advance payment of Tax, • Methods of payment of Tax, (Theory Only). 	<ul style="list-style-type: none"> • To acquire the knowledge about important concepts of Income tax act 1961, such as TDS, TCS, Advance tax etc.

Teaching Methodology: -

Teaching Hours Theory + Tutorials /Project	Innovative Methods to be used	Practical/tutorials	Expected outcome
Unit 1 -10 Hours	Interactive Sessions followed by feedback, You Tube Videos for better understanding of history of Indian Income tax structure.	Group discussion on tax structure of India can be conducted. Use of PAN & its benefits & applications can be discussed.	Learning will be more practical based on theory, thereby aid students in better understanding.

Unit 2 -14 Hours	Use of e-content to understand different forms of Income under income tax act 1961. Conceptual short videos can be given to the students for better understanding.	Short videos of different heads of income can be created. Practical assignments to be given to students, students may collect comprehensive data regarding all the heads of income, it can be studied in a group.	Development of interest in Indian tax regime. Make students aware about different heads of income to understand Income tax act 1961.
Unit 3 - 14 Hours	Use of Income tax website/portal to show students all types of ITR utilities. Comprehensive list of exemptions U/S 80 can be prepared & be given to students for study.	Students are required to prepare consolidated ITR of all five heads of income. Students can take any assumption based example of having income from all the sources.	Understanding of actual online ITR filing. Making students aware about exemptions u/s 80 of Income tax act 1961.(as per the union budget of every financial year by Government of India).
Unit 4 - 10 Hours	Arranging Sessions of tax experts to understand various important concepts of Income tax act.	To understand various types of TDS & its sub-sections, it can be divided among the group of students, their PPT presentations can be taken to make everyone understand.	Understanding of various types of TDS (From section 192-194 including its sub-sections). Making students aware about different rate of TDS for different sections under Income tax act 1961.
Tutorial			

Evaluation: - Internal 50 and External 50

Subject : Business Tax	Internal Evaluation	External Evaluation 50 marks Paper
Unit – I	Internal Assessment 30 marks and Practical based Viva 20 marks total 50 marks	50% Theory & 50% Practical Problems (Based on Theory & Practical)
Unit – II		
Unit – III		
Unit – IV		
	50 Marks	50 Marks

Notes: 1. Amendments made prior to commencement of every Academic Year in the above act should be considered.

2. Theory questions will carry 50% marks.

3. Problems will carry 50 % marks.

Suggested References: -

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Taxmann's Students' Guide to Income Tax.	Dr. Vinod K Singhania and Dr. Monica Singhania	Taxmann Publication.	New Delhi.
2	Practical Approach to Income Tax	Girish Ahuja, Ravi Gupta	Wolters Kluwer India Private Limited	New Delhi.
3	Indian Income Tax Act	H.C. Malhotra	Sahitya Bhavan Publication.	Mumbai.
4	Income Tax Laws	V K Singhania,	Taxmann Publication.	New Delhi.
5	Direct Taxes	B. B. Lal, N. Vashisht.	I K International Publishing House Pvt. Ltd.	New Delhi.
6	Students Handbook on Taxation	T N Manoharan & G R Hari	Snow White	--
7	Direct Tax Laws and Practice	Vinod Singhania	Taxmann Publication.	New Delhi.

Savitribai Phule Pune University
Question paper Pattern 2019 for SY BBA
University Examination Sub: Business Taxation
Course Code – 405 B
Credit - 4 (3+1)

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
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1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	5 Marks
2	Solve any 1 out of 2	Problem on income for salary with computation of tax liability	1*15 Marks	15 marks
3	Solve any 1 out of 2	Problem on house property with basic adjustment	1*10 Marks	10 Marks
4	Solve any 1 out of 2	Long answer question	1*10 Marks	10 Marks
4	Solve any 2 out of 4	Short Notes	2*5 Marks	10 Marks
	Total			50 Marks

Savitribai Phule Pune University
SY BBA Semester IV (CBCS) Pattern 2019
Course: Financial Services. 406 B- FM
Course code: 406 B-FM
Credits: 4 = (2+2)

Depth of the Course: Fundamental knowledge of financial services.

Course Objectives:

1. To Study in detail financial services in India.
2. To study & Understand working of Indian financial system.
3. To make the students well acquainted regarding financial markets.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Indian Financial system: an overview	<ul style="list-style-type: none"> • Introduction to Indian Financial System • Structure of Financial system- financial institutions, markets, financial instruments and financial services. • Overview of Indian Financial System • Financial intermediaries in Financial System- Merchant Bankers, underwriters, depositors, Brokers, Sub brokers, bankers. 	<ul style="list-style-type: none"> • To study & understand the basic concepts of Indian Financial system. • To take an overview of Financial structure of the nation.
2	Fundamental of Financial Markets	<ul style="list-style-type: none"> • Primary Markets: Meaning, functions, Role in Economic Development. • Secondary markets: Meaning, functions, Role in Economic Development. • Issue & Management of IPOs • Role of stock Exchanges in economic development. BSE, NSE, OTCEI- Functions. • Money Market Instruments. • Difference between Money Market & Capital Market. 	<ul style="list-style-type: none"> • To understand the functioning of primary & secondary market. • To study the role of stock exchanges in India.
3	Financial Services in India and Derivatives &Commodity Market	<ul style="list-style-type: none"> • Mutual Funds- Meaning, Types, Advantages and Disadvantages, Factors affecting investment in mutual fund. Mutual fund investment- Selection of best mutual funds. • Factoring- Meaning, types, advantages and disadvantages. 	<ul style="list-style-type: none"> • To Study & examine various financial services provided by various financial institutions in India

		<ul style="list-style-type: none"> • Venture Capital- meaning, importance, process. • Credit rating Agencies-Importance & Role. Derivatives- Meaning & Definition, Importance. • Future and Options- meaning, types, importance. • basics of Future, Forward, Option contracts, Swaps, Hedging, Swap etc. • Commodities, Multi Commodity Exchange of India Limited (MCX)- Functioning & Importance. • Exchange traded funds- Functioning & Importance. 	<ul style="list-style-type: none"> • Basic knowledge of derivatives & Commodity market.
4	Computer laboratory work	<ul style="list-style-type: none"> • 	

Teaching Methodology

Teaching Hours Theory + Tutorials /Project/ Practical	Innovative methods to be used	/Tutorials /Project for 1 credit – (If Applicable)	Expected Outcome
Unit 1- 10 Hours	PPT, Video, Group discussion,	<ul style="list-style-type: none"> • Guest lecture on Indian Financial system • PPT 	Understanding of Financial system of India.
Unit 2- 14 Hours	PPT, Video, Group discussion	<ul style="list-style-type: none"> • Visit to BSE OR NSE • Study of different types of Debt equity listed at stock market • Comparative study of IPO launched in last 5 years 	Understanding of the functioning of Financial markets of India.
Unit 3- 14 Hours	PPT, Video, Group discussion	<ul style="list-style-type: none"> • Different types of Mutual funds introduced in last 5 years • Study of mutual funds on the basis of risk, return and investors preference Opening Demat account and live trading • Virtual trading 	<p>Actual functioning of financial institution of India.</p> <p>Understanding new trends of financial market.</p> <p>Making students aware about derivatives & commodity market.</p>

Unit 4- 10 Hours	PPT, Video, Group discussion	This will help the students to understand how the computers are used in business for collection of information, generating source of information, post entries, various information required to take decisions, data collection , identification of particular source of information and how the information is further processed. Reports are generated based on the filled data.
Project	Computer training	

B-406 - Guidelines for Computer Training Courses

2 credits for Project Report and evaluation will be based on Project and Viva for 50 marks.

Objectives of Computer Enabling Activities:

- To familiarize Computer Applications used in particular department and understanding jargons of that respective field.
- To understand various concepts and steps relating to designing of computer technologies and its applications in various field.

Method of Conducting Practical Training:

Requirement – High Speed Internet or Wi-Fi , computer and screen.

For the specialisation courses, teachers are requested to search and download the free demo modules available on the internet.

- Teachers will run the software through dummy entries and will explain the process to the students.
- Students are expected to learn from online demo modules and its utility in the business.

Expected Outcome: This will help the students to understand how the computers are used in business for collection of information, generating source of information, post entries, various information required to take decisions, data collection , identification of particular source of information and how the information is further processed. Reports are generated based on the filled data.

Project Guidelines for Students:

Students can search information after learning through demo. Students will prepare project report based on data collected (Online or off-line). They will have to prepare requirement sheets of various industries and will analyse computer enabled activities. The students will study various difficulties faced and identify probable solutions for the same.

Tentative projects for Financial Services B 406

Practical - Course Details (Students can prepare the project individually or in a group and can (select any) five topics from the list.

- Computers in Banking and Financial Institutes
- Concept of Core Banking Details , standalone system and new integrated system
- Basics of Banking Software , Web server technology , Standards for Core Banking Software
- General Guidelines for using software, Cloud Security
- Online banking , internet banking UPI payments and Payment gateways , Security aspects for the same.
- Demo on free online banking software by using Projects
- For Example - Collect information **There are three core banking software/systems used by different banks in India;**
For Example -
- Finacle by Infosys.
- BaNCS by TCS.
- Flexcube by Oracle.
- Blockchain

- Artificial Intelligence. ...
- Mobile Banking. ...
- Customer Relationship Management (CRM) ...
- Cyber security.
- IT report of Banking technologies on - **Future of Banking** :Fintech firms and bigtech how the information is captured capturing value chain, providing services such as payments, checking etc.
- **IT in banking sector - Technologies** include Artificial Intelligence (AI), big data, robotic process automation (RPA), The Controller of Certifying Authorities, Institute for Development and Research in Banking Technology (IDRBT)
- Certification Authority (CA) for digital signatures. Process of registration authorities (RA) negotiated dealing system (NDS), the electronic clearing service (ECS) and electronic funds transfer (EFT)
- Customer-to-customer one-click payments, the consumer-to-business effortless digital banking system, password-free biometrics, new crypto currency opportunities, location administrations and offers, and conversational Interface

Evaluation

Internal Evaluation	External Evaluation
30 marks for project+ 20 marks viva= 50 marks	25% MCQ , 35% Short Notes , 40% Long Answers

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Capital Markets and Financial Services	Srinivasan D.	Everest Publishing House	Delhi
2	The Indian financial System	Vasant Desai	Himalaya	Delhi
3	Financial Markets & Services	Financial Markets & Services	Himalaya	Delhi
4	Financial Services and Markets	Dr.S.Gurusamy	Thomson	Delhi
5	Financial Markets, Institutions, And Financial Services	Clifford Gomez	Online	
6	Financial Institutions & Markets	Bhole	Tata McGraw hill Education Pvt Ltd.	New Delhi.
7	Indian Financial System	M. Y. Khan	Tata McGraw hill Education Pvt Ltd.	New Delhi.

Savitribai Phule Pune University
Question paper Pattern 2019 for SY BBA
University Examination Sub: Financial Services B
Course Code – 406 B
Credit - 4 (2+2)

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Savitribai Phule Pune University
SY BBA Semester IV (CBCS) Pattern 2019
Course- Human Resource Management Functions& Practices- DSE 405 C- HRM
Course Code: DSE- 405 –C-HRM
Credits: (3+1) = 4

Depth of the Course-Comprehensive Knowledge of Human Resource Management Functions & Practices

Course Objectives:

1. To acquire comprehensive Knowledge of Human Resource Management Functions & Practices.
2. To explain the methods of Performance Appraisal, Training, Executive Development and Employee Compensation.
3. To acquire knowledge about various HR practices adopted by the organization.

Unit No.	Unit Title	Contents	Purpose & Skills to be develop
1	Introduction to HRM Functions, Performance Appraisal, Training and Executive Development	<ul style="list-style-type: none"> • Introduction to HRM Functions , • Performance Appraisal: Meaning, Definition, Purpose, Approaches, Process, Methods- Traditional and Modern Methods. Errors. Job Evaluation V/S Performance Appraisal. • Promotion, Demotion, Transfer and Separation. • Training- Meaning, Definition, Purpose, Areas, Importance, Process, Methods; E-Training 	<ul style="list-style-type: none"> • To understand and explain the Concepts of Performance Appraisal, Training and Executive Development. • To make use of Methods Performance Appraisal, Training and Executive Development for overall development of the Organisation.

		<ul style="list-style-type: none"> • Executive Development - Meaning, Definition, Objectives, Process and methods, E-Development, Difference between Training and Executive Development. 	
2	Employee Compensation and Other Functions of HRM	<ul style="list-style-type: none"> • Employee Compensation :Meaning, Definition, Objectives, Employee Compensation Administration, Determinants of Employee Compensation, Methods, Fringe Benefits. • Other Functions of HRM: Personnel Research, Human Resource Accounting (HRA), Strategic Human Resource Management 	<ol style="list-style-type: none"> 5. To understand and explain the Concepts of Employee Compensation and other functions of HRM. 6. To make students understand how Employee Compensation and other Functions of HRM play a vital role in the Organisation.
3	Introduction to HRM Practices, Workers Participation in Management	<ul style="list-style-type: none"> • Introduction to HRM Practices, • Workers Participation in Management: Definitions, objectives, Importance, • Forms, • Workers participation in Management practices in India. 	<ul style="list-style-type: none"> • To develop an understanding about how Workers Participation is an important aspect in an organization and various forms of WPM.
4	Organisational Development	<ul style="list-style-type: none"> • Organisational Development: Concept and objectives of OD - Organisational development programme, organizational Development process power politics and ethics in OD – • Organizational learning organizational Development Interventions. 	<ul style="list-style-type: none"> • To develop an understanding among the students regarding OD Programme and its interventions.

Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical	Innovative methods to be used	Expected Outcome
Unit 1 -10 Hours	1. Chart preparation and Presentation of Process of Performance Appraisal, Training and Executive Development.	1. Better understanding of Processes of Performance Appraisal, Training and Executive Development through Charts Presentations.

	<ol style="list-style-type: none"> 2. Caselets on Performance Appraisal, Training and Executive Development. 3. Role plays on Promotion, Demotion, Transfer and Separation. 	<ol style="list-style-type: none"> 2. Development of Problem-solving and decision making skills of students.
Unit 2 -14 Hours	<ol style="list-style-type: none"> 1. Project report on Fringe Benefits of anyone organisation. 2. Caselets on Employee Compensation and other Functions of HRM. 	<ol style="list-style-type: none"> 1. Better understanding of Fringe Benefits and its application in Organisation. 2. Development of Problem-solving and decision making skills of students.
Unit 3 - 14 Hours	<ol style="list-style-type: none"> 1. Role-Plays on Workers Participation in Management. 2. Caselets on Workers Participation in Management. 	<ol style="list-style-type: none"> 1. Better Understanding of importance of WPM. 2. Development of Problem-solving and decision making skills of students.
Unit 4 - 10 Hours	<ol style="list-style-type: none"> 1. Group Discussion/ Debate on Organizational Power and Politics. 2. Caselets on Organisational Development Programme and Interventions. 	<ol style="list-style-type: none"> 1. Creation of awareness about Organizational Power and politics. 2. Understanding of Application of OD Interventions. 3. Development of Problem-solving and decision making skills of students.
Tutorial	Students can prepare project on any topic which they have learnt under this subject.	Develop better understanding of theoretical concepts by undergoing the project.

Evaluation

Unit Number	Internal Evaluation		External Evaluation
	Evaluation of students on the basis of	Marks	
I	<ol style="list-style-type: none"> 1. Role Play 2. Chart Preparation and Presentation 3. Debate 4. Group Discussion 5. Caselet Solution & Discussion 	30	25% MCQ 35% short notes 40% long answers
II			
III			
IV			
Project			
Total –		50 Marks	50 Marks

Suggested references:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Human Resource Management	L. M. Prasad	Sultan Chand & Company Ltd.	New Delhi
2	Human Resource Management	K. Ashwathappa	Tata McGraw Hill	New Delhi
3	Personnel Management	C. B. Mamoria	Himalaya Publishing House	Mumbai
4	Personnel & Human Resource Management	A.M. Sharma	Himalaya Publishing House	Mumbai

Savitribai Phule Pune University
Question paper Pattern 2019 for SY BBA
University Examination Sub: Human Resource Management Functions & Practices
Course Code – 405 C
Credit - 4 (3+1)

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks

3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Savitribai Phule Pune University
SY BBA Semester III (CBCS) Pattern 2019
Course : Employee Recruitment & Record Management DSE- 406 C- HRM
Course Code: DSE-406 C- HRM
Credits: 4 = (2+2)

Depth of the course- Functional Knowledge

Course Objectives:

1. To study and explain employee acquisition and its importance in industry.
2. To cultivate right approach towards employee recruitment and record management.

Unit No.	Unit Title	Contents	Purpose & Skills to be Develop
1	Manpower Planning and Forecasting	<ul style="list-style-type: none"> • Manpower planning, Meaning, Definition, Need, Objectives, Levels, Importance, • Process, Techniques of Manpower Forecasting, • Factors influencing estimation of Manpower, • Barriers to Manpower Planning 	<ol style="list-style-type: none"> 1. To study and explain Process and Importance of Manpower Planning. 2. To understand the Techniques of Manpower Forecasting.

2	Recruitment and Selection	<ul style="list-style-type: none"> • Recruitment : Meaning, Definition, Need, • Factors Affecting Recruitment, Internal and External Sources of Recruitment and its Advantages and Disadvantages, • Traditional and New Methods of Recruitment- E-Recruitment, Talent Acquisition, • Difference between Recruitment and Talent Acquisition. • Selection: Meaning, Definition, Process, Difference between Recruitment and Selection, 	<ol style="list-style-type: none"> 1. To Study and Explain the Sources and Methods of Recruitment. 2. To understand detailed Process of Selection in the Organisation.
3	Employee Record Management	Meaning, Definition, Essentials of a Good Record Principles of Record Keeping, Precautions in Maintaining Records, Importance of Employee records, Types of Employee records.	<ol style="list-style-type: none"> 1. To gain knowledge & Applications of Employee Record Management in Organisation. 2. To understand the types of Employee Records.
4	<p>Computer Course (Prescribed Course or Online Course)</p> <p>C-406 HRM Tentative –Computer Enabled Project Topics for C-406</p> <p>Practical - Course Contents (students can perform the project in the group or individual and can opt five topics from the list .</p>	<ul style="list-style-type: none"> • Blockchain integration. ... • People analytics tools. ... • Real-time performance management. ... • Biometric time tracking. ... • Connected platforms in the workplace. ... • Harassment-reporting tools. • HRMS Business Value • HCM cloud application • Employees engagement • Human Resources Cloud Powerhouse emerging technologies, including AI, chatbots, blockchain, and the Internet of Things (IoT). • Data Security and Privacy Controls HRMS to Oracle HCM Cloud, <ul style="list-style-type: none"> • Core Human Resources 	<ul style="list-style-type: none"> • To familiarise Computer applications used in particular department and understanding jargons of the field. • To understand various concepts and steps relating to designing of computer technologies and its applications in various field.

		<ul style="list-style-type: none"> • Onboarding • Benefits • Absence Management • Workforce Modeling and Predictions • Workforce Directory • HR Help Desk • Work Life Solutions • Advanced HCM Controls 	
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Teaching Methodology

Teaching Hours Theory + Practical, Computer Lab	Innovative methods to be used	Expected Outcome
<p align="center">Unit 1- 10 Hours</p>	<ol style="list-style-type: none"> 1. Preparation and Presentation of Chart of Process of Manpower Planning and Techniques of Manpower Forecasting. 2. Caselets on Manpower Planning and Forecasting. 3. Instead of types of Interviews you can state how to face interviews. 4. Case studies signifying application of different trends in HRM 	<ol style="list-style-type: none"> 1. Better understanding of the Process of Manpower Planning. 2. Describes the understanding of Techniques of Manpower Forecasting.
<p align="center">Unit 2- 14 Hours</p>	<ol style="list-style-type: none"> 1. Group Discussion/ Debate on Internal Sources V/S External Sources of Recruitment. 2. Project Report on Application Blank Formats and Reference Check Formats of Small scale, Medium Scale and Large Scale Industry. 3. Caselets on Recruitment and Selection. 4. Newspaper cut outs showing different recruitment adds, 	<ol style="list-style-type: none"> 1. Develop the knowledge & ability of the students about Advantages and Disadvantages of Internal Sources External Sources of Recruitment . 2. Better understanding of Process of Selection.

Unit 3- 14 Hours	<ol style="list-style-type: none"> 1. Guest Lecture on New Trends in Employee record Management. 2. Caselets on Employee Record Management 3. Students' participation in workshops, conferences to emphasize on and off the job training. 	<ol style="list-style-type: none"> 1. Better understanding of New Trends in Employee record Management.
Unit 4- 10 Hours	<ul style="list-style-type: none"> • Teachers will run the software through dummy entries and will explain the process to the students. • Students are expected to learn from online demo modules and its utility in the business 	<ol style="list-style-type: none"> 1. This will help the students to understand how the computers are used in business for collection of information, generating source of information, post entries, various information required to take decisions, Data Collection identification of particular source of information and how the information is further processed. Reports are generated based on the filled data.
Computer Training		

C 406- Guidelines for Computer Training Courses

2 credits for project report and evaluation will be for Project and Viva for 50 marks.

Objectives of Computer Enabling Activities:

- To familiarize Computer Applications used in particular department and understanding jargons of the respective field.
- To understand various concepts and steps relating to designing of computer technologies and its applications in various field.

Method of Conducting Practical Training:

Requirement – High Speed Internet or Wi-Fi , computer and screen.

For the specialisation courses, teachers are requested to search and download the free demo modules available on the internet.

- Teachers will run the software through dummy entries and will explain the process to the students.
- Students are expected to learn from online demo modules and its utility in the business.

Expected Outcome: This will help the students to understand how the computers are used in business for collection of information, generating source of information, post entries, various information required to take decisions, data collection , identification of particular source of information and how the information is further processed. Reports are generated based on the filled data.

Project Guidelines for Students:

Students can search information after learning through demo. Students will prepare project report based on data collected (Online or off- line). The students will have to prepare requirement sheets of various industry and will analyse computer enabled activities. The students will study various difficulties faced and identify probable solutions for the same.

Evaluation

Subject	Internal Evaluation	External Evaluation
Unit – I	Practical Examination to be conducted in Computer Lab.Good combination of Oral+ Written Exam + Actual Practical Work can be conducted.	25% MCQ 35% short notes 40% long answers (50 marks)
Unit – II		
Unit – III		
Project VIVA		--
Total –	50 marks	50 marks

Suggested References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Human Resource Management	L. M. Prasad	Sultan Chand & Company Ltd.	New Delhi
2	Human Resource Management	K. Ashwathappa	Tata McGraw Hill	New Delhi
3	Personnel Management	C. B. Mamoria	Himalaya Publishing House	Mumbai
4	Personnel & Human Resource Management	A.M. Sharma	Himalaya Publishing House	Mumbai
5	Human Resource Management	S. S. Khanka	Sultan Chand & Company Ltd.	New Delhi

Savitribai Phule Pune University
Question paper Pattern 2019 for SY BBA
University Examination Sub: Employee Recruitment & Record Management
Course Code – 406 C
Credit - 4 (2+2)

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Savitribai Phule Pune University
SY BBA
Semester IV (CBCS) Pattern 2019
Subject: Banking and Insurance Management –DSE 405 D-SM
Course Code – 405 D-SM
Credits – (3+1) = 4

Depth of the Syllabus: Functional Working Knowledge

Course Objectives:

1. To create the awareness among the students of Indian banking and insurance services offered.
2. To enables students to understand the various services& other developments in the Indian banking and Insurance service sector.
3. To provide students insight into Functions & Role of modern services offered to cater the current needs.
4. To enable students to understand the various digital platforms offered by Banking and Insurance sector to cater the emerging trends.

Unit No	Unit Title	Contents	Purpose and Skills to be Developed
1	Customer Relationship Management in Banking and Insurance Sector	<ul style="list-style-type: none"> • Customer Relationship Management in Indian Banking and Insurance sector- Introduction, objectives, Process, importance. • Customer service in banks; Emerging trends, Role of Marketing officer, Branch to door servicing, Bank marketing to urban – rural areas. • Customer Relationship Management through Call Centres in Banking sector, E- CRM in Banking and Insurance sector, Relationship marketing for creating value in business & market. • Ombudsman Scheme – Scope, types of complaints, mechanism of redressal, major provisions for Banking and Insurance policies. 	<ul style="list-style-type: none"> • Understand the Role and concept of CRM services in Banking and Insurance sector. • Understand the role of Ombudsman services offered.
2	Retail Banking Services	<ul style="list-style-type: none"> • Retail Banking- Introduction, Scope in India, Trends in retailing - New products like Insurance-online / Phone 	<ul style="list-style-type: none"> • Understand the ancillary retail banking services offered and its importance.

		<p>Banking, Call Centres, Property services, Investment advisory, Cross selling opportunities. Top ups Loans.</p> <ul style="list-style-type: none"> • E banking – Electronic payment system, Types, Digital Token-based EPS, Smart Card EPS, Credit Card EPS, SMS banking. • Opening of Demat accounts, Role of Merchant Bankers, Wealth Management, Portfolio Management services. 	<p>Understand the electronic services offered by banks as an add on service.</p>
3	Universal Banking Services	<ul style="list-style-type: none"> • Universal Banking Services - Concept, Services to Government, Payment & Settlement, Merchant Banking, Mutual Fund, Depository Services, NRI Remittance. • Mobile Banking, App based Banking, Point of transaction (POS) Terminal, Unified Payment Services (UPI), kiosks, ATM's, Digital Signature, M – Wallets, Credit and Debit cards, Aadhar linking. • Online opening of bank accounts – savings & current, and application for credit cards, loan. Applicability of KYC norms in Banking Sector 	<p>Understand the services offered by banks for their products other than traditional banking.</p>
4	Insurance Services and Types	<ul style="list-style-type: none"> • Introduction, emerging trends, Need and Importance, Purpose. • Types – Health, Motor, Travel, Home against loan Insurance, Electronic appliances, Cell phone Insurance, Pandemic Insurance, Cancer Insurance, Contract works Insurance, Education Insurance, Unit based plans, Micro wealth plans. • Pension and Group Schemes, Online KYC, Online policy buying and renewal, Mobile Insurance services, App based services, Collateral Insurance services, Modern payment mechanism services, online claims. 	<ul style="list-style-type: none"> • Understand the need of emerging types of Insurance plans and policies. • Understand the online and digital medium of services offered by Insurance companies.

Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical	Innovative Methods to be used/ AV Applications	Project	Expected Outcome
Unit 1 -10 Hours	Films/Videos on CRM policies and services offered on Banking and Insurance sector. Videos/ Discussions on Importance of CRM services.	Listing out various services offered through CRM techniques in the banking and Insurance sector. List out the functions of Ombudsman.	To understand the role and significance of CRM in Banking and Insurance sector.
Unit 2 -14 Hours	Films/Videos on Importance of ancillary Retail banking and services. Case studies/Discussions on Retail banking services and its growth	List out the significance and evolution and growth of Retail banking and ancillary services offered in financial management.	To understand the functions and significance of Retail banking and its ancillary services.
Unit 3 - 14 Hours	Videos, Case Studies/ Discussions on Universal banking, and mobile banking services. Analysis of the universal and mobile banking services.	List out the Universal banking policies and services offered. Evaluate the growth and scope of universal banking services	To understand the concept and various services offered under Universal banking system.
Unit 4 - 10 Hours	Videos, Case Studies/ Discussion on Insurance services offered and its types. Videos, case studies on digital methods adopted by Insurance sector for offering services.	Identify various Insurance services offered by Insurance companies. List out various digital platforms rendered to offer services in Insurance sector. Students are expected to visit Minimum 5 banks & insurance organizations covering all business aspects Students shall prepare project report based upon these visits. Viva will be conducted at college level - For 20 marks	To Understand various novel services offered by Insurance companies along with traditional policies To understand various services of Insurance sector on digital platform.

Tutorial		Anyone of the above	

Evaluation:

Subject	Internal Evaluation	External Evaluation
Unit – I to IV	Internal evaluation for 30 marks MCQ on Banking Concepts MCQs, Short and long answers based on insurance industry, sales implementation concepts. MCQs Tutorial – presentation for 20 marks	25% MCQ 35% short notes 40% long answers
Total –	50 Marks	50 Marks

Suggested References: -

Sr. No.	Title of the Book	Author/s	Publication
1	Retail Banking.	Indian Institute of Banking and Finance,	Macmillan India Ltd (2010/Latest)..
2	Commercial Bank Management	Kanhaiya Singh and VinayDutta.	McGraw Hill
3	Bank management and financial services.	Rose, Peter, and Sylvia Hudgins	The McGraw–Hill,
4	Bank management: text and cases	Hempel, George H., Donald G. Simonson, and Alan B. Coleman,	Taxmann Publication.
5	E-Banking in India: Challenges and Opportunities-	RimpiJatana, R. K. Uppal	-
6	Frontiers of E-Commerce	Ravi Kalakota, Andrew B. Whinston	Pearson Education
7	E-CRM – Concepts and Cases	MadhaviGarikaparthi,	The ICFAI University Press..

Savitribai Phule Pune University
Question paper Pattern 2019 for SY BBA
University Examination Sub: Banking and Insurance Management
Course Code – 405 D
Credit - 4 (3+1)

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Savitribai Phule Pune University
SY BBA Semester IV (CBCS) Pattern 2019
Course: Social Service and NGO Management DSE- 406 D-SM
Course Code – 406 D-SM
Credits – (2+2) = 4

Depth of the Course: Functional Working Knowledge

Course Objectives:

1. The course is designed for the students, workers of social sectors and others who wish to develop orientation towards NGOs and their functioning. At the same time, the course is also beneficial for those who wish to attain skills and orientation in Social Work profession.
2. Understand the role and challenges of NGOs in the development concerns of the community
3. Exposure to the success stories of NGO and other organization - International / National / Regional level.

Unit No	Unit Title	Contents	Purpose and Skills to be Developed
1	Introduction to Professional Social Work	<ul style="list-style-type: none"> • Social Work: Definition, objectives, and functions – Historical development of social work in India, Social work education in India. • Contexts of social work practice – Social service, Social welfare, Social reform, Social policy, Social security, Social justice and Social development. • Social Work as a Profession – Qualities of EQ and Ethics in social services ,Philosophy, values, principles and code of ethics of professional social work – • Knowledge and Skills base of social work – Tenets of the social work profession. Registration Process for entering in the social work field. 	<ul style="list-style-type: none"> • Understand the Role and Scope of Social Work with various aspects. • Understand the concepts and role Social Work practice.
2	Social Casework as a method of Social Work –	<ul style="list-style-type: none"> • Concept & Definition – Historical development of Social Casework – Distinctions between needs and wants, 	<ul style="list-style-type: none"> • Understand the role of Social Individual and Group work.

		<ul style="list-style-type: none"> • Social Individual and Group Work – Objectives, Concept, Historical development of Group Work, Values and Skills, Principles and Purpose. • Tools and Techniques - listening, observation, Interview , home visits, collateral contacts, emotional support, advocacy, role playing, confrontation. • CSR Management – Purpose, Need and Role of Industry. • Fieldwork – Nature and objectives – Importance of field work supervision Professional Associations of social work • Methods of community organization – Awareness creation, Planning and Organizing, Education, Networking, Society Participation, Leadership • Community organization with vulnerable communities – Migrants, Refugees, Slum dwellers and transgender 	<ul style="list-style-type: none"> • Understand the role of CSR and Community management towards Social Work.
3	Development and Importance of NGOS and Fundraising and Grant Proposals - Institutional Readiness	<ul style="list-style-type: none"> • Concept of Volunteerism, Charity, Welfare and Development, Historical perspective of Volunteerism in India • NGOs: An Introduction and Trends in NGOs in the past 10-40 years, NGO Success stories in India and foreign countries. • Concepts and Functions of NGOs, Challenges in NGO Management, Purpose of Social Welfare Boards, Philanthropy- Concept, Role in NGO and Social Mind-set. • National Policy- 2003 related to NGOs, Legal Aspects of NGOs, Trust Management – Concept, Purpose, legal aspects, Difference between Trusts and NGO. • Importance and Scope of Communication Skills, Interpersonal and Group Communication Defining appropriate marketing tools, Developing a coherent fundraising strategy • Grant Proposals - Identification of budget lines and donor expectations, Structure of grant proposals • Elaboration of a grant proposal, with good examples and exercises • NGOs, coordinating agencies, Funding Agencies and Schemes, International Organizations, National and Regional organizations. • Schemes for NGOs under various ministries of Government of India 	<ul style="list-style-type: none"> • Understanding the role and importance of NGO in society. • Understanding various Functions, objectives and scope and legal aspects of NGO. • .Understand the process of fundraising and grant proposals to the Institutions. • Understand various schemes of NGO and the structure of grant proposals
4	Computer based laboratory	<ul style="list-style-type: none"> • Please refer end of syllabus 	<ul style="list-style-type: none"> • .

Teaching Methodology

Teaching Hours Practical, Computer Lab –	Innovative Methods to be used/ AV Applications	Project	Expected Outcome
Unit 1- 10 Hours	Films/Videos/Case Studies on social work done all over the world.	Listing out various kind of social work undertaken all over the world by many organisations.	Understand the Role and Scope of Social Work with various aspects. Understand the concepts and role Social Work practice.
Unit 2- 14 Hours	Films/Videos/Case Studies on Social Individual Group Work and CSR activities done by corporates.	List out the CSR activities carried out by MNC's all over the world.	Understand the role of Social Individual and Group work. Understand the role of CSR and Community management towards Social Work.
Unit 3- 14 Hours	Case Studies NGO management and its functions and role.	List out various NGO's working actively and their contribution to the society.	Understanding the role and importance of NGO in society Understanding various Functions, objectives and scope and legal aspects of NGO
Unit 4- 10 Hours	Computer based laboratory		
Computer training			

D406 - Guidelines for Computer Training Courses

2 credits for project report and evaluation will be for Project and Viva for 50 marks.

Objectives of Computer Enabling Activities.

- To familiarise Computer applications used in particular department and understanding jargons of the field.
- To understand various concepts and steps relating to designing of computer technologies and its applications in various field.

Method of conducting practical Training.

Requirement – High Speed internet or Wi-Fi, computer and screen.

For the specialisation course teachers are requested to search and download the free demo modules available on the internet.

- Teachers will run the software through dummy entries and will explain the process to the students.
- Students are expected to learn from online demo modules and its utility in the business

Expected Outcome: This will help the students to understand how the computers are used in business for collection of information, generating source of information, post entries, various information required to take decisions, Data Collection , identification of particular source of information and how the information is further processed. Reports are generated based on the filled data.

Project guidelines for students.

Students can search information after learning through demo. Students will prepare project report based on data collected (Online or off line). They will have to prepare requirements sheet of various industry and will analyse computer enabled activities. They will study various difficulties faced and identify probable solutions for the same.

D 406 Social Service and NGO management (Services Management)

Tentative –Computer Enabled Project Topics D 406

Practical - course contents (students can perform the project in the group or individual and can ant five topics from the list .

Customer relationship - Delight & retain your customers by integrating real-time chat inside your website or mobile apps to provide instant & convenient support to your valuable customers.

Customer Management -Manage all your customer details at a single place with our flexible CRM solution. Build long term relationships with customers by using their order history details in the most effective way.

Business Analytics -Know numbers that matter the most to your business - repeat customers, most ordered items & revenues. Understand your customers' behaviour & target them with your new offerings.

- Creating Search Engine Campaign Ads
- Creating Display Campaign
- Optimising Display Campaign
- Creating Facebook Advertising Campaign and other social media campaign
- Create Remarketing Campaign
- PR, Digital Marketing, Event Management, Advertising, Packaging, Product Design, Trade Shows, Sponsorship etc. Usurers Interfere and Usurers Experience
- Use of Marketing Communication tools effectively
- Prepare the MARCOM strategy

Recommended Books:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Introduction to social work.	Chowdhry, Paul.	Atma Ram and Sons	New Delhi
2	International social work	Cox, David and Manohar Pawar	Vistar Publications.	New Delhi
3	Towards a philosophy of Social Work in India	Dasguta, S.	Popular Book Services	Mumbai
4	Concepts and methods of social work.	Gore, M. S	Prentice hall of India	Mumbai
5	Social work and social work education	Hepworth, Dean H.	Asia Publication House	Bombay

Savitribai Phule Pune University
Question paper Pattern 2019 for SY BBA
University Examination Sub: Social Service and NGO Management
Course Code – 406 D
Credit - 4 (2+2)

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Savitribai Phule Pune University
SY BBA Semester IV (CBCS) Pattern 2019
Course : Rural Marketing : Concepts and Practices- DSE-405 E- ABM
Course Code – 405 E-ABM
Credits – (3+1) = 4

Depth of the Course: Conceptual understanding on the Rural Marketing with special reference to Indian context and develop skills required to planning of Rural Products.

Course Objectives:

1. To develop better understanding of the Indian Rural Economy.
2. Identification of challenges and opportunities in Rural Marketing.
3. To provide exposure to the Rural Marketing Environment and Rural Market.
4. To understand the applications of marketing to Rural Marketing.
5. To understand the application of the Rural Marketing Mix (4 A's) and (4 P's).

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Introduction to Rural Marketing	<ul style="list-style-type: none"> • Concept, Scope, Nature, and Evolution of Rural Marketing in India. • Factors affecting rural marketing: Socio-cultural, economic, and other environmental factors. • Rural Marketing Strategies: 4 P's and 4 A's., -Challenges and Future of Rural Marketing. • Indian Rural Market: Rural Vs Urban Market. • Rural Infrastructure: Connectivity, Electricity, Communication, Healthcare, Education. 	<p>Purpose :-</p> <ul style="list-style-type: none"> -Developing better understanding of Indian rural Economy -Better understanding of Rural Marketing Challenges and Opportunities in India. <p>Skills to be developed :-</p> <ul style="list-style-type: none"> -Analytical abilities : SWOT, SWAC Analysis etc.

2	Consumer Behaviour and Rural Marketing	<ul style="list-style-type: none"> • Characteristics of Buying Behaviour : • Awareness, Understanding, Consumer Purchase Decision, Salesmen influence. • Problems of Rural Consumer : • Adulteration, Short Weight and Measures, Behavioural Aspects: lack of awareness due to illiteracy(unfair Warranties and Guaranties). • Distribution Models in Rural Markets : • FMCGs, Durables, Agri-inputs. Haats, Vans. • PDS, Cooperative Societies, NGOs. 	<p>Purpose :-</p> <ul style="list-style-type: none"> - Understanding of various characteristics of Rural Consumer Behaviour. - Creating awareness about difference between Urban and Rural Consumer Behaviour. <p>Skills to be developed :-</p> <ul style="list-style-type: none"> -Development of Divergent and Convergent thinking abilities w.r.t. Rural Marketing and in general.
3	Agricultural Marketing And Role of Indian Government :	<ul style="list-style-type: none"> • Agricultural Marketing : • Importance, Prospects and Issues. • Role of Cooperative and Self Help Groups(SHG) in Rural Marketing. • Commodity Board: • Role and Contribution of Commodity Board in revenue generation and employment in rural India. • Agricultural Export :Role of (APEDA) • Contribution of Agricultural Export in generating revenue for India: Food Grains, Organic Products, Fruit Export. • Government and Rural India : • NREGA, Jan DhanYojana, Aysuhman Scheme, Skill Development. • Microfinance and Credit Services 	<p>Purpose :-</p> <ul style="list-style-type: none"> -Identification of Rural Marketing Opportunities. - Understanding Potential of Rural Marketing. - Awareness of various Government schemes and Financial Assistance <p>Skills to be developed :-</p> <ul style="list-style-type: none"> - knowledge about self-employment -En-cashing the opportunities offered by the fund raising of Govt.
4	Recent Trends in Rural Marketing	<ul style="list-style-type: none"> • E- Commerce: Importance and Impact of E- Marketing on rural consumers, Concept of Digital Village, Role of Social Media in rural marketing. • Online Marketers: Role of online Marketers, Growth and Challenges. 	<p>Purpose :-</p> <ul style="list-style-type: none"> -Highlighting recent trends in rural marketing. <p>Skills to be developed :-</p>

			Knowledge of recent trends in rural Marketing
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Teaching Methodology (Pedagogy for Course Delivery) :-

Teaching Hours	Innovative Methods to be used	Expected outcome
Unit I-10 Hours	Interactive Sessions followed by feedback, Practical Assignments.	It enables students to learn the basics of Rural Marketing which will help them to provide vision for new businesses in rural market
Unit II-14 Hours	Group Discussion on opportunities in Rural Marketing, Theory lectures for conceptual understanding, Primary Research on Rural Consumer Behaviour.	Development of interest and positive approach towards Rural Marketing.
Unit III-14 Hours	Use of PPT for better understanding of various financial assistance and Government Schemes.	Ability to collect relevant data and its analysis and interpretation.
Unit IV- 10 Hours	Arranging Sessions of Experts from Rural Marketing and Presentations by students for self-learning.	Practical understanding of recent trends in Rural Marketing
Tutorial	Anyone of the above	

Evaluation: Internal Marks 50

Subject	Internal Evaluation	External Evaluation
Unit – I	Evaluation of the students on the basis of various criteria of assessment as prescribed by college and guidelines provided by SPPU.	25% MCQ 35% short notes 40% long answers
Unit – II		
Unit – III		
Unit – IV		
Total =4	50 Marks	50 Marks

Suggested References:-

Sr.No	Title Of the Book	Author/s	Publication	Place
1	The Rural Marketing	PradeepKashyap	Pearson, (Latest)	New Delhi
2	Rural Marketing in India	K.S.Habeeb-Ur-Rahman	Himalaya Publishing House	New Delhi
3	Indian Agricultural Since Independence	M.L.Dantwala	Oxford & IBH Publishing Co. Pvt. Ltd.	-
4	Rural Mraketing : Concepts & Practices	BalramDogra, KarminderGhuman	McGraw Hills	New Delhi

Savitribai Phule Pune University
Question paper Pattern 2019 for SY BBA
University Examination Sub: Rural Marketing : Concepts And Practices
Course Code – 405 E
Credit - 4 (3+1)

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Savitribai Phule Pune University
SY BBA Semester IV (CBCS) Pattern 2019
Course: Banking Operations and Finance-DSE- E406-ABM
Course Code 406 E-ABM
Credits (2+2) =4

Depth of the Course: Reasonable Knowledge about available financial assistance for agriculture sector and rewards and risk associated with it.

Course Objectives:

1. To provide the management students with the knowledge of banking and finance in the area of agriculture.
2. To enable students to know various sources to avail agriculture finance.
3. To study computation of risk as well as rewards with respect to agriculture finance.

Unit No.	Unit Title	Contents	Purpose & Skills to be develop
1	Introduction to Agricultural Banking Operations and Finance	<ul style="list-style-type: none"> • Meaning of banking operations and finance • Need, importance and scope of agriculture finance • Various available types of available agriculture finance • Classification of types of finance for agri business • Scope of banking operations and finance in India for modern agriculture and related business 	<ul style="list-style-type: none"> • To understand the basic concept of agriculture finance. • To understand the financial operations with respect to agriculture finance. • To study the importance and use of agriculture finance.
2	Sources of Agriculture Finance	<ol style="list-style-type: none"> 3. Various types of finance available for agriculture and its related business 4. Traditional and modern sources of finance 5. Money lenders and Zamindars 6. Institutional credit agencies like NABARD, Government co-operative societies, Commercial banks, Primary agriculture societies, Primary and Central land development banks, Kisan Credit Card 	<ul style="list-style-type: none"> • To understand the various traditional and modern means of finance available for agriculture sector. • To study the benefits and drawbacks if any of various sources of agriculture finance. • To understand the operations with respect to availing finance from

			various financial institutions for agriculture.
3.	Computation of Risk and Rewards with respect to Agriculture finance	<ul style="list-style-type: none"> • Time value of money • Cost of capital • Capital budgeting decisions like NPV, ARR, IRR. Payback period, Cost of capital and Weighted average cost of capital 1. Whether to take or not decision 	<ul style="list-style-type: none"> • To understand the various associated risk prevailing with agriculture finance. • To compute various financial risk using various modern tools of risk assessment. • To find out the real time value of returns or loss with respect to agriculture finance.
4	Computer Laboratory Work	<ul style="list-style-type: none"> • Introduction to IFFCO KisanApp, Agri Media Video App, KisanYojana, Mera mobile app, Crop Insurance Mobile App by Digital India • Online study of PM Fasal Bima Yojana, • Introduction to Agri-Fintech startup farMart • All Agriculture Technology • Introduction to IFFCO KisanApp, Agri Media Video App, KisanYojana, Mera mobile app, Crop Insurance Mobile App by Digital India. • Online study of PM FasalBimaYojana. • Introduction to Agri-Fintech start-up far Mart. 	<ul style="list-style-type: none"> • To give practical knowledge about the use of technology and applications used for agricultural banking and finance.

E 406 - Guidelines for Computer Training Courses

2 credits for project report and evaluation will be for Project and Viva for 50 marks.

Objectives of Computer Enabling Activities:

- To familiarize Computer Applications used in particular department and understanding jargons of the respective field.
- To understand various concepts and steps relating to designing of computer technologies and its applications in various field.

Method of Conducting Practical Training:

Requirement – High Speed Internet or Wi-Fi , computer and screen. For the specialisation courses, teachers are requested to search and download the free demo modules available on the internet.

- Teachers will run the software through dummy entries and will explain the process to the students.
- Students are expected to learn from online demo modules and its utility in the business.

Expected Outcome: This will help the students to understand how the computers are used in business for collection of information, generating source of information, post entries, various information required to take decisions, data collection , identification of particular source of information and how the information is further processed. Reports are generated based on the filled data.

Project Guidelines for Students:

Students can search information after learning through demo. Students will prepare project report based on data collected (Online or off- line). The students will have to prepare requirement sheets of various industry and will analyse computer enabled activities. The students will study various difficulties faced and identify probable solutions for the same.

Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical	Innovative methods to be used	Expected Outcome
Unit 1-10 Hours	1. Interactive teaching methods to be adopted. 2. Practically the importance of finance for agriculture sector should be explained to the students 3. Students belonging to agriculture background are to be requested to share their knowledge with respect to agriculture finance and its banking related experiences	<ul style="list-style-type: none"> • To understand the use of making available finance for agriculture sector in the most profitable manner. • To create interest among the students to take benefits of available finance for agriculture sector.
Unit 2 -14 Hours	1. Provide project work with respect to various operations of financial institutions in the area of agriculture 2. Government facilities like subsidies, low or no interest loans etc. to be explained through presentation. 3. Visits to various agricultural finance institutions can be planned for better understanding of the topic.	<ul style="list-style-type: none"> • To understand the changing scenario of agriculture finance. • To understand the eligibility and procedure to avail agriculture finance from various financial institutions dealing with it. • To understand the best source of available finance to be availed amongst the various available sources.
Unit 3 -14 Hours	1. To give live examples of agriculture finance through the source of internet or other available sources. 2. Experts from agricultural finance can be invited for talk with students.	<ul style="list-style-type: none"> • To understand the various calculations which are necessary at or before the time of availing finance. • Development of problem-solving and decision-making skills. • Comparative analysis of various available sources of finance from different sources and find out the best available options amongst them. • To understand the risk and rewards associated with the finance to be availed.
Unit 4 – 10 Hours	<ul style="list-style-type: none"> • Students can search information after learning through demo. Students will prepare project report based on data collected (Online or off line). They will have to prepare requirements sheet of various industry and will analyse computer enabled activities. They will study various 	<ul style="list-style-type: none"> • To familiarise Computer applications used in particular department and understanding jargons of the field.

	difficulties faced and identify probable solutions for the same.	<ul style="list-style-type: none"> To understand various concepts and steps relating to designing of computer technologies and its applications in various field.
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Evaluation

Unit Number	Project and Practical	External Evaluation
4	Practical and project work on the basis of Computer Course assigned to students and guidelines received from SPPU.	25% MCQ 35% short notes 40% long answers
Total –		50 Marks
		50 Marks

Suggested References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Agricultural Finance and Management	Reddy S S	Oxford and IBH Publication	Delhi
2	Introduction to Agricultural Economics	Pearson John B	Pearson India	Delhi
3	Agricultural Finance and Management	Singh and Sharma	Friends Publication	Merrut
4	Kisan Credit Card Scheme: Impact, Weakness and Further Reforms	Sharma Anil	National Council of Applied Economics Research	New Delhi

Savitribai Phule Pune University
Question paper Pattern 2019 for SY BBA
University Examination Sub: Banking Operations and Finance
Course Code – 406 E
Credit - 4 (2+2)

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Acknowledgement

The Syllabus Restructuring of BBA Programme (CBCS-2019 Pattern) is a manifestation of excellence in the field of Management. Savitribai Phule Pune University's focus has always been in raising the academic standards and excellence in the field of education.

The BBA Programme predominantly endeavours for holistic development of students. It has emphasized on cultivating various skills and has also desired business acumen amongst the students.

This revision has been possible only with the help and support of different eminent personalities. The contribution of all the members as a team has enabled the robust revision of all the titles of the Programme. This synergy of the contributors is very crucial in fine tuning of the BBA Programme in its present form.

SPPU is grateful to Hon. Vice Chancellor Dr. Nitin Karmalkar, Hon. Dr. N. S. Umarani, Pro-Vice Chancellor, who has always lent continuous support and encouraged everyone involved in this task of restructuring.

SPPU is also grateful to Hon. Dr. Parag Kalkar, Dean, Faculty of Commerce and Management and Dr. Yashodhan Mithare, Associate Dean, Faculty of Commerce and Management. They have been an inspiration for all the members to complete the work.

Dr. Tanuja Devi, on behalf of SPPU, headed the BBA Restructuring Committee. The experienced members of the Syllabus Restructuring Committee, Dr. Goje – BOS Chairman has contributed through technological blended part in the course content. Dr. Vishwas Iresh Swami, Dr. Prashant Kalshetti, Mr. Prashant Bankar, and Dr. Satish Jagtap, have enabled the revision in a smooth manner. The team is thankful to Dr. Snehal Gaur for her assistance to all the members in framing the syllabus. Dr. Sharmila Kavediya, Dr. Ganesh Patare, and Shri. Sumeet Gaikwad also gave inputs to the curriculum.

Savitribai Phule Pune University, Pune

Bachelor of Business Administration (Computer Application)

BBA(CA)

(Under faculty of Commerce & Management)

(To be implemented from Academic year 2019-20)

1. Name of Programme: Bachelor of Business Administration (Computer Application)

2. Introduction:

The degree shall be titled as Bachelor of Business Administration (B.B.A.)(Computer Application) under the Faculty of Commerce and Management. First Year B.B.A.(CA) choice based credit system is implemented w.e.f. the academic year 2019-2020 , Second Year B.B.A.(CA) II will be implement w.e.f. 2020-2021 and Third Year B.B.A.(CA) III w.e.f. 2021-2022

3. Programme Objectives:

- To produce skill oriented human resource.
- To impart practical skills among students.
- To make industry ready resource.
- To bring the spirit of entrepreneurship.

4. Programme Structure:

- The Programme is of a Three Year (Six semesters) Full Time Degree Programme.
- The programme shall be based on credit system comprising 132 credits.

5. Eligibility for Admission

- A candidate is eligible for admission to the Degree in Bachelor of Business Administration – Computer Application after passing 12th Std. examination (H.S.C. 10 +2) from any stream with English as passing subject and has secured 40% marks at 12th std.
- Three Years Diploma after S.S.C. i.e. 10th Standard of Board of Technical Education conducted by Government of Maharashtra or its equivalent.
- Two Years Diploma in Pharmacy after H.S.C., of Board of Technical Education conducted by Government of Maharashtra or its equivalent.
- MCVC

6. Medium of Instruction: English

7. Award of Credits:

- Each course having 3 credits shall be evaluated out of 100 marks and student should secure at least 40 marks to earn full credits of that course.
- Each course with 2 credits for Sem-I & Sem-II, Sem-V & Sem-VI is divided in theory (50%) & practical (50%) and for Sem-III,IV there will be project work for students. For all practical and project there will be university evaluation. For Sem-I,II,V&VI (30%Internal & 70%Extrenal) is the pattern of evaluation.
- GPA shall be calculated based on the marks obtained in the respective subject provided that student should have obtained credits for that course.

8. Evaluation Pattern:

- Each course carrying 100 marks shall be evaluated with Continuous Assessment (CA) and University Evaluation (UE) mechanism. Continuous assessment shall be of 30 marks while University Evaluation shall be of 70 marks. To pass in the course, a student has to secure minimum 40 marks provided that he should secure minimum 28 marks in University Evaluation (UE).
- CA shall be based on internal tests (minimum 2 for 20 marks). In addition, for remaining 10 marks a teacher may assign various activities such as home assignments,

tutorials, seminars, presentations, group discussion etc, to the students and evaluate accordingly.

9. Method of Evaluation and Evaluation Criteria: - 1. Internal Assessment 30 marks for all theory related subjects 2. Practical and Project will be evaluated separately 3.SPPU - Examination will be 70 marks

- **1. Instructions for teachers for internal evaluation for 30 Marks** - The purpose of internal evaluation is to assess the depth of knowledge, understanding and awareness. For this purpose a teacher is expected to use different evaluation methods in order to have rational and objective assessment of the learners and available resources.
- The class work will carry 30 marks in each course. Internal Evaluation includes continuous evaluation of a student by adopting variety of techniques such as Assignments, Presentation, Internal examination, Group Discussions , Projects etc.
- There shall be Four small projects /Tutorials for internal evaluation as compulsory part of assessment (Semester I ,II ,III and IV).

2. Project Examination

For course on Practical and Project work as per the regular practice there will be Written Report and viva presentation of 100 marks at SPPU level.

3. External Examination: - There will be written Examination of 70 marks and 3 hrs duration for every course at the end of each Semester.

Setting of Question Papers (Applicable to theory subjects)

1. A candidate shall have to answer the questions in all the subjects in English only.
2. Question papers shall be framed so as to ensure that no part of the syllabus is left out of study by a candidate.
3. question paper shall be balanced in respect of various topics outlined in the syllabus.
4. The question papers shall have a combination of long, short answer and MCQ type questions.

10. Restructuring of courses –Equivalence and Transitory Provision

The University will conduct examination of old course for next three academic years from the date of implementation of new course.

The candidate of old course will be given three chances to clear his subjects as per the old course and thereafter he will have to appear for the subjects under new course as per the equivalence given to old course.

11. Completion of Degree Programme:

A student who earns 132 credits, shall be considered to have completed the requirements of the B.B.A.(CA) degree program and CGPA will be calculated for such student.

12. Credit Allocation

CC-Core Course, EC-Elective Course, PR-Practical, PJ-Project, AECC-Ability Enhancement Compulsory Courses, SEC-Skill Enhancement Courses.

Total - 132 Credits for Three years Programme

Sr. No.	Sem ester	CC – Credit	EC Credit	PR Credit	PJ Credit	AEC C-credit	SEC – Credit	Lectures + Project +add on courses= Total Credits
1	I	15		4			2	15+4+2 =21
2	II	15		4			2	15 +4 +2=21
3	III	9	6	6		2		9+6+6+2=23
4	IV	9	3	4	4		2	9+3+4+4+2=22
5	V	9	3	4	4		2	9+3+4+4+2=22
6	VI	10	3	4	4		2	10+3+4+4+2=23
Total		67	15	26	12	2	10	67+15+26+12+2+10=132

13. Titles of Papers and Scheme of Study for B.B.A. (C.A.) Programme**CC-Core Course, EC-Elective Course, PR-Practical, PJ-Project,****AECC-Ability Enhancement Compulsory Courses, SEC-Skill****Enhancement Courses.****SEMESTER- I**

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-101	Business Communication	CC	3	
CA-102	Principles of Management	CC	3	
CA-103	C Language	CC	3	
CA-104	Database Management System	CC	3	
CA-105	Statistics	CC	3	
CA-106	Computer Laboratory Based on 103 &104 (2 credits each)	PR		4
107	Add-On (PPA) (30 Hours)	SEC	2	

SEMESTER- II

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-201	Organization Behavior & Human Resource Management	CC	3	
CA-202	Financial Accounting	CC	3	
CA-203	Business Mathematics	CC	3	
CA-204	Relational database	CC	3	
CA-205	Web Technology HTML-JS-CSS	CC	3	
CA-206	Computer Laboratory Based on 204 & 205(2 credits each)	PR		4
207	Add-On (Advance C) (30 Hours)	SEC	2	

SEMESTER- III

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-301	Digital Marketing	CC	3	
CA-302	Data Structure	CC	3	
CA-303	Software Engineering	CC	3	
CA-304	Angular JS	EC	3	
OR				
CA-304	PHP	EC	3	
CA-305	Big data	EC	3	
OR				
CA-305	Block chain	EC	3	
CA-306	Computer Laboratory Based on 302 , 304 and 305 (2 credits each)	PR		2+2+2 = 6
307 AECC	Environment Awareness	AECC	2	

SEMESTER- IV

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-401	Networking	CC	3	
CA-402	Object Oriented Concepts Through CPP	CC	3	
CA-403	Operating System	CC	3	
CA-404	NODE JS	EC	3	
OR				
CA-404	Advance PHP	EC	3	
CA-405	Project	EC		4
CA-406	Computer Laboratory Based on 402,404 (2 credits each)	PR		4
4	ADD-On (30 Hours)	SEC	2	

SEMESTER- V

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-501	Cyber Security	CC	3	
CA-502	OOSE	CC	3	
CA-503	Core Java	CC	3	
CA-504	Mongo DB	EC	3	
OR				
CA-504	Python	EC	3	
CA-505	Project	PJ		4
CA-506	Computer Laboratory Based on 503 and 504(2 credits each)	PR		4
5	Add on Course-IOT(30 Hours)		2	

SEMESTER- VI

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-601	Recent Trends in Information Technology(Tutorial/Assignment)	CCT	3+1	
CA-602	Software Testing	CC	3	
CA-603	Advanced Java	CC	3	
CA-604	Android Programming	EC	3	
OR				
CA-604	Dot Net framework	EC	3	
CA-605	Project	PJ		4
CA-606	Computer Laboratory Based on 603 and 604(2 credits each)	PR		4
6	Add on Course-Soft Skills Training		2	

14. Acknowledgement: The focus of BBA CA Programme (CBCS-2019 Pattern) has always been raising the academic standards, excellence and holistic development of students. Hon. Prof.

Dr. Nitin Karmalkar, Vice Chancellor, Hon. Dr. N. S. Umarani, Pro-Vice Chancellor, Hon. Dr.Parag Kalkar, Dean, and Associate Dean, Dr. Yashodhan Mithare, Faculty of Commerce and Management have given insights in designing the BBA CA Programme.

Dr. Sanjay Kaptan ,Head ,Savkar Chair has shared his immense knowledge and expertise for designing the structure. Also, the Industry experts panel has added insights in course titles ofthe BBA CA Programme. Dr. Tanuja Devi co-ordinated the BBA CA Restructuring Committee Dr. Ranjit Patil , Shakila Sishawantan , Prashant Mule Shivendu Bhushan have contributed greatly. This synergy of contributors is very crucial in fine tuning of the BBA CA Programme in its present form.

Savitribai Phule Pune University, Pune

B.B.A. (Computer Application)

(Under faculty of Commerce & Management)

(To be implemented from Academic year 2019-20)

Business Communication Skills

Course Code: -- 101

Credit 3

Depth of the syllabus - Reasonable knowledge of the communication

Program objectives

- 1 To understand what is the role of communication in personal and business world
2. To understand system and communication and their utility
3. To develop proficiency in how to write business letters and other communications in required b

Unit No.	Contents	Lectures
1	1. Concept of Communication and Introduction to Communication 1.1 Role of Communication in social and economic system 1.2 Need for effective communication 1.3 Meaning and definition 1.4 Principles of effective communication 1.5 Barriers to communication and over comings	12
2	Methods and types of Communication 2.1 Written communication, 2.2 Forms of written communication. 2.3 Qualities ,difficulties in written communication , 2.4 Constraints in developing effective written communication 2.5 Merits and Limitations of written communication 2.6 Listening Written communication, 2.7 Forms of written communication. 2.8 Qualities, difficulties in written communication , 2.9 Constraints in developing effective written communication	12
3.	Business Correspondence 3.1 Concept , 3.2 Need and functions of Business .Correspondence , 3.3 Types of Business letters , 3.4 Layout Drafting of business , 3.5 Sales Letter , 3.6 Orders sales circulars and business promotion letters 3.7 written methods& types of communication	12
4.	Analysis of different Media of Communication 4.1 Fax communication ,	12

	4.2 Voice mail , 4.3 e-mails , 4.4 Tele conferencing , 4.5 Communication through social media	
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References

Sr. No.	Title of the Book	Author/s	Publication
1	Business Communication	Meenakshi Raman , Prakash Singh	Oxford
2	Business Communication	HomaiPradhan , N.S. Pradhan	Himalaya Publishing House
3	Business Communication	R.K. Madhukar	Vikas Publishing House
4	Business Communication and personality Development	BiswajitDas .ipswwtaSatpathy	Excel Books
5	Business Communication – Concepts , Cases and applications	P.D Chaturvedi , MukeshChaturvedi	Dorling Kindersley
6	Business Communication – Connecting at work	HorySankarMukerjee	Oxford
7	Business Communication Today	Courtland L. Bovee , John V. Thill , AbhaChatterjee	Pearson
8	Hand Book of internal Communication	Eileen Scholes	Infinity Books

Principles of Management
Course Code 102
Credit -3

Depth of the course- Reasonable working knowledge

Program Objectives

- To understand basic concept regarding org. Business Administration
- To examining how various management principles
- To develop managerial skills among the students

Unit No.	Contents	Lectures
1	<p>Nature of management</p> <p>Meaning , importance , functions ,types Management as an art ,science and social system Universality of concept of management and organization</p>	12
2	<p>Evolution of management thoughts</p> <p>Concept of managerial thoughts Contribution of Taylor, Mayo and Fayol and Drucker and Indian Management Ethos</p>	12
3.	<p>Major managerial Functions</p> <p>Planning , need types ,methods , advantages ,merits Forecasting. need types ,methods , advantages ,merits Decision making types process and techniques Directions nature and principles and Motivation –nature, principles and theories Organizing –concept delegation of authorities decentralization concepts and importance</p>	12
4.	<p>Recent trends in Management</p> <p>Management of change , Mgt of crises ,TQM ,stress management (Principles ,concepts merits)</p>	12

References

Sr. No.	Title of the Book	Author/s	Publication
1	Management Concepts and Strategies	J.S. Chandan	Vikas Publishing House Pvt. Ltd.
2	Principles of Management	Harold Koontz , Heinz Weihrich , A. RamachandraArysri	McGraw hill companies
3	Management A Global and Entrepreneurial Perspective	Heinz Weihrich , Mark V. Cannice , Harold Koontz	McGraw hill companies
4	Management – 2008 Edition	Robert Kreitner , MamataMohapatra	Biztantra – Management For Flat World
5	Introduction to Management	John R. Schermerhorn	Wiley India Pvt. Ltd.
6	Principles of Management	P.C. Tripathi , P.N. reddy	McGraw hill companies
7	Management Text and Cases	R. SatyaRaju , A. Parthasarthy	PHI learning Pvt. Ltd
7	Management (Multi-Dimensional Approach)	H. R. Appannaiah , G. Dinakar , H.A. Bhaskara	Himalaya Publishing House

Subject : C-Programming
Course Code-103
Credit-3

Unit No.	Topics	No. of Lectures
1	Introduction to C language 1.1 History 1.2 Basic structure of C Programming 1.3 Language fundamentals 1.3.1 Character set, tokens 1.3.2 Keywords and identifiers 1.3.3 Variables and data types 1.4 Operators 1.4.1 Types of operators 1.4.2 Precedence and associativity 1.4.3 Expression	3
2	Managing I/O operations 2.1 Console based I/O and related built-in I/O functions 2.1.1 printf(), scanf() 2.1.2 getch(), getchar() 2.2 Formatted input and formatted output	2
3	Decision Making and looping 3.1 Introduction 3.2 Decision making structure 3.2.1 If statement 3.2.2 If-else statement 3.2.3 Nested if-else statement 3.2.4 Conditional operator 3.2.5 Switch statement 3.3 Loop control structures 3.3.1 while loop 3.3.2 Do-while loop 3.3.3 For loop 3.3.4 Nested for loop 3.4 Jump statements 3.4.1 break 3.4.2 continue 3.4.3 goto 3.4.4 exit	9
4	Programs through conditional and looping statements Addition / Multiplication of integers Determining if a number is +ve / -ve / even / odd Maximum of 2 numbers, 3 numbers Sum of first n numbers, given n numbers Integer division, Digit reversing, Table generation for n, ab Factorial, sine series, cosine series, nCr , Pascal Triangle Prime number, Factors of a number	5

	Other problems such as Perfect number, GCD of 2 numbers etc (Write algorithms and draw flowcharts)	
5	Arrays and Strings 5.1 Introduction to one-dimensional Array 5.1.1 Definition 5.1.2 Declaration 5.1.3 Initialization 5.2 Accessing and displaying array elements 5.3 Finding smallest and largest number from array 5.4 Reversing array 5.5 Finding odd/even/prime number from array 5.4 Introduction to two-dimensional Array 5.4.1 Definition 5.4.2 Declaration 5.4.3 Initialization 5.5 Accessing and displaying array elements 5.6 Matrices: Addition, Multiplication, Transpose, Symmetry, upper/lower triangular 5.7 Introductions to Strings 5.7.1 Definition 5.7.2 Declaration 5.7.3 Initialization 5.8 Standard library functions 5.9 Implementations without standard library functions.	12
6	Functions 6.1 Introduction 6.1.1 Purpose of function 6.1.2 Function definition 6.1.3 Function declaration 6.1.4 Function call 6.2 Types of functions 6.3 Call by value and call by reference 6.4 Storage classes	9
7	7 Introduction to pointer 7.1 Definition 7.2 Declaration 7.3 Initialization 7.4 Indirection operator and address of operator 7.5 Pointer arithmetic 7.6 Dynamic memory allocation 7.7 Functions and pointers	4
8	8 Structures 8.1 Introduction to structure 8.2 Definition 8.3 Declaration 8.4 Accessing members 8.5 structure operations 8.6 nested structure	4

Reference Book :-

- 1) Let us C –YashwantKanetkar, BPB publication.
- 2) Ansi C- Balagurusamy
- 3) The complete Reference- Herbeltschildt

Subject Name :- Database Management Systems
Course Code: 104
Credit-3

Sr. No.	Chapter No.	Name of Chapter and Contents	No. of Lect.
1	1	File Structure and Organization 1.1 Introduction 1.2 Logical and Physical Files 1.2.1 File 1.2.2 File Structure 1.2.3 Logical and Physical Files Definitions 1.3 Basic File Operations 1.3.1 Opening Files 1.3.2 Closing Files 1.3.3 Reading and Writing 1.3.4 Seeking 1.4 File Organization 1.4.1 Field and Record structure in file 1.4.2 Record Types 1.4.3 Types of file organization 1.4.3.1 Sequential 1.4.3.2 Indexed 1.4.3.3 Hashed 1.5 Indexing 1.5.1 What is an Index? 1.5.2 When to use Indexes? 1.5.3 Types of Index 1.5.3.1 Dense Index 1.5.3.2 Sparse Index	6

2	2	<p>Database Management System</p> <p>2.1 Introduction</p> <p>2.2 Basic Concept and Definitions</p> <p> 2.2.1 Data and Information</p> <p> 2.2.2 Data Vs Information</p> <p> 2.2.3 Data Dictionary</p> <p> 2.2.4 Data Item or Field</p> <p> 2.2.5 Record</p> <p>2.3 Definition of DBMS</p> <p>2.4 Applications of DBMS</p> <p>2.5 File processing system Vs DBMS</p> <p>2.6 Advantages and Disadvantages of DBMS</p> <p>2.7 Users of DBMS</p> <p> 2.7.1 Database Designers</p> <p> 2.7.2 Application programmer</p> <p> 2.7.3 Sophisticated Users</p> <p> 2.7.4 End Users</p> <p>2.8 Views of Data</p> <p>2.9 Data Models</p>	14
		<p>2.9.1 Object Based Logical Model</p> <p> a. Object Oriented Data Model</p> <p> b. Entity Relationship Data Model</p> <p>2.9.2 Record Base Logical Model</p> <p> a. Relational Model</p> <p> b. Network Model</p> <p> c. Hierarchical Model</p> <p>2.10 Entity Relationship Diagram(ERD)</p> <p>2.11 Extended features of ERD</p> <p>2.12 Overall System structure</p>	

3	3	Relational Model 3.1 Introduction 3.2 Terms a. Relation b. Tuple c. Attribute d. Cardinality e. Degree of relationship set f. Domain 3.3 Keys 3.3.1 Super Key 3.3.2 Candidate Key 3.3.3 Primary Key 3.3.4 Foreign Key 3.4 Relational Algebra Operations a. Select b. Project c. Union d. Difference e. Intersection f. Cartesian Product g. Natural Join	8
4	4	SQL (Structured Query Language) 4.1 Introduction 4.2 History Of SQL 4.3 Basic Structure 4.4 DDL Commands 4.5 DML Commands 4.6 Simple Queries 4.7 Nested Queries 4.8 Aggregate Functions	12
5	5	Relational Database Design 5.1 Introduction 5.2 Anomalies of un normalized database 5.3 Normalization 5.4 Normal Form 5.4.1 1 NF 5.4.2 2 NF 5.4.3 3 NF 5.4.3.4 BCNF	8

References:

- 1) Database System Concepts By Henry korth and A. Silberschatz
- 2) SQL, PL/SQL The Programming Language Oracle :- Ivan Bayross, BPB Publication.
- 3) Database Systems Concepts, Designs and Application by Shio Kumar Singh, Pearson
- 4) Introduction to SQL by Reck F. van der Lans by Pearson
- 5) Modern Database Management by Jeffery A Hoffer , V.Ramesh, Heikki Topi ,Pearson
- 6) Database Management Systems by Debabrata Sahoo ,Tata MacgrawHill

Business Statistics

Course code 105

Credit 3

Depth Reasonable working knowledge

Objective of the program

1. To understand role and importance of statistics in various business situations
2. To develop skills related with basic statistical technique
3. Develop right understanding regarding regression, correlation and data interpretation

Unit No.	Contents	Lectures
1	Concept of statistics. Role of statistics. In informatics business science Tabulation, Data condensations and tabulation, Data Condensation and graphical Methods :Raw data , attributes and variables , classification , frequency distribution ,cumulative frequency distributions. Graphs - Histogram, Frequency polygon. Diagrams - Multiple bar , Pie ,Subdivided bar.	12
2	Measures of central tendency and dispersion Criteria for good measures of central tendency, Arithmetic mean, Median and Mode for grouped and ungrouped data, combined mean.	12
3.	Measures of Dispersion : Concept of dispersion , Absolute and relative measure of dispersion, Range, Variance, Standard deviation, Coefficient of variation, Quartile Deviation , Coefficient of Quartile deviation.	12
4	Correlation and Regression(for ungrouped data) Concept of correlation, positive & negative correlation, Karl Pearson's Coefficient of correlation, meaning of regression, Two regression equations, Regression coefficients and properties.	12

References

Sr. No.	Title of the Book	Author/s	Publication
1	Business Statistics	GirishPhatak	Tech – Max
2	Statistics for Business	Dr. S. K. Khandelwal	International Book House
3	Fundamentals of Business Statistics	J.K. Sharma	Pearson
4	Business Statistics	G.C. Beri	The McGraw-Hill companies
5	Statistics Theory and Practice	R.S. N. Pillai Bagavathi	S. Chand
6	Statistics for Managerial decision Making	Dr. S. K. Khandelwal	International Book House
7	Business Statistics For Contemporary Decision Making	Ken Black	Wiley India Edition
8	Fundamentals of statistics	S.C. Gupta	Himalaya Publication House

Savitribai Phule Pune University
FY BBA- CA Semester II (CBCS) Pattern 2019
Organizational Behavior & Human Resource Management
Course code 201
Credit 3

Depth of the course- Basic working knowledge

Program Objectives:

- i) To understand basic concept of HRM & OB
- ii) To make aware students about traditional & modern methods of procurement & development in organization.
- iii) To know the major trends in HRM & OB

Unit No.	Unit Title	Contents	Purpose and Skills to be developed
1	Introduction to Organizational Behavior	Definition, concept, scope, Models of OB, Major trends in OB:-Total Quality management, Cultural diversity, Organizational change, Stress Management: Sources of Stress, Effects of Stress & Stress Management, Work life Balance and Quality of Work Life	To understand the basic concept of OB & To develop knowledge about major trends & ability to handle cultural diversity Stress, change and to maintain work life balance.
2	Introduction to HRM	Introduction to HRM- Definition, Concepts, scope, importance Functions ,Objectives & limitations, , Role of HR Manager , Areas in which Human Resource Manager can be of assistance	To understand the basic concept of HRM & developing knowledge & ability of the student about HRM.
3	Procurement	HRP- Concept, Definition, Merits & Demerits, process , influencing factors of HRP Recruitment- Concept, Definition, sources of recruitment and their utility in identifying vacancies, methods, E-recruitment, Selection- Concepts, definition, process, Types of interviews and frequently asked interview questions from the candidate at each step and how to answer them, E- selection	To understand process & importance of HR procurement and to develop the skills among students regarding awareness of new trends of Recruitment Selection and interview preparation
4	Training & Development	Training & Development- Concept, definition, importance, Methods, E-Training, Recent trends in Training	To know the training & performance appraisal methods & To develop evaluation skill.

Teaching Methodology

Teaching Hours	Innovative methods to be used	Project	Expected Outcome
10	Lecture ,Interactive teaching & Ice breaking session	Role play on HR Manager	To develop group cohesiveness.
10	Lab activity of Searching links about E-recruitment and E- selection.	Project report	Up gradation of knowledge of new trends in Recruitment and Selection.
12	Guest lecture	Assignment	Up gradation of skill.
13	Case Study , Video clips on Cultural Diversity and Stress management	Case study report	To develop decision making skill.

Evaluation Method

Internal Evaluation	External Evaluation
One project Report : 5 Marks One assignment : 5 marks One Case Study Solution Report : 5 marks Internal Examination : 15 marks	25% MCQ Short notes 35% Long answers 40%
30	70

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Human Resources Management.	-L.M. Prasad	Sultan and Chand Publishing Company	New Delhi
2	Human Resources Management.	K. Ashwathappa –	Tata McGraw Hill	New Delhi
3	Personnel Management.	C. B. Mamoria		
4	Organizational Behavior Text, Cases and Games	- K. Aswathappa,	Tata McGraw Hill	New Delhi
5	Organizational Behavior -	L.M. Prasad	Sultan and Chand Publishing Company	New Delhi

Savitribai Phule Pune University
FY BBA- CA Semester II (CBCS) Pattern 2019
Financial Accounting
Course code 202
Credit 3

Depth of the syllabus: Reasonable working knowledge

Program objectives

- i) To develop right understanding regarding role and importance of monetary and financial transactions in business
- ii) To cultivate right approach towards classifications of different transactions and their implications
- iii) To develop proficiency preparation of basic financial as to how to write basis accounting statement - Trading and P&L

Unit No.	Unit Title	Contents	Purpose and Skills to be developed
1	Financial Accounting-	definition and Scope, objectives, Accounting concepts, principles and conventions	To understand role and importance of accounting in Business and how accounting concept can be implemented in business Computation ability in business ability to distinguished between various accounting concepts and practices
2	Accounting Transactions and Final Accounts	Voucher system; Accounting Process, Journals, Ledger, Cash Book , subsidiary books ,Trial Balance preparation of Final Accounts of Sole Proprietorship(Trading and Profit & Loss Account and Balance Sheet	To understand how to record different financial transactions and their financial implications Ability to write different accounting tractions and prepare basic financial tractions
3.	Bank Reconciliation Statements	Meaning, importance and preparation of Bank Reconciliation Statement	To understand the kind of accounting relationship between customer and bank Ability to write necessary set of entries in books of accounts and in cash book and compare them with bank statement to understand their implications and effect

	Computerized Accounting	Role of computers and Financial application, Accounting Software packages	Ability to understand growing importance of software and to know how to use software and to write books of accounts Ability to use software like tally for writing of accounts
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Teaching Methodology

Teaching Hours	Innovative methods to be used	AV Applications	Project	Expected Outcome
10	Applying accounting concepts in real life business Ability to distinguish between accounting transactions and real life business	Role of accounting in business	Importance of accounting of business and nonprofit organizations	To learn about importance of acc. In business
15	Using practical situations for writing Transactions And applying accounting concepts different situations	Writing ledger and cash book	Developing model of Journals and model books of accounts Preparing flow chart of accordance of different transactions	Ability to distinguish between different transactions and its nature
11	Interpretation of bank passbook and its statement Comparative analysis of bank pass book and statement and their interpretation	Lesson on How to write bank reconciliations. Statement from YouTube	Preparing BR. With imaginary data	Ability to prepare and interpret bank reconciliation statement
12	NIL	To Understand how various transactions are recorded while using software and what cautions are need to be taken while recording transactions.	Film on silent features of tally accounting As business software	Applying software basic financial statement and converting row financial data into well written financial data

Evaluation Method

Unit No	Internal Evaluation	External Evaluation	Suggested Add on Course
I	MCQ on various aspects of accounting Presentations on accounting and its importance in business	25%MCQ Short notes 35% Long answers 40%	Tally and computer based accounting
II	Practical problems on how to write different accounting tractions and maintaining books of accounts		
III	Practical problems on Bank Reconciliation		
IV	Demonstrations and hands on of experience regarding application of Tally and other accounting software		
	30	70	

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Advance Accounting Vou- I	S.N. Maheshwari & S.K. Maheshwari	Vikas Publication	New Delhi
2	Advance Accounting Vou- I	M.C. Shukla , T.C. Grewal , S.C Gupta	S. Chand	New Delhi
3	Accountancy (Vol- I)	S. Kr. Paul	Central Educational Enterprises (P). Ltd.	Kolkata
4	Accounting (text and Cases)	Robert N. Anthony , David F. Hawkins , Kenneth A. Merchant	McGraw Hill Companies	New Delhi
5	Advanced Accountancy(Volume – I)	R.L. Gupta , M. Radhaswamy	Sultan Chand & Sons	New Delhi

Savitribai Phule Pune University
FY BBA- CA Semester II (CBCS) Pattern 2019
Business Mathematics
Course code 203
Credit 3

Course Depth: Fundamental Knowledge

Objectives:

- i) To understand role and importance of Mathematics in various business situations and while developing softwares.
- ii) To develop skills related with basic mathematical technique

Unit No.	Topic	No. of Lecture
1	1. Ratio, Proportion and Percentage: Ratio – Definition, Continued Ratio, Inverse Ration, Proportion, Continued Proportion, Direct Proportion, Inverse Proportion, Variation, Inverse Variation, Joint Variation, Percentage, computation of Percentage.	8
2	2. Profit and Loss: - Terms and Formulae, Trade discount, Cash discount, Problems involving cost price, selling price, Trade discount and cash discount. Introduction to Commission and brokerage, Problems on commission and brokerage	6

3	<p>3. Interest and Annuity: - Simple interest, Compound interest, Equated monthly Installments (EMI) by interest of reducing balance and flat interest methods and problems.</p> <p>Ordinary annuity, sinker fund, annuity due, present value and future value of annuity.</p> <p>Shares and Mutual Funds:- Concepts of Shares, face value, market value, dividend, brokerage, equity shares, preferential shares, bonus shares, examples and problems, Concept of Mutual Funds, Change in Net Asset Value (NAV), Systematic Investment Plan (SIP), Examples and Problems.</p>	7
4	<p>4. Matrices and Determinant: - Definition of Matrices, Types of Matrices, Algebra of Matrices, Determinant, Adjoint of Matrix, Inverse of Matrix, System of Linear equations, Solution of System of Linear Equation by adjoint method (upto 3 variables only).</p>	10
5	<p>5. Linear Programming Problem (LPP) Concept of LPP, Formulation of LPP and solution of LPP by graphical method.</p> <p>Transportation Problem (T.P.):-</p> <p>Concept of Transportation Problem, Initial Basic Feasible Solution, North-West Corner Method (NWCM), Least Cost Method (LCM), Vogel's Approximation Method (VAM).</p>	5
Total		48

Reference Books:

- 1) Business Mathematics by Dr. AmarnathDikshit and Dr. Jinendrakumar Jain.
- 2) Business Mathematics by V. K. Kapoor – Sultan, Chand and sons. Delhi.
- 3) Business Mathematics by Bari – New Literature publishing company, Mumbai.
- 4) Operation Research by S. D. Sharma - Sultan, Chand and sons.
- 5) Operation Research by J. K. Sharma - Sultan, Chand and sons.

Savitribai Phule Pune University
FY BBA- CA Semester II (CBCS) Pattern 2019
Relational Data Base
Course code 204
Credit 3

Course Depth: Fundamental Knowledge

Objectives:

- i) Enables students to understand relational database concepts and transaction management concepts in database system.
- ii) Enables student to write PL/SQL programs that use: procedure, function, package, cursor and trigger.

Unit No.	Unit Title	Contents	Purpose	Expected Outcome
1.	Introduction To RDBMS	Introduction to popular RDBMS product and their features	To understand concept of RDBMS & use in business	Understanding of various RDBMS products()
		Difference Between DBMS and RDBMS	To understand advantages of RDBMS over DBMS	Use of relational database
		Relationship among application programs and RDBMS	To understand interface between application programs and data	To get knowledge of Front End and Backend

2.	PL-SQL	Overview of PLSQL Data Types ,PLSQL Block	To understand various data types , operators , functions and control statements	Understanding of various programming aspects
		Exception Handling	To understand predefined and user defined exceptions	Learning of different exceptions
		Functions, Procedures	To understand concept of compact program writing by making use of functions and procedure	Writing of compact code (Small program writing)
		Cursor	To understand types of cursors and selective data retrieval	Understanding of exact data retrieval
		Trigger Package	To understand concept of stored	Writing of triggers and

			procedure and compiled data	packages(S all application using all contents)
3.	Transaction Management	Transaction Concept	To understand effect of transaction process on database	Understanding use of transaction and effect on database
		Transaction Properties	To understand properties like atomicity, consistency, isolation and durability	Application of properties (Case solving)
		Transaction States	To understand various states such as active, partially committed, Failed , aborted, committed	Understanding of various states
		Concurrent Execution	To understand concept of reduction in waiting time	
		Serializability	To understand Conflict Serializability and View Serializability	
4	Concurrency Control & Recovery System	Lock Based Protocol	To understand meaning Locks, Granting of Locks ,Two Phase Locking Protocol	To understand concept of shared and exclusive lock
		Timestamp Based Protocol	To understand Timestamp and timestamp ordering protocol	To learn how to prevent deadlock situation
		Deadlock Handling	To understand dead lock detection, prevention and recovery	Understand what deadlock is and how it can occur when giving mutually exclusive access to multiple resources
		Failure Classification	To understand transaction failure and system crash	To learn concepts related to hardware failures
		Recovery & Atomicity	To understand log based recovery and checkpoint	Data recovery with different techniques
		Recovery with concurrent transaction	To understand concept of transaction rollback	Restoring of data which is changed by mistake

Suggested References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Database Management System	Bipin Desai	Galgotia Publications	New Delhi
2	SQL/PLSQL the programming language of oracle	Ivan Bayross	BPB Publications	New Delhi
3	An Introduction to Database Systems Eighth Edition	C. J.Date, A.Kannan, S.Swamynathan	Pearson Publications	North America
4	Database System Concepts 5th Edition	Silberschatz, Korth, Sudershan	McGraw-Hill	New York

Savitribai Phule Pune University
FY BBA- CA Semester II (CBCS) Pattern 2019
Web Technology (HTML-JSS-CSS)
Course code 205
Credit 3

Course Depth: Fundamental Knowledge

Objectives:

- i) To know & understand concepts of internet programming.
- ii) To understand how to develop web based applications using JavaScript.

Unit No	Topic	No. of Lecture
1	1. Introduction 1.1 Clients- Servers and Communication 1.2 Internet-Basic, Internet Protocols (HTTP, FTP, IP) 1.3 World Wide Web(WWW) 1.4 HTTP request message, HTTP response message	5
2	2. Web Design 2.1 Concepts of effective web design 2.2 Web design issues including Browser Bandwidth and Cache 2.3 Display resolution 2.4 Look and Feel of the Website 2.5 Page Layout and linking 2.6 User centric design 2.7 Sitemap 2.8 Planning and publishing website 2.9 Designing effective navigation	9

3	3. HTML 3.1 Introduction to HTML 3.2 Basic HTML Structure 3.3 Common HTML Tags 3.4 Physical and Logical HTML 3.5 Types of Images, client side and server-side Image mapping 3.6 List, Table, Frames 3.7 Embedding Audio, Video 3.8 HTML form and form elements 3.9 Introduction to HTML Front Page	12
4	4. Style sheets 4.1 Need for CSS 4.2 Introduction to CSS 4.3 Basic syntax and structure 4.4 Using CSS- 4.4.1 background images, colors and properties, 4.4.2 manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS 4.5 Overview and features of CSS2 and CSS3	10
5	5. JavaScript 5.1 Introduction to Java Script 5.2 Identifier & operator, control structure, functions 5.3 Document object model(DOM), 5.4 DOM Objects (window, navigator, history, location) 5.5 Predefined functions, math & string functions 5.6 Array in Java scripts 5.7 Event handling in Java script	12
Total		48

Reference Books:

1. Complete HTML- Thomas Powell
2. HTML and JavaScript – Ivan Bayross
3. HTML & CSS: The Complete Reference, Fifth Edition
4. Mastering HTML, CSS & Javascript Web Publishing

Reference websites:

1. www.w3schools.com
2. www.tutorialspoint.com

SPPU/BBA(CA) SYLLABUS SEMESTER-II CBCS/2019 PATTERN

S.Y.B.B.A.(C.A.) Semester –III

Course Code: CA-301

Subject: Digital Marketing

Objectives:

1. The aim of this syllabus is to give knowledge about using digital marketing in and as business.
2. To make SWOT analysis, SEO optimization and use of various digital marketing tools.

Unit	Topic	No. of Lectures
1.	E-Commerce 1.1 Introduction 1.2 Understanding Internet Marketing 1.3 Search Engine Optimization 1.4 Search Engine Marketing 1.5 Email Marketing 1.6 Digital Display Marketing	4
2.	Introduction to New Age Media (Digital) Marketing 2.1 What is Digital Marketing 2.2 Digital vs. Real Marketing 2.3 Digital Marketing Channels 2.4 Types of Digital Marketing(Overview)-Internet Marketing ,Social Media Marketing, Mobile Marketing	4
3.	Creating Initial Digital Marketing Plan 3.1 Content management 3.2 SWOT analysis: Strengths, Weaknesses, Opportunities, andThreats 3.3 Target group analysis EXERCISE: Define a target group	4
4.	Marketing using Web Sites 4.1 Web design 4.2 Optimization of Web sites 4.3 MS Expression Web EXERCISE: Creating web sites, MS Expression	4
5.	Search Engine Optimization 5.1 SEO Optimization 5.2 Writing the SEO content EXERCISE: Writing the SEO content	4
6.	Customer Relationship Management 6.1 Introduction to CRM 6.2 CRM platform 6.3 CRM models EXERCISE: CRM strategy	4

7.	Social Media Marketing	
	7.1 Understanding Social Media Marketing	1
	7.2 Social Networking (Facebook, LinkedIn, Twitter, etc.) Social Media (Blogging, Video Sharing - Youtube, Photosharing – Instagram, Podcasts)	2
	7.3 Web analytics - levels	2
	7.4 Modes of Social Media Marketing-	
	7.4.1 Creating a Facebook page Visual identity of a Facebook page , Types of publications, Facebook Ads , Creating Facebook Ads , Ads Visibility	3
	7.4.2 Business opportunities and Instagram options Optimization of Instagram profiles , Integrating Instagram with a Web Site and other social networks , Keeping up with posts	3
	7.4.3 Business tools on LinkedIn Creating campaigns on LinkedIn , Analyzing visitation on LinkedIn	3
	7.4.4 Creating business accounts on YouTube YouTube , Advertising , YouTube Analytics	3
	7.4.5 E-mail marketing E-mail marketing plan , E-mail marketing campaign analysis , Keeping up with conversions	3
	7.5 Digital Marketing tools: Google Ads, FaceBook Ads, Google Analytic, Zapier, Google Keyword Planner EXERCISE: Social Media Marketing plan. EXERCISE: Making a Facebook page and Google Ads	(20)
8.	Digital Marketing Budgeting	4
	8.1 Resource planning	
	8.2 Cost estimating	
	8.3 Cost budgeting	
	8.4 Cost control	
Total		48

Reference Books:

- 1) Digital Marketing for Dummies By Ryan Deiss and Russ Hennesberry
- 2) Advertising and Promotion: An Integrated Marketing Communications Perspective,
George Belch, San Diego University Michael Belch, San Diego University
- 3) Advertising Management: Rajeev Batra, John G. Myers, David A. Aaker
- 4) Belch: Advertising & Promotions (TMH)
- 5) The Social Media Bible: Tactics, Tools, & Strategies for Business Success by Lon Safko
- 6) Web Analytics 2.0 – AvinashKaushik

S.Y.B.B.A(C.A) Semester – III

Course Code: CA-302

Subject : Data Structure

Objectives:

1. To understand the concepts of ADTs
2. To learn linear data structures – lists, stacks, and queues
3. To understand sorting, searching and hashing algorithms
4. To apply Tree and Graph structures

Unit	Topic	No. of Lectures
1	Basic Concept and Introduction to Data Structure 1.1 Pointers and dynamic memory allocation 1.2 Algorithm-Definition and characteristics 1.3 Algorithm Analysis -Space Complexity -Time Complexity - Asymptotic Notation Introduction to Data structure 1.4 Types of Data structure 1.5 Abstract Data Types (ADT) Introduction to Arrays and Structure 1.6 Types of array and Representation of array 1.7 Polynomial - Polynomial Representation - Evaluation of Polynomial - Addition of Polynomial 1.8 Self Referential Structure	5
2	Linear data structures 2.1 Introduction to Arrays - array representation 2.2 Sorting algorithms with efficiency - Bubble sort, Insertion sort, Merge sort, Quick Sort, Selection Sort 2.3 Searching techniques –Linear Search, Binary search	6
3	Linked List 3.1 Introduction to Linked List 3.2 Implementation of Linked List – Static & Dynamic representation, 3.3 Types of Linked List - Singly Linked list(All type of operation) - Doubly Linked list (Create , Display) - Circularly Singly Linked list (Create, Display) - Circularly Doubly Linked list (Create, Display) 3.4 Generalized linked list – Concept and Representation	6
4	Stacks 4.1 Introduction 4.2 Representation- Static & Dynamic 4.3 Primitive Operations on stack 4.4 Application of Stack 4.5 Conversion of Infix, prefix, postfix , Evaluation of postfix and prefix	8

	4.6 Simulating recursion using stack	
5	Queues 5.1 Introduction 5.2 Representation - Static & Dynamic 5.3 Primitive Operations on Queue 5.4 Circular queue, priority queue 5.5 Concept of doubly ended queue	4
6	Trees 6.1 Concept & Terminologies 6.2 Binary tree, binary search tree 6.3 Representation – Static and Dynamic 6.4 Operations on BT and BST – create, Insert, delete, , counting leaf, non-leaf & total nodes , 6.5 Tree Traversals (preorder, inorder, postorder) 6.6 Application - Heap sort 6.7 Height balanced tree- AVL trees- Rotations, AVL tree examples.	12
7	Graph 7.1 Concept & terminologies 7.2 Graph Representation – Adjacency matrix, adjacency list, inverse Adjacency list, adjacency multilist, orthogonal list 7.3 Degree of Graph 7.4 Traversals – BFS and DFS 7.5 Applications – AOV network – topological sort, AOE network – criticalPath	7
Total		48

Reference Books:

1. Fundamentals of Data Structures ---- By Horowitz Sahani (Galgotia)
2. Data Structures using C and C++ --- By YedidyahLangsam, Aaron M. Tenenbaum, Moshe J. Augenstein
3. Introduction to Data Structures using C---By Ashok Kamthane
4. Data Structures using C --- Bandopadhyay&Dey (Pearson)
5. Data Structures using C ---By Srivastava BPB Publication.

S.Y.B.B.A. (C.A.) Semester –III

Course Code: CA-303

Subject: Software Engineering

Objectives:

1. To understand System concepts.
2. To understand Software Engineering concepts.
3. To understand the applications of Software Engineering concepts and Design in Software development

Unit	Topic	No. of lectures
1	Introduction to System Concepts 1.1 Definition 1.2 Basic Components 1.3 Elements of the System 1.4 Types of System 1.5 System Characteristics	4
2	Introduction to Software Engineering 2.1 Definition of Software 2.2 Characteristics of Software 2.3 Definition of Software Engineering 2.4 Need for Software Engineering 2.5 Mc Call's Quality factors 2.6 The Software Process 2.7 Software Product and Process 2.8 V& V Model	6
3	Software Development Life Cycle 3.1 Introduction 3.2 Activities of SDLC 3.3 A Generic Process Model 3.4 SDLC 3.5 Waterfall Model 3.6 Incremental Process Models 3.7 Prototyping Model 3.8 Spiral Model	8
4	Requirement Engineering 4.1 Introduction 4.2 Requirement Elicitation 4.3 Requirement Elaboration 4.4 Requirement Gathering 4.5 Feasibility study	8

	4.6 Fact Finding Techniques 4.7 SRS Format	
5	Analysis And Design Tools 5.1 Decision Tree and Decision Table 5.2 Data Flow Diagrams (DFD) (Up to 2 nd level) 5.3 Data Dictionary 5.4 Elements of DD 5.5 Advantages and Disadvantages of DD 5.6 Input and Output Design 5.7 Structured Design Concepts 5.8 Structure Chart 5.9 Coupling and Cohesion 5.10 Compulsory Case Studies on above topics	12
6	Software Testing 6.1 Definition 6.2 Software testing Process 6.3 Unit Testing 6.4 Integration Testing 6.5 System Testing	6
7	Software Maintenance and Software Re-Engineering 7.1 Maintenance definition and types 7.2 Software reengineering 7.3 Reverse Engineering 7.4 Restructuring and forward Engineering.	4
Total		48

Reference Books:

1. Software Engineering: A Practitioner's Approach- Roger S. Pressman, McGraw hill International Editions 2010(Seventh Edition)
2. System Analysis, Design and Introduction to Software Engineering (SADSE) - S. Parthasarthy, B.W. Khalkar
3. Analysis and Design of Information Systems(Second Edition) - James A. Senn, McGraw Hill
4. System Analysis and Design- Elias Awad, Galgotia Publication, Second Edition

S.Y.B.B.A.(C.A.) Semester – III

Course Code: CA- 304 (Option)

Subject: Angular - JS

Objectives:

- By the end of this course, the students should be able to Understand Client Side MVC and SPA
- Explore AngularJS Component
- Develop an AngularJS Single Page Application
- Create and bind controllers with Javascript
- Apply filter in AngularJS application

Unit	Topics	No. of Lectures
1	AngularJS Core Concepts: 1.1 What is AngularJS? 1.2 Difference between Javascript and Angular JS 1.3 Advantages of Angular 1.4 AngularJS MVC Architecture 1.5 Introduction to SPA 1.6 Setting up the environment 1.7 First App using MVC architecture	8
2	AngularJS Directives and Expressions: 2.1 Understanding ng attributes ng-app, ng-init, ng-model, ng-controller, ng-bind, ng-repeat, ng-show, ng-readonly, ng-disabled, ng-if, ng-click 2.2 Expression and Data Binding 2.3 Working with directives	10
3	AngularJS Modules, Controller, View and Scope: 3.1 Angular Modules 3.2 Angular Controller 3.3 Angular View 3.4 Scope hierarchy	10
4	Filter, Forms and Ajax Filters 4.1 Built-in filters - upper case and lower case filters, date ,currency and number formatting ,orderBy, filter ,custom filter, 4.2 Angular JS Forms – Working with AngularJS forms, model binding,	12

	form controller ,Using CSS classes, form events , custom model update triggers ,custom validation, \$http service , 4.3 Ajax implementation using \$http	
5	Dependency Injection, Services 5.1 What is dependency injection? 5.2 Understanding services 5.3 Using built-in service 5.4 Creating custom service, 5.5 Injecting dependency in service	8
Total		48

Reference Books:

1. Beginning Angular with Typescript (updated to Angular 5) by Greg Lim
2. Mastering Web Application Development with AngularJS by Pawel Kozlowski, Peter Bacon Darwin
3. <https://www.tutorialsteacher.com/angularjs/angularjs-scope>

S.Y.B.B.A.(C.A.) Semester – IV

Course Code: CA- 304(Optional)

Subject: PHP

Objectives:

1. Understand how server-side programming works on the web.
2. Using PHP built-in functions and creating custom functions
3. Understanding POST and GET in form submission.
4. How to receive and process form submission data.
5. Read and process data in a MySQL database.

Unit	Topic	No. of Lectures
1	PHP Basics 1.1 Setting up a development environment 1.2 Variables, numbers and strings 1.3 Calculations with PHP 1.4 Using Arrays	6
2	Control Structures and Loops 2.1 Conditional Statements 2.2 Using Loops for Repetitive tasks 2.3 Combing Loops and Arrays	7
3	Functions, Objects and Errors 3.1 PHP's Built-in functions 3.2 Creating Custom functions 3.3 Passing Values by Reference 3.4 Understanding Objects	7
4	Working with Forms 4.1 Building a Form 4.2 Processing a Form's Data 4.3 Differences between POST and GET 4.4 Preserving User Input	7
5	More with Forms 5.1 Dealing with checkboxes and radiobuttons 5.2 Retrieving values from lists 5.3 Validating and restricting data 5.4 Sending Email	7
6	Storing and Protecting Data 6.1 Setting and Reading Cookies 6.2 Protecting Online Files 6.3 Understanding Session Variables	7
7	MySQL Database Overview	7

	7.1 phpMyAdmin Overview	
	7.2 Using a MySQL Database	
	7.3 Reading and Writing Data	
Total		48

Reference Books:

1. Php: A Beginner's Guide 1st Edition McGraw-Hill Osborne Media; 1 edition by Vikram Vaswani
2. Murach's PHP and MySQL (2nd Edition) by Joel Murach and Ray Harris
3. PHP: The Complete Reference Paperback – 1 Jul 2017 by Steven Holzner (Author)

S.Y.B.B.A.(C.A.) Semester – III

Course Code: CA- 305(Optional)

Course Title : Big Data

Objectives:

1. To enable learners to develop expert knowledge and analytical skills in current and developing areas of analysis statistics, and machine learning
2. To enable the learner to identify, develop and apply detailed analytical, creative, problem solving skills.
3. Provide the learner with a comprehensive platform for career development, innovation and further study.

Unit	Topic	No. of lectures
1	INTRODUCTION TO BIG DATA 1.1 Introduction to Big Data 1.2 Types of Digital Data 1.3 Big Data Analytics 1.4 Application of Big data	5
2	INTRODUCTION TO DATA SCIENCE 2.1 Basics of Data Analytics 2.2 Types of Analytics – 2.2.1 Descriptive, 2.2.2 Predictive, 2.2.3 Prescriptive 2.2.4 Statistical Inference 2.3 Populations and samples 2.3.1 Statistical modelling, 2.3.2 Probability 2.3.3 Distribution 2.3.4 Correlation 2.3.5 Regression	10
3	INTRODUCTION TO MACHINE LEARNING 3.1 Basics of Machine Learning 3.2 Supervised Machine Learning 3.2.1 K- Nearest-Neighbours, 3.2.2 Naïve Bayes 3.2.3 Decision tree 3.2.4 Support Vector Machines	20

	3.3 Unsupervised Machine Learning 3.3.1 Cluster analysis 3.3.2 K means 3.3.3 EM Algorithm 3.3.4 Association Rule Mining 3.3.5 Apriori algorithms 3.4 Regression Analysis 3.4.1 Linear Regression 3.4.2 Nonlinear Regression	
4	DATA ANALYTICS WITH R/ WEKA MACHINE LEARNING 4.1 Introduction 4.2 Data Manipulation 4.3 Data Visualization 4.4 Data Analysis	13
Total		48

Reference Books:

1. SeemaAcharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015.
2. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
3. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012

S.Y.B.B.A.(C.A.) Semester – III

Course Code: CA-305 (Option)

Course Title : BlockChain

PREREQUISITES:

This course is highly technical in nature and would require the student to be comfortable with coding. To prepare for the class all students MUST:

- Understanding of basic programming language like Java, or Javascript.
- Understanding of PKI and Docker.

WHAT YOU'LL LEARN

- Understand what and why of Blockchain
- Explore the major components of Blockchain
- Learn about Bitcoin, Cryptocurrency, Ethereum
- Deploy and exercise example smart contracts
- Identify a use case for a Blockchain application
- Create your own Blockchain network application

COURSE OBJECTIVES

By the end of the course, students will be able to

1. Understand how blockchain systems (mainly Bitcoin and Ethereum) work,
2. To securely interact with them,
3. Design, build, and deploy smart contracts and distributed applications,
4. Integrate ideas from blockchain technology into their own projects.

Unit	Topic	No. of Lectures
1	Introduction To Blockchain 1.1 Digital Trust 1.2 Asset 1.3 Transactions 1.4 Distributed Ledger Technology 1.5 Types of network 1.6 Components of blockchain or DLT 1.7 Ledger 1.7.1. Blocks 1.7.2. Blockchain 1.8 PKI and Cryptography 1.8.1. Private keys 1.8.2. Public keys 1.8.3. Hashing 1.8.4. Digital Signature 1.9. Consensus	12

	<ul style="list-style-type: none"> 1.9.1. Byzantine Fault 1.9.2. Proof of Work 1.9.3. Poof of Stake 1.10. Security <ul style="list-style-type: none"> 1.10.1.DDos 1.11 Cryptocurrency 1.12.Digital Token 	
2.	How Blockchain Works <ul style="list-style-type: none"> 2.1 How Blockchain Works 2.2. Structure of Blockchain 2.3.Block 2.4. Hash 2.5. Blockchain 2.6. Distributed 2.7. Lifecycle of Blockchain 2.8. Smart Contract 2.9. Consensus Algorithm 2.10 Proof of Work 2.11 Proof of Stake 2.12 Practical Byzantine 2.13 Fault Tolerance 2.14 Actors of Blockchain 2.15 Blockchain developer 2.16 Blockchain operator 2.17 Blockchain regulator 2.18 Blockchain user 2.19 Membership service provider 2.20 Building A Small Blockchain Application 	12
3.	Introduction to Bitcoin <ul style="list-style-type: none"> 3.1 Currency 3.2 Double Spending 3.3 Cryptocurrency 3.4 P2P Payment Gateway 3.5 Wallet 3.6 Mining 	8
4.	Ethereum <ul style="list-style-type: none"> 4.1.Ethereum network 4.2. EVM 4.3.Transaction fee 4.4.Mist 4.5.Ether, gas 4.6.Solidity - Smart contracts 4.7.Truffle 4.8.Web3 4.9.Design and issue Cryptocurrency 4.10. Mining 	8

	4.11. DApps 4.12. DAO	
5	Introduction To Hyperledger Fabric V1.1 5.1. Introduction to Hyperledger 5.2 What is Hyperledger 5.3 Why Hyperledger 5.4 Where can Hyperledger be used 5.5 Hyperledger Architecture 5.6 Membership 5.7 Blockchain 5.8 Transaction 5.9 Chaincode 5.10 Hyperledger Fabric 5.11 Features of Hyperledger	8
Total		48

References:

Text Book

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder,
Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

Reference Books

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper. 2014.
4. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

SavitribaiPhule Pune University
Syllabus for BBA(CA) (CBCS 2019 Pattern)
Details for Skill Enhancement (Add-On) Courses

AECC - Course Title: - (M)Basic Course in Environmental Awareness
Credit -2 & Hours -30

Objectives:

- 1) To provide an opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment
- 2) To develop conscious towards a cleaner and better managed environment

Course content

1 Introduction - Environmental studies Definition, scope importance and need for public awareness. (Multidisciplinary nature of environmental studies)

2 Environmental Pollution -Definition, Causes, effects on human, water, soil, air (Mother Earth)

- Air pollution
- Water pollution
- Soil pollution
- Marine pollution
- Noise pollution
- Thermal pollution
- Nuclear hazards

3 Various Government initiatives for conservation of Environment. Controlling measures)

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution. Pollution case studies.
- Disaster management: floods, earthquake, cyclone and landslides.

4 Field work Visit / Project Report preparation

- Visit to a local area to document environmental assets - river / forest / grassland / hill / mountain.
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Effects on plants, insects, birds – As Elements of ecosystem

Evaluation of the course: Continuous evaluation of the student through oral, necessary writing assignments / Quiz and presentations.

Certification: A Course Completion Certificate will be provided by the college to every student who has passed in the continuous evaluation and the Grade as per his / her performance in the evaluation will appear on the Certificate.

OR – (Select Any One Course In Semester III – For BBA , BBA- IB , and BBA –CA)

**SavitribaiPhule Pune University
Syllabus for BBA (CA) (CBCS 2019 Pattern)
Details for Skill Enhancement (Add-On) Courses**

**AECC - Course Title: - (N)Advance Course in Environmental Awareness
Credit -2 & Hours -30**

Course Objectives

- Understand current concern about our impact on the environment.
- Recognize the things they do affect the environment.
- Promote green practices at home and at work.
- Describe what is being done and what we all can do to help prevent harm to the environment.

Course Contents

- **Environmental and Ecosystem Management:**

Concept and scope, Systems of approaches, Standards – International and National, Ecomark, Environmental accounting and auditing, Green funding and taxes, Trade and environmental management. Ecosystem analysis, Modelling, Monitoring and Planning, Ecotourism and Heritage management, Eco restoration,

- **Management of solid waste**

Different types of solid wastes, Methods of disposal and management of Municipal and thermal power plant generated solid wastes, Bio medical wastes and Hazardous wastes, Recycling of wastes, Power generation and waste minimization techniques.

Sanction and enforcement bodies of environmental laws in India.

Legal, administrative and constitutional provisions for environmental protection in India; Role of Supreme Court and Green Bench of High Court; Public awareness and Government measures; Role of Pressure Groups and NGOs; Concepts and Aspects of Public Interest Litigation (PIL); Public Interest Litigation in India on different Environmental Issues.

- **National and Regional Environmental Issues Resource and its conservation;**

Ecological refugees; Conservation strategies of the environment: Mines, riverine networks; forest, soil and wild life

Current Environmental Movements in India. Silent Valley, Chipko, Narmada dam, Appiko, TehriGarwal Dam, Uttara Kannada and Almatti dam movements.

- **Environmental Ethics and Global Imperatives.**

Concepts and aspects of Environmental ethics, Anthropocentrism and Eco-centrism; Deep ecology. Global environmental problems. Green house effect, global warming and climate change, ozone layer depletion, acid rain, deforestation and loss of biodiversity, unplanned urbanization.

Evaluation of the course: Continuous evaluation of the student through oral, necessary writing assignments/ Quiz and presentations.

Certification: A Course Completion Certificate will be provided by the college to every student who has passed in the continuous evaluation and the Grade as per his / her performance in the evaluation will appear on the Certificate.

S.Y.B.B.A.(C.A.) Semester –IV

Course Code: CA-401

Subject: Networking

Objectives:

1. To gain knowledge about Computer Networks concepts.
2. To know about working of networking models, addresses, transmission medias and connectivity devices.
3. To acquire information about network security and cryptography.

Unit	Topic	No. of Lectures
1	Introduction to Computer Network 1.1 Basics of Computer Network 1.1.1 Definition 1.1.2 Goals 1.1.3 Applications, 1.1.4 Network Hardware –Broadcast, Point to Point 1.1.5 Components of Data Communication 1.2 Network Topologies 1.2.1 Mesh 1.2.2 Star, 1.2.3 Bus, 1.2.4 Ring 1.3 Types of Networks 1.3.1 LAN, MAN, WAN, 1.3.2 Internetwork, 1.3.3 Wireless Network 1.4 Modes of Communication 1.4.1 Simplex, 1.4.2 Half Duplex, 1.4.3 Full Duplex 1.5. Server Based LANs & Peer-to-Peer LANs 1.6. Protocols and Standards 1.7. Network Software 1.7.1 Protocol Hierarchies, Layers, Peers, Interfaces 1.7.2 Design Issues of the Layers 1.7.3 Connection Oriented and Connectionless Service	10
2	Network Models 2.1 OSI Reference Model : Functions of each Layer 2.2 TCP/IP Reference Model, Comparison of OSI and TCP/IP	8

	<p>Reference Model</p> <p>2.3 TCP/IP Protocol Suite</p> <p>2.4 Addressing</p> <p> 2.4.1 Physical Addresses</p> <p> 2.4.2 Logical Addresses</p> <p> 2.4.3 Port Addresses,</p> <p> 2.4.4 Specific Addresses</p> <p>2.5 IP Addressing</p> <p> 2.5.1 Classful Addressing</p> <p> 2.5.2 Classless Addressing</p>	
3	<p>Transmission Media</p> <p>3.1 Introduction, Types of Transmission Media</p> <p>3.2 Guided Media:</p> <p> 3.2.1 Twisted Pair Cable- Physical Structure, Categories, Connectors & Applications</p> <p> 3.2.2 Coaxial Cable – Physical Structure, Standards, Connectors & Applications</p> <p> 3.2.3 Fiber Optic Cable- Physical Structure, Propagation Modes, Connectors & Applications</p> <p>3.3 Unguided Media:</p> <p> 3.3.1 Electromagnetic Spectrum for Wireless Communication</p> <p> 3.3.2 Propagation Modes Ground, Sky, Line-of-Sight</p> <p> 3.3.3 Wireless Transmission: Radio Waves, Microwaves, Infrared</p>	8
4	<p>Wired and Wireless LAN</p> <p>4.1 IEEE Standards</p> <p>4.2 Standard Ethernet MAC Sublayer, Physical Layer</p> <p>4.3 Fast Ethernet – Goals, MAC Sublayer, Topology, Implementation</p> <p>4.4 Gigabit Ethernet – Goals, MAC Sublayer, Topology, Implementation</p> <p>4.5 Ten-Gigabit Ethernet – Goals, MAC Sublayer, Physical Layer</p> <p>4.6 Backbone Networks - Bus Backbone, Star Backbone</p> <p>4.7 Virtual LANs Membership, IEEE standards advantages</p> <p>4.8 Wireless LAN</p> <p> 4.8.1 IEEE 802.11 Architecture,</p> <p> 4.8.2 Bluetooth Architecture (Piconet, Scatternet)</p>	8
5	<p>Network Devices</p> <p>5.1 Network Connectivity Devices</p> <p> 5.1.1 Active and Passive Hubs</p> <p> 5.1.2 Repeaters</p> <p> 5.1.3 Bridges- Types of Bridges</p> <p> 5.1.4 Switches</p> <p> 5.1.5 Router</p> <p> 5.1.6 Gateways</p>	6

6	Network Security 6.1 Introduction 6.2 Need for Security 6.3 Security Services : 6.3.1 Message- -Confidentiality, Integrity, Authentication, Non repudiation. 6.3.2 Entity (User)- Authentication. 6.4 Types of Attack 6.5 Cryptography, PlainText,Cipher Text, Encryption,Decryption, Symmetric Key and Asymmetric Key Cryptography 6.6 SubstitutionTechniques, Caesar Cipher,and Transposition Cipher (Problems should be covered.) 6.7 Firewalls- Packet Filter firewall, Proxy firewall 6.8 Steganography, Copyright	8
Total		48

Reference Books:

1. Computer Networks by Andrew Tanenbaum, Pearson Education.[4th Edition]
2. Data Communication and Networking by BehrouzForouzan, TATA McGraw Hill. .[4th Edition]

S.Y.B.B.A.(C.A.) Semester –IV

Course Code: CA-402

Subject: Object Oriented Concepts Through CPP

Objectives:

1. Acquire an understanding of basic object-oriented concepts and the issues involved in effective class design.
2. Enable students to write programs using C++ features like operator overloading, constructor and destructor, inheritance, polymorphism and exception handling.

Unit	Topic	No. of Lectures
1	Introduction to C++ 1.1 Basic concepts, features, advantages and applications of OOP 1.2 Introduction, applications and features of C++ 1.3 Input and Output operator in C++ 1.4 Simple C++ program	2
2	Beginning with C++ 2.1 Data type and Keywords 2.2 Declaration of variables, dynamic initialization of variables, reference variable 2.3 Operators: 2.3.1 Scope resolution operator 2.3.2 Memory management operators 2.4 Manipulators 2.5 Functions: 2.5.1 Function prototyping, call by reference and return by reference 2.5.2 Inline functions 2.6 Default arguments	6
3	Classes and Objects 3.1 Structure and class, Class, Object 3.2 Access specifiers, defining data member 3.3 Defining member functions inside and outside class definition. 3.4 Simple C++ program using class 3.5 Memory allocation for objects 3.6 Static data members and static member functions 3.7 Array of objects, objects as a function argument 3.8 Friend function and Friend class 3.9 Function returning objects	8
4	Constructors and Destructors 4.1 Constructors 4.2 Types of constructor : Default, Parameterized, Copy 4.3 Multiple constructors in a class 4.4 Constructors with default argument	6

	4.5 Dynamic initialization of constructor 4.6 Dynamic constructor 4.7 Destructor	
6	Inheritance 6.1 Introduction 6.2 Defining Base class and Derived class 6.3 Types of Inheritance 6.4 Virtual Base Class 6.5 Abstract class 6.6 Constructors in derived class	6
7	Polymorphism 7.1 Compile Time Polymorphism 7.1.1 Introduction, rules for overloading operators 7.1.2 Function overloading 7.1.3 Operator Overloading unary and binary 7.1.4 Operator Overloading using friend function 7.1.5 Overloading insertion and extraction operators 7.1.6 String manipulation using operator overloading 7.2 Runtime Polymorphism 7.2.1 this Pointer, pointers to objects, pointer to derived classes 7.2.2 Virtual functions and pure virtual functions	8
8	Managing console I/O operations 8.1 C++ streams and C++ stream classes 8.2 Unformatted I/O operations 8.3 Formatted console I/O operations 8.4 Output formatting using manipulators 8.5 User defined manipulators	3
9	Working with Files 9.1 Stream Classes for File operations 9.2 File operations - Opening, Closing and updating 9.3 File updating with random access. 9.4 Error handling during File operations 9.5 Command Line arguments	6
10	Templates 10.1 Introduction 10.2 Class Template and class template with multiple parameters 10.3 Function Template and function template with multiple parameter 10.4 Exception Handling Introduction	3
Total		48

Reference Books:

- 1) Object Oriented programming with C++ by E Balagurusamy
- 2) Object Oriented Programming with C++ by Robert Lafore
- 3) The Complete Reference C++ by Herbert Schildt
- 4)

S.Y.B.B.A.(C.A.) Semester-IV

Subject: Operating System

Course Code:CA-403

Objectives:

1. To know the services provided by Operating System
2. To know the scheduling concept
3. To understand design issues related to memory management and various related algorithms.
4. To understand design issues related to File management and various related algorithms

Unit	Topic	No. of Lectures
1	Introduction to Operating System 1.1 What is operating system 1.2 Computer system architecture 1.3 Services provided by OS 1.4 Types of OS 1.5 Operating System Structure – - Simple structure -Layered approach -Micro kernels -Modules 1.6 Virtual Machines – Introduction, Benefits	3
2	System Structure 2.1 User operating system Interface 2.2 System Calls– -Process or job control -Device Management - File Management 2.3 System Program 2.4 Operating System Structure	3
3	Process Management 3.1 Process Concept – - The process - Process states - Process control block 3.2 Process Scheduling – - Scheduling queues - Schedulers -Context Switch 3.3 Operation on Process – - Process Creation -Process Termination 3.4 Interprocess Communication –	4

	<ul style="list-style-type: none"> - Shared memory system - Message passing systems. 	
4	<p>CPU Scheduling</p> <p>4.1 What is scheduling</p> <p>4.2 Scheduling Concepts –</p> <ul style="list-style-type: none"> - CPU- I/O Burst Cycle - CPU Scheduler -Preemptive and Non-preemptive scheduling - Dispatcher <p>4.3 Scheduling criteria</p> <p>4.4 Scheduling Algorithms –</p> <ul style="list-style-type: none"> - FCFS - SJF (Preemptive& non-preemptive) - Priority Scheduling (Preemptive& Non- preemptive) - Round Robin Scheduling <ul style="list-style-type: none"> - Multilevel Queues - Multilevel Feedback queues 	6
5	<p>Process Synchronization</p> <p>5.1 Introduction</p> <p>5.2 Critical section problem</p> <p>5.3 Semaphores –</p> <ul style="list-style-type: none"> - Concept - Implementation - Deadlock & Starvation - Types of Semaphores <p>5.4 Classical Problems of synchronization –</p> <ul style="list-style-type: none"> -Bounded buffer problem - Readers & writers problem - Dining Philosophers problem 	6
6	<p>Deadlock</p> <p>6.1 Introduction</p> <p>6.2 Deadlock Characterization</p> <p>6.3 Necessary Condition</p> <p>6.4 Deadlock Handling Technique–</p> <ul style="list-style-type: none"> -Deadlock Prevention <ul style="list-style-type: none"> - Deadlock Avoidance – - Safe State - Resource allocation graph algorithm - Bankers algorithm <ul style="list-style-type: none"> - Deadlock Detection - Recovery from Deadlock – -Process Termination -Resource Preemption 	7

7	<p>Memory Management</p> <p>7.1. Background –</p> <ul style="list-style-type: none"> - Basic hardware - Address binding - Logical versus physical address space - Dynamic loading - Dynamic linking and shared libraries <p>7.2 Swapping</p> <p>7.3 Contiguous Memory Allocation –</p> <ul style="list-style-type: none"> - Memory mapping and protection - Memory allocation - Fragmentation <p>7.4 Paging –</p> <ul style="list-style-type: none"> - Basic Method - Hardware support - Protection - Shared Pages <p>7.5 Segmentation –</p> <ul style="list-style-type: none"> - Basic concept - Hardware <p>7.6 Virtual Memory Management –</p> <ul style="list-style-type: none"> - Background - Demand paging - Performance of demand paging - Page replacement – <ul style="list-style-type: none"> - FIFO - OPT - LRU - Second chance page replacement - MFU - LFU 	8
8	<p>File System</p> <p>8.1 Introduction & File concepts (file attributes, Operations on files)</p> <p>8.2 Access methods –</p> <ul style="list-style-type: none"> - Sequential access - Direct access <p>8.3 File structure –</p> <ul style="list-style-type: none"> - Allocation methods - Contiguous allocation - Linked Allocation - Indexed Allocation <p>8.4 Free Space Management –</p> <ul style="list-style-type: none"> - Bit Vector - Linked List - Grouping 	7

	- Counting	
9	I/O System 9.1 Introduction 9.2 I/O Hardware 9.3 Application of I/O Interface 9.4 Kernel I/O Subsystem 9.5 Disk Scheduling – - FCFS - Shortest Seek time first - SCAN - C- SCAN - C- Look	4
Total		48

Reference Books:

1. Operating System Concepts - Siberchatz, Galvin, Gagne (8th Edition).
2. Operating Systems : Principles and Design – Pabitra Pal Choudhary (PHI Learning Private Limited)

S.Y.B.B.A.(C.A.) Semester – IV

Course Code: CA- 404 (Option)

Course Title : Advance PHP

Objectives :-

1. To know & understand concepts of internet programming.
2. Understand how server-side programming works on the web.
3. Understanding How to use PHP Framework (Joomla / Druple)

Unit No	Topic	No. of Lectures
1	Introduction to Object Oriented Programming in PHP 1.1 Classes 1.2 Objects 1.3 Introspection 1.4 Serialization 1.5 Inheritance 1.6 Interfaces 1.7 Encapsulation	6
2	Web Techniques 2.1 Server information 2.2 Processing forms 2.3 Sticky forms 2.4 Setting response headers	4
3	XML 3.1 Introduction XML 3.2 XML document Structure 3.3 PHP and XML 3.4 XML parser 3.5 The document object model 3.6 The simple XML extension 3.7 Changing a value with simple XML	8
4	Ajax with PHP 4.1 Understanding java scripts for AJAX 4.2 AJAX web application model 4.3 AJAX –PHP framework 4.4 Performing AJAX validation 4.5 Handling XML data using php and AJAX 4.6 Connecting database using php and AJAX	6

5	Introduction to Web Services 5.1 Definition of web services 5.2 Basic operational model of web services, tools and technologies enabling web services 5.3 Benefits and challenges of using web services. 5.4 Web services Architecture and its characteristics 5.5 Core building blocks of web services 5.6 Standards and technologies available for implementing web services 5.7 Web services communication models 5.8 Basic steps of implementing web services.	10
6	PHP Framework (Joomla / Druple) 6.1 Introduction to Joomla/Druple 6.1.1 Introduction 6.1.2 Joomla/Druple features 6.1.3 How joomla/Drupleworks ? 6.1.4 The platformComponents, Modules and Plugins 6.2 Administering Joomla/Druple 6.2.1 Presentation Administration 6.2.2 Content Administration 6.2.3 System Administration 6.3 Working with Joomla/Druple 6.3.1 Adding articles 6.3.2 Adding menus to point to content 6.3.3 Installing new templates 6.3.4 Creating templates 6.3.5 Adding a Module and Component 6.3.6 Modifying the existing templates 6.3.7 Creating templates with web editors 6.3.8 Creating real templates	14

Reference Books

- Php: A Beginner's Guide 1st Edition McGraw-Hill Osborne Media; 1 edition by Vikram Vaswani
- Murach's PHP and MySQL (2nd Edition) by Joel Murach and Ray Harris
- PHP: The Complete Reference Paperback – 1 Jul 2017 by Steven Holzner (Author)
- Building Web Services with Java, 2nd Edition, S. Graham and others, Pearson Edn., 2008.
- Java Web Services, D.A. Chappell & T. Jewell, O'Reilly, SPD.
- www.php.net.in
- www.W3schools.com

S.Y.B.B.A.(C.A.) Semester – IV

Course Code: CA- 404(Optional)

Course Title : Node - JS

Objectives:

1. Understand the JavaScript and technical concepts behind Node JS
2. Structure a Node application in modules
3. Understand and use the Event Emitter
4. Understand Buffers, Streams, and Pipes
5. Build a Web Server in Node and understand how it really works
6. Connect to a SQL or Mongo database in Node

Pre-requisite / Target Audience:

- 1) Basic Knowledge of JavaScript and OOPS
- 2) Knowledge in async programming will be added advantage

Unit	Topics	No. of Lectures
1	Introduction to Node JS 1.1 Introduction 1.2 What is Node JS? 1.3 Advantages of Node JS 1.4 Traditional Web Server Model 1.5 Node.js Process Model 1.6 Install Node.js on Windows 1.7 Working in REPL	8
2	Node JS Modules 2.1 Functions 2.2 Buffer 2.3 Module 2.4 Module Types 2.5 Core Modules 2.6 Local Modules 2.7 Module.Exports	10
3	Node Package Manager 3.1 What is NPM ? 3.2 Installing Packages Locally 3.3 Adding dependency in package.json 3.4 Installing packages globally 3.5 Updating packages	6
4	Web server	

	4.1 Creating web server 4.2 Handling http requests 4.3 Sending requests	6
5	File System 5.1 Fs.readFile 5.2 Writing a File 5.3 Writing a file asynchronously 5.4 Opening a file 5.5 Deleting a file 5.6 Other IO Operations	8
6	Events 6.1 EventEmitter class 6.2 Returning event emitter 6.3 Inhering events	4
7	Database connectivity 7.1 Connection string 7.2 Configuring 7.3 Working with select command 7.4 Updating records 7.5 Deleting records	6
Total		48

Reference Books:

- 1) Node.js complete reference guid , velentinBojinov, David Herron, DiogeResende, packt Publishing ltd
- 2) Mastering Nod.js By SandroPasquali , packt Publishing
- 3) Smashing Node.js Javascript Everywhere , Guillermo Rauch, John wiley& Sons

Acknowledgement

The Syllabus Restructuring of BBA (CA) Programme (CBCS-2019 Pattern) is a manifestation of excellence in the faculty of Commerce and Management. Savitribai Phule Pune University's focus has always been in raising the academic standards and excellence in the field of education.

The BBA (CA) Programme predominantly endeavours for holistic development of students. It has emphasized on cultivating various skills and has also desired software technology acumen amongst the students.

This revision has been possible only with the help and support of different eminent personalities. The contribution of all the members as a team has enabled the robust revision of all the titles of the Programme. This synergy of the contributors is very crucial in fine tuning of the BBA(CA) Programme in its present form.

SPPU is grateful to Hon. Prof. Dr. Nitin Karmalkar, Vice Chancellor, Hon. Dr. N. S. Umarani, Pro-Vice Chancellor, who has always lent continuous support and encouraged everyone involved in this task of restructuring.

SPPU is also grateful to Hon. Dr. Parag Kalkar, Dean, Faculty of Commerce and Management and Dr. Yashodhan Mithare, Associate Dean, Faculty of Commerce and Management. They have been an inspiration for all the members to complete the work.

Dr. Tanuja Devi, on behalf of SPPU, headed the BBA(CA) Restructuring Committee. The technological aspect in the course content Dr. Ranjit Patil, Shakila Sishawantan, Prashant Mule, Shivendu Bhushan have contributed to a great extent. The team is thankful to Mrs. Leena Bhat, Mrs. Nimbalkar and Mrs. Priyanka Jain for assisting to all the members in framing the syllabus.

Savitribai Phule Pune University
Faculty of Commerce & Management
Structure for Three - Year
B.Com. Degree course (Choice Based Credit System)
(2019 Pattern)
With effect from June 2019

Preamble:-

Commerce education is that area of education, which develops the required knowledge, skills and attitudes for the handling of Trade, Commerce and Industry. Commerce education is entirely different from other disciplines. Hence, it must charter Course routes to service the aspirations of the nation. To meet the growing needs of the business society, there is greater demand for sound development of commerce education. The relevance of commerce education has become more imperative, this means a marked change in the way commerce and management education is perceived in India. The Commerce education is dedicated to developing tomorrow's leaders, managers, and professionals.

The existing education system of imparting commerce education needs to be more dynamic to incorporate all local and global changes in the field of trade and commerce. The curriculum needs to be restructured accordingly. The learning inputs are required to be more update, skill based and with appropriate applications. This will be achieved through the introduction of Choice based Credit System at undergraduate level.

The choice based credit system offers a cafeteria approach where the students have the liberty to choose courses of their own choice. The credit system allows students to opt for additional courses where he /she can score more than the required credits. The system will focus on student centric learning methods, which include use of Information and Communication Technology, innovative methods of teaching and learning and emphasis on industry interaction to enable the learners to take up professional challenges more effectively.

1. INTRODUCTION

The B.Com Degree Course (2019 pattern) will be introduced in the following order:-

- | | |
|-----------------------|-----------|
| a. First Year B.Com. | 2019-2020 |
| b. Second Year B.Com. | 2020-2021 |
| c. Third Year B.Com. | 2021-2022 |

The B.Com. Degree Course will consist of six semesters divided into three Years.

The first year (Semester I and II) choice based credit system examination will be held at the end of the each semester.

The Second Year (Semester III and IV) and Third Year (Semester V and VI) choice based credit system examination will be held at the end of each semester.

2. ELIGIBILITY

- a) No Candidates shall be admitted to the First Year of the B.Com. Degree Course (**2019 pattern**) unless he/she has passed the Higher Secondary School Certificate Examination of the Maharashtra State Board of Higher Secondary Education Board or equivalent or University with English as a passing Course.
- b) No candidate shall be admitted to the Third Semester examination of the second year unless he/ she has cleared first two semesters satisfactorily for the course at the college affiliated to this University.
- c) No candidate shall be admitted to the Third Year B.Com. (Fifth semester) Degree Course (**2019 pattern**) unless he/she has cleared all the papers of first and second semester Examination of F.Y. B.Com. and has satisfactorily kept terms for the second year (Third and Fourth Semester) and also fifth semester for the third year of B.Com) satisfactorily in a college affiliated to this University.

3. A.T.K.T. Rules :

- If a candidate fails in all the courses (subject heads) of passing of semester I shall be allowed to proceed semester II. However, a student who fails in four theory courses and two practical courses at semester I and II taken together may be admitted to semester III & IV.
- If a candidate fails in all the courses (subject heads) of passing of semester III shall be allowed to proceed to semester IV.
- If a candidate fails in all the courses (subject heads) of passing of semester V shall be allowed to proceed to semester VI. However, a student who fails in four theory courses and two practical courses at semester III and IV taken together may be admitted to semester V & VI.
- No candidate shall be allowed to proceed to semester V unless the candidate has cleared semester I & II in all courses (Subjects).
- ATKT rules are applicable for 2nd and 4th semester.

4. COURSES CARRYING PRACTICALS

- a) Each practical course will be of one credit.
- b) There will be practical and practical examination for semester I and II of the F.Y.B.Com. For the Course Financial Accounting.
- c) There will be practical and practical examinations for the special Courses (Discipline Special Elective) of S.Y.B.Com. (Semester III and IV) and of T.Y.B.Com. (Semester V & VI)
- d) There will be Practical for the S.Y.B.Com level Compulsory Course Business Communication (Semester III and IV) & for T.Y.B.Com Auditing and Taxation (Semester V) & (Semester VI)
- e) A Student must offer the same Special Course at T.Y.B.Com. (Semester V & VI) which he / she has offered at S.Y.B.Com. (Semester III and IV)
- f) In an exceptional case, a student may change the Course chosen by him at third and fourth semester of second year during the first semester of the third year provided he keeps the additional terms of the Course at S.Y.B.Com.

Course having practical examination:-

Semester	Type of Course	Name of Practical Course	Course Code
I	Core Course	Financial Accounting – I	PR - 112
II	Core Course	Financial Accounting – II	PR – 122
III	Core Course	Business Communication – I	PR - 231
III	Discipline Specific Elective	Special Course Paper (I) a) Business Administration b) Banking and Finance c) Business Law and practices d) Cooperation and Rural Development e) Cost and Works Accounting f) Business Statistics g) Business Entrepreneurship h) Marketing Management i) Agricultural and Industrial Economics j) Defence Budgeting, Finance and Management k) Insurance, Transport and Tourism l) Computer Programming and Application	PR- 236
IV	Core Course	Business Communication – II	PR- 241
IV	Discipline Specific Elective	Special Course Paper (I) a) Business Administration b) Banking and Finance c) Business Law and practices d) Cooperation and Rural Development e) Cost and Works Accounting f) Business Statistics	PR- 246

		<ul style="list-style-type: none"> g) Business Entrepreneurship h) Marketing Management i) Agricultural and Industrial Economics j) Defence Budgeting, Finance and Management k) Insurance, Transport and Tourism l) Computer Programming and Application 	
V	Core Course	Auditing & Taxation – I	PR- 354
V	Discipline Specific Elective	<p style="text-align: center;">Special Course Paper (II)</p> <ul style="list-style-type: none"> a) Business Administration b) Banking and Finance c) Business Law and practices d) Cooperation and Rural Development e) Cost and Works Accounting f) Business Statistics g) Business Entrepreneurship h) Marketing Management i) Agricultural and Industrial Economics j) Defence Budgeting, Finance and Management k) Insurance, Transport and Tourism l) Computer Programming and Application 	PR- 355
V	Discipline Specific Elective	<p style="text-align: center;">Special Course Paper (III)</p> <ul style="list-style-type: none"> a) Business Administration b) Banking and Finance c) Business Law and practices d) Cooperation and Rural Development e) Cost and Works Accounting f) Business Statistics g) Business Entrepreneurship h) Marketing Management i) Agricultural and Industrial Economics j) Defence Budgeting, Finance and Management k) Insurance, Transport and Tourism l) Computer Programming and Application 	PR- 356
VI	Core Course	Auditing & Taxation – II	PR- 364
VI	Discipline Specific Elective	<p style="text-align: center;">Special Course Paper (II)</p> <ul style="list-style-type: none"> a) Business Administration b) Banking and Finance c) Business Law and practices d) Cooperation and Rural Development 	PR- 365

		e) Cost and Works Accounting f) Business Statistics g) Business Entrepreneurship h) Marketing Management i) Agricultural and Industrial Economics j) Defence Budgeting, Finance and Management k) Insurance, Transport and Tourism l) Computer Programming and Application	
VI	Discipline Specific Elective	Special Course Paper (III) a) Business Administration b) Banking and Finance c) Business Law and practices d) Cooperation and Rural Development e) Cost and Works Accounting f) Business Statistics g) Business Entrepreneurship h) Marketing Management i) Agricultural and Industrial Economics j) Defence Budgeting, Finance and Management k) Insurance, Transport and Tourism l) Computer Programming and Application	PR- 366

5. MEDIUM OF INSTRUCTION

The medium of instruction for B.Com. Degree course shall be either Marathi or English except languages. The Medium of instructions for Business Communication (S.Y.B.Com) shall be English only.

6. UNIVERSITY TERMS

The dates for the commencement and conclusion of the first and the second terms shall be as determined by the University Authorities. Only duly admitted students can keep the terms. The present relevant ordinances pertaining to grant of terms will be applicable.

7. VERIFICATION AND REVALUATION

The candidate may apply for verification and revaluation or result through Principal of the College which will be done by the University as per ordinance framed in that behalf.

8. RESTRUCTURING OF COURSES

This revised course structure shall be made applicable to the colleges implementing 'Restructured Programme at the undergraduate level from June, 2019. The Colleges under the Restructured Programme which has revised their structure in the light of the "2019 Pattern" shall be introduced with effect from academic year 2019-20.

9. STANDARD OF PASSING.

A candidate is required to obtain 40% marks in Internal Assessment, Practical Examination and Semester End University Examination.

It means that passing separately at internal assessment, practical examination and semester end university examination is compulsory.

10. METHODS OF EVALUATION, PASSING, AND EVALUATION CRITERIA:-

The evaluation of students will be done on three parameters:-

- a. Internal assessment
- b. Practical Examination (list of Courses having practical is given in note No. 4)
- c. University examination

For university examination, question papers will be set for seventy marks (three hours duration)

Evaluation will be done on a continuous basis, three times during each semester. Internal assessment will be of 30 marks. The colleges need to adopt any three out of the following methods for internal assessment:-

- a. Written examination
- b. Quiz
- c. Presentations
- d. Projects
- e. Assignments
- f. Tutorials
- g. Oral examination

11. STRUCTURE OF TRANSCRIPT:

Conversion of percentage into credit(s) and grade(s): The following illustrations could be taken as an example for computing SGPA and CGPA from percentage to credits for Honours courses in all disciplines, degree Program courses in Science subjects and degree Program courses in Humanities, Social Sciences and Commerce subjects:

1. Percentage to Grades and Grade Points

The following formula may be used to convert marks (%) into letter grades.

Let \bar{X} = mean of % age marks of all student appeared in the paper.

σ = Standard deviation

m = % of marks obtained

Letter grade	Numerical grade	Formula
O (outstanding)	10	$m \geq \bar{X} + 2.5 \sigma$
A+ (Excellent)	9	$\bar{X} + 2.0 \sigma \leq m < \bar{X} + 2.5 \sigma$
A (Very Good)	8	$\bar{X} + 1.5 \sigma \leq m < \bar{X} + 2.0 \sigma$
B+ (Good)	7	$\bar{X} + 1.0 \sigma \leq m < \bar{X} + 1.5 \sigma$
B (Above average)	6	$\bar{X} \leq m < \bar{X} + \sigma$
C (Average)	5	$\bar{X} - 0.5 \sigma \leq m < \bar{X}$
D (Pass)	4	$\bar{X} - \sigma \leq m < \bar{X} - 0.5 \sigma$
F (Fail)	0	$m < \bar{X} - \sigma$
Ab (Absent)	0	

* Minor variations may be adjusted by the individual institution.

- 1 A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.
- 2 For non credit courses 'Satisfactory' or 'Unsatisfactory' shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.
- 3 The Universities can decide on the grade or percentage of marks required to pass in a course and also the CGPA required to qualify for a degree taking into consideration the recommendations of the statutory professional councils such as AICTE, MCI, BCI, NCTE etc.,
- 4 The statutory requirement for eligibility to enter as assistant professor in colleges and universities in the disciplines of arts, science, commerce etc., is a minimum average mark of 50% and 55% in relevant postgraduate degree respectively for reserved and general category. Hence, it is recommended that the cut-off marks for grade B shall not be less than 50% and

12. RESTRUCTURING OF COURSES – EQUIVALENCE AND TRANSITORY PROVISION:

The University will conduct examination of old course (2013 Pattern) for next three academic years from the date of implementation of course.

The candidate of old course will be given three chances to clear his/her Courses as per the old course (2013 Pattern) and thereafter he/she will have to appear for the Courses as per the equivalence given to old course (2013 Pattern).

13. SCHEMES OF CREDITS –

Total credits for three year integrated B.Com. Course is as follows:-

Sr. No.	Semester No	No. of courses	Lecture Hours	Credit per course	Credit for practical courses	Add on course credit (*)	Lectures + Practical + add on courses= Total Credits
1	I	7	48	3	1	1	21 +2 =23
2	II	7	48	3	1	1	21 +2 =23
3	III	6	48	3	2	0	18+2 =20
4	IV	6	48	3	2	2	18+2+2 =22
5	V	6	48	3	3	0	18+3=21
6	VI	6	48	3	3	2	18+3+2 =23
Total No. of credits							132

Suggested Add On courses (*)

Sr. No.	Add on course	Class	Semester	Credit
1.	Value added course - I	F.Y.B.Com.	I	1
2.	Value added course – II	F.Y.B.Com.	II	1
3.	Environment Awareness	S.Y.B.Com.	IV	2
4.	Specific Add - on Course related to specialized Course/ Internship	T.Y.B.Com.	VI	2
Total				6

**Revised structure of Choice Based Credit System Course
First Year B. Com. Semester – I w.e.f. 2019- 20**

Course No.	Course / Title of Paper	Course	No. of lectures (Per Week)	No of Credits	Internal Assessment	University Assessment		Total Marks	Duration of Theory Examination
						Univ. Exam	Practical Exam		
111	Compulsory English- I	Ability Enhancement Compulsory Course	4	3	30	70	--	100	3 Hours
112	Financial Accounting - I	Core Course	4	4	30	50	20	100	3 Hours
113	Business Economics- I	Core Course	4	3	30	70	--	100	3 Hours
114 (A)	Business Mathematics and Statistics - I	Core Course	4	3	30	70	--	100	3 Hours
114 (B)	Computer Concepts and Application- I								
115	Optional Group. (A) (Any one of the Following) a) Organization Skill Development b) Banking and finance c) Commercial Geography d) Defence Organization and Management in India e) Cooperation f) Managerial Economics	Generic Elective Course	4	3	30	70	--	100	3 Hours

Course No.	Course / Title of Paper	Course	No. of lectures (Per Week)	No of Credits	Internal Assessment	University Assessment		Total Marks	Duration of Theory Examination
						Univ. Exam	Practical Exam		
116	Optional Group. (B) (Any one of the Following) a) Essentials of E-Commerce b) Insurance & Transport c) Marketing & Salesmanship d) Consumer Protection and Business Ethics e) Business Environment & Entrepreneurship f) Foundation Course in Commerce	Generic Elective Course	4	3 -	30	70	--	100	3 Hours
117	Any one of the following Language Additional English/ Marathi/ Hindi/ Gujarati/ Sindhi/ Persian/ Urdu/ French/ German / Sanskrit / Arabic	Ability Enhancement Course	4	3	30	70	--	100	3 Hours

First Year B. Com. Structure of the Syllabus w.e.f. 2019- 20

Semester – II

Course No.	Course / Title of Paper	Course	No. of lectures (Per Week)	No. of Credits	Internal Assessment	University Assessment		Total Marks	Duration of Theory Examination
						Univ. Exam	Practical Exam		
121	Compulsory English- II	Ability Enhancement Compulsory Course	4	3	30	70	--	100	3 Hours
122	Financial Accounting - II	Core Course	4	4	30	50	20	100	3 Hours
123	Business Economics- II	Core Course	4	3	30	70	--	100	3 Hours
124(A)	Business Mathematics and Statistics - II	Core Course	4	3	30	70	--	100	3 Hours
124(B)	OR Computer Concepts and Application- II								
125	Optional Group. – (A) (Any one of the Following) a) Organization Skill Development b) Banking and finance c) Commercial Geography d) Defence Organization and Management in India e) Cooperation f) Managerial Economics	Generic Elective Course	4	3	30	70	--	100	3 Hours

Course No.	Course / Title of Paper	Course	No. of lectures (Per Week)	No. of Credits	Internal Assessment	University Assessment		Total Marks	Duration of Theory Examination
						Univ. Exam.	Practical Exam.		
126	Optional Group. (B) (Any one of the Following) a) Essentials of E- Commerce b) Insurance & Transport c) Marketing & Salesmanship d) Consumer Protection and Business Ethics e) Business Environment & Entrepreneurship f) Foundation Course in Commerce	Generic Elective Course	4	3	30	70	--	100	3 Hours
127	Any one of the following Language- II Additional English/ Marathi/ Hindi/ Gujarati/ Sindhi/ Persian/ Urdu/ French/ German / Sanskrit / Arabic	Ability Enhancement Course	4	3	30	70	--	100	3 Hours

Second Year B. Com. w.e.f. 2020- 21.

Semester – III

Course No.	Course / Title of Paper	Course	No. of lectures (Per Week)	Total No. of Credits	Internal Assessment	University Assessment		Total Marks	Duration of Theory Examination
						Univ. Exam	Practical Exam		
231	Business Communication- I	Core Course	4	4	30	50	20	100	3 Hours
232	Corporate Accounting- I	Core Course	4	3	30	70	--	100	3 Hours
233	Business Economics - I (Macro)	Core Course	4	3	30	70	--	100	3 Hours
234	Business Management - I	Core Course	4	3	30	70	--	100	3 Hours
235	Elements of Company Law- I	Core Course	4	3	30	70	--	100	3 Hours
236	Special Course Paper- I (Any One) a) Business Administration b) Banking and Finance c) Business Law and practices d) Cooperation and Rural Development e) Cost and Works Accounting f) Business Statistics g) Business Entrepreneurship h) Marketing Management i) Agricultural and Industrial Economics j) Defence Budgeting, Finance and Management k) Insurance, Transport and Tourism l) Computer Programming and Application	Discipline Special Elective	4	4	30	50	20	100	3 Hours

Second Year B. Com. w.e.f. 2020- 21

Semester – IV

Course No.	Course / Title of Paper	Course	No. of lectures (Per Week)	Total No. of Credits	Internal Assessment	University Assessment		Total Marks	Duration of Theory Examination
						Univ. Exam	Practical Exam		
241	Business Communication- II	Core Course	4	4	30	50	20	100	3 Hours
242	Corporate Accounting- II	Core Course	4	3	30	70	--	100	3 Hours
243	Business Economics – II (Macro)	Core Course	4	3	30	70	--	100	3 Hours
244	Business Management - II	Core Course	4	3	30	70	--	100	3 Hours
245	Elements of Company Law- II	Core Course	4	3	30	70	--	100	3 Hours
246	Special Course Paper- I (Any One) a) Business Administration b) Banking and Finance c) Business Law and practices d) Cooperation and Rural Development e) Cost and Works Accounting f) Business Statistics g) Business Entrepreneurship h) Marketing Management i) Agricultural and Industrial Economics j) Defence Budgeting, Finance and Management k) Insurance, Transport and Tourism l) Computer Programming and Application	Discipline Special Elective	4	4	30	50	20	100	3 Hours

Third Year B. Com. w.e.f. 2021- 22
Semester – V

Course No.	Course / Title of Paper	Course	No. of lectures (Per Week)	No. of Credits	Internal Assessment	University Assessment		Total Marks	Duration of Theory Examination
						Univ. Exam	Practical Exam		
351	Business Regulatory Framework - I	Core Course	4	3	30	70	--	100	3 Hours
352	Advanced Accounting - I	Core Course	4	3	30	70	--	100	3 Hours
353	Indian and Global Economic Development - I Or International Economics - I	Core Course	4	3	30	70	--	100	3 Hours
354	Auditing & Taxation - I	Core Course	4	4	30	50	20	100	3 Hours
355	Special Course Paper – II (Same Special Course Offered at S.Y.B.Com) a) Business Administration b) Banking and Finance c) Business Law and practices d) Cooperation and Rural Development e) Cost and Works Accounting f) Business Statistics g) Business Entrepreneurship h) Marketing Management i) Agricultural and Industrial Economics j) Defence Budgeting, Finance and Management k) Insurance, Transport and Tourism l) Computer Programming and Application	Discipline Specific Elective	4	4	30	50	20	100	3 Hours

Course No.	Course / Title of Paper	Course	No. of lectures (Per Week)	No. of Credits	Internal Assessment	University Assessment		Total Marks	Duration of Theory Examination
						Univ. Exam	Practical Exam		
356	Special Course Paper – III (Same Special Course Offered at S.Y.B.Com) a) Business Administration b) Banking and Finance c) Business Law and practices d) Cooperation and Rural Development e) Cost and Works Accounting f) Business Statistics g) Business Entrepreneurship h) Marketing Management i) Agricultural and Industrial Economics j) Defence Budgeting, Finance and Management k) Insurance, Transport and Tourism l) Computer Programming and Application	Discipline Specific Elective	4	4	30	50	20	100	3 Hours

Third Year B. Com. w.e.f. 2021- 22

Semester – VI

Course No.	Course / Title of Paper	Course	No. of lectures (Per Week)	No. of Credits	Internal Assessment	University Assessment		Total Marks	Duration of Theory Examination
						Univ. Exam	Practical Exam		
361	Business Regulatory Framework - II	Core Course	4	3	30	70	--	100	3 Hours
362	Advanced Accounting - II	Core Course	4	3	30	70	--	100	3 Hours
363	Indian and Global Economic Development - II Or International Economics - II	Core Course	4	3	30	70	--	100	3 Hours
364	Auditing & Taxation - II	Core Course	4	4	30	50	20	100	3 Hours
365	Special Course Paper – II (Same Special Course Offered at S.Y.B.Com) a) Business Administration b) Banking and Finance c) Business Law and practices d) Cooperation and Rural Development e) Cost and Works Accounting f) Business Statistics g) Business Entrepreneurship h) Marketing Management i) Agricultural and Industrial Economics j) Defence Budgeting, Finance and Management k) Insurance, Transport and Tourism l) Computer Programming and Application	Discipline Specific Elective	4	4	30	50	20	100	3 Hours

Course No.	Course / Title of Paper	Course	No. of lectures (Per Week)	No. of Credits	Internal Assessment	University Assessment		Total Marks	Duration of Theory Examination
						Univ. Exam	Practical Exam		
366	Special Course Paper – III (Same Special Course Offered at S.Y.B.Com) a) Business Administration b) Banking and Finance c) Business Law and practices d) Cooperation and Rural Development e) Cost and Works Accounting f) Business Statistics g) Business Entrepreneurship h) Marketing Management i) Agricultural and Industrial Economics j) Defence Budgeting, Finance and Management k) Insurance, Transport and Tourism l) Computer Programming and Application	Discipline Specific Elective	4	4	30	50	20	100	3 Hours

Revised syllabi (2019Pattern) for three years F.Y. B. Com. Degree course (CBCS)

Semester: I
Financial Accounting- I

Course Code - 112

No. of Credits :- 03 and for practical – 01

Objective of the Course:-

1. To impart knowledge of basic accounting concepts
2. To create awareness about application of these concepts in business world
3. To impart skills regarding Computerised Accounting
4. To impart knowledge regarding finalization of accounts of various establishments.

Unit No.	Unit Title	Contents	Purposed Skills to be developed
1	Accounting Concepts, Conventions and Principles and an overview of Emerging Trends in Accounting	<p>(A) Accounting Concepts, Conventions and Principles</p> <ol style="list-style-type: none">1. Money Measurement2. Business Entity3. Dual Aspect4. Periodicity Concept5. Realization Concept6. Matching Concept7. Accrual / Cash Concept8. Consistency Concept9. Conservatism Principle10. Materiality Concept11. Going Concern Concept12. Historical Cost Concept <p>(B) Emerging Trends in Accounting</p>	<ul style="list-style-type: none">• Knowledge about various accounting Concepts, Conventions and Principles.• Understanding emerging trends in accounting and its effect on accounting Practices.

		<ol style="list-style-type: none"> 1. Inflation Accounting 2. Creative Accounting 3. Environmental Accounting 4. Human Resource Accounting 5. Forensic Accounting 	
2	Piecemeal Distribution of Cash	<ol style="list-style-type: none"> 1. Surplus Capital Method only, Asset taken over by a partner, 2. Treatment of past profits or past losses in the Balance sheet, 3. Contingent liabilities 4. Realization expenses/amount kept aside for expenses 5. adjustment of actual, Treatment of secured liabilities, 6. Treatment of preferential liabilities like Govt. dues/labour dues etc., Excluding: Insolvency of partner and Maximum Loss Method. 	<ul style="list-style-type: none"> • Knowledge about process of dissolution of partnership firm.
3	Accounts from Incomplete Records (Single Entry System)	<ol style="list-style-type: none"> 1. Meaning of single entry system 2. Features of Single Entry System 3. Conversion of Single Entry into Double Entry 	<ul style="list-style-type: none"> • Knowledge about single entry systems. • Purpose and advantages of double entry system • Process of conversion of single entry into double entry system.
4	Introduction to Goods and Services Tax laws and Accounting	<ol style="list-style-type: none"> 1. Constitutional Background of GST, Concepts and definition of GST. 2. IGST, CGST and SGST 3. Input and Output Tax credit 4. Procedure for registration under GST 	<ul style="list-style-type: none"> • Knowledge about conceptual framework of the GST • Knowledge about various components of GST. • Types of taxes under GST • Registration process under GST for business establishments.

Practical for Semester– I

Topic	Mode of Practical
Constitutional Background of GST, Concepts and Implications of GST.	Library Assignment
IGST, CGST and SGST	Guest Lecture
Procedure for registration under GST	Visit to a business establishment
Input and Output Tax credit	PowerPoint Presentation

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	PowerPoint Presentations	Videos available on YouTube	Library assignment on Types of accounting principles and conventions with its usage and emerging trends in accounting	Students will be able to acquire in-depth knowledge
2	12	Group Activity	Videos available on YouTube	--	Students will be able to acquire in-depth knowledge
3	12	PowerPoint Presentations	Videos available on YouTube	Group activity of conversion of single entry into double entry system	Students will be able to understand the process and importance of conversion of single entry into double entry system
4	12	Visit and interview	Videos available on YouTube	Compilation of information about the contents in the syllabus in a journal	Students will gain knowledge about GST and its implications.

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Advanced Accounts	M.C. Shukla, T.S. Grewal, S.C. Gupta	S. Chand Publication	New Delhi.
2.	Financial Accounting for B.Com	CA (Dr.) P.C. Tulsian S.C. Gupta	S. Chand Publication	New Delhi.
3.	Introduction to Accountancy	S.R.N Pillai & Bhagavathi	S.Chand & CompanyLtd	New Delhi
4.	Corporate Accounting	Raj Kumar Sah	Cengage Publications	Noida, Uttar Pradesh
5.	Advanced Accounting	S. N. Maheshwari		
6.	GST Law and Analysis with Conceptual Procedures	Bimal Jain and Isha Bansal (Set of 4 Volumes)	Pooja Law Publishing Company	New Delhi
7.	Guidance Note on GST by ICAI	--	The Institute of Chartered Accountants of India	New Delhi

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**Semester-I
Business Economics (Micro) - I**

Course Code - 113

No. of Credits :- 03

Objectives of the course:-

1. To impart knowledge of business economics
2. To clarify micro economic concepts
3. To analyze and interpret charts and graphs
4. To understand basic theories, concepts of micro economics and their application

Unit No.	Unit Title	Contents	Purpose & skills to be developed
1	Introduction and Basic Concepts	1.1 Meaning, Nature, Scope and Importance of Business Economics 1.2 Concept of Micro and Macro Economics 1.3 Tools for Economic Analysis- Functional Relationship, Schedules, Graphs and Equations 1.4 Basic Concepts: Household, Consumer, Firm, Plant and Industry 1.5 Goals of Firms- Economic and Non-Economic	<ul style="list-style-type: none"> • To make the students aware of concepts in micro economics • To help the students understand the difference between micro and macro economics • To make the students understand economic and non-economic goals of firms. <p>Skills : Analyze and think critically, develop writing skills</p>
2	Consumer Behavior	Utility: Concept and Types 2.2 Cardinal Approach: Law of Diminishing Marginal Utility and Law of Equi Marginal Utility 2.3 Consumer Surplus: Concept and Measurement 2.4 Ordinal Approach: Indifference curve	<ul style="list-style-type: none"> • To help the students understand the concept of utility • To impart knowledge of cardinal and ordinal approach • To make them understand the concept of consumer surplus <p>Skills: Understanding complex theories and concepts Geometrical skills, mathematical aptitude, writing skills</p>

		Analysis- Concept, Characteristics, Consumer Equilibrium	
3.	Demand and Supply Analysis	<p>3.1 Concept of Demand</p> <p>3.2 Determinants of Demand</p> <p>3.3 Law of Demand</p> <p>3.4 Elasticity of Demand</p> <p>3.4.1 Price Elasticity of Demand - Meaning, Types, Measurement, Uses and Significance</p> <p>3.4.2 Income Elasticity of Demand-Meaning and Types</p> <p>3.4.3 Cross Elasticity of Demand-Meaning and Types</p> <p>3.5 Supply : Concept, Determinants and Law of Supply</p> <p>3.6 Equilibrium of Demand and Supply for Price Determination</p>	<ul style="list-style-type: none"> • To understand the concept of demand and elasticity of demand • To impart knowledge of law of supply and the determinants of law of supply • To help the students understand price determination in varied demand and supply condition <p>Skills imparted: Applying mathematical and statistical analysis methods extracting information, drawing conclusions</p>
4.	Production Analysis	<p>4.1 Concept of Production Function</p> <p>4.2 Total, Average and Marginal Production</p> <p>4.3 Law of Variable Proportions</p> <p>4.4 Law of Returns to Scale</p> <p>4.5 Economies and Diseconomies of Scale- Internal and External</p>	<ul style="list-style-type: none"> • To help the students understand the relation between revenue concepts • To understand theories of production function • To make students know about economies and diseconomies of scale <p>Skills: Interpret economic theories, writing skills, understand charts and graphs.</p>

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	<ul style="list-style-type: none"> • Open book discussion • Case studies • Problem solving based learning 	You tube lectures on micro and macro economics	<ul style="list-style-type: none"> • Functional relations • Goals of firms 	<ul style="list-style-type: none"> • Students will understand basic concepts of micro economics, • Will be able to analyze and interpret
1.	12	<ul style="list-style-type: none"> • Digital lectures • Jigsaw reading 	You tube lectures	Types of utility	<ul style="list-style-type: none"> • Will know cardinal and ordinal approach • Will understand the concept of consumer surplus
2.	12	<ul style="list-style-type: none"> • Game oriented classes • Pair learning • Group discussion 	<ul style="list-style-type: none"> • Films • You tube lectures 	Type of goods and elasticity of demand	<ul style="list-style-type: none"> • Will understand the concept of demand and elasticity of demand • Will understand the concept of supply • Able to interpret equilibrium in the market
3.	12.	<ul style="list-style-type: none"> • Group discussion • Teacher driven power point presentation • Games and simulation 	<ul style="list-style-type: none"> • You tube lectures • Online PPTs 	Effect of economies of scale on industries (with example of an industry)	<ul style="list-style-type: none"> • Will understand revenue concept • Will know economies and diseconomies of scale

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Microeconomics	B. Douglas Bernheim and Michael D. Whinston	Tata McGraw Hill	New York
2	Microeconomics	Pindyck, R.S. and D.L. Rubinfeld	Pearson Education	London

3	Principles of Economics	Stiglitz, J.E. and C.E. Walsh	Oxford Univ. Press	United Kingdom
4	Microeconomics: Theory and Applications	Salvatore, D.L	Oxford Univ. Press	United Kingdom
5	Intermediate Microeconomics: A Modern Approach	Varian, H.R.,	W.W. Norton	United Kingdom, United states
6	Microeconomic Theory,	Sen, Anindya	Oxford Univ. Press	United Kingdom
7	Modern Microeconomics	Koutsoyiannis, A	MacMillan Press	India
8	Principles of Microeconomics	H.L. Ahuja	S. Chand	New Delhi

Suggested references

Web reference

Sr. no	Lectures	Films	Animation	PPTs	Articles
1.	https://mitpress.mit.edu/books/lectures-microeconomics	https://www.economicsnetwork.ac.uk/teaching/Video%20and%20Audio%20Lectures/Principles%20of%20Microeconomics	https://www.youtube.com/redirect?q=http%3A%2F%2Fwww.thateconstutor.com&v=Zre4tp90Aog&redir_token=6U11cd7zsOZt8fGKACK3B5JHJNh8MTU1NzkyNzkzMUAxNTU3ODQxNTMx&event=video_description	https://ctaar.rutgers.edu/gag/ppc2_files/ppc2.ppt	http://scholar.google.co.in/scholar?q=articles+on+microeconomics&hl=en&as_sdt=0&as_vis=1&oi=scholar
2.	https://www.amazon.com/Lectures-Microeconomics-Questions-Approach-Press/dp/0262038188	https://nptel.ac.in/courses/109104125/	https://www.youtube.com/watch?v=ewPNugIqCUM	https://www.slideshare.net/tribhuwan64/presentation-on-importance-of-microeconomics	http://theconversation.com/global/topics/microeconomics-3328

Revised syllabi (2019Pattern) for three years F.Y. B. Com. Degree course (CBCS)

Semester: I

Business Mathematics & Statistics- I

Course Code – 114 (A)

No. of Credits :- 03

Objective of the Program

1. To introduce the basic concepts in Finance and Business Mathematics and Statistics
2. To familiar the students with applications of Statistics and Mathematics in Business
3. To acquaint students with some basic concepts in Statistics.
4. To learn some elementary statistical methods for analysis of data.
5. The main outcome of this course is that the students are able to analyze the data by using some elementary statistical methods

Unit No.	Unit Title	Contents	Purpose/Skills to be developed
1	Interest and Annuity	<p>Interest: Concept of Present value and Future value, Simple interest, Compound interest, Nominal and Effective rate of interest, Examples and Problems</p> <p>Annuity: Ordinary Annuity, Sinking Fund, Annuity due, Present Value and Future Value of Annuity, Equated Monthly Installments (EMI) by Interest of Reducing Balance and Flat Interest methods, Examples and Problems.</p>	<ol style="list-style-type: none"> 1. To understand the concept of Simple interest, compound interest, effect of compounding. 2. To understand the concept of Annuity and its applications for EMIs and Amortization Schedule.
2	Shares and Mutual Funds	<p>Shares: Concept of share, face value, market value, dividend, brokerage, equity shares, preferential shares, bonus shares. Examples and Problems</p> <p>Mutual Funds: Concept of Mutual Funds, Problems on calculation of Net Income after considering entry load, Dividend, Change in Net Asset Value (NAV) and exit load. Averaging of price under the Systematic Investment Plan (S.I.P.). Examples and Problems</p>	<ol style="list-style-type: none"> 1. To understand the concept of shares and mutual funds. 2. To understand contribution of shares and mutual funds in systematic investment plans 3. To solve problems related to shares and mutual funds
3	Population and Sample	<p>Definition of Statistics, Scope of Statistics in Economics, Management Science and Industry. Concept of population and sample, methods of data collection: Census and sampling with illustration. Methods of random sampling – SRSWR, SRSWOR, Stratified, Systematic (Description of sampling procedures only).</p>	<ol style="list-style-type: none"> 1. Collection of data 2. Analyzing and interpreting data. 3. Knowing different method of sampling

4	Measures of Central Tendency and Measures of Dispersion	<p>Frequency distribution: Raw data, attributes and variables, Classification of data, frequency distribution, cumulative frequency distribution, Histogram and ogive curves.</p> <p>Requisites of ideal measures of central tendency, Arithmetic Mean, Median and Mode for ungrouped and grouped data. Combined mean, Merits and demerits of measures of central tendency, Geometric mean: definition, merits and demerits, Harmonic mean: definition, merits and demerits, Choice of A.M., G.M. and H.M.</p> <p>Concept of dispersion, Measures of dispersion: Range, Variance, Standard deviation (SD) for grouped and ungrouped data, combined SD, Measures of relative dispersion: Coefficient of range, coefficient of variation. Examples and problems.</p>	<ol style="list-style-type: none"> 1. To classify and represent data in tabular and graphical form. 2. To compute various measures of central tendency and measures of dispersion.
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Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Expected Outcome
1	16	ICT	Students will be able to apply concepts of interests and annuities to calculate EMI, prepare amortization schedule, calculate insurance premiums etc
2	8	ICT	Students will be able calculate dividend, brokerage on shares and mutual funds. Also students will be able to identify the contribution of shares and mutual funds in systematic investment plans and to select best investment options
3	8	ICT	Students will be able to recognize and classify different types of data. Students will be able to take a sample of appropriate size using suitable method of sampling.
4	16	ICT	Students will be able to calculate measures of central tendency and measures of dispersion. Students will be able to use appropriate measure of central tendency or measure of dispersion for given data to given problems from business or economics.

References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Practical Business Mathematics	S. A. Bari	New Literature Publishing Company	New Delhi
2	Mathematics for Commerce	K. Selvakumar	Notion Press	Chennai
3	Business Mathematics with Applications	Dinesh Khattar & S. R. Arora	S. Chand Publishing	New Delhi
4	Business Mathematics and Statistics	N.G. Das & Dr. J.K. Das	McFraw Hill	New Delhi
5	Fundamentals of Business Mathematics	M. K. Bhowal	Asian Books Pvt. Ltd	New Delhi
6	Operations Research	P. K. Gupta & D. S. Hira	S. Chand Publishing	New Delhi
7	Mathematics for Economics and Finance: Methods and Modeling	Martin Anthony and Norman Biggs	Cambridge University Press	Cambridge
8	Financial Mathematics and Its Applications	Ahmad Nazri Wahidudin	Ventus Publishing ApS	Denmark
9	Fundamentals of Mathematical Statistics	Gupta S. C. and Kapoor V. K.;	Sultan Chand and Sons	23, Daryaganj, New Delhi 110002
10	Statistical Methods	Gupta S. P.:	Sultan Chand and Sons	23, Daryaganj, New Delhi 110002
11	Applied Statistics	Mukhopadhyaya Parimal	New Central Book Agency Pvt. Ltd.	Calcutta.
12	Fundamentals of Statistics	Goon A. M., Gupta, M. K. and Dasgupta, B.	World Press	Calcutta.
13	Fundamentals of Applied Statistics	Gupta S. C. and Kapoor V. K.;	Sultan Chand and Sons	23, Daryaganj, New Delhi 110002

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Semester: I

Computer Concepts and Application - I

Course Code – 114 (B)

No. of Credits :- 03

Objective:

1. To make the students familiar with Computer environment.
2. To make the students familiar with the basics of Operating System and business communication tools.
3. To make the students familiar with basics of Network, Internet and related concepts.
4. To make awareness among students about applications of Internet in Commerce.
5. To enable make awareness among students about e-commerce and M commerce.

Unit 1 Introduction to Computer and Operating system

[12]

Introduction to Computer

Definition, Block Diagram, Computer Hierarchy, (Classification),
Characteristics of Computer

Computer System Hardware

Computer Memory
Input and Output Devices

Definition – Software

Software Types - System Software, Application Software

Definition of Operating System

Types of Operating Systems,
Functions of Operating Systems

Working with Windows Operating System:

Introduction, The Desktop, Structure of Windows, Windows Explorer, File and Folder Operations, The Search, The Recycle Bin, Adding or Removing New Programs using, Control Panel, Applications in windows (Paint, Notepad, WordPad, and Calculator)

Introduction to Free and Open Source Software

Definition of Computer Virus, Types of Viruses, Use of Antivirus software.

Unit 2 Office automation tools

[12]

Definition of Information Technology (IT)
Benefits of Information Technology (IT)
Applications of Information Technology (IT)

Office automation tools

MS-Word: Introduction, Starting MS-Word, MS-Word Screen and its Components, Elementary Working with MS-Word

MS-Excel: Introduction, Starting MS-Excel, Basics of Spread sheet, MS-Excel Screen and Its Components, Elementary Working with MS-Excel

MS-PowerPoint: Introduction, Starting MS-PowerPoint, Basics of PowerPoint, MS-PowerPoint Screen and Its Components, Elementary Working with MS PowerPoint

Data Processing: Files and Records, File Organization (Sequential, Direct/Random, Index)

Unit 3 Introduction to Computer Network

[12]

Introduction
Importance of Networking
Computer Network (LAN, WAN, MAN)

Network Components (Hub, Switch, Bridge, Gateway, Router, Modem)
Network Topology, Wireless Network
Internet and Internet application
Introduction, Internet evolution, Working of Internet, Use of Internet

Overview of World Wide Web (Web Server and Client)
Introduction to Search engine and Searching the Web, Downloading files, Introduction to Web Browsers, Working with E-mail (creation and use of the same)

Introduction to Internet Security
Security, Privacy, Ethical Issues & Cyber Law

Unit 4 Computer applications in Commerce

[12]

Computer Applications in Business – Need and Scope

Computer Applications in various fields of Commerce:
Personnel Administration, Accounting, Cost and Budgetary Management, Purchasing, Banking, Insurance and Stock-broking, e-governance

E-Commerce

Defining e-Commerce, Main Activities of Electronic Commerce, Benefits of E-Commerce; Broad Goals of Electronic Commerce; Main Components of E-Commerce; Functions of Electronic Commerce – Communication, Process Management, Service Management, Transaction Capabilities;

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Semester: I

Organizational Skills Development- I

Course Code – 115 - A

No. of Credits :- 03

Objectives of the course

1. To introduce the students to the emerging changes in the modern office environment
2. To develop the conceptual , analytical , technical and managerial skills of students efficient office organization and records management
3. To develop the organizational skills of students
4. To develop Technical skills among the students for designing and developing effective means to manage records , consistency and efficiency of work flow in the administrative section of an organisation
5. To develop employability skills among the students

Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Concept of Modern Office	<ol style="list-style-type: none">a. Modern Office :- Definition, Characteristics, importance and functionsb. Office environment:- Meaning and Importancec. Office Location :- Meaning, Principles and factors affecting Office locationd. Office Layout :- Meaning, Principles and factors affecting Office Layout	<ol style="list-style-type: none">1. Conceptual Clarity on the meaning of a modern office2. Developing understanding on the internal and external factors of an office environment3. Developing analytical and technical skills to contribute towards planning office location and layout
2	Office Organisation and Management	<ol style="list-style-type: none">a. Office Organisation : Definition, Importance, Principles and Types of Organisationb. Office Management:- Definition, Functionsc. Scientific Office Management :- Meaning, Aims, Techniques of Scientific Office Management and Steps for installation of Scientific Office Management	<ol style="list-style-type: none">1. Conceptual clarity on the meaning of Scientific office management2. Development of understanding in various techniques for scientific management

3	Office Records Management	<p>a. Office Records Management -Definition, Objectives, Scope of Records Management, Significance, Principles of Records management.</p> <p>b. Digitalization of records:- Advantages and Problems of Digitalization</p> <p>c. Form Design:- Objectives, types of forms, Significance, Principles of form designing</p> <p>d. Office Manual – Definition, Contents Types , benefits and limitations</p>	<p>1. Introduction to concept of digitalization of records</p> <p>2. Technical skills and critical analysis skills for designing of various office documents for effective records creation and maintenance</p>
4	Office work	Office work :-Meaning and Characteristics, Flow of work :- Significance, Features of Ideal flow of work ,benefits of flow of work ,problems in smooth flow of work , suggestions for even flow of work	1. Analytical skills for process improvement in office work.

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Power Point Presentation	Online Videos	Making a model of office layout in groups	Conceptual Clarity on meaning of Modern Office, internal and external factors of an office environment
2	12	Power Point Presentation			Conceptual clarity on the meaning of Scientific office management and understanding various techniques for scientific management

3	12	Guest Lectures by Experts	Visit to any organization , college, bank etc (group assignment)	Report on the records management system based on the visit	Technical skills and Critical analysis skills
4	12	PPT , Educational Videos	Visit to any organization , college, bank etc (group assignment)	Report on the visit and suggestions for improvement in work flow of the organization visited	Development of Technical and Analytical abilities

References :

List of Books Recommended :-

1. Modern Office Management – By Mills, Geoffrey
2. Office Management – By Dr. R.K. Chopra , Priyanka Gauri
3. Office Management – By R.S.N. Pillai
4. Office Management – By K.L.Maheshwari , R.K . Maheshwari
5. Modern Office Management : Principles and Techniques – By J.N.Jian , P.P.Singh

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Semester: I

BANKING & FINANCE- I

(Fundamentals of Banking I)

Course Code – 115 - B

No. of Credits :- 03

Objectives -

- To provide knowledge of fundamentals of Banking
- To create awareness about various banking concepts
- To conceptualize banking operations.

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1.	Evolution of Banking	<ul style="list-style-type: none">• Meaning, Definition and Origin of 'Bank'• Evolution of Banking in Europe and Asia• Evolution of Banking in India• Structure of Indian Banking System	<ul style="list-style-type: none">• Knowledge of evolution of banking.• Understanding structure of Indian Banking
2.	Functions of Bank	<p>Primary Functions:</p> <ul style="list-style-type: none">○ Accepting Deposits:<ul style="list-style-type: none">i. Demand Deposits - Current Deposit and Savings Deposits;ii. Time Deposits - Fixed Deposit and Recurring Flexi Deposits (Auto Sweep)○ Granting Loans and Advances-<ul style="list-style-type: none">i. Short Term Loan- Overdraft Facility, Cash Credit Facility, Purchasing and Discounting of Bills,ii. Term Loan	<ul style="list-style-type: none">• Understanding primary and secondary functions of a bank.• Understanding the concepts related to lending and ratios.

		<p>Secondary Functions:</p> <p>A. Agency Functions- Payment and Collection of a Cheque, Bill and Promissory Note, Execution of standing instructions, Acting as a Trustee and Executor</p> <p>B. General Utility Functions- Safe Custody, Safe Deposit Vaults, Remittance of funds, Pension payments, Acting as a Dealer in Foreign Exchange (FOREX) Market.</p> <p>C. Distribution of Third Party Products, Bancassurance, Mutual Funds, Issuance of Credit Card and Debit Card</p> <p>D. Non Fund Based Credit Facilities- Letter of Credit, Bank Guarantee and Deferred Payment.</p> <p>E. Government Business – Collecting GST, Stamp Duty, Excise Payment, etc.</p> <ul style="list-style-type: none"> • Concepts of Priority and non- priority sector lending Security Based and Purpose Oriented Lending, Bridge Loans, Reserve Ratios- CRR and SLR. Credit Appraisal and Credit Monitoring 	
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<p>3.</p>	<p>Procedure for Opening and Operating of Deposit Account</p>	<p>Procedure for Opening of Deposit Account: Know Your Customer Norms, (KYC Norms), Application Form, Introduction, Proof of Residence, Specimen Signature, and Nomination Facility: Their Importance. No Frill Account</p> <p>Procedure for Operating Deposit Account: Pay-in-slip, Withdrawal slip, Issue of Pass Book, (Current, Savings or Recurring Deposit), Issue of Cheque Book, Issue of Fixed Deposit Receipt, Premature encashment of a Fixed Deposit and Loan against Fixed Deposit. Recurring Deposit: Premature encashment and loan against Recurring Deposit.</p> <p>a) Closure of Account</p> <p>b) Transfer of Account</p> <p>c) Death Claim Procedure</p> <p>Types of Account Holders</p> <p>a) Individual Account Holders- Individual Account, Joint Account, Illiterate, Minor, Married Woman, Pardahnashin Woman, Non-Resident Account</p> <p>b) Institutional Account Holders- Sole Proprietorship, Partnership Firm, Joint Stock Company, Hindu Undivided Family, Clubs, Associations, Societies and Trusts.</p>	<ul style="list-style-type: none"> • Understanding the process of opening and operating procedure of bank accounts. • Understanding various types of bank accounts holders
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4	Methods of Remittance	<p>Demand Draft, Bankers' Cheque</p> <p>Electronic Funds Transfer (EFT) – Real Time Gross Settlement (RTGS), National Electronic Funds Transfer (NEFT), Procedure of fund transfer through NEFT/ RTGS,</p> <p>Society for Worldwide</p> <p>Interbank Financial Telecommunication (SWIFT)</p> <p>Immediate Payment Service (IMPS) - Interbank (Bank to Bank) and Intra Bank (Branch to Branch) Fund Transfer</p>	<ul style="list-style-type: none"> • Understanding various methods of remittance.
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Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1.	10	Lecture, PPT/ Poster Presentation, Group Discussion, Library / Home Assignment	Relevant YouTube videos	NA	<ul style="list-style-type: none"> • Knowledge of evolution of banking. • Understanding structure of Indian Banking
2.	14	Lecture, PPT/ Poster Presentation, Group Discussion, Library / Home Assignment	Relevant YouTube videos	Report writing of expert lecture	<ul style="list-style-type: none"> • Understanding primary and secondary functions of a bank. • Understanding the concepts related to lending and ratios.

3.	14	Lecture, Expert Lecture, PPT/ Poster Presentation, Group Discussion, Library / Home Assignment,	Relevant YouTube videos	Visit to a bank	<ul style="list-style-type: none"> • Understanding the process of opening and operating procedure of bank accounts. • Understanding various types of bank accounts holders
4.	10	Lecture, Expert Lecture, PPT / Poster Presentation, Group Discussion, Library / Home Assignment,	Relevant YouTube videos	Visit to a bank	<ul style="list-style-type: none"> • Understanding various methods of remittance.

References:

1. Majumdar N. C., 'Fundamentals of Modern Banking', New Central Book Agency (P) Ltd., New Delhi.
2. Arondekar A.M. & Others, 'Principles of Banking', Macmillan India Pvt. Ltd.
3. Srinivasan D. & Others, 'Principles & Practices of Banking', Macmillan India Pvt. Ltd.
4. Agarwal O.P., (4th Edition, 2017), 'Banking and Insurance', Himalaya Publishing House.
5. Gopinath M. N., (1st Edition, 2008), 'Banking Principles and Operations', Snow White Publications Pvt. Ltd, Mumbai
6. Gordon E. & Natarajan K., 'Banking - Theory, Law and Practice', (21st Revised Edition), Himalaya Publishing House.
7. Joshi Vasant & Joshi Vinay, (3rd Edition), 'Managing Indian Banks', Sage Publication, New Delhi.
8. Varshney P.N. (12th Edition, 2003), 'Banking - Law and Practice', Sultan Chand & Co. New Delhi
9. Kothari V., (26th Edition) 'Tanna's Banking Law & Practice in India,' Lexis Nexis Publication.

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Semester- I

Defense Organization and Management in India

DEFENSE ORGANISATION AND MANAGEMENT IN INDIA-I

Course Code – 115 - D

No. of Credits :- 03

Objectives:

- 1) To understand the role of Armed Forces and Defense structure of Indian Armed Forces.
- 2) To know the vital elements of Indian Defense Organization in India.
- 3) To know the second line of Defense in India

Unit No.	Topic	No. of Lectures	Teaching Method	Skills to be developed
1.	Development of Defense Organization after Independence 1.1 Reconstruction of Indian Armed Forces since 1947. 1.2 Development of the Army after Independence. 1.3 Development of the Navy after Independence. 1.4 Development of the Air Force after Independence. 1.5 Principles of Defense Organisation.	12	Lecture, PPT, Group Discussion, Library Work, Assignment	<ul style="list-style-type: none">• Understanding defence organization after independence.• Understanding the principles of Defense organization
2.	Elements of Defense Organization in India. 2.1 Powers of the President in relation to the Armed Forces. 2.2 Defense Committee of the Cabinet. 2.3 Ministry of Defense – its organizational & function.	12	Lecture, PPT, Group Discussion, Library Work, Study Visit	<ul style="list-style-type: none">• Understanding the elements of defense organization in India.

	2.4 National Security Council.			
3.	Defense Structure of Indian Armed Forces 3.1 Chief of Staff Committee. 3.2 Organization of Army, Naval & Air Headquarters. 3.3 Organization of Army, Naval & Air Commands.	12	Lecture,PPT, Group Discussion, Library Work,	<ul style="list-style-type: none"> Understanding the defense structure of Indian Armed Forces
4.	Para Military Forces of Defense 4.1 Border Security Force. 4.2 Coast Guard. 4.3 Territorial Army. 4.4 Home Guard. 4.5 Civil Defense. 4.6 National Cadet Corps (N.C.C.) 4.7 Central Reserve Police Force. 4.8 State Reserve Police Force.	12	Lecture,PPT, Group Discussion, Library Work, Assignment	<ul style="list-style-type: none"> Understanding the paramilitary force of defense.
	Total	48		

References:

- 1) Ron Mathews, "Defense Production in India" ABC, New Delhi.
- 2) Raju G. C. Thomas (1978), "The Defense of India a Budgetary Perspective of Strategy and Politics", Mac Millan Publication, New Delhi.
- 3) Sam C.Sarhesian – The Military Industrial Complex a Reassessment', Sage Publication, New Delhi.
- 4) Maj. Gen. Pratap Narain [Retd] (1998), India's Arms Bazar," Shilpa Publication, New Delhi.
- 5) L t. Gen. R. K. Jasbir Singh(1999),Indias Defense Year Books', Nataraj Publication, Dehradun.
- 6) Chaudhari A.P., 'संरक्षणशास्त्र' Nilkantha Publication, Pune
- 7) Jadhav V.Y, 'भारताची राष्ट्रीय सुरक्षा', Snehvardhan Publication , Pune.
- 8) Venkateshwaram A. L. 'Defense Organisation in India'
- 9) C. Lakshmi (1998) 'Trends in India's Defense Expenditure,' ABC, New Delhi.

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Semester- I

Theory and Practice of Co-operation- I

Course Code – 115 - E

No. of Credits :- 03

Objectives of the course:

1. To acquaint the students with the concept of co-operative movement.
2. To introduce the scope of Co-operation.
3. To make students build their career in the field of Co-operation and Rural Development.

Depth of Programme: - Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Co-operation-	Meaning & Definitions, Objectives, Nature and Scope of Co-operation, Strength and Weakness of Co-operative Movement ,Principles of Co-operative International Co-operative Alliance (ICA) Meaning ,objectives, ICA Board Code of Governance, International Co-operative Alliance (I.C.A) Committee-1937,1966,1995 Problems & Challenges faced by the Co-operative sector	i. To understand the objectives, Nature and scope of co-operation ii. To understand the Co-operative Movement iii. To understand International Co-operative Alliance and ICA Committee 1937,1966,1995

2	History of Co-operative Movement in India	Introduction and Development of Co-operative Movement in Pre Independence period. Strength and weakness of Co-operative Movement , Sir Fedrick Nicholson Report 1904 , Maclagen Committee Report 1912 , Study of eminent supporters and their contribution	<ul style="list-style-type: none"> i. To understand the development of Co-operative Movement in India ii. To understand Sir Fedrick Nicholson Report and Maclagen Committee Report To understand eminent supporters and their contribution in Co-operative Movement of India
3	Development of Co-operative Movement in India in post Independent Era	Contribution of Co-operative Leaders in post Independent Era up to the present Stage, Gorewala Committee Report 1954 , Vaidyanathan Committee Report 2005 , Development of Co-operative Movement in Maharashtra , Current scenario of Co-operative Movement in India	<ul style="list-style-type: none"> i. To understand the Contribution of Co-operative Leaders in India ii. To understand the Gorewala Committee Report, Vaidyanathan Commiittee Report iii. To understand Current scenario of Co-operative Movement in India
4	Government and Co-operative Movement	Role of Central Government , Role of State Government Co-operative Vs Capitalism & Communism	<ul style="list-style-type: none"> i. To understand the role of Government in Co-operative Movement ii. To understand Co-operative Vs Capitalism & Communism

Teaching Methodology

Topic No.	Total Lectures	Innovative Methods to be used	Film Shows and AV Application	Project	Expected Outcome
1	12	Pre reading, Class discussion, examples from real life through newspapers and internet resources. Debate on The Strength and Weakness of co-operative movement in Maharashtra, Poster presentation	Short Film Show on Co-operative Movement, AV Application (Audio and Visual Application)	Project on Current scenario of Co-operative Movement in Maharashtra	Understanding of basic knowledge of co-operative movement Understanding Scope, Strength and Weakness of co-operative movement. Understanding International Co-operative Alliance

2	12	Organise Semesterinar/workshop for students, Pre reading, Class discussion, Internet resources. case studies, Field visit to Co-operative Sugar Factory, visit to Agriculture Co-operative and Non Agriculture Co-operative society, Survey report	You Tube Video on History of Co-operative Movement in India	Project Report on Co-operative Sugar Factory, Rural Co-operative and Urban Co-operative credit Society	Understanding History and current scenario of Co-operative Movement in India
3	12	Guest Lectures of eminent personalities in co-operative movement and Rural Development , experience sharing, Pre reading, Class discussion, examples from real life through newspapers and internet resources, case studies, PPT, Interview of co-operative leader	Presentation on Contribution of Co-operative Leaders in post Independent Era up to the present Stage	Project Report on Development of Co-operative Movement in Maharashtra	Understanding Contribution of Co-operative Leaders in post Independent Era up to the present Stage , Development of Co-operative Movement in Maharashtra
4	12	Pre reading, Class discussion, examples of various co-operative institution through Newspapers and internet resources, Guest Lectures of eminent personalities ,PPT	Group discussion on Co-operative Vs Capitalism & Communism	Project Report on Role of Government in Co-operative Movement	Understanding Role of Government in Co-operative Movement

References

Sr. No	Title of Book	Author/s	Publication	Place
1	Co-operation and Rural Development	Principal Dr.Nitin Ghorpade	Success	Pune
2	Co-operation- Principles and Practice-	Dr. D.G. Karve		
3	Theory, History and Practice of Co-operation	Dr. R.D. Beddy		
4	Bhartiya Sahkari Chalval- Tatve va Vyavhar (Marathi)	Prof. Jagdish Killol; Prof. Arvind Bondre; Prof. A. C. Bhavsar		
5	Sahkari Chalval 1904-2004 (Marathi)	Prof. K. L. F ale		
06	Rural Development in India-Policies and Programme	Abdul Azees NP and S.M. Javed Aktar	Kalpaz Publication	
07	Human Resource Management Practices in Co-operative sector	Principal Dr.Shaikh Aftab Anwar	Idea Publication	New Delhi
08	Report of the High Power Committee on Co-operative May 2009 Ministry of Agriculture Government of India			
09	Journal of Commerce and Management Thought(JCMT)			
10	Journal Co-operative Organization and Management , Journal of Co-operative studies			

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Managerial Economics I Semester - I

Course Code – 115 - F

No. of Credits :- 03

Objectives:

1. To acquaint the students with the concepts and techniques used in micro and macroeconomics.
2. To give the introduction to basic principles of microeconomics and to demonstrate how application of economic theory can improve decision making.
3. To build a perspective necessary for the application of modern economic concepts, precepts, tools and techniques in evaluating business decision taken by a firm.

Unit No.	Unit Title.	Content	Purpose Skills to be developed
1	Introduction	1.1 Nature, Scope and significance of managerial economics. 1.2 Managerial economics and microeconomics. 1.3 Managerial economics and macroeconomics. 1.4 Main characteristics of managerial economics. 1.5 Fundamental economic concepts- opportunity cost, Discounting Principle, Time perspective, incremental reasoning, equi-marginal concept. 1.6 Application of economics in managerial decision making. 1.7 Role and responsibilities of managerial economist in business.	i) To know the meaning, nature of managerial economics ii) To understand fundamental principles of economics. iii) To know the application of principles of managerial economics in business decision making.
2	Demand Analysis	2.1 Basis for demand - concept of utility 2.2 Cardinal Utility approach- Law of marginal utility, maximization of utility, consumer surplus. 2.3 Ordinal Utility approach- Indifference Curve, maximization of utility. 2.4 Law of demand- determinants of demand. 2.5 Elasticity of demand- Price, Income and Cross elasticity of demand. 2.6 Managerial application and importance of elasticity of demand.	i. To understand the concept of utility. ii. To understand the law of diminishing marginal utility in law of demand. iii. To understand the concept of elasticity and its importance in managerial decision making process.

3	Demand forecasting	3.1 Demand forecasting-Meaning, Methods of demand forecasting- Expert opinion, surveys and market experiments, Time series analysis, Trend Projection, Barometric forecasting. 3.2 Demand forecasting for a new product.(Developing, Testing and launching of new products)	i. To understand the concept of demand forecasting and its utility in demand forecasting of new product. ii. To make the students understand different methods of demand forecasting
4	Production and Cost Analysis	4.1 Law of supply- Determinants of supply. 4.2 Theory of production- Meaning and concept of production, 4.3 Law of Variable Proportions and Returns to a Scale. 4.4 Cost Analysis- Types of Cost - Economic cost and accounting cost, Private cost and social cost, Actual cost and opportunity cost, Past cost and future cost, Explicit cost and implicit cost, Incremental cost and Sunk cost. 4.5 Cost and cost curves under short-run and long run- Fix cost and variable cost, Average cost and marginal cost, Relation between average cost and marginal cost. 4.7 Revenue Curves- Concept of average, marginal and total revenue under different market conditions, relation between average and marginal revenue.	i. To understand the law of supply. ii. To know the various concept of costs and revenues.

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	14	i. Open book discussion ii. Interactive lectures	i. Online PPTs ii. You tube lectures	i. Study costs in a local project. ii. Application of cost principles	The students will be able to decipher, analyze and apply the theory and practice of Managerial Economics
2	12	i. Open book discussion. ii. Group discussion with examples.	i. Online PPTs ii. You tube lectures	i. Study of types of elasticity of demand. ii. Study of elasticity of demand in managerial decision.	Students will develop an understanding of the need of businessman to locate the various factors affecting demand of the product and plans of marketing and business strategies accordingly.
3	08	i.) Interactive lectures	i. Online PPTs ii. You tube lectures	i. Study of methods of demand forecasting in a local firm.	Students will understand the demand forecasting of existing and new

		ii.) Case studies. iii.) Teacher driven power point presentation.		ii. Comparative study of advantages of methods of demand forecasting.	product and its importance in managerial decision making.
4	14	i. Case studies. ii. Interactive lectures.	i. Online PPTs ii. You tube lectures	i. Study of law of variable proportions in a firm. ii. Study of concept of costs in short run and long run.	Students will understand the analytics of supply and its various uses. Students will follow the relationship between costs, revenue, profit and losses.

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Managerial Economics	Domnik Salvatore-	Oxford University Press	Oxford University Press
2	"Managerial Economics-	Mark Hirschey, .	2. Mark Hirschey, Log "managerial Economics-An Integrative Approach", Cengage Learning.	2. Mark Hirschey, Log "managerial Economics-An Integrative Approach", Cengage Learning.
3	Managerial Economics-	D.M.Mithani,	Himalaya Publishing House	Mumbai
4	Managerial Economics,	P.L.Mehatha,	S.Chand Publishing	Mumbai
5	Managerial Economics, Pearson Education	Craig Peterson, Lewis and Jain,	Pearson Education	Pearson Education
6	Modern Economic Theory	K.K.Dewett,		
7	Managerial Economics, Margham Publications, Madras	Shankaran S.	Margham Publications, Madras	Madras
8	Managerial Economics,	Thomas Christopher R. and Charles, Maurice S.	McGraw Hill Irwin, Boston.	McGraw Hill Irwin, Boston.

Suggested references

Web reference

1. <https://nptel.ac.in/courses/110101005/2>
2. <https://nptel.ac.in/downloads/110101005/>
3. <http://cec.nic.in/Pages/Home.aspx>
4. <http://en.wikipedia.org/wiki/Economics>
5. <http://www.investopedia.com/university/economics/#axzz1XwhFTmtm>
6. <http://www.tutor2u.net/blog/index.php/economics/>
7. <http://www.economicshelp.org/>
8. <https://www.intelligenteconomist.com/economics-blogs/>
9. <https://www.coursera.org/courses?query=managerial%20economics>
10. <https://www.edx.org/course/introduction-to-managerial-economics-0>
11. <https://www.mooc-list.com/tags/managerial-economics>
12. <https://online.stmary.edu/mba/courses/managerial-economics>
13. <https://www.tru.ca/distance/courses/econ3041.html>
14. <https://www.euomba.org/managerial-economic>

Revised syllabi (2019 Pattern) for three years B.Com. Degree course (CBCS)

Semester - I

Essentials of E- Commerce

Course Code – 116 A

No. of Credits :- 03

Objectives of the course

1. To acquaint the learner with knowledge on the basics of E-commerce.
2. To develop knowledge on various types of E-commerce business.
3. To develop practical knowledge on effective design of Website and Domain Registration.
4. To Develop knowledge on various modes of online transaction for crating convenience in day to day financial transactions and promoting cashless economy.
5. To introduce the learner to the concept of Electronic Data Inter exchange and its significance.

Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Overview of Electronic Commerce(EC)	Concept, Features and Functions of e-commerce practices v/s traditional practices ,scope and limitations of e-commerce , Recent trends in e-commerce , Risks in e-commerce and preventive measures	1. Conceptual understanding of basics of e-commerce
2	Types of e-Commerce Business	Definition and types of e-commerce business : B2B, B2C, C2B, C2C,B2G, C2G, B2A, C2A and P2P, B2B service provider.	1. Awareness on the various forms of e-commerce
3	Infrastructure	Internet and its role in e-commerce, Mobile and its role in e-commerce , procedure of registering an Internet domain , establishing connectivity to Internet ,tools and services of Internet , Requisites of selecting an appropriate domain name ,Website – Essential factors in designing and importance of an effective website	1. Technical knowledge on registration of a domain 2. Practical Knowledge on role of Internet in e-commerce 3. Analytical skills and Creative skills for web page designing

4	E- Payment and Electronic Data Inter exchange	<p>A. <u>E- Payment</u> : Transactions through Internet , requirements of e-payments systems, functioning of Debit and credit cards, pre and post payment services Overview on Online Payment Portals and apps in India, CC Avenue, Paytm, BHIM, UPI, Phone Pe etc. Concept of Payment Gateway and Payment Processor</p> <p>B. <u>Electronic Data Inter exchange</u>: Evolution, uses, benefits, Working of EDI, EDI standards (includes variable length EDI standards), Cost Benefit Analysis of EDI, Electronic Trading Networks, EDI Components, File types, EDI Services , EDI Software.</p>	<ol style="list-style-type: none"> 1. Practical Oriented Skills on E-commerce 2. Conceptual Clarity on Online Payment Process 3. Conceptual Clarity on EDI and Electronic
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Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	10	Lecture Methods / Guest Lectures	Online Educational Videos		Developing understanding on E-commerce
2	12	Guest Lectures by subject Experts / Case Study	Online Educational Videos and Success stories	Case study on any one success story	Awareness on various e-commerce platforms
3	12	PPT / Lectures / Guest Lectures	Demonstration by Industry Expert		Technical , Practical , Analytical and Creative Skills
4	14	Live Demonstrations/PPT/Lectures	Online Educational Videos	Actual online transactions of Money transfer and online purchase via online payment for small value orders (can be	Technical and Practical Skills

				undertaken as a group) Payments to vendors via various payment apps apps	
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Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	MCQ /Written Test /PPT	As per University norms	Certificate Web Page Designing
Unit – II	MCQ/Written test /Report Writing	As per University norms	Certificate course on Digital Marketing
Unit – III	Written Test/ Report and /or PPT on any 5 well designed websites	As per University norms	
Unit – IV	Written Test / MCQ	As per University norms	

References :

List of Books Recommended :-

1. The Complete E-Commerce Book - By Janice Reynolds
2. E-Commerce Website optimization – By Dan Corxen- John and Johaan van Tonder
3. E- Commerce – An Indian Perspective – By P.T.Joseph S.J.
4. E- Commerce – Business, Technology, Society – By Kenneth c. Laudomn and Carol Guercio Traver
5. Essentials of E-Commerce Technology – By. V.Rajaraman
6. E Business R(Evolution)- By Daniel Amor
7. E-Commerce Management - By Krishnamurthy
8. E-Commerce: Strategy, Technologies and Applications By David Whiteley

Revised Syllabi (2019 Pattern) for three years B.Com Degree Course (CBCS)

Semester - I Insurance and Transport- I (Insurance)

Course Code – 116 - B

No. of Credits :- 03

Objectives:

1. To acquaint students with the concepts of Insurance.
2. To create awareness regarding basic knowledge about Life Insurance, Fire Insurance and Marine Insurance.
3. To make the students aware of career opportunities in the field of Insurance

Unit No.	Topic	No. of Lectures	Teaching Method	Proposed skills to be developed
1.	Introduction to Insurance 1.1 Meaning and Nature of Insurance 1.2 Importance of Insurance 1.3 Scope of Insurance 1.4 Principles of Insurance 1.5 Risk and Insurance 1.6 Types – Life and General Insurance 1.7 Difference between Life and General Insurance 1.8 Career opportunities in Insurance Sector	16	Lecture, PPT, Group Discussion, Library Work, Assignment Companies	<ul style="list-style-type: none">• Understanding the concept of insurance
2.	Life Insurance 2.1 Meaning and Features of Life Insurance 2.2 Nature of Life Insurance 2.3 Origin of Life Insurance 2.4 Importance of Life Insurance 2.5 Principles of Life Insurance 2.6 Types of Life Insurance Policies 2.7 Procedure of Life Insurance Contract	16	Lecture, PPT, Group Discussion, Library Work, Study Visit to Office of the Insurance	<ul style="list-style-type: none">• Understanding the concept of life insurance.

3.	Fire Insurance 3.1 Meaning and Features 3.2 Nature of Fire Insurance Contract 3.3 Types of Fire Insurance Policies	08	Lecture,PPT, Group Discussion, Library Work,	<ul style="list-style-type: none"> Understanding the concept of fire insurance
4.	Marine Insurance 4.1 Meaning and Features 4.2 Marine Insurance Contract 4.3 Types of Marine Insurance Policies	08	Lecture,PPT, Group Discussion, Library Work, Assignment	<ul style="list-style-type: none"> Understanding the concept of marine insurance
	Total	48		

References:

1. Khan M.Y. (1997), Financial Services, Tata McGraw-Hill Publishing Company Limited New Delhi .
2. Mishra M.N. (2004) Insurance - Principles and Practice, S. Chand and Company Ltd. New Delhi.
3. Gulati Neelam C., Principles of Insurance Management, Excel Books.
4. Haridas R., Life Insurance in India, New Century Publication New Delhi.
5. Godwin Frank, The Principles and Practice of Fire Insurance, Isaac Pitman and Sons Ltd. London.
6. Panda G.S., Principles and Practice of Insurance, Kalyani Publishers Ludhiana.
7. Kanwal L.S., Text Book of Insurance, Kalyani Publishers Ludhiana.
8. Mathew M.J., Insurance, RBSA Publisher Jaipur.
9. सराफमोहन,विमाशास्त्र,सी .जमनादासआणिकंपनी

Revised syllabi (2019 Pattern) for three years B.com Degree course (CBCS)

Semester - I

Marketing and Salesmanship- I

(Fundamentals of Marketing)

Course Code – 116 - C

No. of Credits :- 03

Objectives of the Course

1. To introduce the basic concepts in Marketing.
2. To give the insight of the basic knowledge of Market Segmentation and Marketing Mix
3. To impart knowledge on Product and Price Mix.
4. To establish link between commerce, business and marketing.
5. To understand the segmentation of markets and Marketing Mix.
6. To enable students to apply this knowledge in practicality by enhancing their skills in the field of Marketing.

Unit No.	Unit Title	Contents	Purposed Skills To Be Developed
1	Introduction to Market and Marketing	1.1 Meaning and Definition of Market 1.2 Classification of Markets 1.3 Marketing Concept: Traditional and Modern 1.4 Importance of Marketing 1.5 Functions of Marketing: Buying, Selling, Assembling, Storage, Transportation, Standardization, Grading, Branding, Advertising, Packaging, Risk Bearing, Insurance, Marketing Finance, Market Research and Marketing Information. 1.6 Selling vs. Marketing	The basic knowledge of Market and Marketing will be developed amongst students.

2	Market Segmentation and Marketing Mix	<p>2.1 Market Segmentation: -</p> <p>2.1.1 Introduction</p> <p>2.1.2 Meaning and Definition</p> <p>2.1.3 Importance</p> <p>2.1.4 Limitations</p> <p>2.1.5 Bases for Segmentation</p> <p>2.2 Marketing Mix</p> <p>2.2.1 Introduction</p> <p>2.2.2 Meaning & Definition</p> <p>2.2.3 Elements of Marketing Mix- Product, Price, Place and Promotion</p> <p>2.2.4 Importance of Marketing Mix</p>	Students will develop the Marketing Segmentation knowledge along with the basic concept of Marketing Mix.
3	Product Mix and Price Mix	<p>3.2 Product Mix</p> <p>3.2.1 Meaning and Definition</p> <p>3.2.2 Product Line and Product Mix</p> <p>3.2.3 Product Classification</p> <p>3.2.4 Product Life Cycle</p> <p>3.2.5 Factors Considered for Product Management</p> <p>3.3 Price Mix</p> <p>3.3.1 Meaning and Definition</p> <p>3.3.2 Pricing Objectives</p> <p>3.3.3 Factors Affecting Pricing Decision</p> <p>3.3.4 Pricing Methods</p>	Students will get proper insight of Product and Price Mix.

4	Place Mix and Promotion Mix	<p>a. Place Mix</p> <ul style="list-style-type: none"> i. Meaning and Definition of Place Mix ii. Importance iii. Types of Distribution Channels – consumer goods and Industrial Goods iv. Factors Influencing selection of Channels <p>4.2 Promotion Mix</p> <ul style="list-style-type: none"> 4.2.1 Meaning of Promotion Mix 4.2.2 Elements of Promotion Mix- Personal Selling, Public Relation and Sales Promotion 4.2.3 Factors Affecting Market Promotion Mix 4.2.4 Promotion Techniques or Methods 	<p>Students will develop the skills of promoting a product along with gaining knowledge about the distribution channels.</p>
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Teaching Methodology

Topic No.	Total Lectures	Innovative Methods to be used	Film shows and AV Applications	Expected Outcome
1	14	Power Point Presentation, Survey Analysis	Short Film AV Application	Student will get acquainted with the basics of marketing field.
2	07	Power Point Presentation, Survey Analysis, Group Discussion	Short Film AV Application	It will highlight on the core marketing concepts namely 'Marketing Mix'. It will help students to implement this knowledge in practicality by enhancing their skills in the field of market segmentation.
3	14	Conceptual Learning Group Discussion	AV Application	Students will develop the skills of Pricing the product along with gaining knowledge on Product Mix
4	13	Conceptual Learning, Power Point Presentation, Group Discussion	Short Film, AV Application Use of You Tube	It will help the students to apply the various techniques of Promotion and understand the various channels of distribution

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Marketing Management	Philip Kotler	Pearson Publication	
2	Marketing Management	Rajan Saxena	McGraw Hill Education	
3	Principles of Marketing	Philip Kotler	Pearson Publication	
4	Sales & Distribution Management	Tapan K Panda	Oxford Publication	
5	Advertising Management	Rajiv Batra	Pearson Publication	
6	Retail Management	Swapna Pradhan	McGraw Hill Publication	
7	Retail Management	Gibson Vedamani	Jayco Publication	
8	Marketing Management	V. S. Ramaswamy & S. Namakumari	Macmillan Publication	
9	Supply Chain Management	Sunil Chopra, Peter Meindl & D. V. Karla	Pearson Publication	

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Semester - I

Consumer Protection and Business Ethics - I

Course Code – 116 - D

No. of Credits :- 03

Objectives of the Program

1. To develop general awareness of consumerism among the students.
2. To understand the consumers rights, responsibility and role of United Nations.
3. To have a comprehensive understanding about the existing law on consumer protection in India.
4. To create awareness among the students about dispute redresses machinery and basic procedures for handling consumer dispute.
5. To understand the issues relating to e-commerce, e-Banking emerging issues and internet regulations.

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Consumer Protection - An Overview	Consumerism- Meaning, Evolution, Rational, Need and Importance of Consumerism, Consumer protection- objectives, scope and importance, Consumer rights and Standardization United Nations guideline on consumer protection- Objectives, scope of application , general principles and framework for consumer protection	understand the concept of consumerism Equip the students with knowledge the evolution, need and importance, of consumerism Understand the role of United Nations to protect consumer's interest.
2	Consumer Education and Awareness	Consumer education-Need and importance, Consumer Responsibility Role of consumer Association and Councils in consumer education and Awareness- Voluntary organization, Consumer protection councils, Media, Educational Institute and Government Skills required for career in Consumer studies field	Handling the emerging issues about consumer protection Acquaint knowledge and skills for career opportunity.

5.	Consumer Protection Law in India *	Consumer Protection Movement in India Consumer Protection Act 1986- Overview features, important definitions-consumers, Goods, services, Defect , Deficiency, unfair trade practices, Dispute, Complaint - Objectives, Consumer Disputes Redressal Agencies. (Composition, Jurisdiction, Powers and Functions.) Procedure of filling complaint and Procedure to deal with complain.	Compressive understanding about the existing consumer protection Act 1986. Apply the Law for consumer protection
6.	E -Commerce and consumer Protection	E Commerce- scope and limitations, Need and importance of E commerce , Prospects and challenges of Ecommerce and its effect on consumer Need and importance of E-Education consumer Protection in E-Banking Recent Emerging Issues in E-Commerce	Understand the concept of E commerce and Consumer Protection Acquaint students about various issues of E commerce. Able to appreciate the emerging questions and policy issues

[Note: Recent amendments in the Acts and relevant Landmark cases decided by courts are expected to be studied]

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Documentary , PPT, Narration, Quiz, Survey Analysis Article review	Short film about consumer movement, Role of UN	Report Review	Acquaint knowledge and maturity to understand the consumers interest
2	12	Project making, Street play, jingles, slogan Competition,	Use of You tube, Review of Movie	New Emerging Issues in consumer protection	To get training to face emerging issues. To seek career opportunity in this field.

3	12	Case study, Poster making, Interview of lawyer , Mute court	Case Analysis, Mute court ,E filing of the case	Recent Laws and silent feature	To Acquaint knowledge and application of laws
4	12	Virtual Learning, Group Discussion,	Film on cyber security, Internet precautions	Project on E COMMERCE and Consumer protection	To defend and safety in e commerce. To learn e skills

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Grahak Darshan	Mr. Bindu Madhav Joshi	Akhil Bhartiy Grahak Panchayat	Pune
2	Grahak Sanrakshan Adhiniyam	Ad Ghare S S	Mukund Publication	Pune
3	E- Commerce : An Indian Perspective	Dr.P. T. Joshep	PHI Publication	New Delhi
4	E Banking in India	Dr R K Uppal	New Century Publication	New Delhi
5	Consumer education and empowerment	Dr. S. S. Singh, Dr.Sapna Chadah	Abhijit Publication	New Delhi
6	GrahakRaja Jaga Ho	Prof. G. V. Kayandepatil	Chaitanya Publication	Nashik
7	United Nations Guidelines on Consumer Protection	unctad.org	UNCTAD	UNCTAD Geneva Switzerland
8	The Consumer Protection Act, 1986	Act	Govt of India	Delhi
9	The law of E Commerce	Dr A Alghamdi	Auther House	Mumbai

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Semester - I

Business Environment & Entrepreneurship - I

Course Code – 116 - E

No. of Credits :- 03

Objectives of the course:

- 1) To understand the concept of Business Environment and its aspects
- 2) To make students aware about the Business Environment issues and problems of Growth
- 3) To examine personality competencies most common to majority of successful entrepreneurs and to show how these competencies can be developed or acquired
- 4) To understand the difference between Entrepreneurial and non-Entrepreneurial behaviour
- 5) To provide knowledge of the significance of Entrepreneurship in economy
- 6) To familiarize the students with the contribution of selected institutes working to promote Entrepreneurship
- 7) To generate entrepreneurial inspiration through the study of successful Entrepreneurs

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Business Environment	Concept- Importance - Inter relationship, between environment and entrepreneur, Aspects of Environment- Natural- Economic - Political - Social - Technical - Cultural - Educational - Legal & Cross-cultural – Geographical etc.	Understanding the concept of Business Environment and its aspects Skill-correlating aspects of business environment and entrepreneur
2	Environment Issues	Pollution-Concept and types –Causes of pollution-Remedies of Pollution, Remedies of pollution-protecting the natural environment-Conservation of natural resources - Opportunities in Environment	Making students aware about business environment issues and problems of growth Skills-capable of understanding and analysing environment issues and finding out solutions to resolve these issues

3	Problems of growth	Unemployment- Concept-Types-Causes- Remedies, Poverty- Concept- Causes- Remedies , Regional Imbalance- Concept-Effects –Solutions , Social injustice- Concept, Effects, Solutions ,Black Money –Meaning – Sources –Effects- Measures, Lack of technical knowledge and information-Problems-Remedies	Understanding the problem of growth Skill-Application of mind to resolve the problem of growth
4	The Entrepreneur	Evolution of the term entrepreneur –Definition - Competencies of an Entrepreneur – Distinction between a) entrepreneur and manager-b)Entrepreneur and Enterprise, Intrapreneur-Concept and importance –Distinction between Entrepreneur and Intrapreneuer	Understanding the concept of entrepreneur, competencies of a successful entrepreneur, realising the difference between various concepts Skill-knowing the entrepreneurial competencies and imbibing the same by students

Teaching Methodology- F.Y.B.Com Semester-I, Paper-I

Topic No.	Total Lectures	Innovative Methods to be used	Film Shows and A.V. Application	Project	Expected Outcome
1	12	Case Study-Role play	Related videos and PPT	Distribute aspects of business environment in group and ask them to prepare in brief report on it- Field Assignment	Understanding of various aspects business environment useful for would be entrepreneurs
2	12	Conducting survey and collecting information about various types of pollution	Film shows with the help of environment related organizations	Undertake survey of pollution level, its ill effects and remedies	Understanding of various aspects of pollution and its ill effects
3	12	Collecting necessary information through various resources	Related videos and PPT	Compilation of facts, figures and remedies	Understanding of Problems and their causes and remedies
4	12	Case Study	Biographical CDs of successful entrepreneurs	Interview of various types of entrepreneurs e.g. First Generation entrepreneur, Women entrepreneur, Social entrepreneur and collect entrepreneurial competencies, Collection of success stories	Understanding the concept of entrepreneur, competencies of a successful entrepreneur

				of persons organisation in the area, arranging guest lecture by eminent entrepreneurs on various aspects of entrepreneur and entrepreneurship	
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References

Sr. No	Title of Book	Author/s	Publication	Place
1	Business Environment	Francis Cherunilam	Himalaya Publishing House	New Delhi
3	Dynamics of Entrepreneurship Development and Management	Desai Vasant	Himalaya Publishing House	New Delhi
4	Entrepreneurial Development	Khanka S.S.	S. Chand	New Delhi
5	Entrepreneurial Development	Gupta, Shrinivasan	S. Chand	New Delhi
6	Udyog	--	Udyog Sanchalaya	Mumbai
7	Indian Economy	Ruddar Datt, K.P.M. Sundharam	S. Chand	New Delhi

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Semester – I

Foundation Course in Commerce

Course Code – 116 – F

No. of Credits :- 03

Objectives of the course

1. To acquaint the student with knowledge of forms of business organizations and new business models.
2. To understand the latest government regulations and policies with relation to business in India .
3. To introduce the students to the various entrepreneurial development programmes in India .
4. To update the students with the latest developments in Service sector in India.

Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Forms of Business Organization	A. Organization – Meaning , Importance B. Sole Proprietorship , Partnership , LLP , Joint Stock Companies, Joint Ventures , Cooperative, Government form of Business Organization(Departmental, Corporation , Government company), Non Government Organizations – Meaning , Definition , Structure , Advantages and Disadvantages	▪ Conceptual Understanding on the various forms of Business Organization,
2	Types of Business Models	Franchise, Brick and Mortar, e- Commerce, Bricks and Clicks ,Nickel and Dime, Freemium , Subscription ,Aggregator, Online Market Place , Data Licensing/ Data Selling , Digital Advertising ,Affiliate Marketing, Drop Shipping , Agency Based, Peer to Peer Catalyst/Platform, Block Chain	1. Overview of the emerging types of business models

3	Industrial Policies and Recent Programmes for Start ups in India	<ol style="list-style-type: none"> 1. Overview of recent Industrial Policies in India – New Industrial Policy 1991, EXIM Policy , India New Foreign Trade Policy 2015 – 2020 , FDI Policy 2. Overview of : <ol style="list-style-type: none"> a. Start up India b. Atal Innovation Mission (AIM) c. Make in India d. Digital India e. Support To Training And Employment Programme For Women (STEP) f. Trade-Related Entrepreneurship Assistance And Development (TREAD) g. Pradhan Mantri Kaushal Vikas Yojana (PMKVY) 	<ol style="list-style-type: none"> 4. Overview of the various policies supporting business in India 5. Awareness on the recent programmes to promote and support for business
4	Emerging Trends in Service Sector	<p>Overview of Recent trends –</p> <ol style="list-style-type: none"> 1. Banking Sector - Internet and Mobile Banking 2. Indian Post Payments Bank 3. Insurance Sector –Malhotra Committee Report 4. Logistics 5. BPO, KPO , TPO , and LPO 6. New trends in Tourism- Religious, Rural, & Medical tourism 	<ol style="list-style-type: none"> 4. Awareness of Recent Trends in the Service Sector

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	PPT , Project Charts	Educational Videos	Individual assignment report	Developing understanding on various forms of business organizations
2	08	Guest Lectures by subject Experts / Industry Expert , Internet Assignments , Case Study Discussion on Real Life success stories	Educational Videos, Videos on Real Life success stories	Case analysis and Discussions, Business Games	Conceptual Clarity and Awareness on Latest Changes
3	14	PPT and Internet Research	https://www.india.gov.in/my-government/schemes	Report Writing , Presentation	Understanding on various Government Policies and Promotion of Entrepreneurial spirit among learners
4	14	Demonstration Method of Online Banking and Mobile Banking , Guest Lectures from experts of respective areas	Educational Videos	Field Visit Internet Research Report	Hands on Training to understand online Baking Awareness on emerging trends and knowledge enhancement

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	MCQ / PPT / Written Test	As per University norms	
Unit – II	Chart Presentation / MCQ/ Written Test	As per University norms	Undertaking a small course under Pradhan Mantri Kaushal Vikas Yojana (PMKVY)
Unit – III	Written Test / Open Book Examination	As per University norms	Certificate Course on Soft Skills for Business
Unit – IV	PPT/ MCQ/Written Test/ Field Visit and Report	As per University norms	

References :

List of Books Recommended :-

1. Financial Management – I. M. Pandey.
2. Financial Management – Theory & practical – Prasanna Chandra
3. Financial Management – S. C. Kuchhal
4. Public Sector in India – Laxmi Nariyan
5. Indian Economy – Rudder Datt
6. Indian Economy – KPM Sundaram
7. Law & practice of banking – S. R. Davar
8. The Business Model Book – Adam J Bock , Gerard George
9. Business Model Innovation – Alexander Osterwalder , Yves Pigneur
10. <https://www.india.gov.in/my-government/schemes>

Syllabus for F.Y.B.Com
Semester-II, Paper-II
Subject Name: - Financial Accounting- II
Course Code - 122

Objectives of the course

This course is intended to introduce the basic theory, concepts and practice of financial accounting and to enable students to understand information contained in the published financial statements of companies and other organizations. It includes the preparation of accounting statements, but their uses and limitations will also be emphasized.

Depth of the program – fundamental Knowledge

Objective of the Program

1. To impart knowledge of various software used in accounting
2. To impart knowledge about final accounts of charitable trusts
3. To impart knowledge about valuation of intangible assets
4. To impart knowledge about accounting for leases

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Software used in Accounting	<ol style="list-style-type: none">1. Types of Accounting Software2. Use of Accounting Software3. Installation of Accounting Software4. Advantages and disadvantages of Accounting Software <p>Voucher entry and Report Generation including GST transactions</p>	<ul style="list-style-type: none">• Students are expected to acquaint themselves with Computerised accounting, its application and utility.

2	Final Accounts of Charitable Trust (Clubs, Hospitals, Libraries etc.)	<ol style="list-style-type: none"> 1. Meaning and Characteristics 2. Accounting Records 3. Income and Expenditure Account 4. Receipt and Payment Account 5. Balance Sheet and Adjustments 	<ul style="list-style-type: none"> • Understanding the accounting process of accounting of charitable trusts • Recording basic accounting transactions and prepare annual financial statements; and • Analyzing , interpreting and communicating the information contained in basic financial statements and explain the limitations of such statements
3	Valuation of Intangibles	<ol style="list-style-type: none"> 1. Valuation of Goodwill (Problem) 2. Valuation of Brands 3. Valuation of Patents, Copyright and Trademark etc. 	<ul style="list-style-type: none"> • Learning the concept of intangible assets and the methods of their valuation.
4	Accounting for Leases	<ol style="list-style-type: none"> 1. Types of Lease (Finance Lease and Operating Lease) 2. Finance Lease (Hire Purchase and installment) (Theory) 3. Operating Lease 4. Royalty, 5. Minimum Rent, 6. Short Workings, 7. Recoupment Of Short Working, 8. Lapse of Short Working <p>Journal Entries and Ledger Accounts in the Books of Landlord and Lessee</p>	<ul style="list-style-type: none"> • Understanding the process and methods of leasing.

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Hands-on experience of using accounting software on computers	Videos available on YouTube	Voucher entries in tally	Students will be able to acquire in-depth knowledge
2	12	Visit to charitable trust for collection of relevant information	Videos available on YouTube	Visit report	Students will be able to acquire in-depth knowledge
3	12	Case studies on intangible assets and its valuation	Videos available on YouTube	Report writing	Students will be able to acquire in-depth knowledge
4	12	Case studies and expert lectures.	Videos available on YouTube	NA	Students will be able to acquire in-depth knowledge

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Advanced Accounts	M.C. Shukla, T.S. Grewal, S.C. Gupta	S. Chand Publication	New Delhi.
2.	Financial Accounting for B.Com	CA (Dr.) P.C. Tulsian S.C. Gupta	S. Chand Publication	New Delhi.
3.	Financial Accounting	Dr. Kishor Jagtap	Tech- Max Publications,	Pune
4.	Introduction to Accountancy	S.R.N Pillai & Bhagavathi	S.Chand & CompanyLtd	New Delhi

5.	Corporate Accounting	Raj Kumar Sah	Cengage Publications	Noida, Uttar Pradesh
6.	Principles of Accountancy	Principles of Accountancy	S.Chand & CompanyLtd	New Delhi
7.	Advanced Accounting	S. N. Maheshwari		
8.	GST Law and Analysis with Conceptual Procedures	Bimal Jain and Isha Bansal (Set of 4 Volumes)	Pooja Law Publishing Company	New Delhi
9.	Guidance Note on GST by ICAI	--	The Institute of Chartered Accountants of India	New Delhi

Practical for Semester – II

Topic	Mode of Practical
Introduction to Computerised accounting, Accounting software, Features, advantages and disadvantages	Library Assignment
Company creation	Computer Laboratory
Groups and ledgers creation	Computer Laboratory
Voucher entries including GST and Report Generation	Computer Laboratory

Revised syllabi (2019 Pattern) for Three Years B. Com. Degree course (CBCS)

First Year B. Com Semester-II Course Code - 123 Business Economics (Micro) - II

Objectives:

1. To understand the basic concepts of micro economics.
2. To understand the tools and theories of economics for solving the problem of decision making by consumers and producers.
3. To understand the problem of scarcity and choices.

Depth of the program – Fundamental Knowledge

Objectives of the Program

1. To impart knowledge of business economics
2. To clarify micro economic concepts
3. To analyze and interpret charts and graphs
4. To understand basic theories, concepts of micro economics and their application

Unit No.	Unit Title	Contents	Purpose skills to be developed
1	Cost and Revenue	1.1 Concepts and Types of Cost- Economic Cost and Accounting Cost, Private Cost and Social Cost, Actual Cost and Opportunity Cost, Explicit Cost and Implicit Cost, Incremental Cost and Sunk Cost, Fixed Cost and Variable Cost 1.2 Relation between Total Cost, Average Cost and Marginal Cost 1.3 Cost Curves in Short run and Long run 1.4 Concept of Total Revenue, Average Revenue and Marginal Revenue	<ul style="list-style-type: none">• To understand the concept and types of cost• To make the students know about short run and long run cost concepts• To impart knowledge about types of revenue Skills: Interpretation of cost curves, integrate cost and revenue concepts, draw inferences

2	Pricing Under Perfect Market Conditions	<p>2.1 Pure Competition: Meaning and Features</p> <p>2.2 Features of Perfect Competition</p> <p>2.3 Price Determination in Perfect Competition</p> <p>2.4 Equilibrium of Firm and Industry in Short Run and Long Run</p>	<ul style="list-style-type: none"> • To help the students understand the concept of pure and perfect competition • To impart knowledge about equilibrium of firm and industry in short and long run. <p>Skills: Understanding, writing skills, critical thinking</p>
3.	Pricing Under Imperfect Market Conditions	<p>1.1 Meaning of Imperfect Competition</p> <p>1.2 Monopoly: Features and Equilibrium, Price Discrimination</p> <p>3.3 Monopolistic Competition- Features and Equilibrium.</p> <p>3.4 Oligopoly: Concept and Features</p> <p>3.5 Duopoly: Concept and Features</p> <p>3.6 Comparison of Perfect and Imperfect Competition</p>	<ul style="list-style-type: none"> • To develop ability to understand the market structures under imperfect competition • Ability to compare perfect and imperfect competition <p>Skills: Understand complex relations, problem solving skill, analytical skill</p>
4	Factor Pricing	<p>4.1 Marginal Productivity Theory of Distribution</p> <p>4.2 Rent- Meaning, Ricardian Theory of Rent, Modern Theory of Rent, Concept of Quasi Rent</p> <p>4.3 Wages-</p> <p>4.3.1 Meaning and Types of Wages-</p> <p>a) Minimum Wages b) Money Wages c) Real Wages d) Subsistence Wages e) Fair Wages</p> <p>4.3.2 Backward Bending Supply Curve of Labour</p>	<ul style="list-style-type: none"> • To understand the theory of marginal productivity • To understand the concept and theories in factor pricing <p>Skills: Critical thinking, logical thinking, apply information processing skills</p>

		<p>4.3.3 Role of Collective Bargaining in Wage Determination</p> <p>4.4 Interest-Meaning, Loanable Fund Theory, Liquidity Preference Theory</p> <p>4.5 Profit- Meaning, Risk and Uncertainty Theory of Profit, Dynamic Theory of Profit, Innovation Theory of Profit</p>	
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Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	8	<ul style="list-style-type: none"> • Open book discussion, • Case studies 	<ul style="list-style-type: none"> • You tube lectures • Online PPTs 	<p>Types of cost in industries</p> <p>Comparison of cost and revenues in industries</p> <p>Trends of cost and revenue in industries</p>	<ul style="list-style-type: none"> • Will understand the concept and types of cost • Students will know about short run and long run cost concepts • Students will have knowledge about types of revenue
2	8	<p>Digital lectures</p> <p>Interactive lectures</p>	<ul style="list-style-type: none"> • You tube lectures • Online PPTs 	<p>Application of perfect competition markets in the markets like that of agricultural products, dairy products etc</p>	<ul style="list-style-type: none"> • Students will understand the concept of pure and perfect competition • Students will know about the equilibrium of firm and industry in short and long run.

3	14	<ul style="list-style-type: none"> • Game oriented classes • Dramatization • Group discussion 	<ul style="list-style-type: none"> • You tube lectures • Online PPTs 	<ul style="list-style-type: none"> • Study of price and output trends in oligopoly markets • Price and non price competition in monopolistic competition 	<ul style="list-style-type: none"> • Will develop ability to understand the market structures under imperfect competition • Will be able to compare perfect and imperfect competition
4	18	<ul style="list-style-type: none"> • Group discussion • Teacher driven power point presentation 	<ul style="list-style-type: none"> • You tube lectures • Online PPTs 	<ul style="list-style-type: none"> • Application of backward bending supply curve of labor in the market • Study of application of theories of factor pricing 	<ul style="list-style-type: none"> • Will understand the theory of marginal productivity. • Will understand the concept and theories in factor pricing

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Advanced Economic Theory, Microeconomic Analysis	Ahuja H.L	S.Chand and Company	New Delhi
2.	Price Theory and Applications	Jack Hirshlifer	Prentice Hall of India, Pvt. Ltd	New Delhi
3.	Microeconomics,	Paul A. Samuelson and William D. Nordhaus	McGrawhill International Ed	New York
4.	First Principles of Economics,	Richard G. Lipsey, Colin Harbury:	Gerorge Weidenfeld and Nicolon Ltd,	London
5.	Consumer Behaviour and Managerial Decision Making,	Frank R. Kardes: Pearson,	Prentice Hall,	New Delhi
6.	, Microeconomics	R. Glenn Hubbard, Anthony Patrick O.	Pearson, Prentice Hall,	New Delhi

		Brien		
7.	Microeconomics: Principles, Application and Tools	O'Sullivan, Sheffrin, Perez	Pearson, Prentice Hall,	New Delhi
8.	Priniples of Economics	Karl E. Case, Ray C.Fair,	Pearson,Prentice Hall	New Delhi

Suggested References
Web Reference

Sr. No	Lectures	Films	PPTs	Articles
1	https://www.youtube.com/watch?v=oA8kL7OD74o	https://www.economicsonline.co.uk/Business_economics/Perfect_competition.html	https://www.slideshare.net/zeeshanyounas35/perfect-and-imperfect-market-competition-76374490	http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1413-70542016000300337
2	https://www.economicshelp.org/blog/311/markets/monopolistic-competition/	https://www.youtube.com/watch?v=TTJ4kFX6uRM	https://slideplayer.com/slide/6410262/	http://www.economicdiscussion.net/price/factor-pricing-concept-and-theories/3875
3	http://www.economicdiscussion.net/price/factor-pricing-concept-and-theories/3875	https://www.youtube.com/watch?v=66fKCrsl_e_8 https://www.youtube.com/watch?v=qXmGnQ0WzPM	http://delhi.gov.in/wps/wcm/connect/40fd320047adb2d2aa2fff3f47d42062/economics-Rands.pps?MOD=AJPERES&lmod=-277090329	https://www.investopedia.com/ask/answers/032515/what-difference-between-perfect-and-imperfect-competition.asp

Syllabus for B. Com. Semester: - II

Subject Name: - Business Mathematics and Statistics - II

Course code: - 124 (A)

Depth of the program – Basic Knowledge of Mathematics and Statistics

Objective of the Program

1. To introduce the basic concepts in Finance and Business Mathematics and Statistics
2. To familiar the students with applications of Statistics and Mathematics in Business
3. To acquaint students with some basic concepts in Statistics.
4. To learn some elementary statistical methods for analysis of data.
5. The main outcome of this course is that the students are able to analyze the data by using some elementary statistical methods

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Matrices and Determinants (up to order 3 only)	Definition of a Matrix, Types of Matrices, Algebra of Matrices, Determinants, Adjoint of a Matrix, Inverse of a Matrix via Adjoint Matrix, Homogeneous System of Linear equations, Condition for Consistency of homogeneous system, Solution of Non-homogeneous System of Linear equations (not more than three variables), Applications in Business and Economics, Examples and Problems.	<ol style="list-style-type: none">1. To understand the concept of matrices and determinants.2. To understand the application of determinant in solving linear equations3. To understand applications of matrices and determinants in business and economics.
2	Linear Programming Problems (LPP) (for two variables only)	Definition and terms in a LPP, formulation of LPP, Solution by Graphical method, Examples and Problems	<ol style="list-style-type: none">1. To understand the concept of LPP and its application in business and decision making.2. To understand graphical method to solve business optimization problems with two variables.
3	Correlation and Regression	Concept and types of correlation, Scatter diagram, Interpretation with respect to magnitude and direction of relationship. Karl Pearson's coefficient of correlation for ungrouped data. Spearman's rank correlation coefficient. (with tie and without tie) Concept of regression, Lines of regression for ungrouped data, predictions using lines of regression. Regression coefficients and their properties (without proof). Examples and problems.	<ol style="list-style-type: none">1. To use correlation for knowing the relationship between two variables.2. To use regression for prediction

4	Index numbers	Concept of index number, price index number, price relatives. Problems in construction of index number. Construction of price index number: Weighted index Number, Laspeyre's, Paasche's and Fisher's method. Cost of living / Consumer price index number: Definition, problems in construction of index number. Methods of construction: Family budget and aggregate expenditure. Inflation, Uses of index numbers, commonly used index numbers. Examples and problems.	<ol style="list-style-type: none"> 1. To know different types index numbers and problems in their construction. 2. To know the applications of various index numbers.
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Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Expected Outcome
1	12	ICT	Students will be able to apply the theory of matrices to solve business and economic problems.
2	12	ICT	Students will be able represent business and economic optimization problems involving two variables as LPP and solve those problems using graphical method
3	16	ICT	<p>Students will able to predict the type of relationship between bivariate data.</p> <p>Students will be able predict the value of unknown from give bivariate data.</p>
4	08	ICT	<p>Students will be able compute different index numbers.</p> <p>Students will be able to compute cost of living.</p>

References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Practical Business Mathematics	S. A. Bari	New Literature Publishing Company	New Delhi
2.	Mathematics for Commerce	K. Selvakumar	Notion Press	Chennai
3.	Business Mathematics with Applications	Dinesh Khattar & S. R. Arora	S. Chand Publishing	New Delhi
4.	Business Mathematics and Statistics	N.G. Das & Dr. J.K. Das	McFraw Hill	New Delhi
5.	Fundamentals of Business Mathematics	M. K. Bhowal	Asian Books Pvt. Ltd	New Delhi
6.	Operations Research	P. K. Gupta & D. S. Hira	S. Chand Publishing	New Delhi
7.	Mathematics for Economics and Finance: Methods and Modeling	Martin Anthony and Norman Biggs	Cambridge University Press	Cambridge
8.	Financial Mathematics and Its Applications	Ahmad Nazri Wahidudin	Ventus Publishing ApS	Denmark
9.	Fundamentals of Mathematical Statistics	Gupta S. C. and Kapoor V. K.,	Sultan Chand and Sons	23, Daryaganj, New Delhi 110002
10.	Statistical Methods	Gupta S. P.:	Sultan Chand and Sons	23, Daryaganj, New Delhi 110002
11.	Applied Statistics	Mukhopadhyaya Parimal	New Central Book Agency Pvt. Ltd.	Calcutta.
12.	Fundamentals of Statistics	Goon A. M., Gupta, M. K. and Dasgupta, B.	World Press	Calcutta.

13.	Fundamentals of Applied Statistics	Gupta S. C. and Kapoor V. K.:	Sultan Chand and Sons	23, Daryaganj, New Delhi 110002
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Suggested references
Web reference for Semester I & II

1. www.freestatistics.tk(National Statistical Agencies)
2. www.psychstat.smsu.edu/sbk00.htm(Onlinebook)
3. www.bmj.bmjournals.com/collections/statsbk/index.shtml
4. www.statweb.calpoly.edu/bchance/stat-stuff.html
5. www.amstat.org/publications/jse/jse-data-archive.html(International journal on teaching and learning of statistics)
6. www.amstat.org/publications/chance(Chancemagazine)
7. www.statsci.org/datasets.html(Datasets)
8. www.math.uah.edu/stat(Virtual laboratories in Statistics)
9. www.amstat.org/publications/stats(STATS : the magazine for students of Statistics)
10. www.stat.ucla.edu/cases(Case studies in Statistics).
11. www.statsoft.com
12. www.statistics.com
13. www.indiastat.com
14. www.unstat.un.org
15. www.stat.stanford.edu
16. www.statpages.net
17. www.wto.org
18. www.censusindia.gov.in
19. www.mospi.nic.in
20. www.statisticsofindia.in

Computer Concepts & Applications - II

Semester – II
Course Code -124 (B)

Unit 1 Introduction to E-commerce Tools

[12]

Process of E-Commerce

Types of E-Commerce; Role of Internet and Web in E-Commerce; Technologies Used in E-Commerce Systems

E-Commerce Activities:

Various Activities of E-Commerce; Various Modes of Operation Associated with E-Commerce; Elements and Resources Impacting E-Commerce and Changes; Types of E-Commerce Providers and Vendors; Opportunity Development for E-Commerce Stages; Development of E-Commerce Business Case; Components and Factors for the Development of the Business Case; Steps to Design and Develop an E-Commerce Website.

Unit 2 Introductions to E-Marketing

[14]

E-Marketing:

Traditional Marketing; E-Marketing; Identifying Web Presence Goals – Achieving web presence goals, Uniqueness of the web, Meeting the needs of website visitors, Site Adhesion: Content, format and access; Maintaining a Website; Metrics Defining Internet Units of Measurement; Online Marketing; Advantages of Online Marketing.

E-Customer Relationship Management:

Customer Relationship Management (CRM) – Marketing automation, Enterprise customer management; Customer Relationship Management Areas; CRM Processes; Architectural Components of a CRM Solution – Customer's information repository, Campaign management, Event triggers, business logic and rules repository, Forecasting and planning tools, Electronic Customer Relationship Management; Need, Architecture and Applications of Electronic CRM.

Supply Chain Management:

Supply Chain Management (SCM); Goals of SCM; Functions of SCM; Strategies of SCM; Electronic SCM and its benefits; Components of Electronic SCM; Electronic Logistics and its Implementation.

Unit 3 Electronic Payment System

[14]

Electronic Data Interchange (Introduction to EDI, EDI Architecture Financial EDI, Overview of the technology involved in EDI

Introduction to EPS

Application of Online payment system ,Introduction to EFT (Electronic Fund Transfer) Types of EFT (NEFT, RTGS), E-Payment Systems: Electronic Funds Transfer; Digital Token Based E-Payment Systems; Modern Payment Systems; Steps for Electronic Payment; Payment Security; Net Banking.

Introduction to Digital Signature and Digital Certificates, Stages of SET

Types of Payment System: Digital Cash, Electronic Cheque, Smart Card, Credit/Debit Card

Unit 4 Introduction to M-Commerce

[8]

Definition, Need and Scope, Advantages and disadvantages of M-commerce, M-Commerce and its applications.,

Types of M-Commerce. Products and Services of M-Commerce,

Mobile payment application. Difference between E-commerce and M-Commerce.

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
Unit – I	12	Use ICT or presentation on E-commerce Tools	U-tube Tutorial on E-commerce Tools	-	Familiar with E-commerce Tools
Unit – II	12	Use ICT or presentation on E-Marketing	U-tube Tutorial E-Marketing	One case study on E-commerce Website	Familiar with E-Marketing
Unit – III	12	Use ICT or presentation on Electronic Payment System	U-tube Tutorial Electronic Payment System	Handle One E-payment Transition application Bhim, Pay...etc	Familiar with Electronic Payment System
Unit – IV	12	Use ICT or presentation on M-Commerce	U-tube Tutorial M-Commerce	-	Familiar with M-Commerce

Reference Books

- [1]. Computer Fundamentals by: Anita Goel, Pearson Education India ISBN: 9788131742136
- [2]. Connecting with Computer Science, by Greg Anderson, David Ferro, Robert Hilton, Course Technology, Cengage Learning, ISBN:9781439080351
- [3]. Fundamentals of Computer : For undergraduate courses in commerce and management, ITL Education Solutions Limited, Pearson Education, ISBN:9788131733349
- [4]. Introduction to Computer Science, 2/e, ITL Education Solutions Limited, Pearson Education, ISBN:9788131760307
- [5]. Frontiers of Electronic Commerce, Ravi Kalakota, Andrew B. Whinston, Pearson Education, ISBN:9788177583922

- [6]. Internet: The Complete Reference, Margaret Levine Young, Tata McGraw Hill Education Private Limited, ISBN: 9780070486997
- [7]. On the Way to the Web: The Secret History of the Internet and Its Founders, A. Banks, Apress Publication, ISBN: 9781430208693
- [8]. Computers and Commerce: A Study of Technology and Management at Eckert-Mauchly Computer Company, Engineering Research Associates, and Remington, Arthur L. Norberg, MIT Press (MA), ISBN: 9780262140904
- [9]. Essential of E-commerce technology By V. Rajaraman, Prentice Hall India Learning Private Limited ISBN 9788120339378
- [10]. E-commerce Fundamental and Application By Henry Chan, Wiley ISBN: -978126514694
- [11]. Information Technology By Dr. Kishor Jagtap, Tech-Max Publications, Pune

Revised syllabi (2019 Pattern) for three years B.Com. Degree course (CBCS)

Semester : - II

Subject : - Organizational Skill Development- II

Course Code - 125 (A)

Objectives of the course

1. To imbibe among the students the qualities of a good manager and develop the necessary skill sets
2. To develop the technical skills of the students to keep up with the technological advancements and digitalization
3. To develop the communication skills of students and introducing them to the latest tools in communication
4. To develop writing, presentation, interpersonal skills of the students for effective formal corporate reporting.
5. To educate the students on the recent trends in communication technology and tools of office automation

Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Office Manager	<ol style="list-style-type: none">a. Qualities of office manager, skills of office manager - Interpersonal skills, Presentation skills, thinking and Negotiation skills ,Duties and Responsibilities of office managerb. Goal Setting:- Concept, Importance of goals, SMART(Specific, Measurable, Achievable, Realistic and Time Bound)c. Time Management :-Meaning, Techniques, Principles and Significance	<ol style="list-style-type: none">1. Developing the necessary set of managerial skills2. Developing Goal setting and Time management skills in all areas of life
2	Management Reporting (Office Reports)	<ol style="list-style-type: none">a. Meaning, Purpose or Objectives and Classification of Report, Principles of preparation of report, qualities of good report, steps in report presentation, evaluating the report ,follow up of reportsb. Office Communication :- Meaning, Significance, Barriers and Recent trends in Communication such as	<ol style="list-style-type: none">1. Enhancing the communication skills2. Developing report writing skills for formal reporting3. Usability of latest Communication Media

		E-mail, Video Conferencing, Tele- Conferencing, Internet, Intranet , WWW, etc.,	
3	Work Measurement and standardization of office work	<p>a. Definition, Objects, Importance, steps in work measurement, techniques of work measurement - Time study and Motion study</p> <p>b. Standardization of office work:- Meaning, objects, areas of standardization, types of standards, methods of setting standards, advantages and limitations of standardization</p>	<ol style="list-style-type: none"> 1. Conceptual Clarity on the concept of need and importance of work measurement 2. Developing Technical and analytical skills for performance measurement. 3. Skills to develop ideal standards at work place.
4	Office Automation	Objects of Mechanization, Advantages of Mechanization, Factors in selecting office machines, Leasing versus Purchasing Office equipment , Types of modern Office Machines	<ol style="list-style-type: none"> 1. Enhancement of Technical knowledge and developing technical skills to adapt to the technical advancements 2. Critical thinking skills and technical skills to overcome the problem of choice among options

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Power Point Presentation SMART Goal Setting activity for oneself for 3 yrs Role plays	TV shows on Management	Self SMART Goal Setting Report in Detail for 3 years	Conceptual Clarity Goal Setting and Goal Measurement, Enhancing the Time Management Skills
2	12	Power Point Presentation Online Videos ,Use of Latest communication Media Live in Class Rooms	Use of Latest Communication Technology and Communication Applications	Report writing on Recent trends in Communication	Enhancing Communication Skills ,Usability of latest communication media
3	12	Guest Lectures by Experts			Development Technical and analytical skills
4	12	PPT , Educational Videos	Online Videos	Report on various office automation tools	Development of Technical skills

References :

List of Books Recommended :

1. **Modern Office Management – By Mills, Geoffrey**
2. **Office Management – By Dr. R.K. Chopra , Priyanka Gauri**
3. **Office Management – By R.S.N. Pillai**
4. **Office Management – By K.L.Maheshwari , R.K . Maheshwari**
5. **Modern Office Management : Principles and Techniques – By J.N.Jian , P.P.Singh**

F.Y B.Com.

Optional Paper

Subject Name: Banking and Finance

Course Code: 125(B)

SEMESTER II: FUNDAMENTALS OF BANKING – II

Objectives:

- To develop the working capability of students in banking sector
- To Make the Students aware of Banking Business and practices.
- To enlighten the students regarding the new concepts introduced in the banking system.

Credit: 04

No. of Lectures: 48

Unit No.	Topics	No. of Lectures	Teaching Method
1.	Lending Principles and Balance Sheet of a Bank Safety, Liquidity, Profitability, Diversification of risks and other Principles of Lending, Conflict between Liquidity, Profitability and Safety Customer assessment through CIBIL and other similar agencies Balance sheet of a bank.	10	Lecture, Expert Lecture, PPT/ Poster Presentation, Group Discussion, Library / Home, Assignment, Visit to a bank
2.	Negotiable Instruments Definition, meaning and characteristics of Negotiable instruments Definition, meaning and characteristics of Promissory Note, Bill of Exchange and Cheque. Types of Cheques- Bearer, Order and Crossed Types of Crossing- General and Special. Dishonour of Cheque	12	Lecture, PPT/ Poster Presentation, Group Discussion, Library /Home Assignment, Visit to a bank

3.	<p>Endorsement Definition and meaning of Endorsement Types of Endorsement- Blank, Full or Special, Restrictive, Partial, Conditional, Sans Recourse, Facultative. Effects of Endorsement.</p>	08	Lecture, PPT/ Poster Presentation, Group Discussion, Library /Home Assignment, Visit to a bank
4.	<p>Technology in Banking Role and Uses of Technology in Banking Automated Teller Machine (ATM) – onsite and offsite ATM, Cash Deposit machine, Cheque Deposit machine, Passbook Printing Machine, Note and Coin counting device, Fake currency detector, Credit card, Debit card –Personal Identification Number (PIN) – Use and Safety, Mobile Banking – Mobile Banking Applications - BHIM (Bharat Interface for Money) / UPI (Unified Payments Interface), Net Banking , Core Banking Online enquiry and update facility, Home Banking- Corporate and Personal. Precautions in using Technology in Banking Current Trends in Banking Technology</p>	18	Lecture, Expert Lecture, PPT/ Poster Presentation, Group Discussion, Library / Home Assignment, Visit to a bank

References:

1. Majumdar N. C., ‘Fundamentals of Modern Banking’, New Central Book Agency (P) Ltd., New Delhi.
2. Arondekar A.M. & Others, ‘Principles of Banking’, Macmillan India Pvt. Ltd.
3. Srinivasan D. & Others, ‘Principles & Practices of Banking’, Macmillan India Pvt. Ltd.
4. Agarwal O.P, (4th Edition, 2017), ‘Banking and Insurance’, Himalaya Publication House.
5. Gopinath M. N., (1st Edition, 2008) ‘Banking Principles and Operations’, Snow White Publications Pvt. Ltd, Mumbai.
6. Gordon E. & Natarajan K., (21st Revised Edition), ‘Banking – Theory, Law and Practice’ ,Himalaya Publication

House.

- 7. Kaptan S S & Choubey N S, “E-Indian Banking in Electronic Era”, Sarup & Sons, New Delhi 2003.**
- 8. Padmalatha Suresh, Justin Paul, “Management of Banking and Financial Services” Second Edition, 2013, Published By Dorling Kindersley (Pearson)**

F.Y.B.com

Optional Paper

Subject name: Defense Organization and Management in India

COURSE CODE: 125 (D)

SEMESTER- II: DEFENCE ORGANISATION AND MANAGEMENT IN INDIA-II

Objectives:

- 1) To understand the Indian intelligence services.
- 2) To know the Evolution of War techniques and Economic warfare.
- 3) To understand Indian internal security.

Unit No.	Topic	No. of Lectures	Teaching Method
1.	Indian Intelligence Services 1.1 History & Types of Intelligence. 1.2 Process & Principals of Intelligence. 1.3 Devices for Collecting Intelligence. 1.4 Role of Intelligence. 1.5 Counter Intelligence. 1.6 Indian Intelligence Organization.	12	Lecture, PPT, Group Discussion, Library Work, Assignment
2.	Evolution of War Techniques 2.1 Definition of war 2.2 Concept of war 2.3 Causes of war 2.4 Function of war 2.5 Elements of war 2.6 Resources of war	12	Lecture, PPT, Group Discussion, Library Work, Study Visit

3.	Economic Warfare 3.1 Meaning 3.2 War time Economy 3.3 Economic Mobilization 3.4 Remedy 3.5 War Economy & War Effects 3.6 Cost of War.	12	Lecture,PPT, Group Discussion, Library Work,
4.	Economic Constraints on Indian Internal Security 4.1 Economic Diversification in various states of India 4.2 Economic Influence on State & Centre Relations 4.3 Unemployment and Poverty. 4.4 Economic losses due to Natural Calamities.	12	Lecture,PPT, Group Discussion, Library Work, Assignment
	Total	48	

References:

- 1) C. Lakshmi (1998), Trends in India's' Defense Expenditure," ABC, New Delhi'.
- 2) Venkateshwaram A. L., 'Defense Organisation in India', Sage Publication, New Delhi.
- 3) Chaudhari A. P. 'Hkkjrh; ;qn/k ra=kphmRdkarh,' Prashant Publication, Jalgaon
- 4) Col.(Retd) S. Sandeep, 'Funding for Defense and Development' Sumit enterprises, New Delhi.
- 5) Sali M.L., 'Military Georgraphy' Manas Publication, New Delhi.
- 6) Chaudhari A.P.,';qn/kfoKku&laj{k.k o lkefjd'kkL=' Diamond Publication, Pune.
- 7) Raju G. C. Thomas (1978) – The Defense of India a Budgetary Perspective of Strategy and Politics," Mac Millan Publication, New Delhi.
- 8) L t. Gen. R. K. Jasbir Singh (1999), 'India's Defense Year Books,'Nataraj Publication, Dehradun.
- 9) Jadhav V.Y, Hkkjrkph jk"V^h; lqj{kk, " Snehvardhan Publication , Pune

Revised Syllabi (2019 Pattern) for three years B.Com Degree Course (CBCS)

Option paper: - Theory and Practice of Co-operation

Semester:-F.Y.B.Com -Semester II

Course Code - 125 (E)

Subject: - -: Theory and Practice of Co-operation- II

Objectives:

1. To acquaint the students with types of co-operatives.
2. To study the role of Government in Co-operative movement.
3. To Analysis the impact of LPG on Co-operation movement.
4. To study the means of Co-operative education and Training.

Depth of Programme: - Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Types of Co-operative	Rural Co-operative and Urban Co-operative Agriculture Co-operative and Non Agriculture Co-operative Credit Co-operative and Non Credit Co-operative Weaker Sections Co-operatives Federation of Co-operatives	i. To understand the Rural Co-operative and Urban C-operative institution ii. To understand the Credit Co-operative and Non credit Co-operative Society
2	Co-operative Management	Co-operative Management , Nature and function, The Role of General Body, Management committee Chairman and Managing Director/Secretary, Professional Management Co-operatives ,Role of leadership in Co-operative Management	i. To understand Co-operative Management ii. To understand Role of leadership in Co-operative Management iii. To understand Professional Management Co-operatives

3	Impact of Liberalization ,Privatization and Globalization on Co-operative movement	Impact of Liberalization, Impact of Privatization , Impact of Globalization , Opportunities for Co-operative movement in global era	To understand the Impact of Liberalization, Privatization and Globalization on Co-operative movement
4	Co-operative Education and Training:.	Co-operative Education and Training, Objectives of Co-operative Education and Training, Role of National Co-operative union of India (NCUI) ,National Council for Co-operative Training (NCCT), Institutional arrangement for co-operative training, State Co-operative Union, Co-operative training, Education and Consultancy in Maharashtra, Regional Institute of Co-operative Management, Vaikunth Mehta National Institute of Co-operative Management Pune, Maharashtra	To understand the Objectives of Co-operative Education and Training, Training arrangement in India To understand Institutional arrangement for co-operative training

Teaching Methodology

Topic No.	Total Lectures	Innovative Methods to be used	Film Shows and AV Application	Project	Expected Outcome
1	12	Documentary, Pre reading, Class discussion, examples from newspapers and internet resources, Article Review, PPT	Short Film Show on Types of Co-operative, AV Application (Audio and Visual Application)	Project Report on Credit Co-operative and Non Credit Co-operative	Understanding of basic knowledge of Types of Co-operative Society

2	12	Guest Lectures of eminent personalities, experience sharing, Pre reading, Class discussion, PPT, study visit to Co-operative department offices and Co-operative society	You Tube Video on Co-operative Management	Project on Nature and function of Co-operative management	Understanding Co-operative Management
3	12	Organise Seminar/workshop for students, Pre reading, Class discussion, Internet resources, case studies, Survey report	Use of You tube , review of particular topic	Project Report on the Impact of Liberalization ,Privatization and Globalization on Co-operative movement	Understanding the Impact of Liberalization ,Privatization and Globalization on Co-operative movement
4	12	Pre reading, Class discussion, examples through Newspapers and internet resources, Guest Lectures of eminent personalities ,PPT	Group discussion on Problems and suggestions of education and training programmes of Co-operative Education	Review of education and training programmes of Co-operative Education	Understanding Co-operative Education and Training . understanding Institutional arrangement for co-operative training

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit-I	Class participation, Assignment, Library Work, Unit Test, Group Discussion	Written Examination	Seminar/Workshop on Types of Co-operative Society
Unit-II	Class participation, Assignment, Library Work, Unit Test, Power point presentation	Written Examination	study visit to Co-operative Institution

Unit-III	Class participation, Assignment, Library Work, Unit Test, Group Discussion, PPT	Written Examination	Guest Lectures of eminent personalities
Unit-IV	Class participation, Assignment, Library Work, Unit Test, Classroom Discussion	Written Examination	study visit to Co-operative training Institution

References

Sr. No	Title of Book	Author/s	Publication	Place
1	Co-operation and Rural Development	Principal Dr.Nitin Ghorpade	Success	Pune
2	Co-operation- Principles and Practice-	Dr. D.G. Karve		
3	Theory, History and Practice of Co-operation	Dr. R.D. Beddy		
4	Bhartiya Sahkari Chalval- Tatve va Vyavhar (Marathi)	Prof. Jagdish Killol; Prof. Arvind Bondre; Prof. A. C. Bhavsar		
5	Sahkari Chalval 1904-2004 (Marathi)	Prof. K. L. F ale		
6	New Dimensions of Co-operative Management	G.S. Kamat	Himalaya Publication	New Delhi
7	Rural Development in India-Policies and Programme	Abdul Azees NP and S.M. Javed Aktar	Kalpaz Publication	
8	Human Resource Management Practices in Co-operative sector	Principal Dr.Shaikh Aftab Anwar	Idea Publication	New Delhi
9	Journal of Commerce and Management Thought(JCMT)			
10	Journal Co-operative Organization and Management , Journal of Co-operative studies			

F.Y.B.Com.
Semester - II
Optional Paper
Subject Name- Managerial Economics- II
Course Code - 125 (F)

Objectives:

1. To aware the students about various pricing practices.
2. The Students learn about the role of profit in business.
3. The Students should realize the importance of the different methods of capital budgeting as tool of project management.
4. To help the students in applying the knowledge so acquired in policy planning and managerial decision making

Unit No	Unit Title	Content	Purpose Skills to be developed
1	Forms of Business Organization	1.1 Sole Proprietorship - Meaning, features, Merits and Demerits. 1.2 Partnership - meaning, features, merits and demerits. 1.3 Joint Stock Company- Meaning, features, merits and demerits, Distinction between public company and private company.	1. To know the fundamental business organization 2.To understand the comparative merits and demerits of these organization.
2	Public Enterprises and MNCs	2.1 Public Enterprise- Meaning, features, merits and demerits, Types of Public Enterprises. 2.2 Public Private Partnership. 2.3 Multinational Corporations- Meaning, features, merits and demerits. 2.4 Role MNCs in India.	1. To understand the need for public enterprises. 2. To know the types of PEs. 3. To be familiar with the features and role of MNCs in an economy.

3	Pricing Practices-	<p>3.1 Factor affecting pricing decision</p> <p>3.2 Components in Pricing of the product</p> <p>3.3 Marginal Cost Pricing, mark-up pricing, transfer pricing, product line pricing, price skimming and penetration.</p> <p>3.4 Profit Management, Nature and measurement of profit, The hypothesis of profit maximization and its alternative.</p>	<p>1. To know the various pricing practices</p> <p>2. To know the importance of profit management in pricing practices.</p>
4	Capital Budgeting and Investment Analysis	<p>4.1 Meaning of Capital Budgeting, Need and nature of capital budgeting.</p> <p>4.2 Demand for Capital and Supply of Capital (sources of capital)</p> <p>4.3 Capital Rationing</p> <p>4.4 Methods of Capital Budgeting- Net Present Value (NPV), Internal Rate of Return (IRR), Payback period method, Average Rate of Return.</p> <p>4.5 Apprizing the profitability of project.</p>	<p>1. To know the importance capital in a business.</p> <p>2. To understand various technical concept related with investment decision.</p>

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	10	<ul style="list-style-type: none"> i. Open book discussion ii. Case studies iii. Group discussion 	<ul style="list-style-type: none"> i. You tube lectures on different types of business organization. 	<ul style="list-style-type: none"> i. Study of comparative merits and demerit of different business organisation 	<p>Students will learn about the intricacies of the various Business Organizations, their features and their comparative merits and demerits.</p> <p>In addition to that the student knows the features and role of MNCs in India.</p>
2	10	<ul style="list-style-type: none"> i. Case Studies ii. Group discussion iii. Pair learning 	<ul style="list-style-type: none"> i. You tube lectures on PEs and MNCs. ii. Films 	<ul style="list-style-type: none"> i. Study of role of MNCs. ii. Study of problem of PEs. 	<p>Student should know types of public enterprises and their comparative advantages and disadvantages. In addition to that students should features and role of MNCs in India.</p>
3	14	<ul style="list-style-type: none"> i. Case Studies ii. Group discussion. iii. Game oriented Classes. 	<ul style="list-style-type: none"> i. Films. ii. You tube lectures 	<ul style="list-style-type: none"> i. Study of pricing policy followed by a firm in your area. 	<p>Awareness of students about various pricing practices</p>
4	14	<ul style="list-style-type: none"> i. Case Studies ii. Open book discussion iii. Group discussion. 	<ul style="list-style-type: none"> i. You tube lectures ii. Films 	<ul style="list-style-type: none"> i. Study of method of capital budgeting. 	<p>Students should realize the importance of the different methods of Capital Budgeting and investment as a tool of profit management</p>

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Managerial Economics- Economic Tools for Todays Decision Makers,	Keat Paul G. and Philip K.Y. Young	Prentice Hall	Prentice Hall, New Jersey
2.	Managerial Economics,	D.N.Dwivedi D.N	Vikas Publishing House	Delhi
3.	Managerial Economics in a Global Economy	Salvatore D.	8th Edition, Oxford University Press.	
4.	Managerial Economics,	Sumitra Paul,	Macmillan 2008	
5.	P.L.Mehatha, Managerial	Managerial Economics	8th Ed. S.Chand Publishing	Economics, 8th Ed. S.Chand Publishing
6.	D.M.Mithani,	Managerial Economics-2008	Himalaya Publishing House	Mumbai
7.	Shankaran S.	Managerial Economics	Margham Publications,	Madras
8.	Thomas Christopher R. and Charles, Maurice S.,	Managerial Economics	McGraw Hill Irwin,	Boston

Suggested references Web reference

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<http://en.wikipedia.org/wiki/Economics>

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<http://www.tutor2u.net/blog/index.php/economics/>

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<https://www.intelligenteconomist.com/economics-blogs/>

<https://www.coursera.org/courses?query=managerial%20economics>

<https://www.edx.org/course/introduction-to-managerial-economics-0>

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<https://online.stmary.edu/mba/courses/managerial-economics>

<https://www.tru.ca/distance/courses/econ3041.html>

<https://www.euomba.org/managerial-economics/>

Revised Syllabi (2019 Pattern) for three year B. Com. Degree Course (CBCS)
Semester – II
Essentials of E- Commerce

Course Code :- 126 A

No. of Credits : 03

Objectives of the course :-

1. To acquaint learners with electronic data interchange and its standards
2. To develop knowledge about e-commerce process and payment solution
3. To develop practical knowledge about security of e- commerce transactions
4. To help students understand traditional v/s electronic retailing

Depth of the programme : Fundamental Knowledge

Unit No.	Unit Title	Contents	Skills to be developed
1	Electronic data interchange	Concept – types- merits-limitations of paper Brand Business, Area groups of business, Essential documents for EDE gawky electronic data interchange simile, Steps to start EDI, EDI standards, Types of EDI files, EDI & internet, Merits of EDI, Bottlenecks & limitations	1. Conceptual understanding of Electronic Data Interchange, documentation and merits of EDI.
2	Commerce Process & Payment solution	Concept of payment solution – need, internet access solution- Areas of solution – solution provider , online commerce solution – essentials of good solution technology, standards for e-commerce, e-service, e-solution, e-business solution. Shopping cart – shopping cart software, Merchant account – Features –digital receipts for online payment, Payment system & devices, Cyber cash, features –utility, Credit card, smart card, features, utility, trades & securities, Internet currency	1. Awareness about payment solutions, various payment methods and modern modes of digital payments.

Unit No.	Unit Title	Contents	Skills to be developed
3	E-commerce – security	Need of E-Commerce security, cybercrimes- resources of privacy- tampering – proxy server system, Encryption – types of security – security precautions – cryptogram – data encryption standards & certificate authority, Ensuring electronic security – e-locking services, Security caution in e-commerce – public key – infrastructure firewall – secure socket layer secure electronic transactions	1. Understanding of E-Commerce security, precautions while using E-Commerce and methods & Process of E-Commerce security.
4	Business oriented E-Commerce	Features of B2B e-commerce, Business models, E-procedure, Virtual Market, Collaborative supply chain management, Intercompany integration, B2B e-commerce communication	1. Technical knowledge about virtual market and other business to business e-commerce communication.

Teaching Methodology:

Topic No.	Total Lectures	Teaching Methods	Film Shows and AV Applications
1	10	Lecture method ,Computer Laboratory demonstrations, Power Point Presentations	Online educational videos on related topics
2	12	Lecture method ,Computer Laboratory demonstrations, Power Point Presentations	Online educational videos on related topics
3	12	Lecture method ,Computer Laboratory demonstrations, Power Point Presentations	Online educational videos on related topics
4	14	Lecture method ,Computer Laboratory demonstrations, Power Point Presentations	Online educational videos on related topics

References:

1. E-Commerce – Henry chan willey, India
2. E-Commerce- P.T. Joseph P. H. I.
3. Understanding e-commerce, J. K. Shim A. A. Quareshi infinity books
4. E-commerce- P. W. Mann MJP publishers
5. E-commerce- C. S. Rayudu, Himalaya publishing house
6. E-commerce-K. K. Bajaj-D. Nag T. M. G. H.

F.Y. B.Com.

Optional Paper

Subject Name : Insurance and Transport - II

Course Code: 126 (B)

SEMESTER II - TRANSPORT

Objectives :

1. To acquaint students with the concepts of transport.
2. To create awareness regarding basic knowledge about transportation system in India.
3. To make the students aware of career opportunities in the field of transport.

No. of Lectures : 48

Unit No.	Topic	No. of Lectures	Teaching Method
1.	Introduction to Transport 1.1 Meaning 1.2 Importance of Transport 1.3 Types of Transport 1.4 Benefits of Transport 1.5 Problems of Transport Development in India 1.6 Measures to solve Transport Problems 1.7 Career opportunities in Transport Sector	12	Lecture, PPT, Group Discussion, Library Work, Assignment

<p>2.</p>	<p>Road Transport</p> <p>2.1 Meaning and Characteristics of Road Transport</p> <p>2.2 Importance of Road Transport in India</p> <p>2.3 Development of Road Transport in India since 1951</p> <p>2.4 Problems and Issues in Road Development</p> <p>2.5 Measures for Improvement in Road Transport</p>	<p>12</p>	<p>Lecture, PPT, Group Discussion, Library Work, Assignment</p>
<p>3.</p>	<p>Railway Transport</p> <p>3.1 Meaning and Features of Railway transport</p> <p>3.2 Significance of Railway transport</p> <p>3.2 Monorail and Metrorail</p> <p>3.3 Gauge of a railway track-Meaning and Classification</p> <p>3.4 Advantages and Limitations of Railway transport</p> <p>3.5 Progress of Railway Transport in India since 1951</p> <p>3.6 Problems of Indian Railways</p> <p>3.7 Measures to solve problems of Indian Railways</p>	<p>12</p>	<p>Lecture, PPT, Group Discussion, Library Work, Assignment</p>
<p>4.</p>	<p>Water and Air Transport</p> <p>4.1 Water Transport:</p> <p>4.1.1 Meaning and Significance of Water Transport</p> <p>4.1.2 Inland Water Transport and Coastal or Marine Transport</p> <p>4.1.3 Indian Shipping Growth and Problems</p> <p>4.1.4 Prospects of Water Transport in India</p>	<p>12</p>	<p>Lecture, PPT, Group Discussion, Library Work, Assignment</p>

	4.1.4 Limitations of Water Transport		
	4.2 Air Transport:		
	4.2.1 Meaning and Features of Air Transport		
	4.2.2 Importance of Air Transport		
	4.2.5 Progress of Air Transport in India		
	4.2.4 Problems and Prospects of Air Transport		
	Total	48	

References:

1. Misra S.K. and Puri V.K (2014) Indian Economy, Himalaya Publishing House, Mumbai.
2. India 2015, Ministry of Information and Broadcasting, Government of India.
3. Datt Gaurav and Mahajan Ashwani (2014) Datt and Sundharam Indian Economy, S. Chand and Company Ltd. New Delhi.
4. Agarwal A.N. (2001) Indian Economy, Problems of Development and Planning, WishwaPrakashan, New Delhi.
5. Shukla M.B. (2012) Indian Economy, Taxmann Publications(P)Ltd.,New Delhi.
6. Government of India, Economic Survey various Issues
7. Reserve Bank of India, Annual Report various issues
8. http://www.indianrailways.gov.in/railwayboard/uploads/directorate/stat_econ/IRSP_2016-17/Facts_Figure/Fact_Figures%20English%202016-17.pdf
9. <http://www.ncert.nic.in/NCERTS/l/legy210.pdf>
10. http://planningcommission.nic.in/reports/genrep/NTDPC_Vol_01.pdf
11. http://www.nwda.gov.in/upload/uploadfiles/files/NWDA_Annual_Report_English_2016-17-low.pdf
12. https://www.epw.in/system/files/pdf/1956_8/16/progress_of_indian_railways.pdf
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Revised syllabi (2019 Pattern) for three years B.com Degree course (CBCS)

FY B Com Semester : II

Course Code - 126 (C)

Subject : Marketing and Salesmanship- Fundamental of Marketing- II

1. Objective of the Course

1. To introduce the concept of Salesmanship.
2. To give insight about various techniques required for the salesman.
3. To inculcate the importance of Rural Marketing.
4. To acquaint the students with recent trends in marketing and social media marketing.

Depth of the Program - Fundamental Knowledge

Objectives of the Program

1. To help the students to prepare themselves for opportunities in marketing field.
2. To study elaborately the process of salesmanship.
3. To know about Rural Marketing which is an important sector in modern competitive Indian Scenario.
4. To educate the students about the sources and relevance of Recent trends in Marketing.

UNIT NO.	UNIT TITLE	CONTENTS	PURPOSE SKILLS TO BE DEVELOPED
1	Salesmanship	1.1 Meaning and Definition of Salesmanship 1.2 Features of Salesmanship 1.3 Scope of Salesmanship 1.4 Modern Concept of Salesmanship 1.5 Utility of Salesmanship 1.6 Elements of Salesmanship 1.7 Salesmanship : Arts or Science	Students will get the knowledge of Salesmanship and various approaches.

		<p>1.8 Salesmanship – a Profession</p> <p>1.9 Qualities of Salesman</p>	
2	Process of Selling	<p>2.1 Psychology of Salesmanship – Attracting Attention, Awakening Interest, Creating Desire and Action</p> <p>2.2 Stages in Process of Selling –</p> <ul style="list-style-type: none"> (i) Pre-Sale Preparations (ii) Prospecting (iii) Pre-Approach (iv) Approach (v) Sales Presentation (vi) Handling of Objections (vii) Close (viii) After Sales Follow-up 	Techniques of salesmanship skills will be developed.
3	Rural Marketing	<p>3.1 Rural Marketing</p> <ul style="list-style-type: none"> 3.1.1 Introduction 3.1.2 Definition of Rural Marketing 3.1.3 Features of Rural Marketing 3.1.4 Importance of Rural Marketing 3.1.5 Present Scenario of Rural Market 3.1.6 Challenges and Opportunities in Rural Marketing 	Awareness and importance of Rural Marketing amongst students.
4	Recent Trends in Marketing	<p>4.1 Digital Marketing</p> <p>4.2 Green Marketing</p> <p>4.3 Niche Marketing</p> <p>4.4 E-marketing</p> <p>4.5 Social Media Marketing- Challenges and Opportunities</p>	Skills of Modern Marketing will be developed.

Teaching Methodology

Topic No.	Total Lectures	Innovative Methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	14	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Short Film AV Application		Students will get knowledge of the basics of salesmanship which is a vital aspect of marketing.
2	14	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Short Film AV Application		It will help the students to implement this knowledge in practicality by enhancing their skills in the field of marketing by using various techniques of salesmanship.
3	12	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	AV Application		It will help the students to gain insights about Rural Marketing and its uniqueness.
4	08	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Short Film, AV Application Use of You Tube		It will help the students to gain the insights about recent trends in marketing field.

Methods of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit - I	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Written Examination	Marketing Management Course
Unit - II	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Written Examination	Sales Marketing Management
Unit - III	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Written Examination	Rural Marketing Online Course
Unit - IV	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Written Examination	Online Marketing Course

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Marketing Management	Philip Kotler	Pearson Publication	
2	Marketing Management	RajanSaxena	McGraw Hill Education	
3	Principles of Marketing	Philip Kotler& Gary Armstrong	Pearson Publication	
4	Sales & Distribution Management	Tapan K Panda	Oxford Publication	
5	Advertising Management	Rajiv Batra	Pearson Publication	
6	Retail Management	Swapna Pradhan	McGraw Hill Publication	
7	Retail Management	Gibson Vedamani	Jayco Publication	
8	Marketing Management	V. S. Ramaswamy & S. Namakumari	Macmillan Publication	
9	Supply Chain Management	Sunil Chopra, Peter Meindl& D. V. Karla	Pearson Publication	

Syllabus for B. Com. Semester –II
Subject Name: - Business Ethics - II
Course code:- 126 (D)

Depth of the program – Fundamental Knowledge

Objective of the Program

1. To enhance students' general awareness of ethical dilemmas at work.
2. To understand differing perceptions of interests in business-related situations
3. To introduce the concept of Corporate Social Responsibility, corporate Governance and explore its relevance to ethical business activity
4. To examine whether ethics set any boundaries on Accounting, marketing, IT, Social Media and workplace.
5. To prepare students to play a constructive role in improving the sustainable development with which they may become involved.

Unit No	Unit Title	Contents	Purpose Skills to be developed
1	Business Ethics	Business ethics–Meaning, definitions, scope , objectives, need and Principles. Human values and moral –meaning, formation and importance. Professional Ethics-meaning and significance, management and ethics Gandhian approach in Ethics. Global Trends in Ethics.	1. Equip the students with a skills to resolve the business problems with ethical norms. 2. Recognize the inherent conflict of interest in many business decisions.

2	Corporate Social Responsibility	<p>CSR – concept, scope, forms of CSR, dimensions of CSR, legal and ethical foundation for CSR, steps to attain CSR,</p> <p>International Approach to CSR</p> <p>CSR Activities in-</p> <ul style="list-style-type: none"> a. Social welfare, b. Healthcare, c. Education and d. Infrastructure 	<p>Understanding the scope CSR and it's scope</p> <p>2. To know the global trends</p>
3.	Corporate Governance and Business ethics	<p>Corporate Governance- concept, objectives, features, core principles of good corporate governance, advantages, system of corporate governance and SEBI's guideline</p> <p>Whsle Blowing- Meaning causes and types.</p> <p>Current issues of Business ethics in-</p> <ul style="list-style-type: none"> a. Accounting, b. Social Media, c. IT, d. Marketing and Advertisement e. Harassments and discrimination at workplace 	<p>Acquaint the students with corporate governance and global business ethics.</p>

4.	Sustainable Development and Ethics	<p>Sustainable Development- concept, need principles and importance, Goals of sustainable development and challenges to achieve SD.</p> <p>Achievements of Sustainable Development in India- clean water, clean energy, no poverty, zero hunger, Good Health, quality education, climates action and Industry innovations infrastructure.</p> <p>Ethics and sustainable development,</p>	<p>Identify various facts of sustainable development Apply the knowledge of sustainable development for people education</p>
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Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Article Review, Group Discussion, Quize	Documentary	-	Acquaint knowledge and maturity to understand the Business Ethics
2	12	Survey report. Poster presentation, Guest lecture	Short film	-	Application of CSR in various sector
3	12	Interview, Game, PPT, Narrating	Documentary	-	To analyze corporate governance in India
4	12	Project making, Street play, jingles m	Short Film	Project	To understand and achieve sustainable development

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Continuous Evolution	Written Exam	Related Short Term Course/ Seminar/Workshop
Unit – II	Continuous Evolution	Written Exam	Related Short Term Course/ Seminar/Workshop
Unit – III	Continuous Evolution	Written Exam	Related Short Term Course/ Seminar/Workshop
Unit – IV	Continuous Evolution	Written Exam	Related Short Term Course/ Seminar/Workshop

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Ethics in Management	S.A. Sherlekar ,	Himalaya Publication	New Delhi
2.	Business Ethics and corporate Governance	S S Khanka	S. Chand Publication	Mumbai
3.	Business Ethics and Corporate Governance	S. K. Bhatia	Deep and Deep sons	New Delhi
4.	Corporate Governance : Principle, Policies and Practices	Bob Tricker	Oxford University Press	New Delhi
5.	Management by Values	S.K.Chakraborti ,	Oxford University Press	Mumbai
6.	Business Ethics And Corporate Governance	A. C. Fernando	Dorling Kindersly	Mumbai
7.	E Commerce - A Study in Business Ethics	Rituparna Raj	Himalaya Publication	New Delhi
8.	E-Commerce and It' Applications	Dr. U. S. Pandey, Rahul Srivastava and Saurabh Shukla.	S. Chand & Company,	New Delhi
9.	The sustainable development goals	United Nations	United Nations Publication	UN

10.	Atlas of Sustainable Development Goals 2017: from World Development Indicators	World Bank	World Bank Publication	-
11.	Business Ethics And Corporate Governance	A. C. Fernando	Dorling Kindersly	Mumbai
12.	The age of sustainable development goals	Jeffery D Saches and Ki Moon Ban	Columbia University Press	- -

Suggested References -Web Reference

Sr. No	
1	http://www.mca.gov.in/MinistryV2/csrdatasummary.html
2	Csr.gov.in
3	https://www.acclimited.com/sustainable/corporate-social-responsibility
4	https://www.youtube.com/watch?v=FN0kRR98518
5	https://sustainabledevelopment.un.org/?menu=1300
6	https://www.toppr.com/guides/business-communication-and-ethics/business-ethics/meaning-and-ethical-principles-in-business/

Syllabus for F.Y.B.Com

Semester-II, Paper-II

Subject Name: - Business Environment & Entrepreneurship - II

Course Code:-126 (E)

Depth of Programme: - Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Entrepreneurial Behaviour	Nature- Comparison between entrepreneurial and non-entrepreneurial, Personality-Habits of Entrepreneurs – Dynamics of Motivation	Understanding the difference between entrepreneurial and non-entrepreneurial, personality, Habits of Entrepreneurs Skill-developing entrepreneurial personality and developing habits of entrepreneurs in students
2	Entrepreneurship	Concept- Need and Importance of Entrepreneurship - Economic Development and Industrialization - Role of Entrepreneurship in economy- Entrepreneur as a catalyst	Providing knowledge and significance of entrepreneurship Skill-Realising role of entrepreneurship in economy
3	Institutions working for promoting entrepreneurship	<ol style="list-style-type: none">1) Entrepreneurship Development Institute of India (EDII)2) Maharashtra Centre for Entrepreneurship Development (MCED)3) District Industries Centre (DIC)4) Maharashtra Chamber of Commerce, Industries and Agriculture(MCCIA)5) Role of local NGO in promoting Entrepreneurship	Gaining knowledge of various institutions promoting entrepreneurship Skill-Acquaintance with these institutions

4	Study of entrepreneurs	1) Hanumant Gaikwad (BVG) 2) Kiran Mazumdar Shaw 3) Suwasini Kirloskar 4) Any successful Entrepreneur from your area	Getting inspiration from the entrepreneurs Skill-Developing entrepreneurial personality by getting inspiration from the entrepreneurs
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Teaching Methodology- F.Y.B.Com Semester-II, Paper-II

Topic No.	Total Lectures	Innovative Methods to be used	Film Shows and A.V. Application	Project	Expected Outcome
1	12	Study of entrepreneurial and non-entrepreneurial personalities with the help of properly designed questionnaire	Related videos and PPT, Film 'Entrepreneurship' produced by Asian Centre for Research and Training (Pune)	A group of 3 to 5 students to interview entrepreneurial and non-entrepreneurial personalities and note the difference among them, also study habits of entrepreneurs, Shadow Training, Work experience, Entrepreneurship and Management Games	Understanding the difference between entrepreneurial and non-entrepreneurial personalities and thereby getting inspiration to make students personality entrepreneurial
2	12	Study of contribution of entrepreneurship in economic development (Study of selected advanced nations)	Film 'Entrepreneurship' produced by Asian Centre for Research and Training (Pune)	Form a group of 3 to 5 students to search role of entrepreneurship in economy, visit to exhibitions to get insight of entrepreneurship	Understanding the significance of entrepreneurship in economy thereby getting inspiration to become entrepreneur
3	12	Visit website of related institutions working for promoting entrepreneurship	Acquire CDs of related institutions working for promoting entrepreneurship	Visit to offices/regional offices of related institutions working for promoting entrepreneurship	Knowing the functions of related institutions
4	12	Study of Biographies of entrepreneurs and presenting in students group	Films on lives of Entrepreneurs	A group of students to interview entrepreneurs	Inspiration from study of Biographies to become entrepreneurs

Method of Evaluation: F.Y.B.Com Semester-II, Paper-II

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit-I	Class participation, Assignment, Library Work, Unit Test, Case Studies	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Study of Entrepreneurial and Non-entrepreneurial Behaviour
Unit-II	Seminar, Class participation Assignment, Library Work, Unit Test	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Entrepreneurship Development
Unit-III	Seminar, Class participation Assignment, Library Work, Unit Test	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Introduction to institutions working for promoting entrepreneurship
Unit-IV	Seminar, Class participation Assignment, Library Work, Unit Test, Field Work	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Inspiring Entrepreneurship

References

Sr. No	Title of Book	Author/s	Publication	Place
1	Business Environment	Francis Cherunilam	Himalaya Publishing House	New Delhi
3	Dynamics of Entrepreneurship Development and Management	Desai Vasant	Himalaya Publishing House	New Delhi
4	Entrepreneurial Development	Khanka S.S.	S. Chand	New Delhi
5	Entrepreneurial Development	Gupta, Shrinivasan	S. Chand	New Delhi
6	Udyog	--	Udyog Sanchalaya	Mumbai
7	Indian Economy	Ruddar Datt, K.P.M. Sundharam	S. Chand	New Delhi

Revised syllabi (2019 Pattern) for three years B.Com. Degree course (CBCS)

Semester : - II (F.Y.B.Com)

Course Code - 126 (F)

Subject : - **Foundation Course in Commerce**

1. Preamble

It is essential for every student of commerce to have understating on the recent improvements and innovations in commerce. The Current commerce industry has seen a major shift from Physical to Digital , with significant emphasis on the service sector form the previous era of manufacturing , from Business to Entrepreneurship.

The students of Commerce need to develop an understanding on the importance of Management and Administration in the early years to develop the skills required for a successful future

Objectives of the course

1. To introduce the students to the Concept of Entrepreneurship
 2. To improve the understanding of the students on E- Commerce
 3. To improve the knowledge of students on recent trends in Retail Sector
 4. To introduce the students to the concept of Management and Administration
- Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Contents	Skills to be developed
1	Entrepreneurship	Entrepreneurship : Introduction , difference between Business and Entrepreneurship , Qualities of an Entrepreneur Role of Entrepreneur in Social and Economical Development of the Country Types of Entrepreneurs	<ol style="list-style-type: none">1. Conceptual Understanding on Entrepreneurship ,2. Motivate the students develop Entrepreneurship Skills3. Develop Innovative entrepreneurial ideas

2	E-Commerce	<p>Introduction- Meaning, Features, Functions and Scope of E-Commerce-Importance and Limitations of E-Commerce.</p> <p>Types of E-Commerce: B2B, B2C, C2B, C2C,B2G, C2G, B2A, C2A and P2P, B2B service provider.</p>	<ol style="list-style-type: none"> 1. Understanding e- Commerce and its future prospectus 2. Awareness on the various forms of e-commerce
3	Retailing	<p>Introduction, Concept of Organized and Unorganized Retailing, Trends in Retailing, Innovations in Retailing in India , Growth of Organized Retailing in India, Measures adopted by Unorganized Retailers for Survival, FDI in Retail in India. Digital Retailing and Overview</p>	<ol style="list-style-type: none"> 1. Introduction to the Recent trend in Retailing 2. To develop conceptual understating on Digital Retailing
4	Management and Administration	<ol style="list-style-type: none"> a) Management: Concept and Features b) Administration: Concept and Features c) Difference between and Management and Administration d) Scope of Management 	<ol style="list-style-type: none"> 1. Conceptual understating on Management and Administration

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	PPT , Success Stories , Organizing Entrepreneurship Fairs al College Level , Guest Lectures by Successful Entrepreneurs	Interview videos and Documentaries and Motivation Videos of Eminent Entrepreneurs	Project on Innovative entrepreneurial Ideas	Developing Entrepreneurial Spirit among the students
2	12	Guest Lectures by subject Experts / Industry Expert , Internet Assignments , Case Study Discussion on Real Life success stories	Educational Videos, Videos on Real Life success stories	Case analysis and Discussions,	Conceptual Clarity and Awareness on Latest trends in e-commerce
3	12	PPT and Internet Research , Field visit to Organized and Unorganized Retail Sector.	Online Videos, Live demonstration on Online Retail e.g. Amazon, Big Basket etc.	Interview of Retailers and Managers in Organized and Unorganized Retail Sector / Project on a Retail Outlet in Organized and Unorganized	Understanding on the recent changes and innovations in the Retail Sector
4	12	PPT , Guest Lectures	Educational Videos	Project Report	Conceptual understanding on Management and Administration Understanding on Difference between Management and Administration

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	MCQ / PPT / Written Test	As per University norms	Entrepreneurship Development Workshop with Certification
Unit – II	Chart Presentation / MCQ/ Written Test	As per University norms	Certificate Course E- Commerce
Unit – III	Written Test / Open Book Examination	As per University norms	Diploma Course on Retail Management
Unit – IV	PPT/ MCQ/Written Test/ Field Visit and Report	As per University norms	Workshop on Leadership Development

References :

List of Books Recommended :-

- Introduction To E – Commerce, Dhawan, Nidhi, International Book House
- E- Commerce - Rajaraman
- Business Organisation Management Maheshwari, Rajendra P ,Mahajan, J. P . International Book House
- Business Organization and Principles of Management by Dutta Chowdury, Central Education
- Retailing Management, Levy Michael., Weitz Barton A, Tata Mcgraw Hill
- Strategic Management, David, Fred R., Phi Learning
- Government Policies on FDI in Retail.
- Retail Management - S.C. Bhatia Atlantic Publishers & Dist, 2008
- Retail Survival of the Fittest: 7 Ways to Future-Proof Your Retail Store by Francesca Nicasio
- Retail Management : Rajnish Tuli , Nidhi Varma Srivastava , Paperback
- Entrepreneurial Development by Khanka S.S , S.Chand
- Innovation and Entrepreneurship by Peter F. Drucker
- The Oxford Handbook of Entrepreneurship Edited by Anuradha Basu, Mark Casson, Nigel Wadeson, and Bernard Yeun

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Savitribai Phule Pune University
Faculty of Commerce & Management
S Y B Com (Semester III)
(Choice Based Credit System)
Revised Syllabus (2019 Pattern)

CORE COURSE – I

Subject: Business Communication-I

Course Code: 231

Total Credits: 04 (Theory 03 + Practical 01=04)

1. Objectives of the Course:

- a. To understand the concept, process and importance of communication.
- b. To acquire and develop good communication skills requisite for business correspondence.
- c. To develop awareness regarding new trends in business communication.
- d. To provide knowledge of various media of communication.
- e. To develop business communication skills through the application and exercises.

Medium of Instruction: English

Unit No.	Unit Title	Contents	Skills to be developed
1	Introduction of Business Communication	1.1 Introduction, Meaning, Definition. 1.2 Characteristics, Importance of communication. 1.3 Principles of communication, Process of communication 1.4 Barriers to communication & Remedies. 1.5 Methods and Channels of Communication.	i. Conceptual Clarity and understanding the Meaning , Characteristics and Importance of communication. ii. To understand the Principles and Process of communication iii. To understand Barriers to communication
2	Business Letters	2.1 Meaning and Importance 2.2 Qualities or Essentials, Physical Appearance 2.3 Layout of Business	i. To understand the importance of business letters. ii. To understand Essentials

		Letter	Qualities of business letters.
3	Soft skills	<p>3.1 Meaning, Need, Importance.</p> <p>3.2 Elements of soft skills.</p> <p>a) Manners & Etiquettes, Grooming.</p> <p>b) Effective Listening & Speaking</p> <p>c) Interview Skills.</p> <p>d) Presentation</p> <p>e) Group Discussion.</p> <p>f) Problem-solving skills</p> <p>G)Time management abilities</p>	<p>i. To acquire the fundamental knowledge about soft skills</p> <p>ii. To understand the Elements of Soft Skills</p>
4	Resume writing & Job Application letters	<p>4.1 Introduction, essential elements of Bio data, Resume writing, Curriculum Vitae.</p> <p>4.2 Meaning & Drafting of Job Application letter.</p>	To understand Resume writing and Job application letter.

Teaching Methodology:

Topic No.	Total Lectures	Innovative Methods to be used	Film Shows and A.V. Application	Project	Expected Outcome
1	12	Lecture, PPT Presentation Poster Presentation, Group Discussion, Library visit ,Home Assignment ,Pre reading, Class discussion , library visit ,	Relevant You Tub Videos ,Relevant slide show, online Video Short Film Show	Individual assignment report	Understanding of basic knowledge of Business Communication .

		internet resources			
2	10	Pre reading, Class discussion, internet resources, Lecture, Expert Lecture, PPT / Poster Presentation, Group Discussion, Library /Home Assignment ,Internal Assignment, case study	Relevant You Tub Videos , Short Film Show, A.V Application	Visit to Office	Understanding the importance and Essentials Qualities of business letters.
3	18	Lecture, PPT Presentation Poster Presentation, Group Discussion, Library visit ,Home Assignment ,Pre reading, Class discussion , library visit , internet resources ,students Seminar/Workshop case study	Relevant You Tub Videos.PPT ,AV Application, online video	Presentation	Understanding the knowledge about soft skills.To create awareness about soft skill among the students
4	08	Guest Lectures of eminent Personalities , Group Discussion, Library visit ,Home Assignment ,case study	Online Videos, Relevant slide show , Short Film Show	Individual Resume / Bio-Data Writing	To create ability among the students for writing resume and Job application letter. To create ability among the students for Business Correspondence
Total	48				

References:

Sr. No	Title of Book	Author/s	Publication	Place
1	Business Communication	K. K.Sinha	Galgotia Publishing	New Delhi.

			Company	
2	Business Correspondence & Report Writing	R. C. Sharma & Krishan Mohan	Tata McGraw Hill Publishing Co. Ltd.	New Delhi.
3	Communication	C.S. Rayudu	Himalaya publication	Mumbai
4	Business Communication	Asha Kaul	Prentice Hall of India	New Delhi.
5	Business Communication	Vasishth Neeru & Rajput Namita	Kitab Mahal	Allahabad
6	Soft Skills	Dr. Alex	S.Chand Publication	Delhi
7	Essentials of Business Communication	Rajendra Pal & Korlahalli	Sultan Chand & Sons	New Delhi.
8	Managerial Communication	P. D. Chaturvedi & Mukesh Chaturvedi	Pearson	Delhi

Guidelines for completion of Practical's:

- 1) At least three Practical's should be completed during each semester by students in consultation with subject teacher.
- 2) Practical should be based on visit as well as library assignments, Project based, Activity based.
- 3) A subject teacher has special privileges to make the allotment of practical topics.
- 4) Students should discuss with the subject teacher at the time of selection of practical topics.
- 5) If a student fails to complete minimum number of practical's, then the student shall not be eligible for appearing at the practical examination.

CORE COURSE – II

Subject: CORPORATE ACCOUNTING -I

Course Code: 232

Total Credits: 03

Preamble

In the modern economic environment, the corporate sector is one of the major contributors towards GDP of any country and is also one of the largest and fastest growing sectors for providing employment opportunities. In last decade, the corporate sector has seen a massive growth in economic terms i.e. the volume of turnover, income and expenses etc. and also in terms of expansion of business across the globe. Accounting plays a vital role in this growth and to ensure safeguard of the interest of the stakeholders and the society. It is, therefore, important to educate the students of commerce in the accounting practices adopted by the corporate organizations.

Objectives of the course:

1. To acquaint the student with knowledge about various Concepts , Objectives and applicability of some important accounting standards associated with to corporate accounting.
2. To develop understanding among the students on the difference between commencement and incorporation of a company and the accounting treatment for transactions during the two phases.
3. To update the students with knowledge for preparation of final accounts of a company as per Schedule III of the Companies Act 2013
4. To empower to students with skills to interpret the financial statements in simple and summarized manner for effective decision making process.
5. To acquaint the student with knowledge about various Concepts , Objectives and applicability of some important accounting standards associated with to corporate accounting.
6. To develop understanding among the students on the difference between commencement and incorporation of a company and the accounting treatment for transactions during the two phases.
7. To update the students with knowledge for preparation of final accounts of a company as per Schedule III of the Companies Act 2013
8. To empower to students with skills to interpret the financial statements in simple and summarized manner for effective decision making process.

Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Contents	Skills to be developed
1.	Accounting Standards	<ul style="list-style-type: none">• Standards 5, 10, 14 Accounting and 21• Its applicability with Practical Examples.	<ul style="list-style-type: none">• To develop conceptual understanding about various Accounting Standards and its applicability in corporate accounting.

2.	Profit Prior to Incorporation	<ul style="list-style-type: none"> • Introduction to the process on incorporation of a company. • Difference between incorporation and commencement of a company. • Accounting of incomes and expenses during Pre- and Post-Incorporation period. • Basis of allocation and apportionment of income and expenses for the Pre- and Post-Incorporation period. 	<ul style="list-style-type: none"> • To develop Conceptual understating about Pre- and Post-Incorporation period. • To develop analytical skills (by understanding the allocation and apportionment of incomes and expenses for the Pre- and Post-Incorporation)
3.	Company Final Accounts	<ul style="list-style-type: none"> • Preparation of Company Final Accounts- Forms and contents as per Provisions Schedule III of the Companies Act 2013 (with the amendments for the relevant academic year) • Related adjustments and their treatment. 	<ul style="list-style-type: none"> • To understand Practical Application of financial statements along with various adjustments. • To understand revised format of company final accounts.
4.	Valuation of Shares	<ul style="list-style-type: none"> • Concept of Valuation, • Need for Valuation, • Special Factors affecting Valuation of Shares, Methods of Valuation – • Net Assets Method, • Yield Basis Method, • Fair Value Method 	<ul style="list-style-type: none"> • To understand the concept and need of valuation of shares • To understand the methods of valuation of shares.

Teaching Methodology:

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	10	Use of e-contents, online lectures and quiz, PowerPoint Presentations	Lectures of experts available on YouTube and other digital platforms	Individual assignment report	Developing understanding on applicability of various Accounting Standards

2	12	Use of e-contents, online lectures and quiz, PowerPoint Presentations	Lectures of experts available on YouTube and other digital platforms	---	Knowledge about types of profit and their apportionment
3	18	Use of e-contents, , online lectures and quiz, PowerPoint Presentations	Study of the Final Accounts an Indian Company from its Annual Report	Individual assignment of solving practical problems	Conceptual Clarity and Practical understanding
4	08	Valuation of shares of an Indian company based on Financial statements of latest relevant financial year by a Chartered Accountant / Subject Expert	Lectures of experts available on YouTube and other digital platforms	Group Activity - Project Report on Valuation of shares of an Indian company based on Financial statements of latest 3 relevant financial years	Analytical skills enhancement and Decision making skills of students will be developed

Method of Evaluation:

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	MCQ / Small Practical Problems	As per University norms	--
Unit – II	Practical Problems	As per University norms	--
Unit – III	Practical Problems written Test / MCQ	As per University norms	--
Unit – IV	Written Test /Report writing on valuation of shares of a company from its latest annual report	As per University norms	Certificate course on GST

List of Books Recommended :-

1. Advanced Accounts: By M.C. Shukla & S.P. Grewal (S.Chand & Co.Ltd.)
2. Advanced Accountancy: By S.P. Jain & K.N. Narang (Kalyani Publishers)
3. Advanced Accountancy: By R.L.Gupta & M. Radhaswamy (Sultan Chand & Sons)
4. Company Accounts: By S.P. Jain & K.L. Narang
5. Advanced Accounts: By Paul Sr.
6. Corporate Accounting: By Dr. S. N. Maheshwari & S.K. Maheshwari
7. Corporate Accounting: By Mukharji & Hanif
8. Accounting Standards –as issued by Institute of Chartered Accountants of India.

CORE COURSE – III

Subject: BUSINESS ECONOMICS (MACRO)

Course Code: 233

Total Credits: 03

Preamble:

An approach to Macro Economics is to examine the economy as a whole. This paper aims to provide knowledge about macroeconomics that includes macro-economic variables and theories. It also aims to make students familiar about the various concepts of macro-economics, national income, macro-economic theories and its implications in the economy.

Scope of the programme –

Basic Knowledge of Macro Economics

Objectives –

- To familiarize the students to the basic theories and concepts of Macro Economics and their application.
- To study the relationship amongst broad aggregates.
- To impart knowledge of business economics.
- To understand macroeconomic concepts.
- To introduce the various concepts of National Income.

Unit	Name and Content of the Chapter	Purpose & Skills to be Developed
Unit 1	Introduction to Macro Economics	Purpose: To make the students aware of concepts in macroeconomics Skills: Analyze & think critically, develop writing skills.
	1.1 Meaning and Definition of Macro Economics.	
	1.2 Nature of Macro Economics.	
	1.3 Scope of Macro Economics.	
	1.4 Significance of Macro Economics.	
	1.5 Limitations of Macro Economics.	
	1.6 Macro Economic Objectives.	
Unit 2	National Income	Purpose: To make the students aware of basic concepts in national income Skills: Analyze & think critically, quantitative aptitude and develop writing skills.
	2.1 Meaning and Importance of National Income.	
	2.2 Concepts: 2.2.1 Gross National Product (GNP) 2.2.2 Net National Product (NNP) 2.2.3 Gross Domestic Product (GDP) 2.2.4 Per Capita Income (PCI) 2.2.5 Personal Income (PI) 2.2.6 Disposable Income (DI)	
	2.3 Measurement of National Income:	

	Methods and Difficulties	
	2.4 Circular Flow of Income: Two sector model	
Unit 3	Theories of Output and Employment:	Purpose: To help the students to understand the concept of Employment and theory Output. Skills: Understanding, writing skills, critical thinking.
	3.1 The Classical Theory of Employment: J.B.Say	
	3.2 Keynes Criticism on Classical Theories of Employment.	
Unit 4	3.3 Keynesian Theory of Employment.	Purpose: To understand the concepts of Multiplier and Accelerator. To impart knowledge of Consumption Function, Saving and Investment Function Skills: Understanding, ability to analyze, quantitative aptitude and writing skills.
	Consumption, Saving and Investment:	
	4.1 The Consumption Function: 4.1.1 Meaning 4.1.2 Marginal Propensity to Consume (MPC) 4.1.3 Keynes's Psychological Law of Consumption. 4.1.4 Determinants of Consumption.	
	4.2 The Saving Function: 4.2.1 Meaning, 4.2.2 Marginal Propensity to Save (MPS) 4.2.3 Determinants of Savings 4.2.4 Relationship between Consumption and Saving Function (MPC and MPS)	
	4.3 Meaning and Types of Investment: Gross, Net, Induced and Autonomous.	
	4.4 Marginal Efficiency of Capital and its Determinants.	
4.5 Concepts of Investment Multiplier and Acceleration Principal.		

Teaching Methodology:

Unit No.	Total Lectures	Innovative methods to be Used	Film shows and AV Applications	Project	Expected Outcome
1	08	<ul style="list-style-type: none"> Open book discussion Digital lectures Reading Projects 	You tube lectures on macro economics	<ul style="list-style-type: none"> Difference in goals of developed and developing 	Students will understand basic concepts of macroeconomics

				<p>economies</p> <ul style="list-style-type: none"> • Comparison between macro and micro economics 	Will be able to analyze and interpret
2	12	<ul style="list-style-type: none"> • Group discussion • Case studies • Problem solving based learning 	You tube lectures, Lectures on SWAYAM Portal	<ul style="list-style-type: none"> • Difficulties in estimation of National income in India. • Method of National Income used by India 	Will know various concepts of national income Will understand the methods of calculation of national income and difficulties involved therein.
3	14	<ul style="list-style-type: none"> • Pair learning • Group discussion • Open book discussion 	Teacher oriented PPTs. You tube lectures	Critical evaluation of Classical theory Keynesian theory In present context	Will understand Says law of employment Will understand the difference between classical and Keynesian theory Able to interpret Keynes theory of effective demand.
4	14	<ul style="list-style-type: none"> • Group discussion • Teacher c • Games and simulation 	You tube lectures Online PPTs	<ul style="list-style-type: none"> • Changing trends of saving and investment in India • Comparison of the trends of saving and investment in India with any other developed or developing country. • Study the impact of multiplier and acceleration by taking an 	Will understand the concept of saving and investment Will know the effect of multiplier and acceleration in the economy.

				hypothetical example.	
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References:

1. Economics: Paul A Samuelson and William D Nordhaus. McGRAW – HILL international Edition.
2. Macroeconomics: N. Gregory Makiw, Worth Publishers, New York.
3. Macro- Economic Theory: M L Zingan, Vrinda Publications (P) Limited.
4. Samashti Arthshstriy Vishleshan : Shridhar Deshpande, Vinayak Deshpande, Himalaya Publication House.
5. Theories of value: output and employment - John Eatwell, Thames Polytechnic, 1979
6. Businss Economics, Dr.J.P.Mishra, Sahitya Bhavan Publications, Agra.
7. Macroeconomics: A Global Text, Sampat Mukherjee, New Central Book Agency Private Limited (Latest Edition), New Delhi
 8. Macroeconomics: A Rough Guide, in Macroeconomics: A Reader, (Ed.) Brian Snowden and Howard Vane, Routledge
 9. Business Economics (Macro): Dr. Rasal, Bhadane, Fernandes, Idol Publication, Pune-2
 10. Macroeconomics: Theory and Policy, S. Chand & Company Limited. (Latest Edition)
 11. Ben Fine & Ourania Dimakou, Macroeconomics: A Critical Companion, Pluto Press (Latest Edition)
 12. Michel De Vroey, A History of Macroeconomics: From Keynes to Lucas and Beyond, Cambridge University Press (Latest Edition)
 13. Sampat Mukherjee, Analytical Macroeconomics: From Keynes to Mankiw, New Central Book Agency Private Limited
 14. Macroeconomics- K R Gupta, R.K.Mandal, Amita Gupta, Atlantic Publishers and distributor’s pvt.ltd.
 15. Money, Inflation, and Business Cycles the Cantillon Effect and the Economy, Arkadiusz Sieroń. Abingdon, Routledge, 2019. NewYork
 16. Macroeconomics: N. Gregory Maki Worth Publishersw, New York
 17. Macro Economics: Rudiger Dornbusch, Stanley Fisher & Richard Startz Tata McGraw Hill Education Private Limited (Latest Edition), US
 18. The General Theory of Employment, Interest, and Money- John Maynard Keynes, General Press
 19. An Analysis of John Maynard Keynes's The General Theory of Employment, Interest and Money- John Collins, CRC Press, 2017.

Suggested Web References

Sr. No	Lectures	Films	Animation	PPTs	Articles
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1.	https://www.youtube.com/watch?v=byqiVAk0dk4	https://inomics.com/insight/10-movies-all-economists-will-love-1292886	https://www.youtube.com/watch?v=B2YYwIElg0c	https://www.slideshare.net/hassanmujtaba7547/frame-work-of-macro-economics-ppt	https://www.journals.elsevier.com/journal-of-macroeconomics/recent-articles
2.	https://www.economicnetwork.ac.uk/teaching/Video%20and%20Audio%20Lectures/Principles%20of%20Macroeconomics	http://www.studyingeconomics.ac.uk/the-little-bits-we-like/films/	https://www.youtube.co.watch=9q27h9o9gJQ	https://sites.google.com/site/davismacroclass/Home/powerpoint-presentations	https://www.britannica.com/topic/national-income
3.	http://web.econ.ku.dk/okocg/MATOEK/Mak%C3%98k2/Mak%C3%98k2-2015/Forel%C3%A6sninger/Pensum-M2-ii-2015-fil-2015.pdf	https://www.cambridge.org/core/books/entertainment-industry-economics/movie-macroeconomics/011C12934F13A076CD4B6D89E8351373	https://journals.sagepub.com/doi/pdf/10.1177/056943451105600106	https://www.slideshare.net/rarichanm/national-income-42518576	https://academic.oup.com/qje/article/73/3/407/1873398

CORE COURSE – IV

Subject: BUSINESS MANAGEMENT -I

Course Code: 234

Total Credits: 03

1. Objectives of the course
 - a. To provide basic knowledge and understanding about various concepts of Business Management.
 - b. To help the students to develop cognizance of the importance of management principles.
 - c. To provide an understanding about various functions of management.
 - d. To provide them tools and techniques to be used in the performance of the managerial job.

2. Depth of the program – fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose / Skills to be developed
1	Management :	<ul style="list-style-type: none">• Meaning definition of Management• Need for Management study• Process and levels of management• Functions of management• Contribution of F.W. Taylor, Henry Fayol, Peter Drucker, Mintzberg and Michel Porter in development of management thoughts	<ol style="list-style-type: none">1. Understanding how management works2. Developing thought process as a manager3. Understanding functions of Management4. Understand the role of Management Thinkers in development of modern management process
2	Understanding Management : Planning and Decision Making	<ul style="list-style-type: none">• Meaning, definition and nature of Planning• Forms and types of Planning• Steps in Planning• Limitations of Planning• Meaning and techniques of Forecasting• Meaning, Types and Steps in Decision Making	<ol style="list-style-type: none">1. How to plan various management activities, programmes and events2. Developing of decision making skills to evaluate various alternatives and situations3. Understanding the concept of forecasting
Unit No.	Unit Title	Contents	Skills to be developed

3.	Management at Work : The process of organizing and staffing	<ul style="list-style-type: none"> • Meaning, Process and Principles of Organizing • Concept of Authority and Responsibility • Delegation of Authority • Difficulties in Delegation of Authority • Need and importance of Staffing • Recruitment : Sources and Methods 	<ol style="list-style-type: none"> 1. Understanding the importance and process of organisation 2. Understanding authority and process of delegation of authority 3. Understanding process of recruitment
4.	Result orientation : Direction and Team Work	<ul style="list-style-type: none"> • Meaning, Elements, Principles, Techniques and Importance of Direction. • Concept of Team Work, Group Dynamics and principles regarding interpersonal communication and Group Behaviour 	<ol style="list-style-type: none"> 1. How to direct a group / team? 2. Team building skills 3. Winning confidence of group members 4. How to initiate healthy discussions to achieve consensus?

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	PowerPoint Presentations, YouTube Videos	Films on Process of Management and Films on Management Thinkers	Poster Presentation on Management Thinkers and their role in present business management	Students will get an idea about the basic managerial process
2	12	PowerPoint Presentations, YouTube Videos	Documentaries	Student group activities which involve Planning and Decision Making	Students will get an idea about how planning works in real life.
3	12	PowerPoint Presentations, YouTube Videos	Lectures on industry experts and documentaries on organizing and staffing	Poster Presentation	Students will understand the process of implementation of both the concepts.
4	12	PowerPoint Presentations, YouTube	documentaries	Student group activities which involve direction and team work.	Students will understand importance of proper direction and

		Videos			team work.
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References :-

1. Essentials of Management - Horold Koontz and Iteinz Weibrich - McGrawhills International
2. Management Theory & Practice - J.N.Chandan
3. Essential of Business Administration - K.Aswathapa Himalaya Publishing House
4. Principles & practice of management - Dr. L.M.Parasad, Sultan Chand & Sons -New Delhi
5. Business Organization & Management - Dr. Y.K. Bhushan
6. Management: Concept and Strategies By J. S. Chandan, Vikas Publishing
7. Principles of Management, By Tripathi, Reddy Tata McGraw Hill
8. Business organization and Management by Talloo by Tata McGraw Hill
9. Business Environment and Policy – A book on Strategic Management By Francis Cherunilam Himalaya Publishing House
10. Principles & practice of management - Dr. L.M.Parasad, Sultan Chand & Sons -New Delhi
11. Business Organization & Management - Dr. Y.K. Bhushan
12. Management: Concept and Strategies By J. S. Chandan, Vikas Publishing
13. Principles of Management, By Tripathi, Reddy Tata McGraw Hill
14. Business organization and Management by Talloo by Tata McGraw Hill
15. Business Environment and Policy – A book on Strategic Management By Francis Cherunilam Himalaya Publishing House

CORE COURSE – V

Subject: ELEMENTS OF COMPANY LAW

Course Code: 235

Total Credits: 03

Objectives of the Program

1. To develop general awareness of Elements of Company Law among the students.
2. To understand the Companies Act 2013 and its provisions.
3. To have a comprehensive understanding about the existing law on formation of new company in India.
4. To create awareness among the students about legal environment relating to the company law.
5. To acquaint the students on e-commerce, E governance and e-filing mechanism relating to Companies.
6. To enhance capacity of learners to seek the career opportunity in corporate sector.

Unit No	Unit Title	Contents	Skills
1.	The Companies Act, 2013: Introduction and Concept	Company and its Formation 1. Background and Features of company the Companies Act, 2013 2. Company: Meaning, Nature and Characteristics of Company. 3. Types of Companies: On the basis of mode of formation, Number of members, liability and Control, Public and Private Companies: Distinction, Advantages, Disadvantages, Privileges and their Conversion into each other. Other kinds of Companies: One Person Company, Charitable Companies, Dormant Company, Sick Company, Small Company, Listed Company, Foreign Company and its business in India etc.	Understand the concept of company and Equip the students with knowledge of nature and types of companies.

2.	Formation and Incorporation of a Company	Formation and Incorporation of a Company: Stages in the Formation and Incorporation. 1. Promotion: Meaning of the term 'Promoter' / Promoter Group - Legal Position of Promoters, Pre-incorporation contracts. 2. Registration/ Incorporation of a company : - Procedure, Documents to be filed with ROC. Certificate of Incorporation- Effects of Certificate of Registration. 3.Capital Subscription/Raising of Capital 4.Commencement of business	Acquaint the students with the procedure of formation of company.
3.	Principal Documents	Principal Documents: Documents relating to Incorporation and Raising of Capital: 1 Memorandum of Association: Meaning and importance- Form and contents- Alteration of memorandum. 2 Articles of Association: Meaning- Contents and form of Articles- Alteration of articles- Doctrine of constructive notice- Doctrine of Indoor Management. 3 Prospectus: Meaning, contents, Statutory requirements in relation to prospectus- Deemed Prospectus- Shelf prospectus - Statement in lieu of prospectus- Misstatement in a prospectus and Liabilities for Mis-statement.	To make students understand the role and importance of various documents like Memorandum
4.	Capital of the Company	Capital of the Company 1. Various Modes for Raising of Share Capital including private placement, public issue, rights issue, bonus shares, ESOS, Sweat Equity Shares, Buy-back of shares. 2. Allotment of Shares: Meaning- - Statutory provisions for allotment, improper and irregular allotment- Consequences of irregular allotment. 3. Calls On Shares: Meaning- Requisites of a valid call, Calls in advance, Share Certificates: Meaning, Provisions regarding issue of share certificates - Duplicate Share Certificate.	To give Comprehensive insight about the capital of Company and various aspects of shares.

		4. Share Capital: Meaning, Structure (Kinds) – Concept of Securities – Definition, Nature and Kinds of Shares.	
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[Note: Recent amendments in the Acts and relevant Landmark cases decided by courts are expected to be studied]

Teaching Methodology:

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	The Companies Act 2013 Document , PPT, Narration, , Survey Analysis Article review	You Tube clips about the Companies Act 2013.	Report Review	Acquaint with knowledge and maturity to understand Company law 2013
2	12	Project making, , jingles, slogan , Quiz Competition,	Use of You tube, Review of Movie on relevant topic.	New Emerging Issues in Principle documents of company	To Acquaint knowledge and application of formation and incorporation of Company
3	12	Case study, Poster making, Interview with Company secretary	Case Analysis, format of principal documents of the company ,	Recent provisions of law and salient feature of principal documents of company.	To understand the knowledge about the principal documents of the company.

4	12	Virtual Learning, Group Discussion, Assignments on share capital, Interview of Corporate lawyer	Film on capital raising procedure, Internet precautions	Project on share capital of the company	To inculcate skills and knowledge about the share capital of the company
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Methods of Evaluations

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Continuous Evaluation,	Written Exam	Seminar on The Companies Act, 2013
Unit – II	Continuous Evaluation	Written Exam	Awareness program
Unit – III	Continuous Evaluation,	Written Exam	Visit to company secretary's office
Unit – IV	Continuous Evaluation,	Written Exam	Awareness program

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	The Companies Act with Rules	Taxmann	Tan Prints (India) Pvt. Ltd. Jhajjar	Chandigarh
2.	The Companies Act, 2013	Bharat	Bharat Law House Pvt. Ltd.	Delhi
3.	Company Law-A Comprehensive Text Book on Companies Act 2013	Dr. G.K. Kapoor & Dr. Sanjay Dhamija	Taxmann Publications Pvt. Ltd	Delhi
4	Company Law	Dr S R Meyani	Asia Law House	Mumbai
5	Company Kaydyachi Olakha	K Shriram	Aarti & Co.	Mumbai
6	Guide to Memorandum, Articles & Incorporation of Companies	Bhandari & Makheeja	Lexis Nexis	Mumbai
7	Elements of Company Law	Arun Gaikawad , Chandrakant Chaudhari & Devendra Bhawari	Bibha	Pune

8 .	Elements of Company Law	Prakash N. Chaudhary	Nirali Prakashan	Pune
9 .	E-Commerce : Legal Compliance	Pratima Narayan	Eastern Book Company	Mumbai

SPECIAL ELECTIVE COURSE – VI

Subject: Business Administration

Course Code: 236(A)

Total Credits: 04 (Theory 03 + Practical 01=04)

1. Objectives of the Course:

- a. To provide basic knowledge about various forms of business organizations
- b. To acquaint the students about business environment and its implications thereon.
- c. To make them aware about the recent trends in business.

2. Depth of the program – fundamental Knowledge

UNIT No.	Unit title	Contents	Purpose/skills to be developed
1	Introduction to Business Administration	Business-Definition, Characteristics, Scope Objectives of Business-Economic & Social Perspectives. Commerce-Meaning, Concept, Trade & Aids to trade- Meaning & Definition of the Terms-Administration, Management and Organisation, Functions of Administration	To understand the concept of Business To understand the various perspectives to business To know the various functions of Business Administration
2	Types of Business Organisations	Sole Proprietorship, Partnership Firm, Limited Liability Partnership, Joint Stock Company, Non-Profit Joint Stock Company under Section 25 of the Companies Act, NGO, One Person Company, MNC, MSME Unorganised (informal)v/s Organized sector(registered/incorporated) Entrepreneurship: Meaning, definition and importance, objectives, skills and qualities required of an entrepreneur,case study of a successful local entrepreneur.	To study the various forms of business organisations To understand the meaning and importance of organized and unorganized sector To introduce the concept of Entrepreneurship as a form of business
3	Business Environment	Meaning of Business Environment Constituents of Business Environment-	To understand the concept of Business Environment

		Economic, Social, Legal, Cultural, Educational, Political, Technological, Natural and international. Impact of New Policies on Business Administration	To study the various aspects of business environment To understand its impact on business
4	Business Promotion and development	Business unit- Promotion, Concept, Stages in business promotion, Business development: Concept, process. Business components to be focused for development like markets, customers and relationships.	To study the various stages in business promotion To understand how to develop a business To study the important factors to be emphasized for Business development

Teaching Methodology

Unit No.	No. of lectures	Innovative method to be used	Project	Expected Outcome
1.	12	PowerPoint Presentations, YouTube Videos	Assignments, poster presentations	Students will get an idea about the basic concepts and functions in administration of business
2.	14	PowerPoint Presentations, YouTube Videos	Assignments, group projects in promotion of a business, generating new ideas of business	Students will get an idea about how different forms of business organisations can be formed and operated.
3.	10	Lectures of industry experts entrepreneurs and documentaries.	Introducing Case studies to understand the impact of the environment on business	Students will understand the impact that various factors operating in external environment can have on business
4.	12	Videos and lectures by experts	Student group activities,	The development strategies of business can be introduced .

Recommended Books:

- i. Modern Business Organisation & Management-N.Mishra, Allied Publishers-Mumbai

- ii. Essentials of Business Administration- K. Ashwathappa-Himalaya Publication
- iii. Business Administration-S.C.Saxena-Sahitya Bhavan, Agra
- iv. The Administrative Process-Stephen Robbins
- v. Industrial Administration & Management- J.Batty
- vi. Basu, C. (2017). Business Organisation and Management. McGraw Hill Education.

SPECIAL ELECTIVE COURSE – VI

Subject: Banking and Finance-I (Indian Banking System - I) Course Code: 236(B)

Total Credits: 04 (Theory 03 + Practical 01=04)

Objectives:

1. To provide the knowledge about Indian Banking System.
2. To create the awareness about the role of banking in economic development.
3. To provide the knowledge about working of Central Banking in India.
4. To know the functioning of private and public sector banking in India.

UnitNo.	Topic	No. of Lectures	Teaching Method	Proposed skills to be developed
1	Indian Banking Structure : Evolution of 1.1 Banking in India Structure of 1.2 Banking in India 1.3. Role of Banking in Economic Development 1.4. Scheduled Banks and Non- scheduled Banks Challenges before Banking 1.5 in India Impact of COVID-19 on Banking Sector 1.6 in India	10	Lecture, PPT, Group and Panel Discussion, Library Work, Assignments	Understanding the structure of Indian Banking. Analyze the role of Banking in Economic Development
2	Central Banking : Definition of 2.1 'Central Banking' Evolution of 2.2 Reserve Bank of India Functions of Reserve Bank of 2.3 India 2.4 Present currency	10	Lecture, PPT, Group and Panel Discussion, Library Work,	Understanding about the Central Banking in India

	<p>system in India Understanding of concepts : Bank Rate,Cash Reserve Ratio(C.R.R.), Statutory Liquidity Ratio (S.L.R.), Repo Rate – Reverse Repo Rate</p>		Assignments	
3	<p>Private Banking : 3.1 Meaning and features of Private Banking 3.2 Classification of Private Banking : i) Indian Private Banks – Old and New ii) Foreign Banks 3.3 Role of Private Banking in Economic Development 3.4 Performance of Private Banks in India 3.5 Challenges before Private Sector Banks in India</p>	12	Lecture, PPT, Group and Panel Discussion, Library Work, Assignments, Projects	<p>Understanding of role and performance of Private Banking in India Analyze the past and present</p> <p>challenges before Private Banks in India</p>
4	<p>Public Sector Banking: Definition and Features of Public Sector Banks 4.1 Classification of Public Sector Banks 4.2 4.2.1 State Bank of India – Evolution , Functions and Performance 4.2.2 Nationalised Banks – Social control , Meaning of Nationalisation, Arguments for and against Nationalisation – Merger of the Banks 4.2.3 Regional Rural Banks –</p>	16	Lecture, PPT, Group and Panel Discussion, Library Work, Assignments, Projects	<p>Understandingabo ut Public sector Banking in India Analyze the challenges before Public Sector Banks</p>

	Objectives , Functions , Capital, Problems before Regional Rural Banks 4.2.4 Lead Bank Scheme 4.3 Challenges before Public Sector Banks in India			
	Total	48		

References:

1. Deb Joyeeta (2019), 'Indian Banking System', Evince Publishing.
2. Desai Vasant (2007), 'Indian Banking-Nature and Problems', Himalaya Publishing House.
3. Gopinath M.N. (2017), 'Banking Principles and Operations', Snow White Publisher.
4. Joshi, Vasant and other (2002), Managing Indian Banks – The Challenges Ahead, Response Books, New Delhi.
5. Mallik, Chaudhury and Sarkar (2018), 'Indian Banking System- Growth, Challenges and Government Initiatives', Kalpaz Publications.
6. Nararajan and Parameswaran (2007), 'Indian Banking', S. Chand Company Ltd. New Delhi.
7. ShahiUjjwala (2013), 'Banking in India: Past, Present and Future', New Century Publications
8. Trivedi, Chaudhary and other (2015), 'Indian Banking System', RBD Publication, Jaipur.
9. Trivedi I.V. and JatanaRenu (2010), 'Indian Banking System', RBSA Publisher.
10. 'Report on Trend and Progress of Banking in India' 2017-18, 2018-19, 2019-20- Reserve Bank of India

SPECIAL ELECTIVE COURSE – VI

Subject: BUSINESS LAWS AND PRACTICE – I

Course Code: 236(C)

Total Credits: 04 (Theory 03 + Practical 01=04)

Objectives of the course:

To develop an understanding of the significant provision of selective Business Law.

To gain the ability of students to address a basic business legal application-oriented issues.

Depth of the program:

Basic & Fundamental

Objectives of the Subject:

- To impart the students with the fundamental understanding of important business laws.
- To study & acquaint students an application & overview based knowledge of Business Law.
- To familiar the students with legal Business Environment of India.
- To develop & strengthen students through the legal practical knowledge and their implications on Indian Business organizations.

Unit No.	Unit Title	Contents	Purpose skills to be developments
1	Maharashtra agricultural produce marketing (development and regulations) Act 1963	Introduction, Meaning of Agricultural Produce, Agriculturist, Broker, Buyer, bye-laws, Commission Agent, Director, Coolee, Local Authority, Market Area, Market Committee, Processor, Secretary, Retail sales, State Marketing Board. Establishment of National Integrated Produce Market; Direct marketing, establishment of private market	Students will get the basic knowledge of the MAPM Act 1963. Awareness about Marketing of Agricultural Produce

		and farmer-consumer market and redressal of disputes; Contract Farming Agreement (Sec. 5), Marketing of Agricultural Produce (Sec 6 to 10)	
2	General Insurance	Introduction, Meaning & Characteristics of Insurance, Importance of Insurance, Basic Principles of General Insurance, Contract of Insurance, Type of Insurance, Basic Terms – Insured, Insurer, Premium, Policy subject matter of Insurance, Claim, Proposal. Insurance Interest. Double Insurance and Reinsurance, Meaning of Fire Insurance, Marine Insurance & Miscellaneous Insurance	It will help the students to gain insights of General Insurance
3	Information Technology Act,2000	Evolution of the IT Act, Digital Signature and Electronic Signature, Electronic Governance, Attribution, Acknowledgement and Despatch of Electronic Records, Secure Electronic Records And Secure Electronic Signature Introductions. (Sec 1 to 16)	To provide legal recognition to all transactions conducted through electronic data exchange, electronic communication or other means of e-commerce.
4	The Maharashtra Shops and Establishments (Regulation of Employment and Conditions of Service) Act, 2017	Meaning, Introduction, Registration of Establishments, Opening and Closing Hours, Hours of Work, Interval For Rest, Spread-Over, Wages For Overtime and Weekly Off, Leave With Pay and Payment of Wages, Welfare Provision(Sec 1 to 26)	Understanding the process and methods of Registration, understand the regulation of conditions of work and employment in shops, and various establishments

Teaching Methodology

Topic No.	Total Lectures	Innovative Methods to be used	Online Shows and AV Applications	Project	Expected Outcome
1	12	Cases of MAPM to be Studied. Group Discussion Article Reviews	E-Content on MAPM provided by UGC/University/M OOC etc. to be analyzed. Other open E-Content Internet Sources.	Project report shall be prepared on efficiency & effectiveness of MAPM.	Understanding the actual working of MAPM & its legal applications with benefits to the stakeholders.
2	12	Benefits of Insurance to be discussed in Group. Internet Sources. Discussion on Claim Settlement.	E-Content on General Insurance provided by UGC/University/M OOC etc. to be analyzed.	Project report can be prepared on benefits of General Insurance to the beneficiaries.	Understanding general insurance, the way to minimize various types of risk.
3	12	Internet Sources Cases on Information Technology.	Youtube E-Content Sources. E-Content on Cyber security/IT Act provided by UGC/University/M OOC etc. to be analyzed.	Project report can be prepared on Cyber Security Measures & Preventions.	Use of online resources carefully. Measures & presentation while using online platform. Awareness about cyber security etc.
4	12	Benefits of Shop Act to be discussed in Group. Internet Sources. Discussion on Procedure to obtain permission under shopact.	Youtube E-Content Sources. E-Content on Shop Act provided by UGC/University/M OOC etc. to be analyzed.	Project report can be prepared on Procedure & documents required to start small business under shop act.	Make students aware about shop act registration to small business owners. Benefits of shop Act to people etc.

References

Sr. No.	Title of the Book	Author/s	Publication
1	Labour Laws	Taxmann	Taxmann
2	Labour & Industrial Laws	S N Misra	Central Law Publication
3	General Insurance	Dr. L P Gupta	Dr. L P Gupta

4	Information Technology Act, 2000	Sachdeva Editorial Unit	Sachdeva Law Publishers
5	The Maharashtra Shops and Establishments Act, 2017	S.D.Puri	--
6	Labour and Industrial Laws	M.N. Mishra	Central Publicaions
7	Business & Commercial Laws	Sen & Mitra	--
8	Business Law for Management	Bulchandani K.R.	--
9	Information Technology Act, 2000	--	Government of India.

Practical for Semester – III

Topic	Mode of Practical
Marketing of Agricultural Produce	Overview & Presentation can be taken.
Insurance Documents and Policy Terms and Conditions	Group Discussion & Survey can be conducted.
Electronic Governance	Online data analysis with library sources.
Registration of Establishments	Applications to studied.

SPECIAL ELECTIVE COURSE – VI

Subject: Co-operation and Rural Development Special Paper-I

Course Code: 236(D)

Total Credits: 04 (Theory 03 + Practical 01=04)

1. Objectives of the Course:

- a. .To acquaint students with the Concept of Co-operation
- b. .To acquaint students with Co-operative legislation
- c. .To create awareness regarding the role of state government in development of Co-operative sector in Maharashtra
- d. : To acquaint students with the role of Social reformers in rural development
- e. : To understand the role of “Panchayat Raj” in rural development
- f. : To make the students aware about Globalization and its effects on rural development

Unit No.	Unit Title	Contents	Skills to be developed
1	Rural Development	1.1 Definition, Meaning, Scope and Objectives 1.2 Significance of Rural Development 1.3 Role of Co-operative Movement in Rural Development 1.4 Approaches of Rural Development – Individual, Group and Mass Approach	1. To understand the meaning of rural development and its significance 2. To understand the role co-operative movement played in rural development.
2	Thoughts and Work of Social Reformers in Rural Development	2.1 Mahatma Jotiba Phule 2.2 Chhatrapati Shahu Maharaj 2.3 Mahatma Gandhi 2.4 Vaikunthlal Mehta 2.5 Padmashree Vikhe Patil 2.6 Dr. Dhananjayrao Gadgil 2.7 Pandit Dindayal Upadhyay	1. To be acquainted with the thoughts of all the great thinkers
3.	Rural Development and Panchayat Raj System	3.1 Concept, Structure and Importance 3.2 Important provisions of Panchayat Raj Act 3.3 Effects of Panchayat Raj System on Rural Development 3.4 Limitations of Panchayat Raj	1. To know the importance of “Panchayat Raj. 2. To understand the structure of “Panchayat Raj.” 3. To know its limitations

4.	Rural Development – People’s Participation and Impact of Globalization	<p>4.1 Concept and Importance of People’s Participation</p> <p>4.2 Mahatma Gandhi National Rural Employment Guarantee Scheme</p> <p>4.3 Development of Model Villages – Ralegan siddhi -Hivre Bazar Bhagirath Gramvikas Pratishtan, Zarap Pani Foundation Naam Foundation</p> <p>4.4 Globalization – Concept, Merits and Demerits</p> <p>4.5 Impact of Globalization on Rural Development</p>	1. To know and realize the importance of people’s participation in rural development
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Teaching Methodology:

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Lecture method & class room discussion Visit to nearby Gram Panchayat.	-----	Report writing on the visit made to Gram Panchayat	Enhanced understanding of the village development
2	12	Class room presentations by the students, Group discussion	AV available on the life of all the great thinkers on ‘You tube’	Writing brief report on the contributions made by all the great thinkers.	Enhanced understanding of the work done by great thinkers
3	12	Class room lecture	-----	-----	Better understanding about rural development and Panchayat raj
4	12	Visit to any of the ongoing projects mentioned in contents	Films available on internet	Writing a report on the project visited	Enhanced level of knowledge

References:

- 1) G.S.Kamat –Cases in Co-operative management
- 2) N.L.Ghorpade- Co-operation and Rural Development
- 3) K.K.Taimani- Co-operative Organization and Management
- 4) G.S.Kamat – New Dimensions of Co-operative Management
- 5) Vasant Desai – Fundamentals of Rural Development
- 6) Dr. Dhiraj Zalte &Others –Theory & Practice of Co-operation, Prashant Publication
- 7) V.M.Dandekar and Rath – Poverty in India
- 8) Dr. P.R.Dubhashi – Rural Development and Administration in India
- 9) V.Reddy – Rural Development in India
- 10) S.K. Gopal – Co-operative Farming in India
- 11) B. Mukharji – Community Development
- 12) I.C.A State and C-operative Movement
- 13) <https://www.bhagirathgram.org/>



SPECIAL ELECTIVE COURSE – VI

Subject: Cost and Works Accounting -I(BASICS OF COST ACCOUNTING)

Course Code: 236(E)

Total Credits: 04 (Theory 03 + Practical 01=04)

Objectives:

- 1. To prepare learners to know and understand the basic concepts of cost.**
- 2. To understand the elements of cost.**
- 3. To enable students to prepare a cost sheet.**
- 4. To facilitate the learners to understand, develop and apply the techniques of inventory control.**

Unit No.	Unit Title	Contents	Skills to be developed
1	Basics of Cost Accounting	a) Concept of Cost, Costing, Cost Accounting and Cost Accountancy. b) Limitations of Financial Accounting. c) Origin of Costing. d) Objectives of Cost Accounting. e) Advantages & Limitations of Costing. f) Difference between Financial Accounting and Cost Accounting. g) Cost Units and Cost Centers. h) Role of a Cost accountant in an organisation	1. To understand the concept of cost, costing and cost accounting. 2. To trace the cost to cost centres and cost units. 3. To identify role of cost accountant in an organisation
2	Elements of Cost and Cost Sheet	a) Material, Labour and other Expenses. b) Classification of Costs. c) Preparation of Cost Sheet, Tender, Quotation and Estimates.	1. To Understand different elements of cost 2. To be able to prepare a cost sheet
3	Purchase Procedure	a) Need and Essentials of Material Control. b) Functions of the Purchase Department. c) Purchase Procedure. d) Purchase Documentation.	To understand the purchase procedure and its documentation

4	Inventory Control	<p>a) Methods of Inventory control</p> <p>a. Stock Levels.</p> <p>b. Economic Order Quantity (EOQ).</p> <p>c. ABC analysis</p> <p>d. Perpetual and Periodic Inventory Control</p> <p>e. Physical verification</p> <p>b) Inventory Turnover Ratio</p>	<p>. To understand the different methods of inventory control.</p> <p>. To calculate EOQ , stock levels and inventory ratio</p>
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Teaching Methodology

Unit No	Total Lectures	Innovative Methods to be used	Films Shows and AV Applications	Practical	Expected Outcome
1	16	PowerPoint Presentations, Group discussions	YouTube Lectures and relevant multimedia compact discs(CD)	Poster Presentation	To remember and understand basic concept of cost accounting. Development of an overall outlook of Cost Accounting
2.	16	PPT, Quiz		Visit small industries to develop an understanding of various cost inputs	Ability to prepare a cost sheet
3	10	Invite a purchase manager in the classroom to provide practical knowledge about Purchase procedures and their documentation.		PowerPoint Presentations	1)Ability to understand which procedures are used for purchasing the material 2)Understand the documentation for purchase procedures
4	06	Invite a storekeeper in the classroom to provide practical knowledge about		Visit small units and understand which	Understanding methods used for controlling the

		inventory control		methods are used to control the inventory	inventory
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Methods of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add-On Course
Unit I	Multiple Choice Questions, Written Test, Internal Examination, PowerPoint Presentations, Orals, Assignments, Tutorials etc.	SPPU	Two industrial visits and subsequently reports on the visits.
Unit II			
Unit III			
Unit IV			

References

Sr. No	Titles of the Book	Names of Authors	Names of Publisher	Place
01	Cost Accounting-Principles & Practices	Jawahar Lal & Seema Shrivastava	Tata Mcgraw Hill	New Delhi
02	Advanced Cost Accounting And Cost Systems	Ravi M Kishor:	Taxmann	New Delhi
03	Cost Accounting Theory And Problems	S. N. Maheshwari	Mittal Shree Mahavir Book Depot.	New Delhi
04	Advanced Cost Accounting	Jain and Narang	Kalyani Publication	New Delhi
05.	Horngren's Cost Accounting-A Managerial Emphasis	Srikant M Datar & Madhav V Rajan	Pearson	Noida Up
06	Cost Accounting-Principles & Practices	Dr. M.N. Arora	Vikas Publishing House,	New Delhi
07	Advanced Cost Accounting	Dr. D. M. Gujarathi	Idol Publication	Pune
08	Advanced Cost Accounting	Dr. Kishor. M. Jagtap	Tech-Max Publication	Pune
09	Cost Accounting Principles And Practice	Jain and Narang	Kalyani Publication	New Delhi
10	Principles and Practice of Cost Accounting	N.K Prasad	Booksyndicate Private Ltd	Kolkata
11	Cost Accounting: Methods and Problems	B.K.Bhar	Academic Publications	Kolkata

Web References

Sr. No	Lectures	Films	PPTs	Articles	Others
For	Guest Lectures by	YouTube	Relevant	Articles from the Professional	https://ic

all the units.	Field Personnel such as working executives from industries and of practising Cost and Management Accountants.	films showing the working of different industries .	powerpoint presentations are available on all these topics.	Journals such as The Management Accountant, The Chartered Accountant, The Chartered Secretary, The Institute of Chartered Financial Analyst of India	mai.in www.globalcma.in eclm.unpune.ac.in
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Notes: The breakup of marks in the Examination will be as follows:

1. 50 % of the Total marks are assigned for Theory purpose whereas rest 50 % of the total marks are allotted for Numerical Problems.
2. Numerical Problems will be of Simple nature only.
3. **Areas Of Practical Problems:**
 - Preparation of Cost Sheet, Tender, Quotation and Estimates.
 - EOQ and Stock level.
 - Inventory Turnover Ratios.

SPECIAL ELECTIVE COURSE – VI

Subject: Business Statistics

Course Code: 236(F)

Total Credits: 04 (Theory 03 + Practical 01=04)

Preamble to the syllabus:

Tools and techniques learned in Statistics give a precise way of formulating and analyzing a problem and to make logical conclusions. Concepts and tools introduced in this course are useful to students for higher studies and career in any branch of Economics, Commerce and Management. Professionals working in these fields, wishing to upgrade their knowledge, will also benefit. The stress of the course will be on building the concepts and their applications.

In modern times, Statistics is viewed not as a mere device for collecting numerical data but as a means of developing some techniques for their handling and analysis and drawing valid inferences from them. Statistics provides tools for making decisions when conditions of uncertainty prevail. So it is very useful in various fields like agriculture, business, management, economics, finance, insurance, education, biotechnology and medical science etc.

Depth of the Course – Basic Knowledge of Elementary Statistics

Objective of the Course

1. To understand and Master the concepts, techniques & applications of Statistical Methods.
2. To develop the skills of solving real life problems using Statistical Methods.
3. To make students to understand the art of applying statistical techniques to solve some real life problems.
4. To gain knowledge of Statistical Computations.

Unit No.	Unit Title	Contents	Purpose/Skills to be developed
1	Theory of Attributes (up to order three only)	Introduction, Classification, Notation, dichotomy, types of classes, Order of a class, dot operator to find relation between class frequency (up to order three), Fundamental set of class frequencies, Consistency up to three attributes, Independence and Association of two attributes, Yule's Coefficient of association, example and problems.	. To understand the concept of attributes, independence of attributes and association of attributes . To apply the concept of attributes to real life problems.

2	Multiple Regression, Multiple and Partial Correlation	Introduction, Multiple Regression, Yule's Notation, Statement of equation of plane of regression of X_1 on X_2 and X_3 . Properties of residuals, Coefficients of multiple and partial correlation, Multiple correlation in terms total and partial correlation, Coefficient of regression, Standard Error of Estimate, Advantages and limitations of multiple Correlation Analysis, . example and problems	<ul style="list-style-type: none"> . To understand the multiple and partial correlation. . To understand the concept of multiple regression. . To apply the concept of multiple regression and multiple and partial correlation to real life problems.
3	Vital Statistics	Introduction, Methods of collecting vital Statistics, Mortality rates : CDR, ASDR, STDR (direct method and indirect method), Fertility rates: CBR, ASFR, TFR,GFR Population Growth rate: GRR and NRR, example and problems	<ul style="list-style-type: none"> . To understand the concept of vital statistics and different methods of collecting vital statistics. . To understand the different types of mortality, fertility and population growth rates. . Apply concepts of vital statistics to real life problems.
4	Life Tables	Introduction, Construction of life table, functions ($l_x, d_x, L_x, p_x, q_x, e_x, T_x$) and their interpretation, Expectation of life, example and problems.	<ul style="list-style-type: none"> . To understand the concept and construction of life tables. . To compute life expectancy and applications of life table in insurance.

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	14	ICT	NA	NA	Students will be able to understand and apply concepts attributes to real world problems.
2	16	ICT	NA	NA	Students will be able calculate multiple regression, multiple correlation and partial correlation coefficients. Students will be able to fit real life data to regression plane and forecasting.
3	10	ICT	NA	NA	Students will be able to calculate different type of mortality, fertility and population growth rates for real world data and interpret it.
4	08	ICT	NA	NA	Students will be able to construct life tables.

SPECIAL ELECTIVE COURSE – VI

Subject: Business Entrepreneurship (Special Paper-I)

Course Code: 236(G)

Total Credits: 04 (Theory 03 + Practical 01=04)

Objectives of the course

- To understand the concepts in Business Entrepreneurship and its aspects.
- To make students aware about the entrepreneur and entrepreneurship.
- To study the new age of entrepreneur and to know in details of entrepreneurship.
- To understand the creativity and innovation required or necessary in the entrepreneurship.
- To study the types of ethics and society responsibilities are followed in the conventional and corporate sector in the new edge followed by the rules and regulations.
- To familiarize the students with practical survey or through project work will be able to understand the concepts in the subject thoroughly.
- To create entrepreneurial encouragement through the study of successful entrepreneurs.

Unit No.	Unit Title	Contents	Skills to be developed
1	Entrepreneur and Entrepreneurship	Definition, Meaning- Functions of an Entrepreneur. Need and Importance of Entrepreneurship- Problem of Unemployment, Importance of Wealth Creation, Enterprise V/s Entrepreneurship – Self Employment V/s Entrepreneurship, Entrepreneurial Competencies, Qualities, Kakinada Experiment	To understand the concept Entrepreneur and Entrepreneurship. Students should be able to differentiate and understand the difference between Enterprise and Entrepreneurship. To equip the students with various aspects of entrepreneurship, their competencies like initiative, how to grab the opportunities etc. and qualities with examples.
2	New Age Entrepreneur	The Internet Entrepreneur: Definition, Advantages, How to Become a Successful Internet Entrepreneur (Example: Snap deal). Environmental Entrepreneurs	Students have to develop the ability to involve in positive thinking. Students should be able to understand the critical issues

		<p>(E2)- Concept, Importance (Example: Help V/s Green, Ecotemme Green Nerdes, Sustain Earth)</p> <p>Social Entrepreneurs- Meaning and Concept- goals of Social Entrepreneurs, Characteristics (Examples: DeAsra Foundation, Aaple Ghar).</p> <p>Artistic Entrepreneurs-Concept, Things Artists and Artistic Entrepreneurs Have in Common.</p> <p>Motivated Entrepreneurs- Concept and Meaning, ways for entrepreneurs to stay motivated.</p> <p>Failed Entrepreneurship-Meaning and Reasons for Failed Entrepreneurship.</p>	<p>affecting the economy and environment.</p> <p>The students should be able to modernize tactics to solving social or environmental problems.</p> <p>To develop students and involve and engages them in new forms of entrepreneurship in the rightest of the world. Students should be able to find the ways to stay motivated as an entrepreneur.</p>
3	Creativity and Innovation	<p>Creativity- Meaning, Creativity Process, Techniques and Tools of Creativity.</p> <p>Innovation- Meaning, Sources of Innovation- Peter Drucker's Principles of Innovation- Do's and Don'ts of Innovation.</p>	<p>Acquaint knowledge and skills of the entrepreneurial process, it shows that creative thinking of an entrepreneur.</p> <p>Understand the concept of innovation that how it refers to develop effective ideas for successful entrepreneurship in the global edge.</p>
4	Business Ethics and Social Responsibility of Business	<p>Business Ethics and Social Responsibility of Business.</p> <p>Business goals- Social Responsibility-Business Ethics- Social Responsibility Towards Their Stakeholders: Investors-Owners- Employees-Government and Society at Large. Leadership by Example. Code of Ethics- Ethical Structure- Social Audit. Brief Introduction to Corporate Governance.</p>	<p>Students should be able to understand the business ethics and social responsibility of business w.r.t. practices in entrepreneurship (e.g. corruption, harmful behaviour to the society).</p>

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Group discussion and case	Related Videos and PPTs	Distribute personal and group project on	Understanding the difference in Entrepreneur and

		studies		new business creation.	Entrepreneurship.
2	12	Collecting the required information on the new age entrepreneur	Related Videos and PPTs	Ask students to prepare a detailed report on new age entrepreneur.	Understanding the new age entrepreneur and will learn each.
3	12	Business planning models (Product Development, Market Research)	Biographical videos or CDs of entrepreneurs	Assign small business models, product or project(s) to students to understand them with the 360 degree of the business.	Students will be able to do the SWOT analysis of their business model.
4	12	Conducting survey and collecting information of practices followed by the nearby organizations w.r.t. business ethics and social responsibility.	Annual Reports of the companies. Videos, PPTs	Assign small projects in individual or in group.	Students will practically study the practices followed by the organizations.

References:-

1. Business Environment, Francis Cherunilam, Himalaya Publishing House, New Delhi.
2. Entrepreneurship Development, Khanna S.S, S. Chand, New Delhi.
3. Entrepreneurship Development, Gupta, Shrinivasan, S. Chand, New Delhi
4. Dynamics of Entrepreneurship, Desai Vasant, Himalaya Publishing House, New Delhi
5. Indian Economy,, Ruddar Datt, K.P.M. Sundharam, S. Chand, New Delhi
6. Udyog,Udyog Sanchalaya, Mumbai
7. Vyawasaya Udyojagata, Dr. S. L. Shiragave, Success Publication, Pune

SPECIAL ELECTIVE COURSE – VI

Subject: Marketing Management

Course Code: 236(H)

Total Credits: 04 (Theory 03 + Practical 01=04)

Preamble

As the commercial scenario has totally changed, the need for advanced concepts has increased. Education system also has to change with the rapidly transforming times. Education system is trying to familiarize the students of commerce with advanced concepts in the field so that they are aware of the changing picture.

Marketing Management is an important subject and has been structured to create awareness of the Marketing Management by giving proper insight to the basics of Marketing, so that the foundation of this subject is strengthened for further studies in Marketing.

From this point of view Savitribai Phule Pune University has introduced Choice Based Credit System of course structure. This system will develop the logical independent thinking for accepting the challenges of the changing Business world.

Objective of the Course

1. To introduce the concept of Marketing Management.
2. To give the students the basic knowledge of Marketing Management to be a successful modern marketer.
3. To inculcate knowledge of various aspects of marketing management through practical approach.
4. To interpret the issues in marketing and their solutions by using relevant theories of marketing management.

Depth of the Program - Fundamental Knowledge of Marketing Management

Objectives of the Program

- To create awareness and impart knowledge about the basics of Marketing Management which is the basic foundation of Marketing subject.
- To orient the students in Marketing Strategy and Consumer Behaviour.
- To help students understand how to craft Marketing Plan which help the organisation outline their marketing goals and objectives.
- To enable students to apply this knowledge in practicality by enhancing their skills in the field of Marketing.

Unit No.	Unit Title	Contents	Purpose Skills To Be Developed
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1	Elements of Marketing Management	1.1 Introduction 1.2 Meaning of Marketing Management 1.3 Nature & Scope of Marketing Management 1.4 Features of Marketing Management 1.5 Functions of Marketing Management 1.6 Components of Marketing Management	To give the students the basic knowledge of Marketing Management.
		1.7 Problems of Marketing Management 1.8 Marketing Management Philosophy 1.9 Marketing Characteristics in Indian Context 1.10 Marketing Management Process	
2	Marketing Strategy and Consumer Behaviour	2.1 Marketing Strategy 2.1.1 Introduction 2.1.2 Concept of Strategy 2.1.3 Meaning of Marketing Strategy 2.1.4 Significance of Marketing Strategy 2.1.5 Aim of Marketing Strategy 2.1.6 Marketing Strategy Formulation 2.1.7 Bases of Formulating Marketing Strategy 2.1.8 Types of Marketing Strategy 2.2 Consumer Behaviour 2.2.1 Introduction 2.2.2 Meaning of Consumer Behaviour 2.2.3 Definition of Consumer 2.2.4 Scope of Consumer Behaviour 2.2.5 Determinants of Consumer Behaviour 2.2.6 Concept of Motivation 2.2.7 Theories of Motivation 2.2.8 Multivariable Models of Consumer Behaviour 2.2.9 Buying Motives & Consumer Importance of Buying Motives 2.2.10 Monadic Models of Consumer	To develop the awareness amongst the students about how marketing strategy plays a vital role in making today's customers want to buy the products and services.

		Behaviour	
3	Marketing Planning	3.1 Introduction 3.2 Meaning of Marketing Planning 3.3 Definition of Marketing Planning 3.4 Nature of Marketing Planning 3.5 Scope of Marketing Planning 3.6 Elements of Marketing Planning 3.7 Importance of Marketing Planning 3.8 Types Marketing Planning 3.9 Principles behind Successful Planning 3.10 Steps in Marketing Planning Process 3.11 Relevance in Marketing Planning 3.12 Structure of Marketing Plan 3.13 Constraints to Effective Marketing Planning	To enable the students to plan and make the best possible utilization of all the human and physical resources so that pre-determined marketing objectives of the firm can be achieved.
4	Marketing Research	4.1 Introduction 4.2 Meaning of Marketing Research 4.3 Definition of Marketing Research 4.4 Scope of Marketing Research 4.5 Role of Marketing Research 4.6 Marketing Research Agencies 4.7 Marketing Information Vs. Marketing Research 4.8 Objectives of Marketing Research 4.9 Marketing Research Procedure 4.10 Problem Definition 4.11 Research Design 4.12 Data Collection 4.13 Sampling and Sampling Designs 4.14 Probability Sampling Techniques 4.15 Data Analysis 4.16 Method of Reporting Research Findings	To make the students able to explain value of Market Research and its impact in decision making.

Teaching Methodology

Topic No.	Total Lectures	Innovative Methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	14	Power Point Presentation, Article Review, Survey Analysis	AV Application	Market Survey	Student will get acquainted with the basics of Marketing Management subject
2	07	Group Discussion, Quiz, Poster Making	Short Film about Buyer Behaviour, AV Application	Interviews of the Buyer	It will help students to know the preferences, likes and dislikes of the consumer which lead to the further modernization of the sales strategies by marketer
3	14	Power Point Presentation, Group Discussion, Survey Analysis	AV Application	Market Survey, Interviews of Seller	It will help them to implement this knowledge practical situations by enhancing their skills in the field of Marketing.
4	13	Power Point Presentation, Group Discussion, Field Visit	Short Film, AV Application	Market Survey, Interviews of Marketing Manager or Head	To enable the students to study the effect of external environment on decision- making of the firm.

Methods of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Quiz, Group Discussion	Examination	Certificate Course in Marketing Management
Unit – II	Practical, Presentation	Examination	Short Course in Sales & Marketing
Unit - III	Presentation, Group Discussion	Examination	E-Learning Training Course
Unit – IV	Project, Presentation	Examination	Marketing Research & Consumer Behaviour

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Marketing Management	Philip Kotler	Pearson Publication	
2	Marketing Management	Rajan Saxena	McGraw Hill Education	
3	Principles of Marketing	Philip Kotler	Pearson Publication	
4	Marketing Planning & Strategy	Subhash Jain & George Haley	Cengage Learning India Pvt. Ltd	
5	Marketing Strategy	Anil Mishra & Amit Kumar Mishra	Excel Books	
6	Consumer Behaviour : Insight from Indian Market	Ramanuj Muzumdar	PHI Learning Pvt. ltd. (2009)	
7	Retail Management	Gibson Vedamani	Jayco Publication	
8	Marketing Management	V. S. Ramaswamy & S. Namakumari	Macmillan Publication	
9	Marketing Research	S. L. Gupta	Excel Books India, 2004	
10	Marketing Research	Naresh K. Malhotra	Pearson Publication	

SPECIAL ELECTIVE COURSE – VI

Subject: Agricultural and Industrial Economics

Course Code: 236(I)

Total Credits: 04 (Theory 03 + Practical 01=04)

Objectives:

1. To understand the basic concepts of Agricultural Economics.
2. To impart adequate knowledge and analytical skills in the field of agricultural economics issues, and enhance expertise in improving the performance.
3. To understand the basic concepts of Agricultural Economics.
4. To expose the students to the concept, significance and uses of Industrial Economics.

Depth of the program – Fundamental Knowledge.

Unit No.	Unit Title	Content	Purpose skills to be developed
1	Fundamentals of Agricultural Economics	1.1 Definition, Nature and Scope of Agricultural Economics 1.2 Importance of Agriculture in Indian Economy 1.3 Transition of Agricultural Sector 1.4 Theories of Agricultural Development (Schultz, Mellor)	<ul style="list-style-type: none">▪ To understand the Basic Concept of Agricultural Economics.▪ To make the students know about the Place of Agriculture sector in the Indian Economy.▪ To impart knowledge about Theories of agricultural development
2	Economics of Agricultural Production	2.1 Basic Concepts in Agricultural Production, 2.2 Agricultural Inputs/ Factors of Production 2.3 Price Behaviour in Agricultural Product, Causes of Price Fluctuation 2.4 Trends in Wholesale Price Index of Food Grains & Commercial Crops 2.5 Trade Cycle in Agriculture: Cobweb Theory 2.6 Large and Small Size of Firm-Advantages & Disadvantages	<ul style="list-style-type: none">▪ To understand the Basic Concept of Agricultural Production Economics.▪ To make the students know about various Price Concept of Agricultural Economics
3	Introduction of Industrial Economics	3.1 Definition, Meaning, Nature, Scope and Importance of Industrial Economics. 3.2 Scope and Significance of Industrial Economics 3.3 The Concept of Plant, Firm and Industry.	<ul style="list-style-type: none">▪ To understand the Basic Concept of Industrial Economics.▪ Ability to compare Plant, Firm and Industry▪ To make the students know about the concept of the

		3.4 Concepts of Private Sector, Large, Medium & Small Scale Industries	various sector in Industrial Economics.
4	Location of Industry	4.1 Factors Affecting the Location of Industries 4.2 Theories of the location of Industries-Weber and Florence. 4.3 Industrial Imbalance, Causes and Measures.	<ul style="list-style-type: none"> Assess the factors affecting on the location of Industries & students know about the Theories of Industrial Location

Teaching Methodology:

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project/ Practical	Expected Outcome
1	12	Lecture, PPT/ Group Discussion, Library, Problem solving based learning, Case study, Jigsaw reading, Practical based learning	Relevant videos, Consortium for Educational Communication- SWF E-Content	<ul style="list-style-type: none"> Evaluate the place of Agriculture Sector in the Indian Economy in Present Era. 	<p>After completing this topic , the student will be able to understand</p> <ul style="list-style-type: none"> The Definition, scope, Nature and Scope of Agricultural Economics. Place of the agriculture sector in Indian Economy. Different Theories of agricultural development
2	12	Lecture, PPT/ Group Discussion, Library, Problem solving based learning, Case study, Jigsaw reading, Practical based learning	Relevant videos, Consortium for Educational Communication- SWF E-Content	<ul style="list-style-type: none"> Sector one Agricultural produce and list out inputs and outputs of that produce. Analyse the wholesale price Index of Agriculture selected Agricultural Produce. 	<ul style="list-style-type: none"> Analyse Trade Cycle in Agriculture The Basic Concept of Agricultural Production Economics. Price Concept of Agricultural Economics
3	12	Lecture, PPT/ Group Discussion, Library, Problem solving based learning,	Relevant videos, Consortium for Educational Communication- SWF E-	<ul style="list-style-type: none"> Evaluate the roll of Public and Privet sector in Indian Economy. 	<ul style="list-style-type: none"> Understand the Basic Concept of Industrial Economics. Ability to compare Plant, Firm and Industry

		Case study, Jigsaw reading, Practical based learning	Content		<ul style="list-style-type: none"> ▪ To make the students know about the concept of various sector in Industrial Economics. ▪ The role and importance of industrial sector vis-à-vis public and private enterprises in the economic development of India.
4	12	Lecture, PPT/ Group Discussion, Library, Problem solving based learning, Case study, Jigsaw reading, Practical based learning	Relevant videos, Consortium for Educational Communicatio n- SWF E- Content	<ul style="list-style-type: none"> ▪ Select one firm in your area and Analyse the factor affecting on localising of that firm 	<ul style="list-style-type: none"> ▪ To understand the factors affecting on the location of Industries ▪ Analyse Theories of Industrial Location

References:

1. Raju, V. T. Rao VS. (2017) Economic of Farm Production and Management, Oxford & Ibh, New Delhi.
2. Misra S.K. & V.K.Puri, (2017) Indian Economy, Himalaya Publication house Mumbai.
3. Kavimandan Vijay, (2009) KrushiArthshastra, Shri Mangesh Prakshan, Nagpur.
4. Gardner B.L.& Rausser G.C. (2001). Handbook of Agricultural Economics. Vol. I. Agricultural Production. Elsevier
5. Kavimandan Vijay, Krush iArthshastra.
6. Ramesh Singh, Indian Economy, Tata Mc-Graw Hill, Publication
7. Annual Reports, Department of Agriculture, Govt. of India,.
8. Barthwal R.R (2204) Industrial Economics Introductory Text Book, New Age International Limited, Kanpur

Suggested Web references:

<https://www.youtube.com/user/cecedusat>

<https://www.swayamprabha.gov.in/>

[http://14.139.13.96:8080/lectures.aspx?pno=Paper05\(O\)-UGC CEC E Contain on Agricultural Economics](http://14.139.13.96:8080/lectures.aspx?pno=Paper05(O)-UGC CEC E Contain on Agricultural Economics)

[http://14.139.13.96:8080/lectures.aspx?pno=Paper06\(O\) -UGC CEC E Contain on Industrial Economics](http://14.139.13.96:8080/lectures.aspx?pno=Paper06(O) -UGC CEC E Contain on Industrial Economics)

SPECIAL ELECTIVE COURSE – VI

Subject: Defense Budgeting, Finance and Management-I

Course Code: 236(J)

Total Credits: 04 (Theory 03 + Practical 01=04)

Objectives

1. To acquaint various concepts in Defence Economics
2. To create awareness different forms of Defence Programming and Budgets
3. To make the students aware about the structure of India's Defence budget
4. To acquire knowledge of different challenges of India's Defence Management

Unit No.	Topic	No. of Lectures	Teaching Method	posed Skill to be Developed
I	Budgets : Introduction and Background 1.1 Introduction 1.2 Parliamentary Budgets 1.3 Union Budget : India 1.4 Form of the Central Budget	12	Lecture, PPT, Group Discussion, Library Work, Assignment, Field Visit	Students will be able to learn structure and trends in India's defense budget
II	Defense Budgets 2.1 Objectives of Defense Budget 2.2 Types of Budgets 2.3 Basic concepts of Planning, Programming and Budgeting System	12	Lecture, PPT, Group Discussion, Library Work, Assignment, Field Visit	Students will be able to learn importance of defense planning and performance budget
III	Structure of Indian Defense 3.1 Defense v/s Development : a debate over expenditure 3.2 Role of DPSU's and Private Sector in India's Defense 3.3 Role of Ministry of Defense : 3.4 Role of DRDO in Indian Defense	12	Lecture, PPT, Group Discussion, Library Work, Assignment, Field Visit	Students will be able to learn the role of public and private sector in India's defense production

IV	Defense Planning and Management in India 4.1 Defense Management : Meaning, Concept, Nature and Scope 4.2 Application of Management in the Armed Forces 4.3 Industrial Management and Military Management 4.4 Role of Leadership in Defense Management 4.5 Principles of Management	12	Lecture, PPT, Group Discussion, Panel Discussion, Library Work, Assignment, Field Visit	Students will be able to learn importance of leadership in defense management and industrial management.
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References:

1. John Downey (1987) , Management in the armed Forces, EBD Educational Pvt Ltd, Dehradun, India
2. Andre Beaufre(1974), Strategy for Tomorrow, Mac Donald Press, London
3. Defence Management, An Annual Journal of College of Defence Managemnet, Secundarbad
4. Mishra H. B. (2000), Defence Management in India, Author Press, New Delhi
5. Venkateshwaran A.L. (1967) , Defence Organization in India, Publication Division, Governemnt of India, New Delhi
6. Ron Mathews(1989), Defence Production in India, ABC, New Delhi
7. Raju G C Thomas(1978), The Defence of India: A Budgetary Perspective of Strategy and politics, MacMillan Publication, New Delhi
8. Sam-C-Sarekesian (1972), The Military Industrial Complex-A Reassessment, Sage publication
9. Maj. Gen Pratap Narain (Retd) (1998), Indian Arms Bazar, Shilpa Publication, New Delhi,
10. Annual reports of The Ministry of Defence, Government of India
11. Brig. Pramod Sasius (2000), Military Logistics-Third Dimensions, Manaspublication, New Delhi,
12. NISDA Security Conference 8-10th October 2006 “Conceptualizing Impediments to National Security” , PROGRAMME BUDGETTING FOR OPTIMISING DEFENCE ALLOCATIONS, Air Marshal (Retd.) Dr. S. Kulkarni

SPECIAL ELECTIVE COURSE – VI

Subject: Insurance Transport and Tourism - I-A(Insurance)

Course Code: 236(K)

Total Credits: 04 (Theory 03 + Practical 01=04)

Objectives

1. To acquaint the students with basic concepts in insurance.
2. To develop a proper understanding to study various facets of insurance.
3. To make aware about the role and importance of insurance.
4. To understand the legislation for insurance business in India.

Unit No	Topic	No. of Lectures	Teaching Method	Proposed skills to be developed
1	An Introduction to Life Insurance 1.1 Life Insurance Business: Components, Human Life Value Approach, Mutuality, Principle of Risk Pooling, Life Insurance Contract, Determinants of Risk Premium. 1.2 Life Insurance Plans: 1.2.1 Traditional- Term Plans, Whole Life Insurance, Endowment Assurance, Dividend Method of Profit Participation Purpose of plans, Riders in plan - Introduction, Forms and procedures. 1.2.2 Non Traditional - Unit Linked Insurance Plan (ULIP) 1.2.3 Difference - Traditional and Non Traditional Plan	12	Lecture, PPT, Group Discussion, Library Work, Assignment, Visit to LIC Institutions	Understanding the concept and products of insurance
2	Policy Conditions of Life Insurance 2.1 Insurance Document: Proposal form, Policy form, Cover note, Certificate of Insurance, Endorsement, Co-insurance and Renewal receipt, Procedure of taking Life Insurance Policy. 2.2 Settlement: Settlement of Claim on Maturity of Policy, Death of Policy	10	Lecture, PPT, Group Discussion, Library Work, Assignments	Understanding The conditions and settlement structure

	holder,			
3	General Insurance: 3.1 Origin and growth of General Insurance 3.2 Principles of General Insurance 3.3 Types of General Insurance- Motor, Accident Insurance, Health, Crop, etc. 3.4 Laws relating to General Insurance Organization and Management of General Insurance in India 3.5 Study of Risk factors, Insurance claims 3.6 Effect of Globalization on Insurance Sector	12	Lecture, PPT, Group Discussion, Library Work, Assignments, tests.	Understanding growth of GIC and effect of globalization
4	Insurance Sector legislation and Regulatory Authority 4.1 Insurance Act: Insurance Act of 1938, L. I. C. Act of 1956 and G. I. C. Act of 1972 – objectives, features and provisions. 4.2 Fundamentals of Agency Law : Procedure of becoming an agent, Code of conduct, Unfair practices and cancellation of license 4.3 Role of IRDA : Insurance Regulatory and Development Authority - Constitution, Objectives, Duties and powers, Role of IRDA in appointing agents.	14	Lecture, PPT, Group Discussion, Library Work, Assignment, Visit to institutions, tests, Interview of agent	Understanding legislation and authority
	Total	48		

References:Book

s:

1. Ghorpade Nitin (2015), *Insurance*, Success Publication, Pune.
2. Gupta L.P. (2018), *Insurance Claims Solutions- A Guide to Life and General Insurance Claims*, DR L.P Gupta Publisher.
3. Gupta P.K. (2017), *Principles of Insurance*, Himalaya Publishing House.
4. Gupta R.K. (2017), *Fundamental of Insurance*, Himalaya Publishing House.
5. Haridas R. (2011), *Life Insurance in India*, New Century Publication New Delhi.
6. P. Periasamy (2011), *Principles and Practice of Insurance*, Himalaya Publishing House.
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8. Pratchbal Shakti and Dwivedi N.P. (2017), *Principles of Insurance*, Himalaya Publishing House.
9. Taxmann (2014), *Insurance Laws and Manuals, An authorised publication of IRDA*,

14th Edition, Taxmann Publication Private Limited.

10. Taxmann (2015), *Insurance products (including Pension Products)*, Indian Institute of Banking and Finance Taxman.

Reports and Other:

1. Annual Report- 2016-17, 2017-18, 2018-19, Insurance Regularity and Development Authority of India
2. Annual Report- 2016-17, 2017-18, 2018-19, Life Insurance Corporation of India
3. Annual Report- 2016-17, 2017-18, 2018-19, General Insurance Corporation of India
4. Annual Report (Integrated) 2016-17, 2017-18, 2018-19, SBI Life Insurance
5. Annual Report- 2017-18, ICICI Prudential Life Insurance
6. https://www.irdai.gov.in/ADMINCMS/cms/frmGeneral_NoYearList.aspx?DF=Creport&mid=12
7. http://www.policyholder.gov.in/IRDAI_Annual_Reports.aspx
8. <http://www.mospi.gov.in/104-insurance-statistics>
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10. https://nipfp.org.in/media/medialibrary/2013/08/insurance_report_final.pdf

SPECIAL ELECTIVE COURSE – VI

Subject: Computer Programming and Application Course

Course Code: 236(L)

Total Credits: 04 (Theory 03 + Practical 01=04)

Web base application in commerce

Objectives:

- a. To make the students familiar with Internet environment.
- b. . To make the students familiar with the basics of Web base technology and its application tools.
- c. . To make the students familiar with basics of Internet, Website and related concepts.
- d. To make awareness among students about applications of Internet inCommerce.

Unit No.	Unit Title	Contents	Skills to be developed
1	Introduction to Internet	1.1 Introduction to internet	Learner able to aware with Internet, Web and App with Cyber Ethics
		1.2 Applications of internet (Web and App), Concept of WWW, Types of Website	
		1.2 Web browsers (internet Explorer, firebox,...,etc.)	
		Surfing and searching and Search engines (Google, msn, yahoo)	
		Internet Banking	
		1.6 Introduction to Social media Application (Facebook, whakapapa Instagram)	
		1.7 Use of Social media application in business (Digital marketing, Advertisement,,etc)	
		1.8 Cyber Ethics	

2	<p style="text-align: center;">Operating Web Based Applications</p>	<p>2.1 Operating Web-based Applications</p> <p>2.2 Online Reservation Systems</p> <p>2.2.1 Advantages of Online Reservation System</p> <p>2.2.2 Precautions while Performing Online Transactions</p> <p>2.2.3 Using Online Reservation Systems</p> <p>2.2.4 Case Study: Book Rail Ticket</p> <p>2.3 E-Governance</p> <p>2.3.1 Initiative</p> <p>2.3.2 E-Governance Sites</p> <p>2.4 Online Shopping and Bill Payments</p> <p>2.4.1 Benefits of Online Shopping</p> <p>2.4.2 How it works</p> <p>2.4.3 Bill Payments</p> <p>2.4.4 Case Study: Online Shopping using Online Shopping Website</p> <p>2.5 Online Courses, Tutorials and Tests</p> <p>2.5.1 Online Educational Sites (Goggle classroom, WebEx, Webinar, Zoom,....etc.)</p> <p>2.6 Project Management - Web Based Application Development</p> <p>2.6.1 Project Essentials and Tips</p>	<p>Learner able to aware with Web-based application with case studies</p>
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3.	Web Based Application Development (HTML	3.1 Introduction to HTML 3.2 HTML Document and Basic Structure 3.3 Working with HTML Text, Heading (Header & Footer), 3.4. Paragraph (Navigation Section), formatting (Article & Aside) 3.5 HTML color link image 3.6 HTML Lists, Tables and Frames 3.7 HTML Forms Block, Layout 3.8 Browser Portability 3.9 Working with Hyperlinks and Multimedia 3.10 Working with Forms and controls. 3.11 Introduction to CSS	Learner able to aware with Web-based application development technologies
4.	Introduction to Web Scripting	4.1 Difference in Client and Server Side Scripting 4.2 JavaScript, ASP.NET (using Visual Basic.NET) 4.3 Web Server Controls 4.4HTML Server Controls 4.5Validation Server Controls 4.6Components and Applications	Learner able to aware with Web-based application development scripting technologies

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	10	Use ICT or presentation on Internet	U-tube Tutorial on Internet		Familiar with Internet
2	14	Use ICT or presentation on	And ethical use of Internet		And ethical use of Internet
3	16	Web base application	U-tube Tutorial Web base application	One Power point presentation of Use of one Web application	Able to handle web application
4	08	Use ICT or presentation on Web base Technology	U-tube Tutorial Web base Technology		Familiar with Web base application Able to work on Web base application

Method of Evaluation

Subject	Internal Evaluation	External Evaluation
Unit – I	30	70
Unit – II	30	70
Unit – III	30	70
Unit – IV	30	70

Guidelines for Examination:

Term End Exam (30 Marks):

To be conducted by college as per rules provided by University of Pune. Semester Exam 70 Marks):

To be conducted by University of Pune at the end of the academic year.

Passing marks for the course are 40 (Out of which **minimum 32** marks are compulsory in Semester Examination).

References :-

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2. HTML Black Book by Steven Holzner-(DreamTech Publication)
3. Web Technologies Black Book By Kogent Learning Solution
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5. Kogent Learning Solutions Inc. Html 5 in Simple Steps. Published by Dreamtech Press, 2010. ISBN 10: 9350040867 / ISBN 13: 9789350040867 (Its EBook Free to Download)
6. Bryan Pfaffenberger. HTML, XHTML, and CSS. Fifth Edition. March 2011. Published by Wiley Publishing. Inc. ISBN: 978-1-118- 08130-3
7. Richard York.2005. Beginning CSS: Cascading Style Sheets for Web Design. Published by Wiley Publishing. ISBN:0-7645-7642-9
8. John Duckett.Beginning HTML, XHTML, CSS, and JavaScript. Published by Wiley (2010). ISBN: 9788126525515
9. DT Editorial Services. HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery. Dreamtech Press; 2 edition (13 October 2016). ASIN: B07BFTJQB1.

Savitribai Phule Pune University
Faculty of Commerce & Management
S Y B Com (Semester IV)
(Choice Based Credit System)
Revised Syllabus (2019 Pattern)

CORE COURSE – I

Subject: BUSINESS COMMUNICATION-II

Course Code: 241

Total Credits: 04 (Theory 03 + Practical 01=04)

1. Objectives of the Course:

- a. To understand the concept, process and importance of communication.
- b. To acquire and develop good communication skills requisite for business correspondence.
- c. To develop awareness regarding new trends in business communication.
- d. To provide knowledge of various media of communication.
- e. To develop business communication skills through the application and exercises.

Medium of Instruction: English

Unit No.	Unit Title	Contents	Skills to be developed
1	Report Writing and Internal Correspondence	Meaning and Significance; Structure of Reports; Negative, Persuasive and Special Reporting- 1. Informal Report – Proposals; 2. Formal Reports; 3. Project Report 4. Introduction and Essential elements of Report writing.(Reporting for a meeting) 5. Organization of Press Report. 6. Office Memo (Memorandums) 7. Office Orders 8. Office Circulars 9. Form Memos or Letters 10. Press Releases 11. Import Export Trade	i. To understand the Report Writing and Internal Correspondence. ii. To understand office Correspondence. iii. To study Import Export Trade Correspondence

		Correspondence	
2	Recent Trends in Business Communication	Internet: Email, Websites, Social Media Network (Twitter, Face book, LinkedIn, You tube, WhatsApp) , Google Doc, Google Form, Google Sheet, Google Slide, Google Class Room, Online Conference, Video conferencing, Meeting through Zoom App, Google meet App ,Cisco Webex meetings App.	To understand the Recent Trends in Business Communication
3	Types and Drafting of Business Letters	1) Enquiry Letters 2) Replies to Enquiry Letters 3) Order Letters 4) Credit and Status Enquiries 5) Sales Letters 6) Complaint Letters 7) Collection Letters 8) Circular Letters	i. To acquire the fundamental knowledge about types of Business Letters ii. To create ability among the students for Drafting of Business Letters
4	Writing Formal Mails and Blog writing.	4.1: Essential elements of mail, Format of mail. 4.2: Introduction and meaning of Blog, Writing a blog.	To understand the Writing Formal Mails and Blog writing.

Teaching Methodology:

Topic No.	Total Lectures	Innovative Methods to be used	Film Shows and A.V. Application	Project	Expected Outcome
1	12	Lecture, PPT Presentation Poster Presentation, Group Discussion, Library visit ,Home Assignment ,Pre reading, Class discussion , library visit , internet resources, case study	Relevant You Tub Videos ,Relevant slide show, online Video Short Film Show	Report writing of students meeting	Understanding of basic knowledge of Report Writing and Internal Correspondence and Import Export Correspondence
2	12	Pre reading, Class discussion, internet resources, Lecture, Expert Lecture, PPT / Poster Presentation, Group Discussion,	Relevant You Tub Videos , Short Film Show, A.V Application	Project Report on types of Social Media	Learning the Recent Trends in Business Communication

		Library /Home Assignment ,Internal Assignment, students Seminar/Workshop	, online Video		
3	16	Lecture, PPT Presentation Poster Presentation, Group Discussion, Library visit ,Home Assignment ,Pre reading, Class discussion , library visit , internet resources ,case study	Relevant You Tub Videos, PPT , AV Application , Short Film Show , Online Videos	Writing of any one Business letter	To create ability among the students for Drafting of Business Letters
4	08	Guest Lectures of eminent Personalities , Group Discussion, Library visit ,Home Assignment, case study	Online Videos, Relevant slide show	Blog writing	To create ability among the students about Writing Formal Mails and Blog writing.
Total	48	Lecture, PPT Presentation Poster Presentation, Group Discussion, Library visit ,Home Assignment ,Pre reading, Class discussion , library visit , internet resources	Relevant You Tub Videos ,Relevant slide show,	-	To create ability among the students about Writing and Internal Correspondence. Also understanding the knowledge of Recent Trends in Business Communication.

References:

Sr. No	Title of Book	Author/s	Publication	Place
1	Business Communication	K. K.Sinha	Galgotia Publishing Company	New Delhi.
2	Business Correspondence & Report Writing	R. C. Sharma & Krishan Mohan	Tata McGraw Hill Publishing Co. Ltd.	New Delhi.
3	Communication	C.S. Rayudu	Himalaya publication	Mumbai
4	Business Communication	Asha Kaul	Prentice Hall of India	New Delhi.
5	Business Communication	Vasishth Neeru& Rajput Namita	Kitab Mahal	Allahabad
6	Soft Skills	Dr. Alex	S.Chand Publication	Delhi

7	Essentials of Business Communication	Rajendra Pal & Korlahalli	Sultan Chand & Sons	New Delhi.
8	Managerial Communication	P. D. Chaturvedi & Mukesh Chaturvedi	Pearson	Delhi

Guidelines for completion of Practical's:

- 1) At least three Practical's should be completed during each semester by students in consultation with subject teacher.
- 2) Practical should be based on visit as well as library assignments, Project based, Activity based.
- 3) A subject teacher has special privileges to make the allotment of practical topics.
- 4) Students should discuss with the subject teacher at the time of selection of practical topics.
- 5) If a student fails to complete minimum number of practical's, then the student shall not be eligible for appearing at the practical examination.

CORE COURSE – II

Subject: CORPORATE ACCOUNTING-II

Course Code: 242

Total Credits: 03

Preamble

In the modern economic environment the corporate sector is one of the major contributors towards GDP of any country and is also one of the largest and fastest growing sectors for providing employment opportunities. In the last decade the corporate sector has seen a massive growth in economic terms i.e. the volume of turnover, income and expenses etc. and also in terms of expansion of business across the globe. Accounting plays a vital role in this growth and to ensure safeguard of the interest of the stake holders and the society at large. It is therefore important to educate the students of commerce in the accounting practices adopted by the corporate organizations.

Objectives of the course

1. To acquaint the student with knowledge of corporate policies of investment for expansion and growth through purchase of stake in or absorption of smaller units.
2. To develop the knowledge among the student about consolidation of financial statement with the process of holding.
3. To update the students with knowledge of the process of liquidation of a company
4. To introduce the students with the recent trends in the field of accountancy

Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1.	Holding Company Accounts	Calculation of Capital Profit, Revenue profit, Cost of Control. Preparation of consolidated Balance sheet of Holding Company with one subsidiary only. Adjustment of intercompany transactions, unrealized profit of stock.	<ul style="list-style-type: none">• Conceptual Understanding of Holding Company Accounts• Practical Application skills• Analytical skills
2.	Absorption of Companies	Introduction , Meaning - Vendor and Purchasing Companies- Purchase Consideration, Accounting entries in the books of vendor Company and Journal entries and Preparation of Balance Sheet after Absorption in the books of	<ul style="list-style-type: none">• Conceptual understanding on the concept of Absorption of companies• Practical application skills in the process of

		Purchasing Company	accounting for Absorption
3.	Accounting for Liquidation of Companies	Meaning of Liquidation- Modes of winding up – (a) Preparation of Liquidator final statement of Account (b) Preparation of Statement of Affairs and Deficiency Account.	<ul style="list-style-type: none"> • Conceptual understanding on Liquidation of Companies • Practical application skills
4.	Forensic Accounting	Introduction , Meaning , Objectives , Types of Forensic Accounting , Nature and key principles of forensic accounting Ethical principles and responsibilities	<ul style="list-style-type: none"> • Conceptual skills • Acquisition of knowledge about forensic accounting and its implication.

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	14	Case Study	-----	-----	Developing understanding on accounting procedure for Holding companies
2	14	Case Study	You Tube and other online platforms for videos	Case study analysis	Conceptual understanding ,Practical application skills in the process of accounting for Absorption
3	12	Case Study , Simulative approach for mock liquidation of an Indian Company based on financial statements	Online Videos for cases	Individual assignment Preparation of Charts , PPT for the format of Statement of Affairs and Deficiency Account.	Practical understanding on Process of Liquidation on companies

4	08	Case Study	Online Videos on recent cases of Forensic Accounting	Case study Analysis	Updation of Knowledge on recent advances in the field of Accountancy
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References :

List of Books Recommended :-

1. Advanced Accounts: By M.C. Shukla & S.P. Grewal (S.Chand & Co. Ltd.)
2. Advanced Accountancy: By S.P. Jain & K.N. Narang (Kalyani Publishers)
3. Advanced Accountancy: By R.L.Gupta & M. Radhaswamy (Sultan Chand & Sons)
4. Company Accounts: By S.P. Jain & K.L. Narang
5. Advanced Accounts: By Paul Sr.
6. Corporate Accounting: By Dr. S. N. Maheshwari & S.K. Maheshwari
7. Corporate Accounting: By Mukharji & Hanif

CORE COURSE – III

Subject: BUSINESS ECONOMICS (MACRO)-II Course Code: 243

Total Credits: 03

Preamble –

An approach to Macro Economics is to examine the economy as a whole. This paper aims to provide knowledge about macroeconomics that includes macro-economic variables and theories. It also aims to make students familiar about the various concepts of macroeconomics like functions of money, trade cycle and macroeconomic policies and also about the concepts used in public finance.

Scope of the programme –

Basic Knowledge of Macro Economics

Objectives –

- To familiarize the students to the basic theories and concepts of Macro Economics and their application.
- To understand the theories of money.
- To understand the phases of trade cycle and policy measures to elongate the trade cycle.
- To understand various concepts related to public finance.
- To understand credit creation of banks and money measures of RBI.

Unit	Name and Content of the Chapter	Purpose & Skills to be Developed
Unit 1	Money:	Purpose: To understand the concept of money. To make the students know about Demand, Supply and Value of Money. Skills: Interpretation, comparative analysis, critical thinking, writing skills
	1.1 Meaning and Functions of Money.	
	1.2 Demand for Money: 1.2.1 Classical Approach. 1.2.2 Keynesian Approach.	
	1.3 Supply of Money: 1.3.1 Credit Creation of Commercial Banks 1.3.2 Money Measure of RBI (M1, M2, M3, M4). 1.3.3 Credit Control Methods.	
	1.4 Value of Money: 1.4.1. Quantity Theory of Money. 1.4.2 Cash Balance Approach : Marshall, Pigou, Robertson and Keynes	
Unit	Inflation:	Purpose:

2	2.1 Meaning and Definition	To understand the concept Inflation. To understand the stagflation and Phillips curve. Skills: Understanding, writing skills, critical thinking
	2.2 Causes of inflation	
	2.3 Consequences of Inflation	
	2.4 Demand Pull and Cost Push Inflation	
	2.5 Stagflation: Meaning and Causes	
Unit 3	Trade cycle:	Purpose: To understand the concept and phases of trade cycle. To understand the policy measures Skills: Understanding, writing skills, critical thinking
	3.1 Meaning and Definition of Trade Cycle	
	3.2 Characteristics of Trade Cycle	
	3.3 Phases of Trade Cycle	
	3.4 Control of Trade Cycle: Monetary Measures and Fiscal Measures	
Unit 4	Public Finance:	Purpose: To understand Public Finance. To understand the Procedure of Budget. Skills: Understanding, Critical thinking and writing skills.
	4.1 Meaning and Definitions.	
	4.2 Scope of Public Finance.	
	4.3 Importance of Public Finance.	
	4.4 Meaning and Types of Tax.	
	4.5 Public Expenditure: Meaning and Causes of Increasing Public Expenditure.	
	4.6 Public Debt: Meaning and Importance.	
	4.7 Budget: Meaning and Types.	

Teaching methodology:

Unit No	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	14	<ul style="list-style-type: none"> Open discussion Casestudies Problem solvingbased learning 	<ul style="list-style-type: none"> You tube lectures Films 	<ul style="list-style-type: none"> Implication of liquidity trap. Credit control methods used by India. 	<ul style="list-style-type: none"> Students will understand concept and theories of money. Will be able to critically evaluate supply of money in the economies.

2	10	<ul style="list-style-type: none"> • Digital lectures • Jigsaw reading • Project based learning 	<ul style="list-style-type: none"> • You tube lectures • Online PPTs 	<ul style="list-style-type: none"> • Inflation trends in developed and developing countries • Trends of agricultural prices in India 	<ul style="list-style-type: none"> • Will understand the causes and consequences of inflation • Will understand the concept of stagflation
3	10	<ul style="list-style-type: none"> • Game oriented classes • Pair learning • Group discussion • Games and simulation 	<ul style="list-style-type: none"> • Films • You tube lectures 	<ul style="list-style-type: none"> • Anti-cyclical policy measures used by various countries • Effect of US recession on the world economy • Implication of these measures 	<ul style="list-style-type: none"> • Will understand phases of trade cycle • Will understand the types of policies • Able to interpret effect of anti-cyclical policies on the economy
4	14	<ul style="list-style-type: none"> • Group discussion • Teacher driven 	<ul style="list-style-type: none"> • You tube lectures • Online PPTs 	<ul style="list-style-type: none"> • Trend of developed and non-developed expenditure in Indian economy • Types of taxes in India • Study of Indian budget 	<ul style="list-style-type: none"> • Will understand public revenue and public expenditure concept • Will be able to analyze, interpret and criticize public policies with theoretical base

References:

1. Economics: Paul A Samuelson and William D Nordhaus. McGRAW – HILL international Edition.
2. Macroeconomics: N. Gregory Makiw, Worth Publishers, New York.
3. Macro- Economic Theory: M L Zingan, Vrinda Publications (P) Limited.
4. Samashti Arthshstriy Vishleshan : Shridhar Deshpande, Vinayak Deshpande, Himalaya Publication House.
5. Theories of value: Output and Employment - John Eatwell, Thames Polytechnic, 1979

6. Business Economics, Dr.J.P.Mishra, Sahitya Bhavan Publications, Agra.
7. Macroeconomics: A Global Text, Sampat Mukherjee, New Central Book Agency Private Limited (Latest Edition), New Delhi
8. Macroeconomics: A Rough Guide, in Macroeconomics: A Reader, (Ed.) Brian Snowdon and Howard Vane, Routledge
9. Paisa, Mahagaie Aani Rajasva: Dr. Rasal, Shelar and Bhadane, Idol Publications, Pune.
10. Macroeconomics: Theory and Policy, S. Chand & Company Limited. (Latest Edition)
11. Ben Fine & Ourania Dimakou, Macroeconomics: A Critical Companion, Pluto Press (Latest Edition)
12. Michel De Vroey, A History of Macroeconomics: From Keynes to Lucas and Beyond, Cambridge University Press (Latest Edition)
13. Sampat Mukherjee, Analytical Macroeconomics: From Keynes to Mankiw, New Central Book Agency Private Limited
14. Macroeconomics- K R Gupta, R.K.Mandal, Amita Gupta, Atlantic Publishers and distributor's pvt.ltd.
15. Money, Inflation, and Business Cycles The Cantillon Effect and the Economy, Arkadiusz Sieroń. Abingdon, Routledge, 2019. NewYork
16. Macroeconomics: N. Gregory Maki Worth Publishersw, New York
17. Macro Economics: Rudiger Dornbusch, Stanley Fisher & Richard Startz Tata McGraw Hill Education Private Limited (Latest Edition),US
18. The General Theory of Employment, Interest, and Money- John Maynard Keynes, General Press
19. An Analysis of John Maynard Keynes's The General Theory of Employment, Interest and Money- John Collins, CRC Press,2017

Suggested Web

References:

Sr. No.	Lectures	Films	Animation	PPTs	Articles
1.	https://www.economicsnetwork.ac.uk/teaching/Video%20and%20Audio%20Lectures/Public-sector%20Economics%20and%20Public%20Choice%20Theory	http://www.studyinternational.com/the-little-bits-we-like/films/	https://ed.ted.com/lessons?category=macroeconomics	https://www.slideshare.net/NayanVaghela/trade-cycle-chapter-4	https://theconversation.com/global-topics/inflation-645

2.	https://www.youtube.com/watch?v=Ac_i3GEhMF54	https://economic.stackexchange.com/questions/9781/what-are-some-exceptional-movies-documentaries-on-macroeconomics	https://www.ufs.ac.za/econ/unlisted-pages/microeconomics-animations	https://www.slideshare.net/NayanVaghela/public-finance-chapter-7	https://journals.sagepub.com/toc/pfr/current
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CORE COURSE – IV

Subject: BUSINESS MANAGEMENT-II

Course Code: 244

Total Credits: 03

Unit No.	Unit Title	Contents	Skills to be developed
1.	Improving peoples' performance : Motivating the staff	<ul style="list-style-type: none">• Meaning, Importance and Theories of motivation• Maslow's Need Hierarchy Theory• Herzberg's Two Factor Theory• Douglas MC Gregor's Theory of X and Y• Ouchi's Theory Z• McClelland's Theory	<ol style="list-style-type: none">1. Skills regarding how to motivate staff and other members of the team.2. Skills regarding retaining motivational level3. Understanding needs and expectations of group members and meeting them effectively.
2.	Organizing from front-Leadership Skills	<ul style="list-style-type: none">• Meaning, Importance, Qualities and Functions of a leader• Leadership styles for effective management• Contribution of Mahatma Gandhi, Dr. Babasaheb Ambedkar and Pt. Jawaharlal Nehru in leadership.	<ol style="list-style-type: none">1. How to lead group2. Understanding followers and their views on various organizational matters.3. Conflict Management
3.	Achieving success at work : Coordination and Control	<ul style="list-style-type: none">• Meaning and need of coordination and control• Techniques and difficulties in establishing coordination and control• Steps in the process of control and it's techniques	<ol style="list-style-type: none">1. How to coordinate group efforts2. Minimizing resource waste3. Skills to establish coordination between departments.
4.	Emerging trends in Business management	<ul style="list-style-type: none">• Corporate Social Responsibility,• Corporate Governance And Corporate Citizenship,• Disaster Management And• Management of Change	<ol style="list-style-type: none">1. How to introduce change2. Significance of Disaster Management3. Importance and implementation of CSR4. Importance of Corporate Citizenship

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be Used	Film shows and AV Applications	Project	Expected Outcome
1	12	PowerPoint Presentations, YouTube Videos	Films how to motivate staff and various theories of motivation available on various digital platforms.	Poster Presentation on motivation theories.	Students will get an idea about the basic motivational tools used in the field of management.
2	12	PowerPoint Presentations, YouTube Videos	Documentaries and movies on leadership. Videos of great leaders in the field of trade and commerce available on various digital platforms.	Student group activities which involve leadership skills and qualities.	Students will get an idea about how leadership influences organizational success.
3	12	PowerPoint Presentations, YouTube Videos	Documentaries and movies on coordination and control available on various digital platforms.	Poster Presentation on coordination and control	Students will understand the significance of coordination and control in modern business management.
4	12	PowerPoint Presentations, YouTube Videos	documentaries and movies emerging trends in management available on various	Projects on various emerging trends in management	Students will come across various emerging trends in management.

References :-

- Management Theory & Practice - J.N.Chandan
- Essential of Business Administration - K.Aswhatha Himalaya Publishing House
- Principles & practice of management - Dr. L.M.Parasad, Sultan Chand & Sons - New Delhi
- Business Organization & Management - Dr. Y.K. Bhushan

- Management: Concept and Strategies By J. S. Chandan, Vikas Publishing
- Principles of Management, By Tripathi, Reddy Tata McGraw Hill
- Business organization and Management by Talloo by Tata McGraw Hill Business Environment and Policy – A book on Strategic Management By Francis Cherunilam Himalaya Publishing House
- Essentials of Management - Horold Koontz and Itenz Weibrich - McGrawhills International
- Management Theory & Practice - J.N.Chandan
- Essential of Business Administration - K.Aswathapa Himalaya Publishing House
- Principles & practice of management - Dr. L.M.Parasad, Sultan Chand & Sons - New Delhi
- Business Organization & Management - Dr. Y.K. Bhushan
- Management: Concept and Strategies By J. S. Chandan, Vikas Publishing
- Principles of Management, By Tripathi, Reddy Tata McGraw Hill
- Business organization and Management by Talloo by Tata McGraw Hill
- Business Environment and Policy – A book on Strategic Management By Francis Cherunilam Himalaya Publishing House

CORE COURSE – V

Subject: ELEMENTS OF COMPANY LAW-II Course Code: 245

Total Credits: 03

Depth of the program – Fundamental Knowledge

Objectives of the Program

1. To develop general awareness among the students about management of company
2. To have a comprehensive understanding about Key managerial Personnel of company and their role in Company administration.
3. To acquaint the students about E Governance and E Filing under the Companies Act, 2013.
4. To equip the students about the various meetings of Companies and their importance.
5. To make students capable of becoming good human resource of the corporate sector.

Unit No	Unit Title	Contents	Purpose Skills to be developed
1	Management of Company	Management of Company: 1. Board of Directors: Definition, Powers, Restrictions, Prohibition on Board. 2. Director: Meaning and Legal position of Directors,. Types of Directors, Related Party Transactions(Sec.188) 3. Appointment of Directors, Qualifications and Disqualifications, Powers, Duties, Liabilities of Directors, Loans to Directors, Remuneration of Directors	To Equip the students with procedure and practices

2	Key Managerial Personnel (KMP)	Key Managerial Personnel (KMP) (U/S 203) 1. Meaning, Definition and Appointments of Managing Director, Whole Time Director, Manager, CS 2. Company Secretary (CS)- Term of office/ Tenure of appointment, Role of Company secretary 3. Distinction between Managing Director, Manager and Whole Time Director - Role (Powers, Functions of above KMP) 4. Corporate Social Responsibility (CSR) [U/S 135] – Concept who is Accountable, CSR Committee, Activities under CSR,	To have Comprehensive understanding about the Key Managerial Persons and CSR
3.	Company Meetings	Company Meetings: 1. Board Meeting – Meaning and Kinds 2. Conduct of Meetings - Formalities of valid meeting [Provisions regarding agenda, notice, quorum, proxies, voting, resolutions (procedure and kinds) minutes, filing of resolutions, Virtual Meeting] 3. Meeting of Share Holders General Body Meetings, Types of Meetings A. Annual General Meeting (AGM), (Ss.96 to 99) B. Extraordinary General Meeting (EOGM).(Sec.100) 4. Provisions regarding convening, constitution, conducting of General Meetings contained in Ss.101 to 114	To acquaint students about
4.	E Governance and Winding up Company	E Governance and Winding up of a Company 1. E Governance –meaning, Importance of E Governance 2. E Filing – Basic concept of MCA, E Filing 3. Winding –up: Meaning of winding-up, Dissolution of company, Conceptual understanding of winding-up by the Tribunal, 4. Compulsory winding-up, Members’ voluntary winding-up, Creditors’ voluntary winding-up	To be able to appreciate the emerging E Governance and E- filing under the Companies Act, 2013. Learn the winding up of company.

[Note: Recent amendments in the Acts and relevant Landmark cases decided by courts are expected to be studied]

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome

1	12	Document , PPT, Narration, , Survey Analysis, Article review	You Tube about Company Management	Report, Review on management of company	To Acquaint knowledge and maturity to understand Company management.
2	12	Project making, , jingles, slogan , Quiz Competition, , Interview with Company secretary	Use of You tube, Review of Movie	Article review on new Emerging issues in CSR of company	To Acquaint with knowledge and role of key managerial person of the Companies and Rules about CSR.
3	12	Street play, Case study, Poster making, Mock AGM.	Case Analysis, valid meetings	Recent Laws and salient features of meetings of company.	To get training in to various types of meeting and procedure.
4	12	Group Discussion, Assignments on e-governance and e-filing, Interview of lawyer	Film on E-governance procedure and case study of winding up	Project on winding – up of company and E-governance	To enhance skills and knowledge about the E- governance of the company and winding-up of the company

Methods of Evaluations

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Continuous Evaluation,	Written Exam	Seminar on legal aspects on starting Business

Unit – II	Continuous Evaluation	Written Exam	Awareness program
Unit – III	Continuous Evaluation,	Written Exam	Visit to IPR Websites
Unit – IV	Continuous Evaluation,	Written Exam	Awareness program

1	12	PowerPoint Presentations, YouTube Videos	Films how to motivate staff and various theories of motivation available on various digital platforms.	Poster Presentation on motivation theories.	Students will get an idea about the basic motivational tools used in the field of management.
2	12	PowerPoint Presentations, YouTube Videos	Documentaries and movies on leadership. Videos of great leaders in the field of trade and commerce available on various digital platforms.	Student group activities which involve leadership skills and qualities.	Students will get an idea about how leadership influences organizational success.
3	12	PowerPoint Presentations, YouTube Videos	Documentaries and movies on coordination and control available on various digital platforms.	Poster Presentation on coordination and control	Students will understand the significance of coordination and control in modern business management.
4	12	PowerPoint Presentations, YouTube Videos	documentaries and movies emerging trends in management available on various	Projects on various emerging trends in management	Students will come across various emerging trends in management.

References :-

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	The Companies Act with Rules	Taxmann	Tan Prints (India) Pvt. Ltd. Jhajjar	Chandigarh
2.	The Companies Act, 2013	Bharat	Bharat Law House Pvt. Ltd.	Delhi
3.	Company Law-A Comprehensive Text Book on Companies Act 2013	Dr. G.K. Kapoor & Dr. Sanjay Dhamija	Taxmann Publications Pvt. Ltd	Delhi
4.	Company Law	Dr S R Meyani	Asia Law House	Mumbai
5.	Company Kaydyachi Olakha	K Shriram	Aarti & Co.	Mumbai
6.	Guide to Memorandum, Articles & Incorporation of Companies	Bhandari	Lexis Nexis	Mumbai
7.	Elements of Company Law	Arun Gaikawad Devendra Bhawari	Bibha	Pune
8.	Elements of Company Law	Prakash N. Chaudhary	Nirali Prakashan	Pune
9.	E-Commerce : Legal Compliance	Pratima Narayan	Eastern Book Company	Mumbai

SPECIAL ELECTIVE COURSE – VI

Subject: BUSINESS ADMINISTRATION-II

Course Code: 246(A)

Total Credits: 04 (Theory 03 + Practical 01=04)

Unit No.	Unit Title	Contents	Purpose/Skills to be developed
1	Legal Aspects (Recent Trends)	Compliance of legal requirements in promoting business unit, Licensing, Registration, Filing returns and other documents	To develop a better understanding of the legal compliances in business
2	Productivity	Meaning, Importance & measurements of productivity, Factors affecting productivity, Role of National Productivity Council-Product Quality Control	To understand the term productivity and its importance in business administration
3	Business liasoning	Interface between business and government, society ,and natural environment; etc Business strategy -- meaning and importance and steps in developing strategies.	To develop an understanding of the various forms of liasoning required in business administration
4	Business Alliances (growth strategies)	Mergers & Acquisition, Franchising, Outsourcing-concept and characteristics, Public Private Partnership, Business Engineering	Getting acquainted with the growth strategies of business

Teaching Methodology

Unit No.	No. of lectures	Innovative method to be used	Project	Expected Outcome
1.	12	PowerPoint Presentations, YouTube Videos	Assignments, poster presentations	Students will get an idea about the legal environment of business

2.	12	PowerPoint Presentations, YouTube Videos	Assignments, group presentations	Provide first - hand account of how productivity can be improved
3.	12	Lectures of industry experts entrepreneurs and documentaries.	Interviews /interaction with Business leaders to get a deeper insight on the environment and its impact on business	Help students understand the importance of various stake holders of business and the efficient way of establishing a rapport with them for business development
4.	12	Videos and lectures by experts	Interactions by experts with the students on various cases . Assignments/ presentations by student teams based on such interaction.	Greater insight on mergers , acquisitions and other strategies.

Recommended Books:

- i. Modern Business Organisation & Management-N.Mishra, Allied Publishers-Mumbai
- ii. Essentials of Business Administration- K. Ashwathappa-Himalaya Publication
- iii. Business Administration-S.C.Saxena-Sahitya Bhavan, Agra
- iv. The Administrative Process-Stephen Robbins
- v. Industrial Administration & Management- J.Batty
- vi Basu, C. (2017). Business Organisation and Management. McGraw Hill Education.

SPECIAL ELECTIVE COURSE – VI

Subject: BANKING & FINANCE-II Course Code: 246(B)

Total Credits: 04 (Theory 03 + Practical 01=04)

Objectives:

1. To provide the knowledge of Cooperative Banking in India
2. To analyze the functioning of Development Banking
3. To create the awareness about Banking Sector Reforms
4. To understand the role of various committees on Banking Sector Reforms.

UnitNo.	Topic	No. of Lectures	Teaching Method	Proposed skills to be developed
1.	Co-operative Banking in India: Meaning, significance and 1.1 principles of Cooperation 1.2 Evolution of Cooperative Baking in India. 1.3 Structure of Co-operative Banking in India Role of Co-operative Banking in Economic 1.4 Development 1.5 Challenges before Co-operative Baking in India	12	Lecture, PPT, the Group and Panel Discussion, Library Work, Assignment	Understanding Co-operative Banking Structure in India
2.	Development Banking in India: 2.1 Meaning and Features of Development Banking 2.2 Functions of Development Banks in India Role of Development Banks in Economic 2.3 Development Challenges before the Development Banking in 2.4 India	12	Lecture,PPT, the Group and Panel Discussion, Library Work, Visit to Banks	Understanding Functions and analyze the Role of Development Banking in India
3.	Selective Important Concepts of Banking 3.1 Central Banking , 3.2 Commercial Banking 3.3 Branch Banking , 3.4 Unit Banking	10	Lecture, PPT, the Group Discussion,	Understanding various concepts of Banking

3.5 Wholesale Banking, 3.6 Retail banking 3.7 Social Banking , 3.8 Islamic Banking 3.9 Merchant Banking, 3.10 Digital Banking		Library Work, Projects	
4. Banking Sector Reforms Historical approach, Meaning and Goals of 4.1 Banking Sector Reforms in India 4.2 Banking Reform Measures i) Cash Reserve Ratio (C.R.R.) and Statutory Liquidity Ratio (S.L.R.) ii) Prudential Norms (NPA) iii) Capital Adequacy Norms iv) Credit Deposit Ratio (C.D.Ratio) Framework of Basel Committees on Banking 4.3 Supervision i) Basel – I ii) Basel – II iii) Basel – III iv) Basel – IV M. Narsimhan Committee 4.4 Recommendations of – I (1991) 4.5 Recommendations of M. Narsimhan Committee- II (1998)	14	Lecture, PPT, Group and Panel Discussion, Library Work, Assignment, Projects	Understanding the Goals and Measures of Banking Reforms in India Analyze the role of various committees on Banking Sector Reforms
Total	48		

References:

1. Debaprosanna Nandy (2010), 'Banking Sector Reforms in India and Performance Evaluation of Commercial Banks, Universal Publishers
2. Deb Joyeeta (2019), 'Indian Banking System', Evince Publishing.
3. Desai Vasant (2007), 'Indian Banking-Nature and Problems', Himalaya Publishing House.
4. Gopinath M.N. (2017), 'Banking Principles and Operations', Snow White Publisher.

5. Joshi, Vasant and other (2002), Managing Indian Banks – The Challenges Ahead, Response Books, New Delhi.
6. Mallik, Chaudhury and Sarkar (2018), 'Indian Banking System- Growth, Challenges and
7. Nararajan and Parameswaran (2007), 'Indian Banking', S. Chand Company Ltd. New Delhi.
8. ShahiUjjwala (2013), 'Banking in India: Past, Present and Future', New Century Publications
9. Singh Sultan (2008), 'Banking Sector Reforms in India', Kanishka Publishing House
10. Thirunarayanan R., 'Co-operative Banking in India', Mittal Publication
11. Trivedi, Chaudhary and other (2015), 'Indian Banking System', RBD Publication, Jaipur.
12. Trivedi I.V. and Jatana Renu (2010), 'Indian Banking System', RBSA Publisher.
13. 'Report on Trend and Progress of Banking in India' 2017-18, 2018-19, 2019-20- Reserve Bank of India

SPECIAL ELECTIVE COURSE – VI

Subject: BUSINESS LAW & PRACTICE-II Course Code: 246(C)

Total Credits: 04 (Theory 03 + Practical 01=04)

Objectives of the course:

To develop an understanding of the significant provision of Industrial and Labour Laws.

To gain the ability of students to address a basic business legal application- oriented issues.

Depth of the program:

Basic & Fundamental

Objectives of the Subject:

- To impart the students with the fundamental understanding of important Industrial and Labour laws.
- To study & acquaint students an application & overview based knowledge of Industrial and Labour Laws.
- To familiar the students with legal Business Environment of India.
- To develop & strengthen students through the legal practical knowledge and their implications on Indian Business organizations.
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Unit. No.	Unit Title	Contents	Purpose skills to be developments
1	Maharashtra Cooperative Societies Act, 1960	Definition and Features of a Co-operative Society. Types of Co-operative Societies. Restriction on the society - Registration, Cancellation of Registration and De- registration of a Society. Bye Laws and Amendments of bye-laws.	Understanding the order and laws for development of co-operative societies in the state of Maharashtra.

2	Life Insurance	Meaning, Definition of Life Insurance, Features of Life Insurance, Importance of life Insurance. Basic Principles of Life Insurance. Advantages of Life Insurance, Type of Life Insurance Policy, Procedure of Life Insurance Policy. Settlement of Claims of Life Insurance of Policy, Nomination of Policy. LIC Object, Constitution & Functions, Challenges before LIC, Social Responsibility of LIC.	It will help the students to gain insights of Life Insurance
3	Competition Act 2002	Introductions, definitions, scope, objectives, Prohibition of Certain Agreements, Abuse of Dominant Position and Regulation of Combinations, Competition Commission of India, Duties, Powers And Functions of Commission. (Sec 1 to 39)	To create more awareness about prevented practices that adversely affect competition, and to maintain competition in markets and protect the interests of consumers.
4	Industrial Disputes Act, 1947	Introductions, definitions, scope, objectives, Industrial Disputes, Strikes, Lock-out, lay-off, Standing orders, Rules, Causes of Industrial Disputes. Consequences of Industrial Disputes. Works committee.	Understanding the concepts of dispute, Disputes that relate to the terms and conditions of employment or non-employment or employment of a person.

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	<ul style="list-style-type: none"> ➤ Cases to be discussed in Group. ➤ Internet Sources. 	<ul style="list-style-type: none"> ➤ You tube videos on Success stories of cooperative movement in India. ➤ E-Content on Cooperative societies provided by UGC/University/MOOC / You tube etc. to be studied. 	Project report should be prepared on Various successful cooperative ventures in .India & Outside the India	Understanding the legal requirements of Cooperative Business Model in India. Understanding the cooperative law & its applications.
2	12	<ul style="list-style-type: none"> ➤ Benefits of Insurance to be discussed in Group. ➤ Internet Sources. ➤ Discussion on Claim Settlement. 	<ul style="list-style-type: none"> ➤ E-Content on Life Insurance provided by UGC/University/MOOC etc. to be studied & analyzed. 	Project report can be prepared on benefits of Life insurance to the people.	Legal framework of Life insurance. Insights & benefits to be understood to minimize life risk.
3	12	<ul style="list-style-type: none"> ➤ Internet Sources. ➤ Presentation can be taken. ➤ Applications of this law to be understood. 	<ul style="list-style-type: none"> ➤ E-Content on Competition Act 2002 provided by UGC/University/MOOC/ You Tube etc. to be Watched & analyzed. 	Project report can be prepared on Applications of Competition Act 2002.	Understanding the fair & healthy business competition in India.

4	12	<ul style="list-style-type: none"> ➤ Observation or Survey about Industrial disputes can be conducted and discussed in detail. ➤ PPT Method can be used. 	<ul style="list-style-type: none"> ➤ Various cases on Industrial Disputes can be studied. ➤ E-Content on Industrial Disputes act 1947 provided by UGC/University/MOOC/ You Tube etc. to be Studied & analyzed. 	Project report can be prepared on various dispute cases happened in India & solved under Industrial Disputes Act 1947.	Application & benefits of Industrial Disputes Act 1947. Insights & benefits of the same to the business organizations in India.
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References

Sr. No.	Title of the Book	Author/s	Publication
1	Labour Laws	Taxmann	Taxmann
2	Labour & Industrial Laws	S N Misra	Central Law Publication
3	Maharashtra Cooperative Societies Act, 1960	Current Publications	Current Publications
4	Competition Act 2002	Agarwal V. K.	Bharat Law House Pvt Ltd
5	Industrial Disputes Act, 1947	Lawmann's	Kamal Publishers
6	Labour and Industrial Laws	M.N. Mishra	Central Publicaions

Practical for Semester – IV

Topic	Mode of Practical
Types of Cooperative Society	Case Study Method.
Settlement of Claims of Life Insurance of Policy	Real life examples, Applications with library sources.
Competition Commission of India	Library Assignment.
Strikes, Lock-out, lay-off, Standing orders, Rules, Causes of Industrial Disputes	Review of Research Papers/Articles, News Paper Articles etc.

SPECIAL ELECTIVE COURSE – VI

Subject: CO-OPERATION AND RURAL DEVELOPMENT -II

Course Code: 246(D)

Total Credits: 04 (Theory 03 + Practical 01=04)

Unit No.	Unit Title	Contents	Skills to be developed
1	Co-operative Laws in India	1.1 History of Co-operative Legislation 1.2 Co-operative Societies Act 1904, Objectives and Features 1.3 Co-operative Societies Act 1912 ,Objectives and Features 1.4 Bombay Provisional Co-operative Societies Act 1925, Main Provisions, 1.5 Benefits of Co-operative Legislations	1. To understand progress of co-operative legislation 2. To be acquainted with various co-operative enactments 3. 3. To know the benefits of co-operative legislations
2	Multi-state Co-operative Societies Act	2.1 Need and objectives 2.2 Procedure for Registration of Societies 2.3 Documents required for registration 2.4 Central Registrar – Appointment, Functions, Duties	1. To know the process of registration. 2. To know the various documents essential for registration of societies 3. To understand the rights and functions of Registrar.
3	Maharashtra State Co-operative societies Act, 1960	3.1 Need and objectives of the Act 3.2 Registration of Co-operative Societies 3.3 Privileges of Co-operative Societies 3.4 Membership of Co-operative Societies 3.5 Provisions Regarding Management of Co-operative Societies 3.6 Registrar Appointment, Functions, Duties and Jurisdiction 3.7 Provisions Regarding Audit of Co-operative Societies 3.8 Amendments made in Maharashtra Co-operative Societies, Act in 2013	1. To understand provisions of co-operative societies Act-1960. 2. To know and understand provisions of amendment act 2013. 3. To know the provisions pertaining the audit of co-operative societies.

4	Co-operative Entities – Functions, Problems and Progress	4.1 Present Situation of Agricultural Credit Co-operatives- Primary District and State Co-operative Banks 4.2 Co-operative Sugar Factories 4.3 Contemporary conditions of Non Agricultural Credit Co-operatives 4.4 Dairy Co-operatives 4.5 Co-operative Housing Societies 4.6 Consumer Co-operative Societies 4.7 Urban Co-operative Banks	1. To create understanding about agricultural credit banks. 2. To know the problems of co-operative societies. 3. To know the functions of various co-operative societies.
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Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Theory lectures, group discussion.	----	-----	Concept of co-operation & how co-operative societies act progressed.
2	12	Theory lecture, class room discussion	----	-----	Student should become aware about registration, its benefits & importance.
3	12	Theory lecture, Visit to co-operative registrar's office	AV available on 'You tube'	Collection of Memorandum of Association, Article of Association, Form 'A' & Form 'B'.	Understanding pertaining to registration process, documents & audit of co-operative societies
4	12	Theory lecture, visit to co-operative credit Bank	-----	Preparing Detailed report of the visit.	Understanding about functioning of credit co-operative banks/ Societies

References:

- 1) G.S.Kamat –Cases in Co-operative management
- 2) N.L.Ghorpade- Co-operation and Rural Development
- 3) K.K.Taimani- Co-operative Organization and Management
- 4) G.S.Kamat – New Dimensions of Co-operative Management
- 5) Vasant Desai – Fundamentals of Rural Development

- 6) Dr. Dhiraj Zalte & Others – Theory & Practice of Co-operation, Prashant Publication
- 7) V.M.Dandekar and Rath – Poverty in India
- 8) Dr. P.R.Dubhashi – Rural Development and Administration in India
- 9) V.Reddy – Rural Development in India
- 10) S.K. Gopal – Co-operative Farming in India
- 11) B. Mukharji – Community Development
- 12) I.C.A State and C-operative Movement
- 13) <https://www.bhagirathgram.org/>

SPECIAL ELECTIVE COURSE – VI

Subject: COST & WORKS ACCOUNTING-II

Course Code: 246(E)

Total Credits: 04 (Theory 03 + Practical 01=04)

Objectives:

1. To know the documents that are used in stores and how to calculate the issuing price of material.
2. To provide knowledge to students on classification and codification.
3. To equip students with knowledge regarding the ascertainment of labour cost.
4. To understand the concept of payroll.
5. To know the concepts of labour turnover and merit rating.
6. To understand recent trends in cost accounting.

Unit No.	Unit Title	Contents	Skills to be developed
1	Material Accounting	Store Location and Layout. Classification and Codification of Material. Stores and Material Records. Bin Card & Store Ledger etc. Issue of Material and Pricing Methods for Issue of Material: FIFO. LIFO. Simple Average Methods. Weighted Average Methods. Use of computer in store Accounting.	1. To understand different pricing methods used for issuing the material. 2. To gain knowledge about the documents used in store departments.
2	Labour cost and Payroll	Meaning and definition of wages. Difference Between Wages and Salary Records and methods - time keeping and time booking. Methods of Wage Payment Time rate system. Piece rate system. Taylor's differential piece rate system. Incentive Plan. Halsey Plan. Rowan Plan. Group Bonus scheme. Performance based incentive plan. Payroll meaning and components	To Understand the difference between salary and wages. To know the methods of time keeping and time booking. To enable the student to calculate wages and incentives. To understand meaning and components of payroll
3	Other Aspects of Labour	a. Labour Turnover. b. Job Analysis & Job Evaluation. c. Merit Rating.	To understand the labour turnover, job analysis and evaluation
4	Direct Cost and	Direct Cost Concept and its accounting	To understand the concept of

Introduction to JIT, CAM and ERP.	treatment Introduction to- Just In Time(JIT) CAM(Computer Aided Manufacturing) Enterprise Resource Planning (ERP)	direct cost and recent trends in cost and management accounting
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Teaching Methodology

Unit No.	Total Lectures	Innovative Methods to be used	Films Shows and AV Applications	Project	Expected Outcome
1	16	Invite a storekeeper in the classroom to provide practical knowledge about which records are to be maintained in the store department and pricing methods for issue of material	Youtube Lectures and relevant multimedia compact discs(CD)	Visit small industries for understanding which records are to be maintained in store department	Understanding various methods used in the pricing of the issue of materials
2.	16	Powerpoint presentation and guest lecture	You Tube clippings of methods of remuneration, time keeping and time booking and their methods	1)Calculation of wage payment and incentives. 2)Preparation of a specimen of pay slip.	Enabling to calculate wage payment and incentives.
3	10	Powerpoint presentation and group discussion.	You Tube clippings of Labour turnover, Job Analysis & Job Evaluation Merit Rating.	Analysis and evaluation of jobs in any organisation.	Understanding the process of job analysis, job evaluation and merit rating.
4	6	Guest lecture, powerpoint presentation and group discussion.	You Tube clippings of Labour turnover, Job Analysis & Job Evaluation Merit Rating.	Read articles on the recent trends in cost accounting from Journals, e-journals and web resources.	Insight into recent processes used for cost reduction.

Methods of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add-On Course
Unit I	Multiple Choice Questions, Written Test, Internal Examination, Powerpoint Presentations, Orals, Assignments, Tutorials etc.	SPPU	Two industrial visits and subsequently reports on these visits.
Unit II			
Unit III			
Unit IV			

References

Sr. No	Titles of the Book	Names of Author	Name of Publisher	Place
01	Cost Accounting-Principles & Practices	Jawahar Lal & Seema Shrivastava	Tata Mcgraw Hill	New Delhi
02	Advanced Cost Accounting And Cost Systems	Ravi M Kishor:	Taxmann	New Delhi
03	Cost Accounting Theory And Problems	S. N. Maheshwari	Mittal Shree Mahavir Book Depot.	New Delhi
04	Advanced Cost Accounting	Jain and Narang	Kalyani Publication	New Delhi
05.	Horngren's Cost Accounting-A Managerial Emphasis	Srikant M Datar & Madhav V Rajan	Pearson	Noida Up
06	Cost Accounting-Principles & Practices	Dr. M.N. Arora	Vikas Publishing House,	New Delhi
07	Advanced Cost Accounting	Dr. D. M. Gujarathi	Idol Publication	Pune
08	Advanced Cost Accounting	Dr. Kishor. M. Jagtap	Tech-Max Publication	Pune
09	Cost Accounting Principles And Practice	Jain and Narang	Kalyani Publication	New Delhi
10	Principles and Practice of Cost Accounting	N.K Prasad	Booksyndicate Private Ltd	Kolkata
11	Cost Accounting: Methods and Problems	B.K.Bhar	Academic Publications	Kolkata

Web References

Sr. No	Lectures	Films	PPTs	Articles	Others
For all the units.	Guest Lectures by Field Personnel such as working executives from industries and of practising Cost and Management Accountants.	YouTube films showing the working of different industries.	Relevant powerpoint presentations are available on all these topics.	Articles from the Professional Journals such as The Management Accountant, The Chartered Accountant, The Chartered Secretary, The Institute of Chartered Financial Analyst of India	https://icmai.in www.globalcma.in eclm.unipune.ac.in

Notes: The breakup of marks in the Examination will be as follows:

- 50 % of the marks are assigned for Theory whereas rest 50 % of the total marks are allotted for Numerical Problems.
- The Numerical Problems will be of simple nature only.
- Areas of numerical problems:
 - Pricing Methods Of Issue Of Material.
 - Methods Of Wage Payment and Incentive Plan.
 - Measurement Of Labour Turnover.

SPECIAL ELECTIVE COURSE – VI

Subject: BUSINESS STATISTICS

Course Code: 246(F)

Total Credits: 04 (Theory 03 + Practical 01=04)

Preamble to the syllabus:

Tools and techniques learned in Statistics give a precise way of formulating and analyzing a problem and to make logical conclusions. Concepts and tools introduced in this course are useful to students for higher studies and career in any branch of Economics, Commerce and Management. Professionals working in these fields, wishing to upgrade their knowledge, will also benefit. The stress of the course will be on building the concepts and their applications.

In modern times, Statistics is viewed not as a mere device for collecting numerical data but as a means of developing some techniques for their handling and analysis and drawing valid inferences from them. Statistics provides tools for making decisions when conditions of uncertainty prevail. So it is very useful in various fields like agriculture, business, management, economics, finance, insurance, education, biotechnology and medical science etc.

Depth of the Course – Basic Knowledge of Elementary Statistics

Objective of the Course

1. To understand and Master the concepts, techniques & applications of Statistical Methods Operations Research.
2. To develop the skills of solving real life problems using Statistical Methods and Operations Research.
3. To make students to understand the art of applying statistical techniques to solve some real life problems.
4. To gain knowledge of Statistical Computations

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Time Series	Introduction, Definition, Components of Time Series, : The Trend, Seasonal variation, Cyclical variation, Irregular variation, Additive Model, Multiplicative Model, Methods of estimating Trends, Moving averages (with periods 3,4,5), Fitting of trend line and second degree curve, Exponential smoothing, Example and problems.	<ol style="list-style-type: none">1. To understand the concept time series and its components.2. To understand the interpretation of time series.3. To understand the various data fitting methods for time series.
2	Simplex Method	Definition of Linear programming problem, Canonical and standard form duality relation between primal and dual, example and problems on simplex	<ol style="list-style-type: none">1. To understand the simplex method algorithm.2. To understand and

		method, meaning of unbounded solution, basic feasible solution, alternate solution, degenerate solution	analyze simplex tables.
3	Transportation Problem	Transportation Problem of minimization type objective function, Introduction, balanced and unbalanced TP, Initial Basic Feasible Solution (IBFS) using NWCR, MMM, VAM, Optimal solution using MODI method. Example and problems.	1. To understand the concept of transportation problems. 2. To understand the methods to obtain IBFS and optimal solution of TP.
4	Assignment Problem	Introduction, concept minimization and maximization, Hungarian method example and problems	1. To understand the concept of assignment problem. 2. To understand the method to obtain optimal solution of AP.

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	14	ICT	NA	NA	Students will be able to apply time series techniques to problems from finance and economics.
2	13	ICT	NA	NA	Students will be able to apply simplex algorithm and analysis the solution of LPP.
3	14	ICT	NA	NA	Students will be able to solve transportation problems and obtain optimal solutions. Students will be able to apply TP techniques to real world problems.
4	07	ICT	NA	NA	Students will be able to solve assignment problems. Students will be able to apply AP techniques to real world problems.

Method of Evaluation

Subject	Internal Evaluation	External Evaluation
Unit – I	30%	70%
Unit – II	30%	70%
Unit – III	30%	70%
Unit – IV	30%	70%
Total		

Notes: -

1. Internal evaluation is continuous assessment.
2. Internal evaluation shall have following components: -
 - a. At least one test of 20 marks involving objective questions of following type: - multiple choice, true or false, state definitions/concepts, one line answer etc.
 - b. At least one assignment of 05 marks.
 - c. If time and resources permit then there can be power point presentation of group or individual (this component is not compulsory).
 - d. Final score will be average score of all components.

Text Books:

1. Unit I – Time Series - Bhowal M. K. and Pronob Barua, Statistics Vol. 1, Asian Books Pvt. Ltd., New Delhi and Cheng-Few Lee, John C. Lee and Alice C. Lee, Statistics for Business and Financial Economics, Springer, New York
2. Unit II – Simplex Method - Hamdy A. Taha, Operations Research: An Introduction, Pearson, New Delhi
3. Unit III – Transportation Problems - Hamdy A. Taha, Operations Research: An Introduction, Pearson, New Delhi
4. Unit IV – Assignment Problems - Hamdy A. Taha, Operations Research: An Introduction, Pearson, New Delhi

References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Business Mathematics and Statistics	N.G. Das & Dr. J.K. Das	McFraw Hill	New Delhi
2.	Fundamentals of Business Mathematics	M. K. Bhowal	Asian Books Pvt. Ltd	New Delhi
3.	Operations Research	P. K. Gupta & D. S. Hira	S. Chand Publishing	New Delhi
4.	Mathematics for Economics and Finance: Methods and Modeling	Martin Anthony and Norman Biggs	Cambridge University Press	Cambridge
5.	Fundamentals of Mathematical Statistics	Gupta S. C. and Kapoor V. K.:	Sultan Chand and Sons	23, Daryaganj, New Delhi 110002
6.	Statistical Methods	Gupta S. P.:	Sultan Chand and Sons	23, Daryaganj, New Delhi 110002
7.	Applied Statistics	Mukhopadhyaya Parimal	New Central Book Agency Pvt. Ltd.	Calcutta.
8.	Fundamentals of Statistics	Goon A. M., Gupta, M. K. and Dasgupta, B.	World Press	Calcutta.
9.	Fundamentals of	Gupta S. C. and Kapoor V. K.:	Sultan Chand and Sons	23, Daryaganj, New Delhi

	Applied Statistics			110002
10.	Statistics for Business and Financial Economics	Cheng-Few Lee, John C. Lee and Alice C. Lee	Springer	New York
11.	<i>Operations Research</i>	<i>Kanti Swarup, P. K. Gupta, Man Mohan</i>	Sultan Chand & Sons,	New Delhi

Suggested references

Web reference for Semester I & II

1. www.freestatistics.tk(National Statistical Agencies)
2. www.psychstat.smsu.edu/sbk00.htm(Onlinebook)
3. www.bmj.bmjournals.com/collections/statsbk/index.shtml
4. www.statweb.calpoly.edu/bchance/stat-stuff.html
5. www.amstat.org/publications/jse/jse-data-archive.html(International journal on teaching and learning of statistics)
6. www.amstat.org/publications/chance(Chancemagazine)
7. www.statsci.org/datasets.html(Datasets)
8. www.math.uah.edu/stat(Virtual laboratories in Statistics)
9. www.amstat.org/publications/stats(STATS : the magazine for students of Statistics)
10. www.stat.ucla.edu/cases(Case studies in Statistics).
11. www.statsoft.com
12. www.statistics.com
13. www.indiastat.com
14. www.unstat.un.org
15. www.stat.stanford.edu
16. www.statpages.net
17. www.wto.org
18. www.censusindia.gov.in
19. www.mospi.nic.in
20. www.statisticsofindia.in
21. <https://swayam.gov.in/>

SPECIAL ELECTIVE COURSE – VI

Subject: BUSINESS ENTREPRENEURSHIP (SPECIAL PAPER-I)

Course Code: 246(G)

Total Credits: 04 (Theory 03 + Practical 01=04)

Unit No.	Unit Title	Contents	Skills to be developed
1	Group Entrepreneurship	Concept- Meaning and Significance- Individual Entrepreneurship V/s Group Entrepreneurship. Advantages and Disadvantages of Group Entrepreneurship. Self Help Group- Definition, Meaning and Evolution- Nature- Scope of SHG, Administration Functions and Operation of SHG's , Do's and Don'ts with suitable illustration of Self Help Group	<ol style="list-style-type: none">1. To understand the concept Individual Entrepreneurship and Group Entrepreneurship along with their significance.2. Students should be able to understand its advantages and disadvantages.3. To make aware of the concept Self Help Group with its functions to enhance the knowledge in entrepreneurship.4. To equip the students with various aspects of entrepreneurship, their competencies like initiative, how to grab the opportunities etc. and qualities with examples.
2	Various Entrepreneurial Opportunities	Role of Service Sector in National Economy- Types of Service Ventures, Service-Industry Management, Success Factors in Service Ventures- Opportunities to Service Industry in Rural and Urban Areas, Distinction Between Service Industry and Manufacturing Industries.	<ol style="list-style-type: none">1. Students should know to service sector and its role in National Economy also have to detail knowledge of benefits of industries in rural and urban areas.2. Students should be able to differentiate in service industry and manufacturing conventional industry.3. Information on role of each industry will help the students to develop their interest in entrepreneurship.

3.	Study of Entrepreneurs or Enterprises	1. Mr. Radhakishan Damani (D Mart) 2. Mr. Ritesh Agarwal (OYO Hotels) 3. Mr. Sanjeev Bhikchandani (Naukri.com) 4. Mumbaiche Dabewale 5. Mr. Ratan Tata.	1. To study the real life well known examples of entrepreneurs and enterprises in India, to motivate the students to enhance their competencies and create interest in, to become an enterprisers or to be an entrepreneurs.
4.	Challenges in Entrepreneurship Development	Challenges- Social, Cultural, Educational, Political, Economical, International Situation, Cross Cultural Aspects. Measures and Challenges of Globalization and Entrepreneurship Development in India. Effect of Corona Virus on Entrepreneurship.	1. Students should be able to understand the challenges in entrepreneurship development and how these environmental factors affect the business so the students should be known how to overcome on these factors or challenges.

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Collecting information through available literature.	Related Videos and PPTs	Asked students to prepare detailed report.	Understanding the basics difference in Individual Entrepreneur and Group Entrepreneurship and details in SHG.
2	12	Small research on field market survey.	Related Videos and PPTs	Assign small projects (Product Specific) to students in individual or group research to find the requirement of the society. (Product	Students will identify the opportunities of entrepreneurship in the present market, in terms of production, trading or by providing services

				Specific)	to the society.
3	12	Collecting detail information of entrepreneurs and enterprise through available literature, news, reports, etc.	Biographical videos or CDs of entrepreneurs and enterprises	Prepare a small project on at least one entrepreneur to study its 360 degree.	Students will be able to study and investigate the entrepreneur or enterprise on micro level.
4	12	Conducting survey and collecting information of the challenges (internal and external) in the entrepreneurship development.	Interviews of entrepreneurs videos, PPTs	Assign small projects in individual or in group.	Students will practically study the Challenges in entrepreneurship development.

References:-

- 1..Business Environment, Francis Cherunilam, Himalaya Publishing House, New Delhi.
- 2..Entrepreneurship Development, Khanna S.S, S. Chand, New Delhi.
- 3.Entrepreneurship Development, Gupta, Shrinivasan, S. Chand, New Delhi
- 4..Dynamics of Entrepreneurship, Desai Vasant, Himalaya Publishing House, New Delhi
- 5..Indian Economy,, Ruddar Datt, K.P.M. Sundharam, S. Chand, New Delhi
- 6 .Udyog,Udyog Sanchalaya, Mumbai
- 7.Vyawasaya Udyojagata, Dr. S. L. Shiragave, Success Publication, Pune

SPECIAL ELECTIVE COURSE – VI

Subject: -MARKETING MANAGEMENT -II Course Code: 246(H)

Total Credits: 04 (Theory 03 + Practical 01=04)

1. Preamble

As the commercial scenario has totally changed, the need for advanced concepts has increased. Education system also has to change with the rapidly transforming times. Education system is trying to familiarize the students of commerce with advanced concepts in the field so that they are aware of the changing picture.

Marketing Management is an important subject and has been structured to create awareness of the Marketing Management by giving proper insight to the basics of Marketing, so that the foundation of this subject is strengthened for further studies in Marketing.

From this point of view Savitribai Phule Pune University has introduced Choice Based Credit System of course structure. This system will develop the logical independent thinking for accepting the challenges of the changing Business world.

2. Objective of the Course

1. To create awareness and impart knowledge about the basics of Marketing Management which is the basic foundation of Marketing subject.
2. To orient the students in recent trends in marketing management.
3. To understand the concept of Green Marketing.
4. To enable students to apply this knowledge in practical by enhancing their skills in the field of Marketing.

Unit No.	Unit Title	Contents	Purpose Skills To Be Developed
1	Green Marketing	1.1 Introduction 1.2 Meaning of Green Marketing 1.3 Definition of Green Marketing 1.4 Objectives of Green Marketing 1.5 Importance of Green Marketing 1.6 Strategies of Green Marketing 1.7 Role of Marketing Manager in Green Marketing	To understand the core principles required to create competitive advantage in the marketplace by implementing innovative green

		<p>1.8 Marketing mix of green marketing</p> <p>1.9 Principles of success of green products</p> <p>1.10 Case studies</p>	marketing strategies.
2	E-Marketing	<p>2.1 Introduction</p> <p>2.2 Meaning of E-Marketing</p> <p>2.3 Definition of E-Marketing</p> <p>2.4 Utility of E-Marketing</p> <p>2.5 Advantages of E-Marketing</p> <p>2.6 Limitations of E-Marketing</p> <p>2.7 Challenges before E-Marketing</p> <p>2.8 Online and Offline Marketing</p> <p>2.9 Present status of E-Marketing in India</p> <p>2.10 Scope for E-Marketing in Indian scenario Online Marketing Strategies</p>	To understand Professionals working in E-Marketing to design and implement Internet marketing plans.
3	Digital Marketing	<p>3.1 Introduction</p> <p>3.2 Meaning of Digital Marketing</p> <p>3.3 Definition of Digital Marketing</p> <p>3.4 Difference between Traditional Marketing & Digital Marketing</p> <p>3.5 Digital Marketing Channels</p> <p>3.5.1 Search Engine Optimisation (SEO) Off-page Optimisation On-Page Optimization</p> <p>3.5.2 Social Media Marketing Facebook Marketing Twitter Marketing Google Marketing Video Promotion YouTube Marketing Pinterest Marketing Instagram Marketing</p> <p>3.5.3 Online Paid</p>	To understand how and why to use digital marketing for multiple goals within a larger

		<p>advertisement Google AdWords Facebook Ads Twitter Ads</p> <p>3.5.4 Email Marketing 3.5.5 Mobile App Marketing 3.5.6 Web Analytics 3.5.7 Content Marketing 3.5.8 Affiliate Marketing</p>	
4	Introduction to International Marketing	<p>4.1 Introduction 4.2 Meaning of International Marketing 4.3 Definition of International Marketing 4.4 Scope of International Marketing 4.5 Objectives of International Marketing 4.6 Facets of International Marketing 4.7 Benefits of International Marketing 4.8 Limitation of International Marketing 4.9 Forces influencing International Marketing 4.10 Forces restraining International Marketing</p>	To expand student's knowledge of significant strategic marketing techniques which will give them great advantage to develop their career in marketing.

Teaching Methodology

Topic No.	Total Lectures	Innovative Methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	14	Power Point Presentation, Article Review, Survey Analysis	AV Application	Market Survey	Students will understand how Green Marketing is necessary for marketers to use resources efficiently, so that organizational objectives are achieved without waste of resources.

2	07	Group Discussion, Quiz, Poster Making	Short Film about Buyer Behaviour, AV Application	Interviews of the Buyer	It will help the student to apply the various techniques and methods of E- Marketing practically.
3	14	Power Point Presentation, Group Discussion, Survey Analysis	AV Application	Market Survey, Interviews of Seller	It will help them to implement the knowledge of Digital Marketing in practical by enhancing their skills in the field of Marketing.
4	13	Power Point Presentation, Group Discussion, Field Visit	Short Film, AV Application	Market Survey, Interviews of Marketing Manager or Head	It will help them to gain a solid understanding of the theoretical and conceptual knowledge of International marketing.

Methods of Evaluation

	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit - I	Quiz, Group Discussion	Examination	Environmental Marketing
Unit - II	Practical, Presentation	Examination	Advanced Digital Marketing
Unit - III	Presentation, Group Discussion	Examination	E-Learning Training Course
Unit - IV	Project, Presentation	Examination	Workshop on International Marketing

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Marketing Management	Philip Kotler	Pearson Publication	
2	Marketing Management	Rajan Saxena	McGraw Hill Education	
3	Principles of Marketing	Philip Kotler	Pearson Publication	
4	Sales & Distribution Management	Tapan K Panda	Oxford Publication	

5	Advertising Management	Rajiv Batra	Pearson Publication	
6	Retail Management	Swapna Pradhan	McGraw Hill Publication	
7	Retail Management	Gibson Vedamani	Jayco Publication	
8	Marketing Management	V. S. Ramaswamy & S. Namakumari	Macmillan Publication	
9	Supply Chain Management	Sunil Chopra, Peter Meindl & D. V. Karla	Pearson Publication	

SPECIAL ELECTIVE COURSE – VI

Subject: AGRICULTURAL AND INDUSTRIAL ECONOMICS -II

Course Code: 246(I)

Total Credits: 04 (Theory 03 + Practical 01=04)

Unit No.	Unit Title	Content	Purpose skills to be developed
1	Economics of Farm Management	3.1 Farm Management, Meaning, Scope, Objectives 3.2 Management of Farm input and Output, Types of Farming 3.3 Economies and Diseconomies of Scale 3.4 Recent Changes in Farm Management- (Farmer Collectives/ Producer Organisation)	<ul style="list-style-type: none">▪ To understand the Concept of Farm Management▪ Ability to compare Plant, Firm and Industry To make the students know about the concept of various sector in Industrial Economics.
2	Risk and Uncertainty in Agriculture	2.1 Nature of Risk and Uncertainty in Agriculture 2.2 Types of Risk and Uncertainty (Climatic Variability & Change, Production Risks, Technological) 2.3 Risk and Uncertainty Management Strategies in Agricultural 2.4 Risk Management Through Agricultural Insurance Price	<ul style="list-style-type: none">▪ To get acquainted with Nature and Type of uncertainty in agricultural▪ To Equip the students with a measure to control risk and uncertainty in Agriculture
3	Industrial Finance	3.1 Meaning, Scope, Importance of Industrial Finance 3.2 Sources of Industrial Finance: Shares, Debentures, Bonds, Deposits, Loan Role of IDBI, SIDBI, ICICI, State Finance Corporations 3.3 Foreign Capital: Need for Foreign Capital, Foreign Direct Investment, Foreign Institutional Investment, GDR, ADR, External Commercial Borrowings.	<ul style="list-style-type: none">▪ To get acquainted with meaning scope and Importance on Industrial Finance.▪ To gain knowledge of various industrial financing institution
4	Industrial Productivity & Efficiency	4.1 Productivity - Norms and Measurement 4.2 Factors Affecting Productivity and Capacity Utilization 4.3 Importance of Productivity in the Competitive Environment. 4.4 Measures Required for Improving	<ul style="list-style-type: none">▪ To understand the Concept productivity▪ To make the students know about the Factors affecting Productivity and Measures required for Improving Productivity and efficiency

Teaching Methodology:

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project/Practical	Expected Outcome
1	12	Lecture, PPT/ Group Discussion, Library, Problem solving based learning, Case study, Jigsaw reading, Practical based learning	Relevant videos, Consortium for Educational Communication-SWF E- Content	<ul style="list-style-type: none"> Visit farmer Producer Company and analyse the opportunities and threats of FPO. 	<p>After completing this topic , the student will be able to understand</p> <ul style="list-style-type: none"> Assess and evaluate the New methods of Collective Farming Identify and choose the newer methods
2	12	Lecture, PPT/ Group Discussion, Library, Problem solving based learning, Case study, Jigsaw reading, Practical based learning	Relevant videos, Consortium for Educational Communication-SWF E- Content	<ul style="list-style-type: none"> List of out the Indian Government measure to Control risk and uncertainty in Agriculture. 	<ul style="list-style-type: none"> Evaluate the effects of Risk and uncertainty in agricultural Different measures to overcome risk and uncertainty in the Agricultural Sector
3	12	Lecture, PPT/ Group Discussion, Library, Problem solving based learning, Case study, Jigsaw reading, Practical based learning	Relevant videos, Consortium for Educational Communication-SWF E- Content	<ul style="list-style-type: none"> Information of various Industrial Financial Institution 	<ul style="list-style-type: none"> Analyse the importance and roll of Industrial Financial Institution
4	12	Lecture, PPT/ Group Discussion, Library, Problem solving based learning, Case study, Jigsaw reading, Practical based learning	Relevant videos, Consortium for Educational Communication-SWF E- Content	<ul style="list-style-type: none"> Analyse the factor affecting on Industrial Productivity and Efficiency 	<ul style="list-style-type: none"> Describe the Industrial Productivity and Efficiency. Analyse the factor affecting industrial Productivity and Efficiency

References:

1. Raju, V. T, RaoVS. (2017) Economic of Farm Production and Management, Oxford & Ibh, New Delhi.
2. Misra S.K. &V.K.Puri, (2017) Indian Economy, Himalaya Publication house Mumbai.
3. Kavimandan Vijay, (2009) Krushi Arthshastra, Shri Mangesh Prakshan, Nagpur.
4. Barthwal R.R. (1985), Industrial Economics, Wiley Eastern Ltd., New Delhi.
5. Barthwal R.R.(2004) Industrial Economics Introductory Text Book, New Age International Limited, Kanpur.
6. W. Stewart Howe, Industrial Economics An Applied Approach, Springar Link, Switzerland.
7. Singh, A and A.N. Sandhu (1988), Industrial Economics, Himalaya Publishing House, Bombay.
- 8.Jain S.C. Industrial Economics, (Edition: First, 2019), Publisher: Kailash Pustak Sadan, 30 Shah Building, Hamidia Road, Bhopal (M.P.)

Suggested Web references:

<https://www.youtube.com/user/cecedusat>

<https://www.swyamprabha.gov.in/>

[http://14.139.13.96:8080/lectures.aspx?pno=Paper05\(O\)](http://14.139.13.96:8080/lectures.aspx?pno=Paper05(O))
Economics

-UGC CEC E Contain on Agricultural

[http://14.139.13.96:8080/lectures.aspx?pno=Paper06\(O\)](http://14.139.13.96:8080/lectures.aspx?pno=Paper06(O))
Economics

-UGC CEC E Contain on Industrial

SPECIAL ELECTIVE COURSE – VI

Subject: DEFENSE BUDGETING, FINANCE AND MANAGEMENT-II

Course Code: 246(J)

Total Credits: 04 (Theory 03 + Practical 01=04)

Objectives:

1. To understand the relationship between economy and defence expenditure
2. To create awareness about recent trends in India's Defence Expenditure
3. To understand the importance of War Finance and defence management
4. To create awareness about different challenges to India's defence management.

Unit No.	Topic	No. of Lectures	Teaching Method	Proposed Skill to be Developed
I	Defence Expenditure 1.1 Salient features of Indian Economy 1.2 Analysis of India's Defence Spending from 1947 to till date. 1.3 Determinants of Defence Expenditure 1.4 Recent Trends in India's Defence Expenditure	12	Lecture, PPT, Group Discussion, Library Work, Assignment, Field Visit	The learners will be able to analyse the methodology of defence spending in India.
II	War Potential 2.1 Concept of War Potential 2.2 Industrial Power 2.3 Elements of War Potential 2.4 Cost of War 2.5 Importance of DRDO in War	12	Lecture, PPT, Group Discussion, Library Work, Assignment, Field Visit	The learners will be able to understand the role of Industrial Power and their relationship to national security.
III	War Finance 3.1 Sources of Finance (Domestic and Foreign) 3.2 Peace Time Economy (Merits and Demerits) 3.3 War Time Economy (Merits and Demerits) 3.4 Rationing 3.5 Inflation	12	Lecture, PPT, Group Discussion, Library Work, Assignment, Field Visit	The learners will be able to know the importance and methodology of War Finance

VI	Rationale of Arms Production in the Third World Countries 4.1 Third World Countries : Meaning & Concept 4.2 Relevance of the Arms Production to the Third World Countries 4.3 Military Industrialization	12	Lecture, PPT, Group Discussion, Library Work, Assignment, Field Visit	The learners will be able to understand the rationale of armament production in third world countries
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Reference:

1. Laxmi Y, Trends in Defence Expenditure, New Delhi, ADS 1988
2. Ron Mathew, Defence Production in India, New Delhi, ABC-1989
3. Alok Ghosh, Indian Economy; Its Nature & Problem, New Book Hall-Kolkata-1994
4. S. K. Mishra & V.K. Puri , Indian Economy, Himalaya Publishing House-1998, New Delhi.
5. K.Subramanyam. Perspectives in Defence Planning, Abhinav Publishing Company, New Delhi-1972
6. Raju G. C.Thomas, The Defence of India –A budgetary perspective of strategy and politics, The Macmillan Company of India, New Delhi
7. A. N. Agarwal Economic Mobilization of National Defence ,Asia Publishing House, London 1968 V. N. Shrinivas, Budgeting for Indian Defence, New Delhi, K W Publishers, 2008
8. Amiya Kumar Ghosh, Defence Budgeting & Planning in India: The Way Forward, New Delhi, 2006
9. Alain C. Einthoven & K. Wayne Smith, How much is Enough ?, Shaping the Defence Budget 1961-1969s ,New Delhi, RAND Corporation
10. H.C. Bhatia, Public Finance (Ed), Vikas Publishing House, New Delhi -2006
11. S. P. Ganguly, Fundamentals of Government Budgetary in India, 3rd Ed ,New Delhi, Concept Publishing Co.-2007
12. Jaswant Sing, Defending India, Chennai, MacMillan India Ltd, 1999
13. H. B. Mishra, Defence Programmes of India, Delhi, Author press, 2000
14. Laxmi Y, Trends in Defence Expenditure, New Delhi, ADS 1988
15. Ron Mathew, Defence Production in India, New Delhi, ABC-1989
16. Alok Ghosh, Indian Economy; Its Nature & Problem, New Book Hall-Kolkata-1994
17. S. K. Mishra & V.K. Puri , Indian Economy, Himalaya Publishing House-1998, New Delhi.
18. K.Subramanyam. Perspectives in Defence Planning, Abhinav Publishing Company, New Delhi-1972
19. Raju G. C.Thomas, The Defence of India –A budgetary perspective of strategy and politics, The Macmillan Company of India, New Delhi
20. A. N. Agarwal Economic Mobilization of National Defence ,Asia Publishing House, London 1968 V. N. Shrinivas, Budgeting for Indian Defence, New Delhi, K W Publishers, 2008

21. Amiya Kumar Ghosh, Defence Budgeting & Planning in India: The Way Forward, New Delhi, 2006
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23. Jaswant Sing, Defending India, Chennai, MacMillan India Ltd, 1999
24. V. N. Shrinivas, Budgeting for Indian Defence, New Delhi, K W Publishers, 2008
25. H.C. Bhatia, Public Finance (Ed), Vikas Publishing House, New Delhi -2006
26. S. P. Ganguly, Fundamentals of Government Budgetary in India, 3rd Ed ,New Delhi, Concept Publishing Co.-2007
27. K. Subramanyam , Perspective in Defence Planning, New Delhi, Abhinav Publishing , 1972
28. Jaswant Sing, Defending India, Chennai, MacMillan India Ltd, 1999
29. H. B. Mishra, Defence Programmes of India, Delhi, Author press, 2000

SPECIAL ELECTIVE COURSE – VI

Subject: INSURANCE, TRANSPORT AND TOURISM - II (TOURISM)

Course Code: 246(K)

Total Credits: 04 (Theory 03 + Practical 01=04)

Objectives:

1. To acquaint students with the concepts of tourism.
2. To create awareness about different forms of tourism.
3. To make the students aware of career opportunities in the field of tourism.
4. To aware the students about the growth, scope and challenges of tourism in India.

Unit No.	Topic	No. of Lectures	Teaching Method	Proposed skills to be developed
1.	Introduction 1.1 Concept of Tourism 1.2 Types of Tourism 1.3 Factors affecting Demand for Tourism 1.4 Nature of Tourism 1.5 Significance of Tourism 1.6 Inter-regional and Intra-regional Tourism 1.7 Role of Government in Tourism Development	12	Lecture, PPT, Group Discussion, Library Work, Assignment	Understanding the concept of tourism
2.	Forms of Tourism 2.1 Agritourism 2.3 Health Tourism 2.4 Heritage Tourism 2.5 Eco Tourism 2.6 Cultural Tourism 2.7 Religious Tourism 2.8 Educational Tourism 2.9 Business Tourism 2.10 Sports Tourism 2.11 Family Tourism 2.12 Sea Tourism	12	Lecture, PPT, Group Discussion, Library Work, Study Visit to Tourism centre	Understanding the forms of tourism
3.	Impact of Tourism 3.1 Globalization and Tourism 3.2 The Economic Impact of Tourism 3.3 The Socio-cultural Impact of Tourism 3.4 Environmental Impact of Tourism 3.5 Career Opportunities in Tourism	10	Lecture, PPT, Group Discussion, Library Work,	Understanding the impacts of tourism

4.	Tourism in India 4.1 Growth of Tourism in India 4.1.1 Contribution to Gross Domestic Product 4.1.2 Employment Generation 4.1.3 Foreign Tourist Arrivals (FTAs) 4.1.4 Share of India in International Tourist Arrivals (ITAs) in World 4.1.5. Foreign Exchange Earnings (FEEs) from Tourism in India 4.2 Tourism Infrastructure Development in India 4.3 Scope of Tourism in India 4.4 Challenges before Indian Tourism Sector 4.5 Measures adopted by Government for Development of Tourism in India	14	Lecture, PPT, Group Discussion, Panel Discussion, Library Work, Assignment	Understanding the Tourism growth and career opportunities in tourism sector in India
	Total	48		

References:

Books:

1. Arora S. (2007), *Adventure Tourism and Sports Issues and Perspectives*, Cyber Tech Publications, New Delhi.
2. A Satish Babu (2008), *Tourism Development in India*, APH Publishing, New Delhi.
3. Badan B. S. and Bhatt H. (2007), *Eco-Tourism*, Common Wealth Publishers, New Delhi
4. Batra G.S. and Agarwal R.C. (2002), *Tourism Promotion and Development*, Deep & Deep Publications Pvt. Ltd. Delhi
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6. Leonard J. Lickorish & Carson L. Jenkins (2011), *An Introduction- Tourism*, Routledge, New York.
7. Nickerson N. (1996), *Foundations of Tourism*, Prentice Hall, New Delhi.
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Reports and Other:

1. Annual Report 2017-18, 2018-19 and 2019-20, Ministry of Tourism Government of India.
2. Government of India, Economic Survey 2019-20.
3. India Tourism Statistics at a Glance, 2019, Ministry of Tourism, Government of India.
4. Working Paper, Services Sector: Challenges, Issues and Policy Suggestions with special focus on (IT-BPM, Tourism, Shipping, Real Estate Services and Project Exports), December 2017 Government of India, Ministry of Finance, Department of Economic Affairs, Economic Division.
5. <https://destinationreporterindia.com>
6. <http://tourism.gov.in>

SPECIAL ELECTIVE COURSE – VI

Subject: - COMPUTER PROGRAMMING AND APPLICATION II

Course Code: 246(L)

Total Credits: 04 (Theory 03 + Practical 01=04)

Relational Database Management System (Semester – IV)

1. Objectives of the course: To aware principles of databases, database management operations, fundamental concepts of RDBMS.

Unit No.	Unit Title	Contents	Skills to be developed
1	Introduction to Database management Systems	1.1 Introduction Information, Data and file 1.2 Need and Importance of Database management System 1.3 Definition of DBMS and Types (DDBMS, RDBMS) 1.4 Keys(Super key, Candidate, Primary, Foreign Key) 1.5 Working with tables (create and Manage table) 1.6 Introduction to DML, TCL, DDL, DCL 1.7 Introduction to RDBMS 1.8 Advantages and Disadvantages of RDBMS	1. Learner able to aware with Information, Data and file 2. Learner able to aware with Data base Management System ,its Type and need 3. Learner able to aware and able to working with table by specifying Key 4. Learner able to aware with Relational database management systems with advantages and Disadvantages

2	Introduction to SQL (Structure Query Language)	2.1 Introduction to SQL 2.2 SQL Language Elements 2.3 Classification of SQL commands 2.4 Applying Constraints 2.5 Aggregate Functions 2.6 Group by Having Clause 2.7 Creating Other Database Objects (Views, Indexes, Sequences, Synonyms)	1. Learner able to aware with Structure Query Language and its Functionality. 2. Learner able to aware and able working with view ,Index Sequence and Synonyms of Table or data
3	Introduction to (Sub queries, SET Operators, Date time Functions)	3.1 Enhancements to GROUP BY function (ROLLUP and CUBE Operator) 3.2 SET OPERATORS (INTERSECT, UNION, UNION ALL, MINUS Operator) 3.3 DATETIME FUNCTIONS (Parsing Date and Time) 3.4 JOINS (Inner Join, Equi-Join, Non Equi, Self- join, Outer Joins)	Learner able to aware and able to handle to (Sub queries, SET Operators, Date time Functions)
4	Advanced Sub-queries Security Privileges, and Introduction Database connectivity	4.1 Advanced Sub queries 4.1.1. Introduction 4.1.2 Multiple Column Sub queries (Coding Sub queries in the FROM clause) 4.1.3 Scalar Sub queries 4.1.4 Correlated Sub query 4.1.5 WITH clause (Functions of the WITH clause) 4.1.5 Hierarchical Queries 4.2 Controlling User Access 4.2.1. System privileges 4.2.3 User Privileges (GRANT/REVOKE PRIVILEGES) 4.3 Introduction to Data base connection (Open Database Connectivity, ADO, ADO.NET , ODBC, JDBC)	1. Learner able to aware and able to handle to (Sub queries with multiple Columnar, Correlated contains and with clause for prepare report form multiple Table. 2. Learner able to aware and able to handle to user access control

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Use ICT or presentation on DBMS /RDBMS	U-tube Tutorial on DBMS /RDBMS		Familiar with DBMS /RDBMS
2	12	Use ICT or presentation on SQL	U-tube Tutorial SQL	One case study on SQL Queries	Familiar with SQL
3	12	Use ICT or presentation on SQL Queries	U-tube Tutorial SQL Queries		Familiar with SQL Queries
4	12	Use ICT or presentation SQL Privileges and	U-tube SQL Privileges and	Prepare mini project (Paper work) on online	

Method of Evaluation

Subject	Internal Evaluation	External Evaluation
Unit – I	30	70
Unit – II	30	70
Unit – III	30	70
Unit – IV	30	70

Guidelines for Examination:

[5].Term End Exam (30 Marks):

[6].To be conducted by college as per rules provided by University of Pune. Semester Exam 70 Marks):

[7].To be conducted by University of Pune at the end of the academic year.

[8].Passing marks for the course are 40 (Out of which **minimum 32** marks are compulsory in Semester Examination).

References:-

1. Fundamentals of Database Systems (4th Ed) By: Elmasri and Navathe
2. Database System Concepts (4th Ed) By: Korth, Sudarshan, Silberschatz Practical PostgreSQL O'REILLY
3. Beginning Databases with PostgreSQL, From Novice to Professional, 2nd edition By Richard Stones , Neil Matthew, Apress
4. SQL: THE COMPLETE REFERENCE 3rd Edition Author: James Groff, Paul
5. Weinberg, Andy Opper Tata Mc-graw Hill Publishing Co.ltd.-New Delhi ISBN : 9781259003882
6. SQL, PL/SQL: The Programming Language Of Oracle (With CD-ROM) 4th RevisedEdition Author: Ivan Bayross BPB PUBLICATIONS ISBN-13 9788176569644
7. Oracle Database 11G: The Complete Refere 1st Edition Author: KEVIN LONEY Tata Mcgraw Hill Education Private Limited ISBN-13 9780070140790
8. MySQL, The Complete Reference By Vikram Vaswani, ISBN 0-07-222477-0, Tata McGraw Hill The Complete Reference in Microsoft Access 2007, Andersen, ISBN13:9780070222854
9. Learning MySQL by O'reilly, Seyed M.M Tahaghogi, Hugh E. Williams, Oreilly Media

SavitribaiPhule Pune University
TY BBA Semester V (CBCS) Pattern 2019
Research Methodology
Course code GC 501
Credit 3

Depth of the course- Reasonable working knowledge

Course Objectives:

1. To develop an understanding of the right approach of Research Methodology and its role in Business.
2. To develop an understanding of the basic framework of the identification of various sources of information for data collection.
3. To develop an understanding of various Designs, Tools and Techniques of Research Study.
4. To enable the students in conducting Research work and write Research Paper and Research Project Report.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Introduction to Research Methodology and Research Problem	1.1 Introduction to Research- 1.2 Objectives of Research, 1.3 Motivations in Research, 1.4 Types of Research, 1.5 Research Approaches, 1.6 Significance of Research, 1.7 Research Process, 1.8 Criteria of Good Research, 1.9 Challenges before Researchers in India. 1.10 Meaning of Research Methodology. 1.11 Concept of Research Problem, 1.12 Selecting the Research Problem,	<ul style="list-style-type: none"> • To encourage students and educators to reflect upon the research process to enable them to position themselves in the bigger picture. • To understand the basic concept of Research and its Methodology. • To make students understand objectives, types, significance, the process of Research. • To make students aware of the concept of Research Problem and technique involved in defining Research Problem. • To know -how to formulate Research Hypothesis and its importance.

		1.13 Techniques involved in defining Research Problem, 1.14 Formulation of Research Hypothesis and its importance	
2	Research Design and Research Sampling	2.1 Research Design 2.2 Meaning of Research Design, 2.3 Need for Research Design, 2.4 Features of a Good Design, 2.5 Types of Research Design 2.6 Concept of Research Sampling, 2.7 Steps in Sampling Design, 2.8 Types of Sampling, 2.9 Determination of Sampling Size	<ul style="list-style-type: none"> • To make students understand the meaning, need, types of Research Design. • To inculcate knowledge of the concept of Research Sampling. • To understand the process of sampling design and types of sampling.
3	Methods of Data Collection and Processing and Analysis of Data	3.1 Collection of Primary Data- 3.2 Meaning and definition of Primary Data, 3.3 Advantages and Limitations of Primary Data, 3.4 Methods of Collecting Primary Data: 3.4.1 Observation Method, 3.4.2 Interview Method, 3.4.3 Questionnaire Method, 3.4.4 Scheduling/ Schedule Method 3.4.5 Other Methods 3.5 Collection of Secondary Data- 3.5.1 Meaning and definition of Secondary Data, 3.5.2 Advantages and Limitations of Secondary Data, 3.5.3 Sources of collecting Secondary Data 3.6 Data Processing – 3.6.1 Editing,	<ul style="list-style-type: none"> • To make students understand the meaning and definition of Primary Data and Secondary Data along with its advantages and limitations. • To provide sound knowledge about methods of collection of Primary Data and sources of collecting Secondary Data. • To find out the factors contributing to Job Satisfaction and use them in the actual functioning of the Organisation. • To provide an understanding of Data Processing and Data Analysis. • To make students aware of Hypothesis Testing.

		<p>3.6.2 Codification, 3.6.3 Classification, 3.6.4 Tabulation, 3.6.5 Scaling & Measurement</p> <p>3.7 Data Analysis- 3.7.1 Meaning of Data Analysis, 3.7.2 Need of Data Analysis, 3.7.3 Methods of Data Analysis</p> <p>3.8 Testing of Hypothesis- 3.8.1 Concepts in Testing of Hypothesis 3.8.2 Steps in the testing of hypothesis, 3.8.3 Chi-square Analysis, 3.8.4 Analysis of Variance</p>	
4	Interpretation and Report Writing	<p>4.1 Interpretation- 4.1.1 Meaning of Interpretation, 4.1.2 Need of Interpretation, 4.1.3 Techniques of Interpretation, 4.1.4 Precaution in Interpretation</p> <p>4.2 Report Writing – 4.2.1 Significance of Report Writing, 4.2.2 Steps in Writing Report, 4.2.3 The layout of the Research Report</p> <p>4.3 Research Paper Writing– 4.3.1 Meaning of Research Paper, 4.3.2 Structure of Research paper, 4.3.3 Referencing Styles 4.3.4 Ethics in Report Writing and Research Paper Writing</p>	<ul style="list-style-type: none"> • To make students aware of the meaning, need and different types of techniques of Interpretation. • To make understand students about steps in Report Writing and layout of the Research Report. • To immerse students in actual research (authentic learning) and motivate them to write Research Paper by providing the knowledge about meaning, structure and ethics in Research Paper writing.

Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical –as applicable	Innovative methods to be used	Expected Outcome
Unit 1 - 12 hours	Ice-breaker activities, Traditional classroom lectures Subject overview and preliminary presentation Class discussion.	Great gains in content knowledge, skill acquisition, and overall confidence and comfort for major concepts in the understanding concept of research. Formulate and evaluate research questions.
Unit 2 – 12 hours	Traditional classroom lectures Individual exercise, Large-group discussion, Small-group exercise,	The shift towards student-centeredness significantly enhanced students’ learning through the use of interactive small group activities and a high level of discussion and interaction. Knowledge acquisition about Research Design and Sampling Design.
Unit 3 – 12 hours	Traditional classroom lectures, Group participation informative evaluation of the topic and sub-topics, Group reflection on the data collection, Computer lab work on data processing and data analysis	Gain experience with instrument development and data collection methods. Practical understanding of data processing and Data Analysis.
Unit 4 – 12 hours	Traditional classroom lectures, Guest lecturer on Research Paper writing, Small-group scenario exercise on project report, Small-group critical reading exercise and class discussion on Ethics in Report Writing and Research Paper Writing.	Understanding about Changing Environment of HRM and its effects. A better understanding of Report and Research Paper writing

Evaluation

Unit Number	Internal Evaluation	External Evaluation
Unit – I	Student's Active participation in Ice-Breaking Session	25% MCQ 35% short notes 40% long answers
Unit – II	Individual exercise, Large-group discussion, Small-group exercise	
Unit – III	Lab-Work/ Activity	
Unit – IV	Research Paper submission and presentation	
Total – 30 Marks		

Suggested references

Sr. No.	Title of the Book	Author/s	Publication
1	Business Research Methods	Donald Cooper & Pamela Schindler	TMGH
2	Business Research Methods	Alan Bryman & Emma Bell	Oxford University Press
3	Research Methodology: Methods and Techniques	K. C.Kothari	New Age International Publication
4	Business Research Methodology .–	J. K. Sachdeva	Himalaya Publication)
5	Research Methodology	Dr. Prasant Sarangi	Taxmann's
6	Business Research Methodology	D. K. Sharma & A. K. Gupta	Delhi
7	Research methodology in Management	Arya P.P.and Pal, Yesh	Deep and Deep Publication, Delhi.

SavitribaiPhule Pune University
Question paper Pattern 2019 for TY BBA
University Examination Sub: Research Methodology
Course code 501

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	20 Marks
		Match the Pairs	5	
		Answer in one sentence	5	
		Fill in the blanks	5	
2	Solve any 3 out of 5	Long Answer Question	3*10 Marks	30 Marks
3	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			70 Marks

SavitribaiPhule Pune University
TY BBA Semester V(CBCS) Pattern 2019
Database Administration and Data Mining
Course Code- GC502
Credit – 3

Depth of the Course- Reasonable working knowledge

Course Objectives:

1. To understand the Database Management System
2. To understand the Data Mining Concepts
3. To understand the current trends in Data Management

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Introduction to Database Management System	1.1 Introduction, 1.2 Objectives, 1.3 DBMS concepts, 1.4 Purpose of Database System, 1.5 Advantages and Disadvantages of Database System	<ul style="list-style-type: none"> • To understand the concepts of a database management system. • To understand the scope of DBMS and its limitations.
2	Database Administration	2.1 Introduction 2.2 Purpose of Database administration, 2.3 Concept of Database Administration, 2.4 Transaction management, Properties of Transaction (ACID Properties)	<ul style="list-style-type: none"> • To understand the concept of transactions. • To understand the working of DBMS.

3	Data Warehousing	3.1 Introduction, 3.2 Purpose, 3.3 Data Warehousing concepts, 3.4 Need of Data Warehousing, 3.5 Applications, Advantages, Limitations	<ul style="list-style-type: none"> • To understand the concept of Data Warehousing. • To understand the relevance of Data Warehousing in businesses.
4	Data Analytics and Data Mining	4.1 Introduction, 4.1.1 Purpose, 4.1.2 Data Analytics Scope, and its Business Relevance. 4.1.3 Types of Data Analytics. Data Mining concepts 4.1.4 Need of Data Mining, Applications, Advantages, 4.1.5 Limitations 4.1.6 Cloud Computing Introduction, Purpose, Cloud 4.1.7 Computing concepts, Need of Cloud Computing, 4.1.8 Applications, Advantages, Limitations	<ul style="list-style-type: none"> • To understand the concept of Data Analytics and Mining. • To understand the relevance of Data Analytics and Mining in businesses. • To understand the concept of Cloud Computing. • To understand the relevance of Cloud Computing in businesses.

Teaching Methodology

Teaching Hours Theory	Innovative methods to be used	Expected Outcome
Unit 1- 12 hours	Students' Presentations, Video Sessions Group Discussions	Understanding of the DBMS concepts.
Unit 2- 12 hours	Students' Presentations, Video Sessions Group Discussions	Understanding of the working of the transaction management in the DBMS.
Unit 3- 12 hours	Students' Presentations, Video Sessions Case Studies	Understanding Data Warehousing and its scope and limitations.

Unit 4 - 12 hours	Students' Presentations, Video Sessions Case Studies	Understanding Data Analytics and Mining and its scope and limitations.
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Evaluation

Subject	Internal Evaluation	External Evaluation
Unit – I	MCQ Test, Open Book Test Group Presentations on DBMS Concepts	25% MCQs 35% Short Notes 45% Long Answers
Unit – II	MCQ Test, Open Book Test Group Presentations on Transaction Management	
Unit – III	MCQ Test, Chart preparation Group Presentations on Data Warehousing	
Unit – IV	MCQ Test, Group Presentations on Data Mining, Cloud Computing	

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Database System Concepts	Abraham Silberschatz, Henry F. Korth, S. Sudarshan	McGraw Hill Education; Sixth edition	India
2	Fundamentals of Database System	ElmasriRamez, NavatheShamkant	Pearson Education; Seventh edition	India
3	Data Mining and Data Warehousing: Principles and Practical Techniques	Parteek Bhatia	Cambridge University Press	India
4	Introduction to Data Mining	Pang-Ning Tan, Michael Steinbach, Vipin Kumar	Pearson Education; First edition	India
5	Cloud Computing	Sandeep Bhowmik	Cambridge University Press; First edition	India

SavitribaiPhule Pune University
Question paper Pattern 2019 for TY BBA
University Examination Sub: Database Administration and Data Mining
Course Code - 502

Q. No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	20 Marks
		Match the Pairs	5	
		Answer in one sentence	5	
		Fill in the blanks	5	
2	Solve any 3 out of 5	Long Answer Question	3*10 Marks	30 Marks
3	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			70 Marks

Savitribai Phule Pune University
TY BBA Semester V (CBCS) Pattern 2019
Subject: Business Ethics
Course Code – GC 503
Credits – 3

Depth: Reasonable Working Knowledge

Course Objectives:

1. To provide a comprehensive understanding of the concepts of Business Ethics
2. To develop theoretical tools to understand current ethical issues and their impacts on business.
3. To analyze the role of Ethics in business, Government and Society.
4. To analyze the Ethical scenario concerning to Environment and consumer protection.

Unit No	Unit Title	Contents	Purpose and Skills to be Developed
1	Introduction to Business Ethics	1.1 Meaning, Nature and Scope of Business Ethics 1.2 Ethics in Contemporary Business 1.3 Organizational Ethical Climate – Ethical Decision Making and Importance of Framing Ethical Policies 1.4 Why Ethical Problems occur in Business 1.5 Difference between workplace Ethics and Laws 1.6 Ethical Code of Conduct in Global Business 1.7 Government protection policies against illegal business practices. 1.8 Influence of Interest Groups on the Government	<ul style="list-style-type: none"> • Understand the Role and Scope of Business Ethics. • Role of Ethics and its importance at National and International Level in business as well as individual level.
2	Corporation and Stakeholder Ethics	2.1 Impact of Business Decisions on Stakeholders 2.2 Leadership Ethics at the organizational level – Training Ethics, imbibing organizational values and cultures, Awareness of rule and	<ul style="list-style-type: none"> • Understand the concepts and role of Business and Stakeholder ethics.

		<p>regulations of an organization, Upskilling and Ethical knowledge of employees.</p> <p>2.3 Organization of Modern corporation and Interaction with stakeholders</p> <p>2.4 Whistleblower Act and Employee Rights: Privacy and Safety</p> <p>2.5 Collective Bargaining and Role of Management in implementing Ethics.</p> <p>2.6 Ethics in Compliance Management – Fraud, Corruption, Sanction Violations, Conflict of Interests, Human Rights Violation.</p> <p>2.7 Health and Safety Issues in Organizations – Workplace Safety, Measures to avoid accidents, Maintenance of Psychological well-being of employees.</p>	<ul style="list-style-type: none"> • Modern Organization role and responsibility towards stakeholders. • Understanding the concept of business, government, and societal ethics.
3	Corporate Social Responsibility and Marketing Ethics	<p>3.1 Role and Responsibility of Organizations towards government and society.</p> <p>3.2 CSR Performance – Meaning and Responsibility.</p> <p>3.3 CSR – Strategy in building community relationships.</p> <p>3.4 Corporate Citizenship and – Concept and Stages</p> <p>3.5 Ethical behaviour in Advertising Practices and Advertising ethics.</p> <p>3.6 Ethical and Unethical Target Marketing in Business</p> <p>3.7 Advertising abuses and Regulation</p> <p>3.8 Media Industry – Role, Impact and Ethical Practices</p>	<ul style="list-style-type: none"> • Understand the role of CSR in traditional and Modern Business. • Identify the efficiency relevancy of CSR in today’s world • Understand Marketing ethics and its importance.
4	Environmental and Consumer Ethical Issues	<p>4.1 Environmental Ethics and Human values – Meaning and Impact on Environmental problems</p> <p>4.2 Environmental legislation – Laws and Regulation with Indian Context and Stages of becoming an ecologically sustainable organization.</p> <p>4.3 Sustainable Development – Definition, Obstacles and Impact, Business operations – A threat to earth’s ecosystem.</p> <p>4.4 Difference between Customer and Consumerism</p> <p>4.5 Government regulation agencies for Consumer protection and Protecting consumer privacy online.</p>	<ul style="list-style-type: none"> • Understand the role of Environmental rules and regulations in protecting the environment. • Initiatives are taken towards building sustainable role models. • Understanding the need for ethics and laws in consumer protection.

Teaching Methodology

Teaching Hours	Innovative Methods to be used/ AV Applications	Project	Expected Outcome
12	<p>Films/Videos of Business Ethics practices adopted by different companies. Videos on corporates explaining the Business ethics scenario.</p> <p>Case studies on Interest Groups policies and their impact.</p> <p>Case studies/Videos on the importance of government protection policies.</p>	<p>Listing out various business ethics and practices adopted by major corporates.</p> <p>List out one company's ethical policy which has benefitted the economy and society at large.</p> <p>Evaluate India's Interest Groups and their impacts.</p> <p>Analyze the government protection policies in India.</p>	<p>To understand the basics of Business Ethics and its role.</p> <p>To understand the Government and societal concepts of ethical behaviour.</p>
12	<p>Films/Videos on corporates and stakeholder ethics and its importance.</p> <p>Case Studies on various International business ethics theories and their impact.</p> <p>Case Studies on government and societal policies impacting ethical behaviour.</p>	<p>List out anyone International case concerning ethical behaviour.</p> <p>List out the corporate and stakeholder ethics theories holding more practical relevance for Indian society.</p> <p>List out the Government and societal ethics concept.</p>	<p>To understand the various corporate and stakeholder ethics policies and their use.</p> <p>To understand workplace ethics and its importance.</p> <p>To understand the importance of Legal acts framed by the government.</p>

12	<p>Case studies and discussions on CSR activities adopted by organizations</p> <p>Case studies and discussions on CSR approach and evolving the concept.</p> <p>Case Studies/ Quiz/ Discussion on Ethical advertising adopted by organizations.</p> <p>Case Study/Debate on ethical and unethical marketing practices.</p> <p>Films/videos/Case study/ Discussion on the media and its role played in forming an ethical environment</p>	<p>List out the CSR activities adopted by companies.</p> <p>Identify the concept of CSR in modern business and Corporate citizenship in today's world.</p> <p>Identify the Ethical and unethical advertising practices adopted by corporations.</p> <p>List out the role played by media, especially Indian media in forming an ethical environment.</p>	<p>To understand various CSR activities adopted and implementation and their role.</p> <p>Understand the CSR and Corporate Citizenship concept.</p> <p>To understand the role and contribution of Media in business and society.</p> <p>Understand the concept of Ethical advertising.</p>
12	<p>Case study on policies and law adopted to protect the environment.</p> <p>Case study/ Discussion on consumer protection policies and their role.</p>	<p>To list out the policies and procedures adopted by leading countries to protect the environment.</p> <p>To identify various protection policies on consumer protection and its impact on society.</p>	<p>To understand the role of government in framing the environmental protection policies.</p> <p>To understand the importance of the consumer protection act and its role.</p>

Evaluation

Subject	Internal Evaluation	External Evaluation
Unit – I	MCQ Test, Open Book Test, Group Presentations on Business Ethics Concepts and its Role.	25% MCQs 35% Short Notes 45% Long Answers
Unit – II	MCQ Test, Group Presentations on Corporation and Stakeholders Ethical Issues, Assignments on Ethical Frameworks and Policies.	
Unit – III	MCQ Test, Assignments on Marketing Ethics, Individual/Group Presentations on CSR activities.	
Unit – IV	MCQ Test, Assignments on various conferences/summits on Environmental Protection Policies. Individual / Group Presentations on Environmental issues	

Suggested References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Business Ethics	Shailendra Kumar and Alok Kumar Rai	Cengage Learning India Pvt Ltd	India
2	Business Ethics: An Indian Perspective	A C Fernando, K P Muralidheeran, E.K Satheesh	Pearson Education	India
3	Business Ethics and Values	Dr. NeeruVasishth, Dr, Namita Rajput	Taxmann	India
4	Business Ethics: Foundation for CSR	P.Kamatchi	Dreamtech Press	India
5	Business Ethics: Principles and Practices	Daniel-Albuquerque	Oxford University Press	India
6	Business Ethics	Gautam Pherwani	Everest Publishing House	India
7	Business Ethics	C. S.V. Murthy,	Himalaya Publishing House	India
8	Understanding Business Ethics	Peter Stanwick, Sarah Stanwick,	Pearson Publishing	India
9	Business Ethics	Manuel G Velasquez,	Prentice-Hall India Learning Private Limited; 6 edition (2006)	India
10	Business Ethics	O.C. Ferrell, John Paul Fraedrich, Linda Ferrell,	Cengage Learning, 2013	India

SavitribaiPhule Pune University
Question paper Pattern 2019 for TY BBA (IB)
University Examination Sub: Business Ethics
Course Code - 503

Q. No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	20 Marks
		Match the Pairs	5	
		Answer in one sentence	5	
		Fill in the blanks	5	
2	Solve any 3 out of 5	Long Answer Question	3*10 Marks	30 Marks
3	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			70 Marks

Savitribai Phule Pune University
TY BBA Semester V (CBCS) Pattern 2019
Course Title: Management of Corporate Social Responsibility
Course Code–GC 504
Credit – 3

Depth of the Course: Reasonable Understanding of Concept of CSR and Sustainability

Course Objectives:

1. To understand the concept and process of CSR
2. To Understand the industrial contribution for CSR Policy
3. To Understand the context of CSR of present-day Management
4. To Understand the contribution of CSR for the development of Society

Unit No.	Unit Title	Contents	Purpose and Skills to be Developed
1	Introduction to CSR	1.1 Meaning and Definition 1.2 Sustainability and Stakeholders Management, 1.3 Concept of Charity 1.4 Corporate Philanthropy 1.5Relation between CSR and Corporate Governance 1.6 Evolution of CSR in India 1.7 Models of CSR in India 1.8 Carroll’s Model 1.9 Initiatives in India	Purpose -Understanding of the concept and evolution of CSR To know about the various models of CSR Importance of CSR activities Skills to be developed -Applicability of concept and its importance -Understanding the functionality of Charity
2	Modules of Corporate Social Responsibility	2.1 Models of CSR- Trusteeship, Stakeholders, 2.2 Ethical Model, Statist Model, Liberal Model 2.3 International Framework of CSR 2.4 Sustainable Development Goals	Purpose – Various stakeholders roles and responsibilities in CSR activities Applicability of Models -Understanding of Goals that impacts the Industry Skills to be developed -Understanding of various models and how to apply them.
3	CSR-Legislation in India and the World	3.1 Section 135 of Companies Act, 3.2 Scope of CSR Activities under Schedule VII,	Purpose Knowing the legal aspect of CSR

		3.3 Appointment of Independent Directors on Board 3.4 Computation of Net Profit's implementation in India	-Statutory Authorities taking decisions -Net Profit contribution for CSR Funds Skills to be developed Knowing the legal aspect for implementing CSR -Decision-making ability
4	Identifying key stakeholders and their Roles and recent trends and opportunities in CSR	4.1 Role of Public Sector in Corporate, Government programmes that encourage voluntary responsible action of corporate 4.2 Role of Non-profit & Local Self-Governance in implementing CSR 4.3 CSR as. Strategic Tool for Sustainability and Challenges 4.4 Case Studies CSR initiatives	Purpose -Voluntary contribution by various corporates -Government Rules and Regulations regarding CSR in India - Learning through Case Studies of functionality and impact on the Corporate and Society Skills to be developed -Problem Solving Approach -Behavioural Skills

Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical	Innovative Methods to be used	Expected Outcomes
Unit 1- 12 hours	Use of PPT for better understanding of the concept	Understanding the concept of CSR and its history
Unit 2- 12 hours	Role Plays, Interactive Sessions with Feedbacks and PPT, expert's lecture on the legality	Need and application of CSR with help of various models
Unit 3- 12 hours	Group Discussions, Theory-based lectures	It will enable the students to understand the legal point of view involved in CSR
Unit 4 - 12 hours	Participative learning, Discussions, assignments, Industrial Expert Lectures	It will help students to understand how corporate is responsible for contributing to the society

Subject: (504) Management of Corporate Social Responsibility	Internal Evaluation (30Marks)	External Evaluation (70 Marks)
Unit – I	Test on MCQs based on the theory	25% MCQs

Unit – II	Group discussion, MCQs	35% Short Notes 45% Long Answers
Unit – III	Preparing report on CRS activities of any 5 Companies	
Unit – IV	Test on MCQs	
Total	30 Marks	70 Marks

Suggested References:-

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Corporate Social Responsibility: An Ethical to Approach	Mark S. Schwartz	TATA McGraw Hill	New Delhi
2	The World Guide to CSR	Wayne Visser and Nick Tolhurst	Prentice Hall India	New Delhi
3	Corporate Social Responsibility in India	Sanjay K Aggarwal	Taxmann	New Delhi
4	Corporate Social Responsibility: Concepts and Cases: The Indian Context	C.V. Baxi, Ajit Prasad	Sage Publication,	New Delhi
5	Sustainable CSR: CSR Basics-	Harsha Mukherjee	TATA McGraw Hill	New Delhi

Savitribai Phule Pune University
TY BBA Semester V (CBCS) Pattern 2019
Course Title: Management of Corporate Social Responsibility
Course Code 504

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	20 Marks
		Match the Pairs	5	
		Answer in one sentence	5	
		Fill in the blanks	5	
2	Solve any 3 out of 5	Long Answer Question	3*10 Marks	30 Marks
3	Solve any 4 out of 6	Short answers /Short notes	4*5 Marks	20 Marks
	Total			70 Marks

Savitribai Phule Pune University
TY BBA Semester V (CBCS) Pattern 2019
Course: Marketing Environment Analysis and Strategies
Course Code- DSE A 505 MM
Credit – (3 + 1) = 4

Depth of the Course- Understanding of the Marketing strategies and Environment Analysis adopting advanced tools.

Course Objectives :

- 1.To develop students' understanding of the factors shaping Marketing Environment
- 2.To develop students' ability to analyze the Business Environment
- 3.To develop students' understanding of the strategies for sustaining the forces in Marketing Environment

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Marketing Environment	1.1 Introduction – Marketing Microenvironment – 1.1.1 Company, 1.1.2 Suppliers, 1.1.3 Marketing intermediaries, 1.1.4 Competitors, Customers 1.2.1 Macro Environment – 1.2.2 Demographic environment, 1.2.3 Economic environment, 1.2.4 Natural environment, 1.2.5 Technological environment, 1.2.6 Political environment, 1.2.7 Social environment, 1.2.8 Cultural environment	<ul style="list-style-type: none"> • The unit introduces the forces shaping the marketing environment, required to analyze the Business position in the market.

2	Business Analysis	<p>2.1 Business Analysis process, 2.2 Analysis Parameters - Industry Size, Segment Size, Category Size, Segment wise contribution, Growth Patterns, 2.3 Growth Drivers, Competition CSF, KPI, BCG matrix, Porter's 5 force analysis 2.4 Data Analytics – Role of Data Analytics in Business Analysis. Scope, and its importance concerning marketing strategies. 2.4.1 Types of Data Analytics. 2.4.2 Challenges of Business Data Analytics.</p>	<ul style="list-style-type: none"> • The unit aims to help understand the Business Analysis process.
3	Marketing Research	<p>3.1 Need of Marketing research, 3.2 marketing research process, 3.3 Consumer Buying Behavior, Marketing environment affecting consumer-buying behaviour 3.4 Big Data Analytics – Concerning Consumer Psychologies</p>	<ul style="list-style-type: none"> • The module reveals the relevance of Marketing Research for finalizing the marketing strategies.
4	Marketing Strategies	<p>4.1 Introduction, 4.2 Product and Pricing Strategies, 4.3 Market Segmentation and Targeting Strategies, 4.4 Distribution Strategies, Communication Strategies. 4.5 Digital Marketing Strategies – Importance, and Challenges.</p>	<ul style="list-style-type: none"> • The module focuses on the marketing strategies in the various business domains.

Teaching Hours Theory + Tutorials /Project	Innovative methods to be used		Expected Outcome
Unit 1- 12 hours	Students' Presentations Marketing Environments		Understanding of basic Marketing Environment Concepts
Unit 2- 12 hours	Group Discussions on Business Analysis parameters		Understanding the parameters of Business Analysis
Unit 3- 12 hours	Presentations on the concept of Marketing Research		Understanding the concept of Marketing Research
Unit 4 - 12 hours	Case Studies on Marketing Strategies		Understanding the real-time scenario of marketing strategies
Tutorial 15 hours		<ul style="list-style-type: none"> • Prepare a key skill involved in running an International Business • Prepare a Business plan for selling in Domestic Market • A report on role of Packaging in Domestic Marketing • Prepare a research-based report on identifying new markets for Indian 	

		products. • Assignment on marketing strategies implemented by MNC's & data analytics	
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Evaluation

Subject	Internal Evaluation	External Evaluation
Unit – I	MCQ Test Open Book Test	25% MCQs 45% Short Answers 30% Long Answers
Unit – II	MCQ Test Group Presentations	
Unit – III	MCQ Test Group Discussions	
Unit – IV	MCQ Test Group Presentations Assignments	
	Tutorial	
Total	30 + 20 = 50 Marks	50 Marks

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Business Environment	Francis Cherunilam	Himalaya Publishing House Pvt. Ltd.	India
2	Business Environment for Strategic Management	Aswathappa, K.	Himalaya Publishing House Pvt. Ltd.	India
3	Introduction to Modern Business – Issues and Environment	Musselman and Hughes	Prentice-Hall: 7th Revised edition	USA
4	Marketing Inside Out	Srinivasan Siva Rao	Notion Press; 1st edition	India
5	Marketing Management - marketing cases in the Indian context	Philip Kotler	Pearson Education; Fifteenth edition	India

SavitribaiPhule Pune University
Question paper Pattern 2019 for TY BBA
University Examination Sub: Marketing Environment Analysis and Strategies
Course Code – DSE A 505

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Savitribai Phule Pune University
TY BBA –Semester V(CBCS) Pattern 2019
Course: Legal Aspects in Marketing Management
Course Code- DSEA 506 MM
Credit – 2+4 =6

Depth of the Course- Functional Working Knowledge

Course Objectives:

1. To understand the application of different legal aspects in Marketing Management

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Introduction and Doorstep Selling/Home Delivery	1.1 Introduction to Legal Aspects of Marketing 1.2 Importance, Scope and Features 1.3 Door Step Selling/Home Delivery – Rules, Order Fixation and Cancellation, Applicability of Rules, Terms and Conditions, and Documents needed for Doorstep Selling/ Home Delivery. 1.4 Tele sales and Direct Mail Sales Concepts	<ul style="list-style-type: none"> • To understand the legal aspect of Marketing Management • To study law related to sales, home delivery, telesales and Direct Mail Sales
2	Advertising and Pricing	2.1 Meaning and Definition, Importance, Types of Advertising (TV, Radio, Print form Advertising) 2.2 Laws for Broadcasting the Advertisement 2.3 Claims for Misleading Advertisement 2.4 Harms and Offence – Children, Medicine and Health, National and Societal Interest 2.5 Meaning and Importance of Pricing related laws 2.6 Laws related to price/payment consumer rights surcharge payment regulations	<ul style="list-style-type: none"> • To understand rules and laws related to broadcasting ads via different forms • To study claims for misled adv campaign • To study price-related laws and consumer rights for surcharge payment
3	Online Marketing and CRM	3.1 Meaning and Definition of Online Marketing 3.2 Legal Consideration for Data Protection (data collected from potential customers, its usage, security) 3.3 Cookies –Monitoring and governing of cookies, security and confidentiality of client data while online marketing 3.4 Concept of CRM, Terms and Conditions related to CRM	<ul style="list-style-type: none"> • To understand issues and laws related to online marketing • To study Terms and conditions in CRM

4	Project Report	<p>Project preparation on any topic from the marketing syllabus. Refer the guidelines for preparation of project report.</p>	<ul style="list-style-type: none"> • To introduce the students to the general Marketing practices in Marketing origination. • To make students aware of different acts and laws and their application in real-time
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Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical	Innovative methods to be used	Project in Legal Aspects 4 Credits	Expected Outcome
Unit 1- 12 hours	Lectures/ Presentation/Discussion/videos	<p>1. Students are required to visit and collect data from market/field/Consumer forums/ organizations/supermarkets/departmental stores/malls individually or in groups and study laws practised, policies, legal issues, rules of Terms and Conditions.</p> <p>2. Students are required to prepare a Project on collected data.</p> <p>Note – Colleges can change the topics for projects as per the requirements of the course</p>	To understand the legal aspect of Marketing Management and law related to sales, home delivery, telesales and Direct Mail Sales To Understand the gist of the case study and way of attempt or solution
Unit 2- 12 hours	Lectures/Case studies/Discussion/videos/Model Making		To understand rules and laws related to broadcasting ads via different forms and claims for misled adv campaign. To study price-related laws and consumer rights for surcharge payment
Unit 3- 12hours	Lectures/ Case Studies/Discussion/Role Plays		To understand issues and laws related to online marketing and Ts & Cs in CRM

Evaluation

Subject	Project Evaluation by SPPU	External Evaluation
Unit – I	Project 30 marks & Viva 20 marks	25% MCQ 35% short notes 40% long answers (50 marks)
Unit – II		
Unit – III		
Project Viva		
Total	50 Marks	50 Marks

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Marketing and the laws	M. A. Sujan and HaishSujan	New Age Publication	New Delhi
2	Mercantile Law	N.D. Kapoor	S. Chand	New Delhi
3	Mercantile Law	Arun Kumar	Atlantic Publishers & Distributors Pvt Ltd	New Delhi
4	Best Practices in Law Firm Business Development and Marketing	Deborah Brightman Farone	Practising Law Institute	US
5	Mercantile & Commercial Laws	Rohini Agrawal	Taxmann	New Delhi

Savitribai PhulePune University
T.Y. BBA Semester V (CBCS) Pattern 2019
Course Title – Analysis of Financial Statements
Course Code- DSE B 505 FM
Credit- 3+1 = 4

Depth of the Course: Overview & Fundamental Knowledge of Analysis of Financial Statements

Course Objectives:

1. To develop the conceptual framework of financial analysis and provide practical exposure to apply various tools of Financial Statement Analysis.
2. To enable to use of various types of ratios for financial and investment decisions.
3. To impart knowledge about Cash Flow and Fund Flow Statements and their importance in financial analysis.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Introduction of Analysis & Interpretation of Financial Statements	1.1 Introduction of Schedule III as per Companies Act 2013, 1.2 Meaning and importance of Analysis of Financial Statements, 1.3 Tools and Techniques of financial analysis- 1.4 Comparative Financial Statements, 1.5 Trend Analysis, 1.6 Common Size Financial Statements, 1.7 Ratio Analysis, Fund Flow Statement and C 1.8 Cash Flow Statement	<ul style="list-style-type: none"> • To develop, critical & analytical skills for understanding the application of various tools of analysis of financial statements
2	Ratio Analysis	2.1 Meaning, Importance, Advantages & Limitations of Ratio, 2.2 Classification of Ratios- 2.2.1 Liquidity ratios, 2.2.2 Turnover ratios, 2.2.3 Profitability ratios and	<ul style="list-style-type: none"> • To develop analytical and interpreting skills for evaluating the financial position of business corporations by calculating and comparing various ratios

		2.2.4 Solvency ratios (Practical Problems based on the ratios- Problems based on reverse ratio is excluded.)	
3	Cash Flow Statement	3.1 Meaning, Objectives, Uses, and Limitations of Cash Flow Statement, 3.2 Methods of Cash Flow Statements- Direct methods and indirect methods. 3.3 Practical sums on an indirect method	<ul style="list-style-type: none"> To understand the cash management of any business corporations by preparing a cash flow statement.
4	Fund Flow Statement	4.1 Meaning, Objectives, Uses, and Limitations of Fund Flow Statement, 4.2 Preparation of Fund Flow Statement-Fund from operations & statement of changes in Working Capital 4.3 Practical sums on Preparation of Fund Flow Statement-	<ul style="list-style-type: none"> To understand the arrangement of funds for day-to-day business operations by preparing a fund flow statement

Teaching Methodology

Teaching + Tutorials Hours	Innovative methods to be used	Tutorials /Project for 1 credit	Expected Outcome
Unit 1- 12 hours	Lecture method, Classroom discussion based on PPT, Problem Solving & Case Study		To understand different tools of analysis & interpretation of financial statements.
Unit 2- 12 hours	Problem Solving, Participative Learning, Peer Learning & classroom Discussion.		To enable to use of various types of ratios for financial & investment decisions.
Unit 3- 12 hours	Problem Solving, Participative Learning, Peer Learning & classroom		To manage the cash flow arrangement of any business corporation

	Discussion.		
Unit 4 - 12 hours	Problem Solving, Participative Learning, Peer Learning & classroom Discussion.		To make available & manage various sources and application of funds for day-to-day business operations
Tutorial 15 Hours		<ul style="list-style-type: none"> • Financial Analysis of any company of three years using Trend Percentage/ Comparative Statement/ Ratio Analysis. • Financial Analysis of two different companies using Trend Percentage / Comparative Statement/ Ratio analysis. 	

Note- Students can do practical by using any one of the tools of Financial Analysis & evaluation can be done by conducting viva/PPT by the respective subject teacher

Evaluation

Subject- Analysis of Financial Statement	Internal Evaluation	External Paper Pattern (50 Marks)
Unit – I	MCQ/ long question/ short notes	Q.1 A Fill in the blanks (5M) Q.2 A Write Short Notes (Any 3) (15M) OR Q.2 Long Answer (15M) Q.3 Problems on Ratio Analysis (15M) Q.4 Problem on Fund Flow Statement
Unit – II	MCQ/Long questions/ problem/ short notes	
Unit – III	MCQ/Long questions/ problem/ short notes	
Unit – IV	MCQ/Long questions/ problem/ short notes	

		OR (15M) Q.4 Problem on Cash Flow Statement
Total –	30+ 20 marks for project= 50 Marks	50 Marks

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Advanced Management Accounting	Ravi Kishore	Taxman	New Delhi
2	Management accounting & Financial Analysis	Ravi Kishore	Taxman	New Delhi
3	Financial Reporting & Analysis	Dr. Jawahar Lal & Dr. Sucheta Guaba	Himalayan Publication House	New Delhi
4	Financial accounting & Analysis	P.Prem Chand & Madan Mohan	Himalayan Publication House	New Delhi
5	Management accounting & Financial Analysis	M.Y.Khan&P.K.Jain	Tata McGraw Hills	New Delhi

Savitribai Phule Pune University
T.Y. BBA Semester V (CBCS) Pattern 2019
Discipline-Specific Electives (DSE- B- FM)
Course Title – Legal Aspects of Finance & Security Laws
Course Code- DSE B 506 FM
Credit-2+4=6

Depth of the Course: Overview & Fundamental Knowledge of Legal Aspects related to finance.

Course Objectives:

1. To understand the Legal Aspects of Finance & Security Laws.
2. To know the legal provisions to obtain finance from various source of finance.
3. To explore various finance & securities-related laws in India.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Introduction to legal aspects of Finance	1.1 Overview of Indian Financial System, 1.2 Introduction to Legal aspect: - Finance, Securities market. 1.3 Basics of insurance, Derivatives, Commercial Banking, Capital Markets, Money Market, Forward Market Commission of India (FMC), Pension Fund Regulatory and Development Authority (PFRDA).	<ul style="list-style-type: none"> • To understand the fundamentals of legal aspects of Finance. • To know the basics of various financial instruments.
2	The issue, Listing of Securities&Investor Protection	2.1 Listing of Securities, 2.2 Issue of Capital and Disclosure Requirements (ICDR), 2.3 Procedure for Issue of Various Types of Shares and Debentures, 2.4 Employee Stock Option Scheme and Employee Stock Purchase Scheme,	<ul style="list-style-type: none"> • To understand the process of fundraising through IPO. • To explore the legal procedure of IPO listing & Delisting.

		2.5 Delisting of Securities.	
3	Companies Act 2013 & Investor Protection	3.1 Introduction to the Companies Act 2013, 3.2 Overviews of Companies Act 2013, 3.3 Legal Documents- Memorandum of Associations (MOA), Articles of Associations (AOA). 3.4 Importance of Preparation of Financial Statements & its disclosure. 3.5 Investor Education and Protection Fund (IEPF) under SEBI Regulations and Companies Act, 2013,	<ul style="list-style-type: none"> • To study & understand the basics of the Companies Act 2013. • To understand various legal documents under the Companies Act 2013 • To study legal norms regarding the selection of the appropriate source of finance. • To make aware students of various investment avenues.
4	Goods & Service Act 2017	4.1 Introduction to GST, 4.2 Types of GST, Overview of CGST, SGST, IGST & UTGST Act 2017, 4.3 Eligibility to register under GST, Benefits of GST Registration. 4.4 Procedure of GST Registration, 4.5 Introduction to GST Network, Functions of GSTN.	<ul style="list-style-type: none"> • To study & understand the basics of Goods & Service Tax. • To study various basic aspects related to GST.

Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical –as applicable	Innovative methods to be used	Expected Outcome
Unit 1 (13 hrs)	Group Discussion, Assignments.	To understand the Various Legal Provisions & Norms in the field of Finance.
Unit 2 (13 hrs)	Case Study, Group Discussion Based on SEBI Rules & Regulations.	To understand the objectives of Securities market regulators & also understand different Legal Provisions of the same.
Unit 3 (13 hrs)	Case Study, Group Discussion, Need-Based Project or Assignments.	To understand the significance of the Companies Act 2013 in the field of finance & also study its legal norms.
Unit 4 (9 hrs)	Group Discussion, Presentations by Students	To Study & understand the significance of Goods & Service Tax & also understand its implications.

Evaluation

Internal Evaluation	External Evaluation
30 Marks for Projects + 20 Marks for viva = 50 Marks	25% MCQs, 35% Short Notes, 40% Long Answers= 50 Marks

Suggested Topics for Projects:-

1. Study of IPOs recently listed on stock market.
2. Investor Education and Protection under SEBI Regulations
3. Investor Education and Protection under Companies Act, 2013,
4. Importance of Financial Education & Investor Grievance Redressed Mechanism at SEBI.
5. Actual of Working of GST IT infrastructure.
6. Implications of GST on Small vendors/businesses.
7. Benefits of GST to the Business & Government.

8. Study of Derivatives in the stock market & their importance for hedging.
9. Actual of Working of IRDA, Money Market, Capital Market, PFC, FMC, PFRDA etc.
10. Study of historical overview of legal aspects of finance.
11. Project on Recent Corporate Governance related cases in various companies.
12. Any other topic can be given based on the syllabus.

Suggested References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Capital Market in India	E. Gordon, K. Natarajan	Himalaya Publishing House	Mumbai
2	Guide to Indian Capital Market	Sanjeev Aggarwal	Bharat Law House	Delhi
3	The Indian Financial System	Vasant Desai	Himalaya	Delhi
4	Financial Services and Markets	Dr. S.Gurusamy	Thomas	Delhi
5	SEBI Practice Manual; 59/32, New Rohtak Road, New Delhi-110005.	V.L. Iyer	Taxman Allied Service (P) Ltd.	Delhi
6	Indian Financial Systems	M.Y. Khan	Tata McGraw Hill.	Delhi
7	SEBI – Law, Practice & Procedure	S. Suryanarayanan	Commercial Law Publishers (India) V. Varadarajan Pvt. Ltd.	Delhi
8	Compliances and Procedures under SEBI Law	Mamta Bhargava	Taxmann: SEBI Manual	Delhi

SavitribaiPhule Pune University
Question paper Pattern 2019 for TY BBA
University Examination Sub: Legal Aspects of Finance & Security Laws
Course Code – DSE B 506

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks

Savitribai Phule Pune University
TY BBA Semester V (CBCS) Pattern 2019
Cross-Cultural HR & Industrial Relations
Course code DSE C 505 HRM
Credit 3+1= 4

Depth of the course- Functional knowledge

Program Objectives

1. To make students understand Cultural Variables in Multinational Enterprises.
2. To learn some basic business etiquette and dining etiquette that will help to work in different countries across the globe
3. To make students understand the relationship between Cross-Culture Management and Human Resource Management.
4. 4. To explain how employees can be prepared for international assignments.
5. 5. To provide students with the fundamental knowledge of Industrial Relations.
6. 6. To provide the knowledge to students of provisions under The Industrial Disputes Act,1947, The Factories Act, 1948 and The Maternity Benefit Act 2017

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Introduction to cross-Cultural Management	1.1 Understanding Culture and Cross-Culture 1.2 Meaning of Culture, 1.3 Six Dimensions of National Culture by Professor Geert Hofstede, 1.4 Cultural differences and similarities, 1.5 Cultural Variables in Multinational 1.6 EnterprisesCommunicating across Cultures 1.7 Negotiating across Cultures 1.8 Multicultural Teams 1.9 Cross-Cultural Management and business etiquette	<ul style="list-style-type: none"> • To understand the basic concept of Culture and Cross-Culture. • To make students understand Cultural Variables in Multinational Enterprises. • To learn some basic business etiquette and dining etiquette that will help to work in different countries across the globe. • To discuss the impact of cross-cultural communication on international business.

2	Cross-Culture and Human Resource Management	2.1 Cross-Culture and Human Resource Management 2.2 Cross-cultural Human Resource Management 2.3 Motivation Across Cultures 2.4 Leadership and Decision Making Across Cultures 2.5 Communication & Negotiation Across Cultures 2.6 Rewards Across Cultures 2.7 Training Across Cultures 2.8 Power and Conflict Across Cultures 2.9 Skills for a Global Manager 2.10 Cross-cultural Differences and Managerial Implications (The Role of Human Resource Management in Cross-Cultural Environment)	<ul style="list-style-type: none"> • To make students understand the relationship between Cross-Culture and Human Resource Management. • To make students aware of Cross-cultural Differences and Managerial Implications. •
3	Fundamentals of Industrial Relations	3.1 Meaning and definition of Industrial Relations, 3.2 Evolution of Industrial Relation, 3.3 Importance of Industrial Relations, 3.4 Scope of Industrial relations 3.5 Approaches towards the study of Industrial Relations (Psychological Approach, Sociological Approach, Socio Ethical Approach, Gandhian Approach, Industrial Relations Approach and HR Approach) 3.6 Ethical Codes & Industrial Relations	<ul style="list-style-type: none"> • To acquire a solid theoretical, practical and ethical perspective on many aspects of industrial relations. • To make students understand the meaning, definition, importance, scope and evolution of Industrial Relation. • To provide sound knowledge about different approaches towards the study of Industrial Relations • To provide an understanding of the relation between Ethical Codes & Industrial Relations •
4	The Industrial Disputes Act,1947, The Factories Act, 1948 and The Maternity Benefit Act 2017	4.1 The Industrial Disputes Act,1947 - 4.2 Definitions, 4.3 Authorities under the Act, 4.4 Power & Duties of authorities, 4.5 Strike & lockout, 4.6 Lay-off, 4.7 Grievance Redressal Machinery 4.8 The Factories Act, 1948	<ul style="list-style-type: none"> • To inculcate the knowledge among students about authorities under The Industrial Disputes Act,1947. • To provide the knowledge to students of provisions under Strikes & Lockout and Lay-off. • To make students aware of how to regulate the conditions of work in manufacturing establishments coming within a factory. • To provide the knowledge of provisions regarding

	<p>4.9 Definitions,</p> <p>4.10 Authorities under the Act,</p> <p>4.11 Provisions regarding Safety,</p> <p>4.12 Provisions regarding Health,</p> <p>4.13 Provisions regarding Welfare,</p> <p>4.14 Provisions regarding Leave with Wages,</p> <p>4.15 Provisions regarding Working hours of adults</p> <p>4.16 The Maternity Benefit Act 2017</p> <p>4.17 Application of Act.</p> <p>4.18 Definition</p> <p>4.19 Right to payment of maternity benefit</p> <p>4.20 Payment of maternity benefit in case of death of a woman</p> <p>4.21 Provision of creche' facility</p>	<p>the parameters such as the Safety, Health, Welfare, Leave with Wages and working hours employees in the organisation.</p> <ul style="list-style-type: none"> To make students understand the provisions under The Maternity Benefit Act 2017.
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Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical –as applicable	Innovative methods to be used	Expected Outcome
Unit 1- 12 hours	<ul style="list-style-type: none"> Traditional classroom lectures Group Discussion Workshop on Business Etiquette Caselets solution 	<p>Great gains in content knowledge, skill acquisition, and overall understanding of the basic concept of Culture and Cross-Culture Management.</p> <p>A better understanding of Dress Etiquette, Dining Etiquette etc through business Etiquette workshop.</p>
Unit 2- 12 hours	<ul style="list-style-type: none"> Traditional classroom lectures Preliminary presentation from students across cultures. Role-play on Cross-cultural Differences and Managerial Implications. 	<p>Strengthen key competencies in individual and group participation, oral communication and persuasion, critical thinking, problem-solving through individual presentation and role-plays.</p> <p>Inculcating key competencies of different concepts of Cross-Culture and Human Resource Management through Caselets solutions.</p>

	<ul style="list-style-type: none"> • Caselets solution 	
Unit 3- 12 hours	<ul style="list-style-type: none"> • Traditional classroom lectures • Essay writing on Industrial Evolution • Student's presentation on different approaches towards the study of Industrial Relations • Group Discussion on Ethical Codes & Industrial Relations 	<p>Gain experience with instrument development and data collection methods.</p> <p>Practical understanding of data processing and Data Analysis.</p> <p>Develop thinking skills, listening abilities and how they are communicating their thoughts on Ethical Codes & Industrial Relations through Group Discussion.</p>
Unit 4 - 12 hours	<ul style="list-style-type: none"> • Traditional classroom lectures <ul style="list-style-type: none"> • Role-Plays on Strike & lockout and Lay-off • Student's presentation on different provisions under The Factories Act 1948 • Debate on Maternity Benefit Act 2017. 	<p>A better understanding of the Authorities under Act/s.</p> <p>Provide real-world scenarios to help students learn skills used in real-world situations through role-Play activity on Strike & lockout and Lay-off.</p> <p>Gain of deep knowledge of different provisions under The Factories Act 1948.</p> <p>Develop the power of deploying rational, reasoned arguments on The Maternity Benefit Act 2017 through debate activities.</p>
Tutorial 15 Hours	<ul style="list-style-type: none"> • Individual Project Report submission and presentation on any topic taught under this course 	

Evaluation

Unit Number	Internal Evaluation	External Evaluation
	Evaluation of students based on	
Unit – I	1. Active participation Group Discussion and Workshop	<p>25% MCQ 35% short notes 40% long answers</p>
Unit – II	<ol style="list-style-type: none"> 1. Individual Presentations, 2. Active participation in Role-Plays 3. Caselets solution 	
Unit – III	<ol style="list-style-type: none"> 1. Essay writing submission 2. Student's Presentations 3. Active participation in Group-Discussion 	
Unit – IV	1. Active participation in Role-Plays and Debate activities	
Tutorial		

Total –	30+20 = 50		50
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Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Cross-cultural Management- Concepts and Cases	ShobhanaMadhavan	Oxford University Press	London
2	Culture's Consequence - International Differences in Work-related Values	Geert Hofstede	Sage Publications	New York
3	International Human Resource Management	Peter Dowling &Denice E. Welch	Cengage Learning	New York
4	Industrial Relations and Labour Laws	A. M. Sarma	Himalaya Publishing House	Pune
5	Labour and Industrial Laws	P.K. Padhi	PHI Learning Private Limited	New Delhi
6	Labour and Industrial Laws	S. P. Jain, Simmi Agarwal	Dhanpat Rai & Co.	New Delhi

Savitribai Phule Pune University
Question paper Pattern 2019 for TY BBA
University Examination Sub: Cross-Cultural HR & Industrial Relations
Course code C 505
Credit 4

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Savitribai Phule Pune University
TY BBA –Semester V (CBCS) Pattern 2019
Cases in Human Resource Management + Project Viva
Course code DSE C 506 HRM
Credit - 2+4 = 6

Depth of the Course- Functional Working Knowledge

Course Objectives:

1. To understand the application of theory into practice.
2. Design critical thinking by making judgments related to problems in Case Studies of Human Resource.
3. Develop critical thinking for solving Case Studies of Human Resource.
4. To analyze the broad fundamental components of HRM.

Note: The Case Study examination paper will be for 2 credits and the Internship and project report along with viva-voce will be for 4 credits.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Case Study – Introduction	1.1 Case – Meaning – Objectives of Case Studies, 1.2 Characteristics & Importance of Case Studies, 1.3 Case Study analysis methodology (steps in Case Study Analysis) 1.4 Guidelines (Dos and Don'ts in Case Study Analysis).	<ul style="list-style-type: none"> • To make student know the gist of the Case Study and the way of attempt or solution. • Explain steps in solving case studies.
2	Areas of Case Study	2.1 Functions of HRM, 2.2 Challenges before HRM, 2.3 Role of HR Manager, 2.4 Job Analysis- Job Description, Job Specification, Job Evaluation, 2.5 Manpower Planning and Forecasting, 2.6 Recruitment and Selection,	<ul style="list-style-type: none"> • Analyze the broad fundamental components of HRM. • Develop critical thinking for solving Case Studies of Human Resource. • To develop the ability about getting acquainted with the theory and its application in real-life scenario of the HR Department.

	<p>2.7 Training and Executive Development, 2.8 Employee Compensation, Performance Appraisal, 2.9 Career Planning, 2.10 Employee Morale, Job Satisfaction, 2.11 Workforce Diversity, 2.12 International HRM, E-HRM, 2.13 Human Resource Information System, 2.14 Work from Home, Change Management 2.15 Out-Sourcing, 2.16 Rights of an employee at the workplace., HR Policy, 2.17 Legal issues related to HR in the Organization, 2.18 Wage & Salary Administration, 2.19 The Workmen’s Compensation Act, 1923, 2.20 The Payment of Gratuity Act, 1972, 2.21 Sexual Harassment of Women at Workplace, 2.22 Workers Participation in Management, 2.23 Organizational Development, 2.24 Employee Record Management, 2.25 Individual Behavior, Group Behavior, Personality, 2.26 Values and Attitude, 2.27 Group Dynamics, Conflict Management,</p>	<ul style="list-style-type: none"> • To make students know about recent happening in important concepts of Human Resource. • Design critical thinking by making judgments related to problems in case studies of Human Resource. • To understand the challenges faced/confronted in recent times.
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Evaluation:

Project Report Evaluation	External Evaluation
<p>Students must undergo for internship and must do fieldwork, survey, analysis of data, prepare a hard binding project report. The project report must be submitted to the college along with a soft copy of the same.</p>	<p>The external evaluation will be done based on an examination paper comprising of Case studies to solve for a maximum of 50 marks.</p>

For external evaluation, there will be a viva voce. Such viva-voce shall be conducted by a referee appointed by the University along with an internal referee.	
Having gone through all the topics, students have to be given cases to solve and are asked to submit a soft copy in PDF and PPT to college.	
Project Report- 30 marks & Viva-Voce - 20 marks = Total Marks 50	50 Marks

Suggested References

Sr. No.	Title of the Book	Author/s	Publication
1	Case Study Solutions Human Resource Development	H. Kaushal	MacMillan
2	Human Resource Management (Text and Cases)	S.S. Khanka	S. Chand
3	Human resource Management Text and Cases	K. Aswathappa	McGraw Hill India
4	Cases in Human Resource Management	David Kimball	SAGE Publications, Inc
5	Organizational Behavior: Text, Cases, Games	K. Aswathappa	Himalaya Publishing House
6	Organizational Behavior: Text & Cases	Suja R, Nair	Himalaya Publishing House

Savitribai Phule Pune University
TYBBA Semester V (CBCS) Pattern2019
Course : Health Care Management
Course Code -DSE D 505 SM
Credit 3+1=4

Depth of the Course –Reasonable working knowledge.

Course Objectives:

1. To create awareness related to health care management and services.
2. To enables students to understand the various healthcare services& other developments in the Indian health care service sector.
3. To provide students insight into the Functions & Role of modern healthcare management services offered to cater for the current needs.

Unit No.	Unit Title	Contents	Purpose and Skills to be developed
1	Basics of Health care Management	1.1 Importance, meaning, objectives of health care Management, 1.2 Types of healthcare services, Need of hospital administration, 1.3 Management of hospital services, 1.4 Wellness and fitness, Homecare and public healthcare service management.	<ul style="list-style-type: none"> • To understand the importance of healthcare management • Ability to understand hospital administration, homecare, and public healthcare.
2	Management & Healthcare	2.1 HR management in the health sector, 2.2 Operations and Supply chain management in health care, Financial Management in healthcare, 2.3 Healthcare -advertising and Media Management, 2.4 Digital Marketing of healthcare services.	<ul style="list-style-type: none"> • To understand how to manage human resource, financial resources, media management, supply chain management required to healthcare services

3.	Problems and Prospects of Health care Management	3.1 The problem faced by the health industry, Quality Management, 3.2 Opportunities in healthcare services and Management, 3.3 Changing scenario of the health industry.	<ul style="list-style-type: none"> To understand problems and prospects of the healthcare industry. Ability to understand changing scenario of the health industry.
4.	IT and Health care Management	4.1 Information System Overview, the structure of MIS specific to the hospital; 4.2 Information and data; Information for control, decision 4.3 IT applications in healthcare Management	<ul style="list-style-type: none"> To understand the role of MIS in healthcare management. To understand the use of IT in decision making. To understand the various applications of IT in healthcare management.

Teaching Methodology

Unit & teaching Hours	Innovative methods to be used	A V Applications	Project	Expected Outcome
I-(14)	Presentation on how healthcare is important in wellness and fitness. Presentation on identifying different needs of healthcare services	Short films on healthcare management	Healthcare Services- Development of Human being and Organization	To develop an awareness of healthcare and to understand its societal importance.
II-(13)	Poster presentation on the various discipline of management and healthcare	Films on different Institutions meeting different needs of finance/Marketing/HR/S up-ply chain management	Developing a suitable financial/ Marketing/HR needs assessment chart.	To develop a rational understanding regarding the role and utility of different sources of finance. Marketing and HR needs

III- (11)	Presentation on the negligence of healthcare and losses. Advantages of healthcare service management	Films on healthcare service industries	A report on the healthcare service industry, hospital administration, quality management	To understand problems, issues related to healthcare services and how it is important to maintain quality in this business for the development of the nation
IV – (10)	Presentation emerging trends in healthcare services, business, Use of IT in healthcare service management	Films on IT applications in healthcare Service management	Are port on IT applications in healthcare Service management	To have the right understanding of how modern healthcare business is changing and what are the new trends in the healthcare industry

Evaluation Method

Unit No	Internal evaluation	External Evaluation
	Evaluation of students based on	
Unit-I Unit-II Unit-III Unit-IV	1. Role Play 2. Chart Preparation and Presentation 3. Debate 4. Group Discussion	25% MCQ 35% Short notes 40% Long answer
Project/ Practical	1 Project Submission. 2. Presentation.	
Total	50 Marks	50 Marks

Suggested References

Sr.No	Title of the Book	Author	Publication	Place
1	Healthcare Operations and Management	Daniel B. McLaughlin and John R. Olson	ISBN 9781567938524	e-book
2	Principles of Hospital Administration and Planning	B.M.Sakharkar	Jaypee Brothers Medical Publishers	New-Delhi
3	Quality Management in Hospitals	S.K. Joshi	Jaypee Brothers Medical Publishers	New-Delhi
4	Delivering Quality Service: Balancing Customer Perceptions expectations	Zeithmal, Parasuraman, Berry	Simon and Schuster Inc.	New-York
5	Hospital Information Systems	Kelkar S.A.	Cloudbtail India	
6	Hospital Management and Hospital Operations	Dr. Shalini Suri	Jain Book Depot	New-Delhi
7	Financial Services and Markets	Dr.S.Gurusamy	Thomson	Delhi
8	Marketing management	Philip Kotler, Keller-Jha	Pearson Education New Delhi	New Delhi
9	Advertising and Promotion	Belch and Belch	Tata McGraw Hill	New Delhi
10	Human Resource Management	L. M. Prasad	Sultan Chand & Company Ltd.	New Delhi

SavitribaiPhule Pune University
Question paper Pattern 2019 for TY BBA
University Examination Sub: Health Care Management
Course Code – DSE D 505

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks

		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Savitribai Phule Pune University
TYBBA Semester V (CBCS) Pattern2019
Course: Permissions and Legal Aspects in Services
Course Code -DSE D 506 SM
Credit 2+4=6

Depth of the Course–Reasonable working knowledge

Course Objectives:

- 1.To create awareness related to services.
2. To enables students to understand the importance of the service sector.
3. To provide students insight into recent practices in the service sector

Unit No.	Unit Title	Contents	Purpose and Skills to be developed
1	Overview of Service Laws	1.1 Concept of services, 1.2 Overview of service laws 1.3 precautions while delivering services, 1.4 Rules and regulations advertising policy for services 1.5 Service Prospects and Proposal-overview of service proposal 1.6 Service agreements -terms and conditions	<ul style="list-style-type: none"> • To understand the fundamentals of different laws related to services.
2	Legality of Service	2.1Performance of Services – Contract of Agencies (Contract Act) 2.2 Effect of breach of services agreement or contract 2.3 Consumer protection act and service industry	<ul style="list-style-type: none"> • To understand legal aspects of the performance of services, consumer protection act and service industry

3.	Legal Responsibilities -Travel & Tourism	3.1 Legal Responsibilities of Travel & Tourism -Travel, Agents & Tour Operators, Online Travel Sales, Transportation & Common Carriers, Tour packages and agreement related to tour- clear publication of facilities, Mode and instalment of Payment, cancellation policy and refund terms and conditions. 3.2 Safety & Security Issues in the Hospitality Industry, Safety & Security Programs,	<ul style="list-style-type: none"> To understand legal responsibilities of travel and tourism, hospitality Industry
4.	Case Study -	4.1 Case Studies related to legal aspects of Services, disputes, jurisdiction in case of the dispute arises	<ul style="list-style-type: none"> Designing of Cases related to legal aspects of services

Teaching Methodology

Teaching Hours Theory + Practical	Innovative methods to be used	AV Applications	Project	Expected Outcome
Unit 1- 12 hours	Presentation on how the law is important related to services	Short films on how the law is important related to services	Discussion on Various Legal issues related to services	To understand service laws and their importance to society and business development.
Unit 2- 12 hours	Post representation on Performance of Services – Contract of Agencies (Contract Act), Effect of breach of services agreement or contract, Consumer protection act and service industry	Films on different legal issues related to services	A report on services agreement, breach of contract	To understand the impact of a breach of service agreement or contract

Unit 3- 12 hours	Presentation on legal responsibilities -travel & tourism	Films on legal responsibilities of travel & tourism	Airport on legal responsibilities of travel & tourism	To understand problems, issues related to travel and tourism.
Unit 4 - 12 hours	Presentation on legal aspects of Services, disputes, jurisdiction in case of the dispute arises	Films on legal aspects of Services, disputes, jurisdiction in case of the dispute arises	A report on legal aspects of Services, disputes, jurisdiction in case of the dispute arises	To understand legal aspects of Services, disputes, jurisdiction in case of the dispute arises

Evaluation Method

Unit No	Internal evaluation	External Evaluation
	Evaluation of students based on	
Project/ Practical	1 Project Submission. 2. Presentation.	25% MCQ 35% Short notes 40% Long answer
Total	50 Marks	50 Marks

Suggested References

Sr. No	Title of the Book	Author	Publication	Place
1	Legal Aspects of Business	Akhileshwar Pathak	Mc-Graw Hill	New-Delhi
2	Legal Aspects of Corporate Management and Finance	Don Mayer, Daniel Warnwer , George Siedel	Saylor Foundation	New-York
3	Legal and economic considerations surrounding reproductive tourism	Anastasia Paraskou and Babu P. George	Jaypee Brothers Medical Publishers	New-Delhi
4	Important Acts that Transformed India: For UPSC Civil Services Examination	Alex Andrews George	Mc-Graw Hill	Delhi
6	Labour Laws: Everybody should know	H.L.Kumar	Universal Law Publishing	New Delhi

Savitribai Phule Pune University
TY BBA Semester V(CBCS) Pattern 2019
Course Title: Warehouse Management
Course Code DSE E 505 ABM
Credit – 3+1=4

Depth of the Course: Understanding Core Aspects of Warehouse Management

Course Objectives:

1. To introduce the fundamental concepts, key principles and activities related to Warehousing function in the modern organization.
2. To address the operational aspects of planning and managing warehouses.
3. To give exposure related to business functions in warehouse and supply chain management including inventory, purchasing, materials and logistics.
4. To familiarize with the issue in core functions in warehouse management.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Warehouse Management	Introduction, Objectives, Supply Chain impact on Stores and Warehousing, Retail Logistics, Retail transportation, Issues in retail logistics, Managing retail shrinkage. 1.3 Need for warehousing management 1.4 Evolution of warehousing, 1.5 Role of a warehouse manager Functions of Warehouses 1.6 Types of Warehouses, Warehousing Cost, 1.7 Warehousing Strategies, 1.8 Significance of Warehousing in Logistics, 1.9 Warehousing Management Systems (WMS)	Purpose :- -Learning & understanding the concept of warehouse management. -Understanding issues in retail logistic. Skills to be developed:- -Development of Managerial Skills. - Learning Warehousing Strategies and warehousing management system.

2	Role and Strategic Aspects of Warehousing in Retail.	<p>2.1 Retailing and Warehousing, Challenges in retail warehousing, Setting up a warehouse, Retail product tracking in the warehouse using RFID.</p> <p>2.2 Types of warehouses, Benefits of warehousing.</p> <p>2.3 Role of government in warehousing.</p> <p>2.4 Characteristics of an ideal warehouse, Storing products in a warehouse</p> <p>2.5 Warehousing and Supply Chain</p> <p>2.6 Different Types of Customers in Warehousing</p> <p>2.7 Importance of Warehouse in a Value Chain, Warehouse Location, Modern Warehouse Operations.</p> <p>2.8 World-class warehousing.</p>	<p>Purpose:-</p> <ul style="list-style-type: none"> - Understanding government role in warehousing. -Understanding the retail product tracking & importance of warehouse in the value chain. -Highlighting various challenges faced by the Retail Industry. - Availing opportunities available indifferent Retail Industry. <p>Skills to be developed:-</p> <ul style="list-style-type: none"> -Adaptability to New /Recent trends. -Acquiring knowledge of warehousing techniques.
3	Technology Aids in Warehouse Management Introduction to Operations and Supply Chain Management	<p>Introduction, Objectives, Bar Code Scanners, Wireless LAN, Mobile Computers, Radio Frequency Identification (RFID)</p> <p>Definition, Concept, Significance and Functions of Operations and SCM. – Evolution from manufacturing to operations management, Physical distribution to Logistics to SCM, Physical Goods and Services Perspectives.</p> <p>Quality: Definitions from various Perspectives, Customers view and Manufacturer's view.</p> <p>Concept of Internal Customer, Overview of TQM and LEAN Management, Impact of Global Competition.</p>	<p>Purpose:-</p> <ul style="list-style-type: none"> -To understand the importance of Supply chain management. -To learn the new aids in Warehouse Management. -To understand customer and Manufacturer view. <p>-Skills to be developed:-</p> <ul style="list-style-type: none"> - To explore the importance of the supply chain technological world, primary trade-offs in making supply chain decisions, and basic tools for the effective and efficient supply chain management.

		3.1 Technological Change, Ethical and Environmental Issues on Operations and Supply Chain function.	
4	Warehouse and its Operations, Warehouse and Dispatch Management	4.1 Introduction, Objectives, Warehouse Structure, Warehouse Operations, 4.2 Receiving inventory, Picking inventory, Locating inventory, Organizing inventory, Dispatching inventory, 4.3 Equipment Used for a Warehouse. Types of warehousing, Warehouse Layout Docking and Marshalling, Warehouse Safety Management	Purpose:- -To satisfy customer needs and requirements. -To evaluate the external and internal factors and control through planning and review. Skills to be developed:- -Development of practical knowhow concerning the warehouse and its management

Teaching Hours Theory + Tutorials /Project Practical	Innovative Methods to be used	Project/ Tutorial for 1 credit	Expected outcome
Unit 1- 12 hours	Group Discussion on opportunities in Warehouse management, Theory lectures for conceptual understanding.	<ul style="list-style-type: none"> • Prepare report on different layouts of warehouses • A report on role of Packaging in warehouse management • Prepare a research-based report on safety measures in warehouse management 	Learning will be more practical based on theory, thereby aid students in better understanding.
Unit 2- 12 hours	Interactive Sessions followed by feedback, Practical Assignments.		It enables students to learn the basics of warehouse management which will help them to provide the vision for new businesses in the current market.
Unit 3- 12 hours	Use of PPT Use of Microsoft Word and Excel for project preparation		Ability to collect relevant data and its analysis and interpretation.
Unit 4 - 12 hours	Arranging Sessions of Experts from Warehouse Management and Presentations by students for self-learning.		Awareness of actual scenario w.r.t. warehouse and its management.
Tutorial 15 hours			

Evaluation Methods

Unit No	Internal Evaluation	External Evaluation
Unit – I	1.MCQ on meaning, Definition and challenges of warehouse management 2. Open Book Test. 3. Presentation on Principles of warehousing	

Unit – II	1.Presentation on different innovative practices by Indian companies in warehousing. 2. Case Study on Foreign warehousing strategies. 3. Chart making on International market selection process.	25% MCQ 35% Short notes 40% Long answers
Unit – III	1.MCQ on contents of unit	
Unit – IV	1.Case study on warehouse safety	
	Tutorial	
Total	30 +20 = 50 Marks	50 Marks

Suggested References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Supply Chain Management Strategy, Planning and Operations	Sunil Chopra/Peter Meindi/ D.V.Kalara	Pearson	New Delhi
2	Warehouse Management	Gwynne Richards	Kogan Page Ltd	Great Britain
3	Logistic and Supply Chain Management	Martin Christopher	FT Publishing	UK
4	Reference Books:-A Supply Chain Logistic Program For Warehouse Management.	David E. Mulcahy,JochimSydow	CRC Press	UK
5	Operations Management	Lee Krajewski, Larry Ritzman, Manoj Malhotra	Pearson Education	New Delhi
6	Supply Chain Management Strategy, Planning and Operations	Sunil Chopra/Peter Meindi/ D.V.Kalara	Pearson	New Delhi

SavitribaiPhule Pune University
Question paper Pattern 2019 for TY BBA
University Examination Sub: Warehouse Management
Course Code – DSE E 505

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Savitribai Phule Pune University
TY BBA Semester V(CBCS) Pattern 2019
Course Title: Permissions and Legal Aspects in Agriculture
Course Code DSE E 506 ABM
Credit – 2+4=6

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Introduction to Framing and Act in India	1.1 Introduction of farmers and Farming, 1.2 Right of Farmers, 1.1 Politics and the legal system Contracts 1.2 Agricultural labour and employment Sales and productibility 1.3 Study of different agricultural Policy	<ul style="list-style-type: none"> • To study and Explain the right of Farmers and Framing • To understand the legal system and politics. • To understand Contracts and torts • To study agricultural labour and employment. • To understand Sales and productibility. <p>Skills to be developed: -Positive approach towards Agricultural sector, identifying opportunities in services, to know the legal fact about agriculture.</p>
2	New Farm Act 2020	2.1 Introduction 2.2 Meaning and Definition Salient feature of	<ul style="list-style-type: none"> • To understand the basic concept of New farm acts 2020 • To understand the Application of the new acts

		<p>real estate sales & finance –secured transactions, farm products rule</p> <p>- farm bankruptcy & mediation, business planning & partnerships</p> <p>- corporations and cooperatives leases& production contracts</p> <p>2.3 Farmers' Produce Trade and Commerce (Promotion and Facilitation)Act,2020</p> <p>2.4 Farmers(Empowerment and Protection) Agreement on Price Assurance and Farm Services Act, 2020</p> <p>2.5 Essential Commodities(Amendment)Act,2020</p>	<ul style="list-style-type: none"> • To understand the practical usage of new Actsto framers <p>Skills To Be Developed-</p> <p>Practical Knowhow</p>
3	Legislations OnAgriculture	<p>3.1 Agricultural Produce (Grading andMarking)Act, 1937</p> <p>3.2 FertilizerControlOrder1985</p> <p>3.3 National Bank for Agriculture and Rural Development Act, 1981</p> <p>3.4 Seeds Act 1966, Property rights,- Fencelaws&propertytaxes</p>	<ul style="list-style-type: none"> • To understand the basic concept of all different acts. • To gain knowledge and application of acts. • Toknowthelegalterm and permission of different acts.
4	Environmental law for agricultural	<p>4.1 Agricultural chemicals</p> <p>4.2 Environmental liabilities</p> <p>4.3 Impact of Climatic changes on Agricultural</p>	<ul style="list-style-type: none"> • To know about laws and act for agricultural • To introduce the students to the general law related to agricultural • To enhance the awareness of the students towards different acts and their application

Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical	Innovative Methods to be used	Project for 4 credit	Expected outcome
Unit 1- 12 hours	Interactive Sessions followed by feedback, YouTube Videos for better understanding.	Preparing small reports on any Law as assigned by subject faculty	Learning will be more practical based on theory, thereby aid students in better understanding.
Unit 2- 12 hours	Visits to various Agricultural related units (organizations or offices) to gain practical knowledge w.r.t. service elements and its effective implementation. Group Discussion on Acts	Asking students to make a report on any Irrigation or agricultural organization of their own choice w.r.t. Agricultural elements.	Development of interest in the Agricultural sector and implementation of various concepts in practice.
Unit 3- 12 hours	Use of PPT and preparation of PPT based on fieldwork for agricultural Market and Marketing	Assigning students with tasks based on the current situation and its impact on the Agricultural sector.	Ability to collect relevant data and its analysis and interpretation.
Unit 4 - 12 hours	Arranging Sessions of experts from the industry (Guest lecture series)	Maintaining a record of every session by the students for evaluation by the teachers	Awareness of actual scenario w.r.t. Agricultural operations and its management.

Evaluation:- Project =50 /External–50Marks

Permissions and Legal Aspect on Agricultural	InternalEvaluation (50 Marks)	External Evaluation (50 Marks)
Unit– I, II, III & IV	Various aspects like assignment, presentation, GDs etc. as decided by college authorities(30marks) Class tests, PPT Notes preparation	50 marks final Paper as per University guidelines
Project	Project - 50marks	50marks

Suggested References

Sr.No.	Title of the book	Author/s
1.	HistoryofAgriculture	M.S.Randhawa
2.	TheFutureofIndianAgriculture	Y.K. Alagh
3.	Land and Water ManagementEngineering	V.V.N.Murty
4.	TheNatureandPropertiesof soil	N.C. Brady and RayWeil
5	Bare Acts	Government of India

TY BBA – Semester VI

Savitribai Phule Pune University
TY BBA Semester VI (CBCS) Pattern 2019
Course: Essentials of E-Commerce
Course Code- GC 601
Credit – 3

Depth of the Course- Reasonable Working knowledge of E-Commerce Management.

Course Objectives :

1. To understand the importance, role, and activities of E-Commerce.
2. To understand various E-Money and E-Payment systems used in E-Commerce.
3. To understand the concept of E-Marketing and its tools in E-Commerce.
4. To Understand the concept of Cyber Space and Cyber Security in E-Commerce.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	E-Commerce and Business Model Concepts	1.1- Introduction to E-Commerce Role of E-Commerce in Business Economy. Growth of E-Commerce in India 1.2 - Factors responsible for the growth of E-Commerce in India Opportunities and Challenges for E-Commerce in India 1.3- E-Commerce Business Models – Introduction, Types, how to choose e-commerce business models. 1.4- Modern Procurement in E-Commerce - E-Procurement – Introduction, E-Commerce and Technological tools 1.5- E-Distribution – Introduction, Features, Scope and	<ul style="list-style-type: none">• To understand the concept and role of E-Commerce business with context to India.• To understand the concept of various business models used in E-Commerce.• To understand the role of IT infrastructure in the development of

		<p>Advantages. Architectural Models in B2B 1.6- E-Commerce and Infrastructure – Electronic Data Interchange, Internet, Intranet, Extranet, Backend Informatics System Integration etc.</p>	E-Commerce in India.
2	E-Money and E-Payment Systems	<p>2.1 - E-Money – FIAT Currency, E-Money classification, Advantages of E-Money. Digital Currencies, Crypto Currencies -Introduction, Digital Disruption in E-Money Market. 2.2- Modern Digital Payment trends – Credit/Debit Cards, QR Code Scanners, Mobile point of sale, NEFT and RTGS. Contactless Payments – Samsung Pay/Apple Pay and use of NFC Technology. 2.3 - Unified Payment Interfaces (UPI) and Mobile Wallets Role of modern digital payment systems and Challenges faced in Indian Retail Sector.</p>	<ul style="list-style-type: none"> • To understand the concept of digital currencies. • To understand various modern digital payment systems used in E-commerce.
3	Role of E-Marketing	<p>3.1- Search Engine Optimization (SEO), Content Marketing, Pay Per Click (PPC) Advertising, Business E -Branding Social Media Marketing and Analytical tools used, Internet Banking, Mobile Retailing.</p> <p>3.2 - Use of Artificial Intelligence and Augmented Reality – Programmatic Advertising, Chatbots, Conversational marketing, Home assistants, Messaging apps, Personalized marketing, Website Designing.</p> <p>3.3 - Visual Search – Social Media Stories, Google lens, Blogs, Use of user-generated content, Privacy Marketing, Semantic Keyword search, Neuro-marketing.</p>	<ul style="list-style-type: none"> • To understand various tools and techniques used in E-Commerce. • The role of modern tools used in E-marketing.

4	Cyber Security and Technology	<p>4.1 - Cyberwarfare - Automotive hacking, Cloud services vulnerability, Mobile Hacking. Data Privacy as a discipline, Insider threats, Phishing, ATM frauds.</p> <p>4.2- Cyber Crimes – Financial Frauds, Defamation, Copyrights, Spying of Trade Secrets, Infringement of IT property, Digital Signature.</p> <p>4.3 - Social Media Crimes, Data Theft, Transfer of data without permission, Spread of Virus/worms, Trojans, Child Pornography, Forgery, Anti-National posts, Cyber-crime against government institutions.</p> <p>4.4 - Information Technology Act -2000: Role, Need and Importance, Software development and legal issues, Shrink-wrap contracts.</p>	<ul style="list-style-type: none"> • To understand the concept of cyber warfare and crimes that took place in cyberspace. • To understand the role of IT Act -2000 with the Indian context.
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Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical	Innovative methods to be used	Expected Outcome
Unit 2- 12 hours	Students' Presentations Case Studies on various business E-Commerce Models.	Understanding of the Role of E-Commerce Industry and the utility of E-Commerce models.
Unit 3- 12 hours	Students' Presentations Videos on success stories of UPI applications Case Study on Paytm, PhonePe, Google Pay etc.	Understanding of the working of the E-Commerce transactions in E-Commerce and its Utility.

Unit 4 - 12 hours	Students' Presentations Group Discussions on the role of modern E-Commerce modes. Case Studies on the use of Artificial Intelligence and Augmented Reality in E-Commerce.	Understanding the recent e-marketing tools and their utility. Understanding the role of technology in the modern E-Commerce sector.
Unit 1- 12 hours	Students' Presentations on building awareness in Cybersecurity and the Information Technology Act 2000. Video Sessions on potential threats of cyber techniques and hacks and measures to avoid it.	Understanding the scope of cybersecurity and technology. Understanding the need for cybersecurity and its implementation.

Evaluation

Subject	Internal Evaluation (30Marks)	External Evaluation (70 Marks)
Unit – I	MCQ Test, Open Book Test Group Presentations on E-Commerce Concepts and their Role.	25% MCQs 35% Short Notes 45% Long Answers
Unit – II	MCQ Test Group Presentations on E-Commerce Transaction systems., Assignments	
Unit – III	MCQ Test, Individual/Group Presentations on E-Commerce tools and techniques.	
Unit – IV	MCQ Test, Assignments, Individual / Group Presentations on Cyber Security and Technology.	

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	E-Commerce – An Indian Perspective	S.J.P.T. Joseph	PHI Learning Pvt. Ltd.; 6th edition (10 October 2019)	India
2	E-Commerce	Shruti Mathur	Pinnacle Learning (1 January 2020)	India
3	E-Commerce Concepts- Models – Strategies.	C.S.V. Murthy	Himalaya Publishing House	India
4	E-Business and E-Commerce Management	David Chaffey	Pearson Education – 5 th Edition	India
5	Ecommerce Unmasked: Hidden Secrets to fight Online battles. (Online Edition)	Rekha Chandulal	Rekha Chandulal; 1st edition (30 January 2015)	India
6	E-Commerce – Strategy Technology and Applications	David Whiteley	McGraw Hill Education (1 July 2017)	India
7	Electronic Commerce – Framework Technologies and Applications	Bharat Bhasker	McGraw Hill Education; Fourth edition (1 July 2017)	India

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Question paper Pattern 2019 for TY BBA
University Examination Sub: Essentials of E-Commerce
Course Code - 601

Q. No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	20 Marks
		Match the Pairs	5	
		Answer in one sentence	5	
		Fill in the blanks	5	
2	Solve any 3 out of 5	Long Answer Question	3*10 Marks	30 Marks
3	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			70 Marks

Savitribai Phule Pune University
TY BBA Semester VI (CBCS) Pattern 2019
Course: Management Information System
Course code GC 602
Credit 3

Depth of the Course- Reasonable Working knowledge of E-Commerce Management.

Course Objectives

1. To describe the basic concept of Information Technology and Management Information System.
2. To describe the role of information technology and information systems in business.
3. To contrast and compare how MIS support business processes.
4. To introduce the fundamental knowledge of Structured System Analysis and Design.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Basic Concepts of Information Technology and Management Information System	1.1 Meaning and basic concept of Information Technology, 1.2 Meaning and basic concept of Information System 1.3 Meaning and basic concept of Management Information System 1.4 Role of Information Technology in Management Information System 1.5 Management Information System as an instrument for organizational change.	<ul style="list-style-type: none"> • To understand the basic concept of Information Technology and Management Information Technology. • To make students understand the role of Information Technology in Management Information System. • To make students understand how MIS can be used as an instrument for Organizational Change.
2	Decision Making and Information	1.5 Decision Making 1.6 Models of Decision Making, 1.7 Classical Model, 1.8 Administrative Model and 1.9 Herbert Simon's Model 1.10 Information	<ul style="list-style-type: none"> • To make students understand the models of Decision Making and their application Decision-Making Process. • To provide sound knowledge about types of Information. • To make students aware of attributes of

		1.11 Types of information, 1.12 Attributes of Information and its relevance to decision making.	Information and its relevance to Decision Making.
3	System Analysis and Design	1.1 System 1.2 Meaning and definition 1.3 System Analysis 1.4 Meaning and definition of system analysis 1.5 Need for system analysis, 1.6 System analysis of the existing system, 1.7 System analysis of new requirements, 1.8 System Development Model, 1.9 Structured System Analysis and Design 1.10 Object-Oriented Analysis.	<ul style="list-style-type: none"> To explain to students the concepts of System, System Analysis. To inculcate knowledge of the different System Development Model. To inculcate the knowledge of Structured System Analysis and Design among students.
4	Information system applications	a. MIS applications, b. DSS – GDSS - DSS applications in E enterprise, c. Knowledge Management System and Knowledge-Based Expert System, d. Enterprise Model System and E-Business, e. E-Commerce, f. E-communication, g. Business Process Reengineering.	<ul style="list-style-type: none"> To make students understand the application of MIS in an enterprise. To provide sound knowledge about DSS – GDSS - DSS applications in E enterprise. To find out the relation between Enterprise Model System and E-Business.

Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical –as applicable	Innovative methods to be used	Expected Outcome
Unit 1- 12 hours	<ul style="list-style-type: none"> Traditional classroom lectures Preliminary presentation from students on Information Technology and Management 	<ul style="list-style-type: none"> Great gains in content knowledge, skill acquisition, and overall confidence and comfort for understanding the basic concept

	<p>Information Technology.</p> <ul style="list-style-type: none"> • Assignment. 	<p>of MIS.</p> <ul style="list-style-type: none"> • Students active participation in an understanding of Information Technology and Management Information Technology.
Unit 2- 12 hours	<ul style="list-style-type: none"> • Traditional classroom lectures • Role-plays • Group Discussion • Caselets solution 	<ul style="list-style-type: none"> • The shift towards student-centeredness significantly enhanced students' learning through the use of interactive small group activities and a high level of discussion and interaction.
Unit 3- 12 hours	<ul style="list-style-type: none"> • Traditional classroom lectures • Lab practice • Guest Lecture from System Analyst and Designer. 	<ul style="list-style-type: none"> • Practical Knowledge Acquisition about System Analysis and Design
Unit 4 - 12 hours	<ul style="list-style-type: none"> • Traditional classroom lectures • Lab practice • Guest Lecture from expert • Caselets solution 	<ul style="list-style-type: none"> • A better understanding of different applications in an enterprise through lab practice and Expert's Guest Lecture.

Evaluation

Unit Number	Internal Evaluation	External Evaluation
	Evaluation of students based on	
I	Students active participation in presentation and assignment submission	25% MCQ 35% short notes 40% long answers
II	Active participation in Role-Plays and Group Discussion Caselets solution	
III	Active participation in Lab practice Guest Lecture attendance	
IV	Active participation in Lab practice Guest Lecture attendance activities Caselets solution	
Total – 30 Marks		70 Marks

Suggested references

Sr. No.	Title of the Book	Author/s	Publication
1	Management Information Systems	Jawadekar, W.S.	Tata McGraw Hill Private Limited
2	Management Information Systems	Kenneth C. Laudon and Jane P. Laudon	Pearson Education
3	Management Information System	Goyal, D.P	MACMILLAN India Limited
4	Management Information System	Davis and Olson	Tata McGraw Hill Private Limited
5	Decision Support Systems and Intelligent Systems	Turban and Aronson	Pearson Education Asia
6	Management Information System	Murthy C.S.V	Himalaya Publications
7	Management Information Systems	James A. O' Brien, George M. Marakas	Global McGraw Hill
8	Information Systems The Foundation of E-Business	Steven Alter	Pearson Education

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Question paper Pattern 2019 for TY BBA
University Examination Sub: Management Information System
Course Code - 602

Q. No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	20 Marks
		Match the Pairs	5	
		Answer in one sentence	5	
		Fill in the blanks	5	
2	Solve any 3 out of 5	Long Answer Question	3*10 Marks	30 Marks
3	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			70 Marks

SavitribaiPhule Pune University
TY BBA –Semester VI (CBCS) Pattern 2019
Course: Business Project Management
Course Code- GC 603
Credits – 3

Depth of the Course- Intermediate knowledge & Insights in Project Management.

Course Objectives:

1. To develop a significant understanding of Project Management.
2. To develop a concept based approach towards Management of Business Projects.
3. To develop the relationship between the significance of Businesses Projects & their Management.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Introduction to Project Management	1.1 Defining Business Project Management 1.2 Exploring opportunities in the project management field 1.3 Developing Project management skills 1.4 Categorising different types of Business Projects 1.5 Understanding the difference between Projects & Programmes.	<ul style="list-style-type: none"> • To understand the role & importance of Management in Business Projects. • To develop the skills of managing Business Projects.
2	Planning & Implementing your Project	1.1 Planning a Project 1.2 Developing a Business Project Management Plan 1.3 Assessing the feasibility of a Project 1.4 Identifying & Managing the Risk 1.5 Managing a Project & Setting up a Project Database. 1.6 Creating an effective work schedule 1.7 Monitoring a business project 1.8 Managing Change 1.9 Address of Problems	<ul style="list-style-type: none"> • To develop conceptual clarity in Planning & Implementation of Business Projects. • To develop the quest of taking calculated risks towards Managing the Business Projects.

3	Business Project Management Techniques	a. Identifying Organisational Structures b. Estimation of Costs & Budget c. Using CPM tools (Gantt Chart, WBS, Project Network Diagram) d. Establishing the CPM e. Implementing PERT Tool f. Using Process improvement tools (Fishbone, SIPOC)	<ul style="list-style-type: none"> • To provide an understanding of the tools & techniques necessary to effectively manage & control the projects in businesses. • To understand the relevance of a technique-based project management system in the success of business projects.
4	Managing Project issues & their commencement	4.1 Identifying Project Costs 4.2 Calculating Return on Investment (ROI) 4.3 Calculating the Payback Period 4.4 Determining Net Present Value (NPV) 4.5 Identifying the life cycle of a Project 4.6 Handling over a Project 4.7 Closing a Project 4.8 Reviewing a Project	<ul style="list-style-type: none"> • To develop the basic understanding behind Business Project Issues & strategies for its addressal. • To develop a mindset of calculation-based business projects to minimise the chances of its failure.

Teaching Hours - Theory	Innovative methods to be used	Expected Outcome
Unit 1- 12 hours	Group-wise discussion to understand the nuances of Business Projects & its need for Management	To have an adequate understanding of the subject their various perspectives.
Unit 2- 12 hours	Unguided sessions based upon case studies, in which strategies are adopted by project-specific organisations.	To help students develop a cognizance towards Project-specific strategy building & its effectiveness.
Unit 3- 12 hours	Adoption of Project-based learning through dummy projects of the business.	To develop the hands-on training mindset amongst the students.
Unit 4 - 12 hours	Analysis of project-related issues and their solutions through case-based learning	To develop the solution-based approach amongst the management students towards problem-solving.

Evaluation :

Subject	Internal Evaluation	External Evaluation
Unit – I	Group Discussion	25% MCQ 35% short notes 40% long answers Fill in the blanks True and False Short answer question -25% Short notes - 35% Long answer questions -40%
Unit – II	Powerpoint Presentations on sub-points	
Unit – III	Simulation of Projects	
Unit – IV	1. Role Play. 2. Case-lets Solution & Discussion	
	30 Marks	70 Marks

Suggested References

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Strategic Project Management	Terry Schmidt	John Wiley & Sons	Mumbai & Pune
2.	Project Management: A Systems approach	Harold Kerzner	Wiley	Mumbai, Delhi
3.	Project Management	V.E. Rama Reddy & P Gopalakrishnan	Trinity	Mumbai
4.	Project Planning & Control	James Lewis	McGraw Hill	Mumbai, Pune & Delhi

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Question paper Pattern 2019 for TY BBA
University Examination Sub: Business Project Management
Course Code - 603

Q. No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	20 Marks
		Match the Pairs	5	
		Answer in one sentence	5	
		Fill in the blanks	5	
2	Solve any 3 out of 5	Long Answer Question	3*10 Marks	30 Marks
3	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			70 Marks

SavitribaiPhule Pune University
TY BBA –Semester VI (CBCS) Pattern 2019
Course: Management of Innovations and Sustainability
Course Code GC 604
Credits – 3

Depth of the Course: Reasonable Practical Knowledge of various core aspects concerning subject concepts.

Course Objectives:

1. To understand the concepts of Innovation and Sustainability in a practical sense.
2. To better know the significance of organisational sustainable development and the economic implications of sustainable development.
3. To learn about the most common errors made when handling sustainable growth.
4. To understand the concept of Sustainability Innovation. Understand socio-political aspects of sustainable development – social responsibility aspect.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1.	Management of Innovation Sustainability: An Introduction	1.1 Introduction 1.2 Defining innovation 1.3 Approaches to innovation 1.4 Differences between invention and innovation 1.5 Product innovation and process 1.6 Technological innovation, commercial or organizational Innovation 1.7 Indicators Characteristics of innovation in different sectors 1.8 Sustainable innovation 1.9 Defining Sustainability Innovation 1.10 Sustainability as Key Driver of Innovation 1.11 Innovation for Sustainable Development	<ul style="list-style-type: none"> • Clarify the concept of Innovation • Understanding the relation between Innovation and Sustainability • Introduction to a management approach to Innovation • Highlight on Changing views of innovation over time • Focusing on Sustainable development and its long-term benefit • Students can Practically understand the concepts of Innovation and Sustainability
2.	Managing Innovation with Firms& Strategies and Concepts for Innovation	.1 Organisation and Innovation .2 The dilemma of Innovation Management .3 Organisational characteristics that facilitate the innovation process	<ul style="list-style-type: none"> • To Identify the factors organisations have to manage to achieve success in Innovation • To Identify the activities performed by key individuals in the management of Innovation.

		.4 Organisation structure and Innovation .5 The role of Individual in the Innovation Process .6 IT System and Their Impact on Innovations .7 The innovation imperative: Why innovate	<ul style="list-style-type: none"> • To highlight Strategies for innovation and its implementation • Understanding Management of Innovation in a practical sense
3.	Service Innovation and Sustainability Innovation in Business	3.1 The Growth in Service 3.2 Different Types of Services 3.3 Characteristics of service and how they differ from product 3.4 Classification of Service innovation 3.5 Service innovation and the consumer 3.6 Energy and Materials: New Challenges in the First Decade of the Twenty-first Century 3.7 Defining Sustainability Innovation	<ul style="list-style-type: none"> • Understanding the scope and complexity of the challenges that have recently spurred sustainability innovation concerning energy and materials. • Gain insight into the fundamental drivers creating opportunities for entrepreneurs and new ventures in the sustainability innovation arena. • Begin to apply the basic ideas and concepts of sustainable design.
4.	Management of sustainable development	4.1 Economic aspects of sustainable development 4.2 Socio-political aspects of sustainable development 4.3 Ecologic aspects of sustainable development 4.4 Green organisations	<ul style="list-style-type: none"> • A better understanding of several aspects of sustainable development • Being able to explain their viewpoints and decisions, work in groups and accept and take into account criticism and comments

Teaching Hours Theory + Tutorials /Project Practical	Innovative Methods to be used	Expected outcome
Unit 1- 12 hours	Interactive Sessions followed by feedback, Role Play for various types of entrepreneur.	It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide the vision for their Start-up.
Unit 2- 12 hours	Group Discussion and Brain Storming sessions for the generation of innovative ideas. Theory lectures for conceptual understanding.	Development of interest and positive approach towards entrepreneurship and new start-ups.
Unit 3- 12 hours	Use of PPT for better understanding of various financial institutions and Schemes	Ability to collect relevant data and its analysis and interpretation.
Unit 4 - 12 hours	Arranging Sessions of experts from the service industry (Guest lecture series), Presentations by students for self-learning.	Understanding key aspects of success and failure of businesses.

Evaluation:

Subject	Internal Evaluation	External Evaluation
Unit – I	Continuous assessment based on criteria such as Presentations Class Tests Practical Assignments as suitable for each unit	25%MCQ, Short notes-35%, Long answers- 40%
Unit – II		
Unit – III		
Unit – IV		
	30 Marks	70 Marks

Suggested References: -

Title of the Book	Author/s	Publication	Place
Innovation Management & New Product Development	Paul Trott	Pearson	Netherland
Sustainable Economic Development and Environment	Raj Kumar Sen, Kartik C. Roy	Atlantic Publishers and Distributors Pvt. Ltd.	India
Sustainability Management	Deb Prasanna Choudhury	Zorba Books	India
Sustainable Development and Environment	Snigdha Tripathi	Ankit Publication	India
Concepts and Approaches for Sustainability Management	Khai Ern Lee	Springer International Publishing	Switzerland AG

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Question paper Pattern 2019 for TY BBA
University Examination Sub: Management of Innovations and Sustainability
Course Code - 604

Q. No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	20 Marks
		Match the Pairs	5	
		Answer in one sentence	5	
		Fill in the blanks	5	
2	Solve any 3 out of 5	Long Answer Question	3*10 Marks	30 Marks
3	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			70 Marks

Savitribai Phule Pune University
TY BBA Semester VI (CBCS) Pattern 2019
Course: International Brand Management
Course Code-DSE A 605 MM
Credit – 3 + 1 = 4

Depth of the Course- Fundamental knowledge of Brand Management in the International Market

Course Objectives :

1. To develop students' understanding of the concept of developing brands
2. To develop students' understanding of the concept of brand equity
3. To develop students' understanding of the strategies in managing brand portfolios

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Understanding Brand	1.1 Introduction, Brand concepts, 1.2 Purpose of Brands, 1.3 Characteristics of strong brands, 1.4 the purpose of branding, 1.5 fundamental concepts of branding	<ul style="list-style-type: none"> • The module aims to familiarize the students with the key conceptual foundations of developing and managing a strong brand.
2	Developing Brand	2.1 Process and methods of developing brand elements, 2.2 creating brand associations and introducing a new brand in the international market, 2.3 identify effective marketing and marketing communications strategies,	<ul style="list-style-type: none"> • The module introduces the process of creating a brand. • Designing marketing/marketing

		2.4 Including the use of social/digital platforms, 2.5 Design marketing and marketing communications programs that build brand equity in the international market	communications programs that effectively communicate the desired brand identity to target markets
3	Evaluating Brand	3.1 Processes and methods of measuring brand performance, 3.2 Qualitative and quantitative tools for measuring brand image and strength, 3.3 Interpret brand performance data, Brand evaluation plans in the international scenario	<ul style="list-style-type: none"> The module reviews the methods of measuring and interpreting brand performance.
4	Managing Brand	4.1 Concepts and tools for managing brands over time, international geographic areas, and market segments, 4.2 Consumer-brand relationships, Strategic alliances, Brand portfolios, and Brand repositioning/revitalization.	<ul style="list-style-type: none"> The module focuses on the stewardship and management of brands over time, geographic areas, and market segments. It covers the strategies for more established brands as they attempt to grow and stay relevant over time.

Teaching methodology

Teaching Hours Theory + Tutorials /Project Practical	Innovative methods to be used	Tutorial/ Projects for 1 Credit	Expected Outcome
Unit 1- 12 hours	Students' Presentations or Role play on brand concepts, Video Sessions on International Brands	<ul style="list-style-type: none"> • Assignment on the characteristics of International Brand concerning its strengths and challenges 	Understanding of basic Brand Concepts
Unit 2- 12 hours	Case Studies on International Brands, Group Discussions on Brand Development in the International circuit	<ul style="list-style-type: none"> • Assignment on developing a new brand for International Markets 	Understanding the process of Brand Development
Unit 3- 12 hours	Presentations or Role play on International Brand comparisons measuring performance data,	<ul style="list-style-type: none"> • Group discussions on International Brand performances 	Understanding the concept and process of Brand Evaluation
Unit 4 - 12 hours	Case Studies, Group Discussions on the Success and Failures of International Brands		Understanding Brand Management
Tutorial 15 hours			

Evaluation

Subject	Internal Evaluation	External Evaluation
Unit – I	MCQ Test Open Book Test	25% MCQs 45% Short Answers 30% Long Answers
Unit – II	MCQ Test Group Presentations	
Unit – III	MCQ Test Group Discussions	
Unit – IV	MCQ Test Group Presentations Assignments	
Total	30 +20 Marks	50 Marks

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Strategic Brand Management	Isaac C. Jacob Kevin Lane Keller, Vanitha Swaminathan, Ambi M.G. Parameswaran	Pearson Education; Fifth edition	India
2	The New Strategic Brand Management: Advanced Insights and Strategic Thinking	Jean-Noël Kapferer	Kogan Page; 5th edition	London, UK

3	Strategic Brand Management: Building, Measuring, and Managing Brand Equity	Kevin Keller, Vanitha Swaminathan	Pearson; 5th edition	India
4	Brand Management: Co-creating Meaningful Brands	Michael Beverland	SAGE Publications Ltd; 1st edition	USA
5	The Origin of Brands: How Product Evolution Creates Endless Possibilities for New Brands	Al Ries, Laura Ries	Harper Business; New edition	USA

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Question paper Pattern 2019 for TY BBA
University Examination Sub: International Brand Management
Course Code – DSE A 605

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

SavitribaiPhule Pune University
TY BBA –Semester VI (CBCS) Pattern 2019
Course: Cases in Marketing Management + Project
Course Code- DSE A 606 MM
Credit - 2+4 = 6

Depth of the Course- Functional Working Knowledge

Course Objectives: To understand the application of theory into practice.

Note: 1. The case study examination paper will be for 2 credits and the Internship and project report along with viva voce will be for 4 credits.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Case Study – Introduction	1.1 Case – Meaning – Objectives of Case Studies 1.2 Characteristics & Importance of Case Studies 1.3 Guidelines for Case Studies & Cases Discussion.	<ul style="list-style-type: none"> To make student know the gist of the case study and way of attempt or solution
2	Areas of Case Study	2.1 Product Mix with PLC 2.2 Price Mix – Elements in Price Mix, Factor affecting Pricing, Pricing Methods. 2.3 Place Mix – Physical Distribution Management System, Types, Intermediaries, strategies, trends in SCM. 2.4 Promotion Mix – Elements, Advertising, Media Mix, AIDA, DAGMAR, IMC. 2.5 Extended Ps of Marketing Mix 2.6 New Product Development 2.7 Product Extension and Product Diversification. 2.8 Traditional Marketing and Modern Marketing 2.9 Rural Marketing	<ul style="list-style-type: none"> To develop the ability about getting acquainted with the theory and its application in a real-life scenario. To make students know about recent happening in marketing. To understand the challenges faced/confronted in recent times

	2.10 Services Marketing 2.11 Organised&Unorganised Retail Marketing 2.12 E-Marketing and Digital Marketing 2.13 Green Marketing 2.14 Market Segmentation 2.15 Targeting 2.16 Positioning and Niche Market	
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Innovative methods to be used	Expected Outcome
Lectures/Case studies/Discussion/videos/ Role Plays	Students shall understand the challenges faced by the people and organisations in the day to day work life. They shall understand the techniques and solutions to overcome those challenges.

Evaluation:

Project Report Evaluation	External Evaluation
Students must undergo for internship - Refer Internship manual For external evaluation, there will be a viva voce. Such viva-voce shall be conducted by a referee appointed by the University along with an internal referee.	Case study based The external evaluation will be done based on an examination paper comprising of Case studies to solve for a maximum of 50 marks 15*3 cases 5*1 short note
Having gone through all the topics, students have to be given cases to solve and are asked to submit a soft copy in PDF and PPT to college.	

Project Report- 30 marks & Viva Voce - 20 marks = Total Marks 50	50 Marks
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Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Marketing Management	Philip Kotler & Keven Lane Keller	Pearson India	South Asia
2	Case Study Solutions Marketing	H. Kaushal	Lakshmi	New Delhi
3	Marketing Management	V. S. Ramaswamy, S. Namakumari	Macmillan	New Delhi
4	Foundational Of marketing	John Fahy & David Jobber	Tata McGraw Hill	New Delhi
5	Marketing In India Text and cases	S. Neelamrgham	Vikas Publication	New Delhi
6	Marketing - Cases Insights	Paul Baines, Chris Fill, Kelly page Piyush K. Sinha	Oxford	New Delhi

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T.Y. BBA Semester VI (CBCS) Pattern 2019
Discipline-Specific Electives (DES- B- FM)
Course Title – Financial Management
Course Code-DSE B 605 FM
Credits –3+1=4

Depth of the Course- Functional knowledge of banking Operations and various Regulatory Authorities in India.

Course Objectives

1. To know various sources of finance of business
2. To study and understand the capital structure of the company and its cost of capital
3. To study optimum capital mix & concept of over capitalisation& undercapitalization.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Sources of Finance	1.1 Long term Sources of Finance- Owned Funds & Borrowed Funds, Equity shares, Preference Shares, Debentures, Term Loan, Lease Financing, Hire Financing 1.2 Short term Sources of Finance- Bank overdraft, Cash Credit, Bills Discounting, Ploughing back of Profit,	<ul style="list-style-type: none"> • To understand various sources of finance for raising capital /funds required for the business. By studying various sources of finance analytical & reasoning skills will be developed.
2	Capital Structure	2.1 Meaning, Concept, Importance, 2.2 Factors affecting Capital Structure-Internal Factors, External Factors & General Factors 2.3 Cost of Capital- Meaning, weighted Average Cost, Operating leverages, 2.4 Financial leverages, Combined Leverages (Problem on Leverages)	<ul style="list-style-type: none"> • To understand the proportion of borrowed capital & owned capital, considering their cost of capital. It helps to develop calculative & mathematical skills.
3	Capitalisation	3.1 Meaning, Modern Concept of Capitalisation, Need, 3.2 Under capitalisation-Meaning, Causes & Remedies	<ul style="list-style-type: none"> • To understand the process of undercapitalization & overcapitalization. It helps to develop professional & problem-solving skills.

		3.3 Over Capitalisation- Meaning, Causes, & Remedies	
4	Capital Budgeting	4.1 Meaning, 4.2 Techniques of Capital Budgeting, 4.3 Mutually Exclusive Proposals	<ul style="list-style-type: none"> To understand the process of evaluation of mutually exclusive proposals. It helps to evaluate different investment proposals through experiential learning.

Teaching Methodology

Teaching + Tutorial Hours	Innovative methods to be used	Tutorials /Project for 1 credit	Expected Outcome
Unit 1- 12 hours	Lecture method, Classroom discussion based on PPT, Case study, Participative learning	Study of different sources of finance available in Public Limited Companies. Students can collect the information of sources of finance of Automobile/Pharma/ Textile/IT/Power/Steel/FMG/Petrochemicals etc.	To understand various sources of finance for raising capital /funds required for the business
Unit 2- 12 hours	Problem Solving, Participative Learning, Peer Learning & Classroom Discussion.		To understand the proportion of borrowed capital & owned capital, considering their cost of capital
Unit 3- 12 hours	Participative Learning, Peer Learning & Classroom Discussion.		To understand the process of undercapitalization & overcapitalization
Unit 4 - 12 hours	Problem Solving, Participative Learning, Discussion on Expert lecture, Peer Learning & classroom Discussion.		To understand the process of undercapitalization & overcapitalization
Tutorial 15 hours			

Note- Faculty can assign separate industry to each student for practical. Students can study 5 to 6 different companies of the same industry of sources of finance.

Evaluation

Internal Evaluation	External Paper Pattern (50 Marks)	
MCQ/ long question/ short notes	Q.1 A Fill in the blanks	(5M)
MCQ/Long questions/ problem/ short notes	Q.2 A Write Short Notes (Any 3)	(15M)
MCQ/Long questions/ problem/ short notes	Q.3 Long Answer (option can be given)	(15M)
MCQ/Long questions/ problem/ short notes	Q.4 Problems on leverages	(15M)
30+ 20 marks for project= 50 Marks	50 Marks	

Suggested references

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Financial Management	I.M.Pandey	Vikas	New Delhi
2	Financial Management	Ravi.M.Kishore	Taxman	New Delhi
3	Financial accounting & Analysis	P.Prem Chand & Madan Mohan	Himalayan Publication House	New Delhi
4	Financial Management	Prasanna Chandra	Tata McGraw Hill	New Delhi
5	Financial Management	Khan & Jain	Tata McGraw Hill	New Delhi

Savitribai Phule Pune University
T.Y. BBA Semester VI (CBCS) Pattern 2019
Course Title – Cases in Finance +Project
Course Code- DSE B 606 FM
Credit- 2+4=6

Depth of the Course: Application-based Knowledge of core areas of finance.

Course Objectives:

1. To Study & understand the core areas of finance.
2. To study the practical applications of finance.
3. To prepare project reports based on the internship & understanding of core areas of finance.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Fund Raising & Capital Budgeting	1.1 Fund Raising: Meaning, Importance, Process. (Theory) 1.2 Investment Decisions: Long term, Medium-term, Short Term, its importance (Theory) 1.3 Capital Budgeting: Meaning, Importance, Types (Practical cases)	<ul style="list-style-type: none"> • To understand the importance of fundraising. • To study & understand the practical applications of Capital Budgeting.
2	Working Capital Management	2.1 Working Capital:- Meaning, Importance, Cases on Working capital.	<ul style="list-style-type: none"> • To understand the concept & importance of Working Capital Management. • To study & understand the practical applications of Working Capital.
3	Cost of Capital	3.1 Return of Capital Employed (ROCE): Meaning, Importance (Theory) 3.2 Return on Investment: Meaning, Importance. (Theory)	<ul style="list-style-type: none"> • To study & understand the basics of ROCE, ROI & Cost of Capital. • To study & understand the practical applications of Cost of Capital.

		3.3 Cost of Capital: Meaning, Importance, Cases on Cost of Capital	
4	Project Report	Project-based on core areas of finance/ based on internship. (Refer to the suggested topics given below) Internship guidelines are attached separately	<ul style="list-style-type: none"> • To study & understand implications of selected core areas of finance under study. • To give insights based on data collection & data analysis to the students. • To inculcate research culture among students through conducting research in finance.

Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical –as applicable	Innovative methods to be used	Expected Outcome
Unit 1- 12 hours	Group Discussion, Assignments. Case Study.	To understand the fundamentals of fundraising.
Unit 2- 12 hours	Case Study, Group Discussion.	To understand the practical applications of capital budgeting.
Unit 3- 12 hours	Case Study, Group Discussion.	To understand the practical applications of Cost of Capital.
Unit 4 - 24hours	Project Report under the guidance of the Subject teacher.	To understand the research-based outcomes of core areas of finance based on internship.

Evaluation

Internship	External Evaluation
30 Marks for Projects + 20 Marks for viva = 50 Marks	Problems and Case studies = 50 Marks

Suggested Topics for Project: -

1. Projected financial statements to be submitted to the bank for a loan proposal.
2. Analysis & interpretations of financial statement with the help of Techniques like
3. Ratio analysis, Fund flow Analysis, Cash flow Analysis.
4. Project-related Insurance sector.
5. Working Capital Management.
6. Any other topic related to core areas of finance based on internship by students.

Suggested References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Capital Market in India	E. Gordon, K. Natarajan	Himalaya Publishing House	Mumbai
2	Guide to Indian Capital Market	Sanjeev Aggarwal	Bharat Law House	Delhi
3	The Indian Financial System	Vasant Desai	Himalaya	Delhi
4	Financial Services and Markets	Dr. S.Gurusamy	Thomas	Delhi
5	Guide to Financial Management	John Tennent	The Economist	Delhi
6	Indian Financial Systems	M.Y. Khan	Tata McGraw Hill.	Delhi
7	Corporate Finance Management	Glen Arnold	Pearson	Delhi
8	Fundamentals of Financial Management	Vyuptakesh Sharan	Pearson	Delhi

Savitribai Phule Pune University
TY BBA Semester VI (CBCS) Pattern 2019
Global Human Resource Management
Course code DSE C 605 HRM
Credit 3+1=4

Depth of the Course- Fundamental knowledge

Course Objectives:

1. To understand the concepts, theoretical framework, and issues of HRM in Global Perspective
2. Identify and Understand issues and practices about the major HRM functions within the context of the global environment.
3. To learn how to conduct strategic human resource management in an international setting.
4. To learn how companies manage their expatriates.
5. To look at HRM in a broader, comparative, and international perspective to deal with complex issues and manifold risks.
6. To study understanding of international approaches to dealing with people in organizations.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Introduction to Global HRM	1.1 Meaning and definition of Global HRM, 1.2 Features of Global HRM, 1.3 Objectives of Global HRM, 1.4 Development of Global HRM, 1.5 Significance of Global HRM in International Business 1.6 Categorization of countries and employees in the concept of Global HRM 1.7 Difference between Global HRM and Domestic HRM	<ul style="list-style-type: none"> • To introduce the students to the study and the practice of Global HRM. • To learn the development of Global HRM. • To review the significance of Global HRM in International Business. <p>To make students understand the difference between Global HRM and Domestic HRM.</p>
2	Global HR Functions-I	2.1 Global Staffing, 2.2 The role of expatriates and non-expatriates, 2.3 Staffing Policy Approaches in International HRM 2.4 Recruiting staff for Global Assignment	<ul style="list-style-type: none"> • To provide information about Global Workforce Management functions.

		<p>2.5 Global labour market 2.6 Global Recruitment function; head-hunters, cross-national advertising, e-recruitment; 2.7 Selecting staff for Global Assignment 2.8 Criteria and techniques,</p>	<ul style="list-style-type: none"> • To get insights into the concepts of Expatriates and Non- Expatriates • To inculcate knowledge of the concept of Global Recruitment and Selection. • To understand the Global Staffing issues.
3	Global HR Functions-II	<p style="text-align: center;">Global Training & Development</p> <p>3.1 Meaning definition, 3.2 Objectives, 3.3 Importance, 3.4 The role of expatriate training, 3.5 Key components of effective pre-departure training, 3.6 Developing staff through international assignments, 3.7 Barriers in Global Training & Development 3.8 Global Compensation Meaning & definition, Objectives, 3.9 Key components of Global Compensation program, 3.10 Approaches to Global Compensation 3.11 Barriers in Global Compensation</p>	<ul style="list-style-type: none"> • To provide information about Global Workforce Management functions. • To make students understand the concepts of Global Training & Development, Global Compensation and Global Performance Management. • To make students aware of barriers in Global Training & Development, Global Compensation and Global Performance Management.
4	Global HRM Trends and Future Challenges	<p>4.1 Strategic HRM in multinational enterprises, 4.2 Ethics-related challenges for the HR function of the multinational enterprise 4.3 Challenges in an uncertain world: Safety, security and counterterrorism 4.4 The evolving role of the HRM function in MNCs Role of Technology in Global HRM Knowledge Management and Global HRM</p>	<p>To provide sound knowledge about strategic HRM and Ethics related challenges for the HR functions in multinational enterprises.</p> <p>To make students aware of technology in Global HRM.</p> <p>To make students understand the relationship between Knowledge Management and Global HRM.</p>

Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical –as applicable	Innovative methods to be used	Tutorial/Project	Expected Outcome
Unit 1- 12 hours	<ul style="list-style-type: none"> Traditional classroom lectures Preliminary presentation from students on study and practice of Global HRM. Assignment. 	<ul style="list-style-type: none"> Caselets from MNC's on successful expatriation Designing an e-recruitment campaign using various methods and mediums for E-recruitment Comparison between techniques of international selection and domestic selection. Comparative study of various cultures of different nations with respect to work ethics, time and job performance <p>Tutorial 15 hours</p>	<ul style="list-style-type: none"> Great gains in content knowledge, skill acquisition, and overall confidence and comfort for major concepts in understanding the concept of Global HRM. Students' active participation in understanding Global HRM.
Unit 2- 12 hours	<ul style="list-style-type: none"> Traditional classroom lectures Role-plays on expatriates and non-expatriates. Group Discussion Caselets solution Guest Lecture from any MNC's Recruitment and Selection HR Manager 		<ul style="list-style-type: none"> The shift towards student-centeredness significantly enhanced students' learning through the use of interactive small group activities and a high level of discussion and interaction. Practical Knowledge Acquisition about Global Recruitment and Selection.
Unit 3- 12 hours	<ul style="list-style-type: none"> Traditional classroom lectures Group Discussion Caselets solution Guest Lecture from any MNC's HR Manager 		<ul style="list-style-type: none"> Practical Knowledge Acquisition about Global Training & Development, Global Compensation and Global Performance Management.
Unit 4 - 12 hours	<ul style="list-style-type: none"> Traditional classroom lectures Debate activity on Global Safety, security and counterterrorism Role-play on the evolving role of the HRM function in MNCs. 		<ul style="list-style-type: none"> A better understanding of Global HRM Trends and Future Challenges through students activities.

	• Caselets solution		

Evaluation

Unit Number	Internal Evaluation		External Evaluation
	Evaluation of students based on	Marks	
I	3 Student's active participation in presentation and assignment submission.	30	25% MCQ 35% short notes 40% long answers
II	4. Student's active participation in Role-Plays and Group Discussion 5. Caselets solution		
III	4 Caselets solution 5 Active participation in Group-Discussion		
IV	4. Active participation in Role-Plays and Debate activities 6 Caselets solution		
Total		30+20=50	50

Suggested References

Sr. No.	Title of the Book	Author/s	Publication
1	International Human Resource Management	Peter Dowling and Denice Welch	Cengage Learning
2	International Human Resource Management: Globalization, National Systems and Multinational Companies	Tony Edwards	Pearson Education

3	International Human Resource Management	Monir Tayeb	Oxford University Press

SavitribaiPhule Pune University
Question paper Pattern 2019 for TY BBA
University Examination Sub: International Human Resource Management
Course Code DSE C 605

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Savitribai Phule Pune University
TY BBA Semester VI (CBCS) Pattern 2019
Recent Trends & HR Accounting + Project
Course Code DSE C 606 HRM
Credit 2+4 = 6

Depth of the Course- Comprehensive Knowledge

Course Objectives

- 1.To make students understand the theoretical and practical fundamental knowledge of Recent Trends in HRM and HR Accounting.
- 2.To describe various Employee Engagement Strategies to enhance Employee Engagement.
- 3.To discuss the uses of Human Resource Information Systems in organizations.
4. To explain the different methods used to calculate the value of human Resources.
5. To define Human Resource Audit and outline its scope.
6. To study the methods of Human Resource Valuation.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Employee Engagement	1.1 Meaning and definition of employee Engagement, 1.2 Factors Influencing Employee Engagement, 1.3 Strategies for Enhancing Employee Engagement, 1.4 Company values and building employee loyalty, 1.5 Challenges in engaging employees, 1.6 Employee engagement and company branding strategies	<ul style="list-style-type: none"> • To understand the basic concept of Employee Engagement. • To study factors influencing Employee Engagement. • To describe various Employee Engagement Strategies to enhance Employee Engagement. • To make students understand the relationship between Employee Engagement and company branding strategies.

2	Human Resource Information System and Personnel Research	<p>2.1 Human Resource Information System</p> <p>2.2 Meaning and definition of Human Resource Information System,</p> <p>2.3 Components of Human Resource Information System,</p> <p>2.4 Advantages and Limitations of Human Resource Information System,</p> <p>2.5 Process of designing of Human Resource Information System</p> <p>2.6 Personnel Research</p> <p>2.7 Meaning and definition of Personnel Research,</p> <p>2.8 Approaches to Personnel Research,</p> <p>2.9 Process of Personnel Research</p>	<ul style="list-style-type: none"> • To make students understand the basic concept of Human Resource Information System. • To discuss the uses of Human Resource Information Systems in organizations. • To list the advantages and identify the limitations of the Human Resource Information System. • To map out the process involved in designing of Human Resource Information System. • To make students understand the meaning and definition of Personnel Research and Human Resource Audit. • To appreciate the purpose of Personnel Research in an organization. • To discuss the major approaches employed for Personnel Research. • To delineate the process followed in conducting Personnel Research.
3	Human Resource Accounting and Human Resource Audit	<p>3.1 Human Resource Accounting</p> <p>3.2 Meaning and definition of HR Accounting,</p> <p>3.3 Need and Objectives of HR Accounting,</p> <p>3.4 Advantages and Limitations of HR Accounting,</p> <p>3.5 Human Resource Valuation: Monetary and Non-Monetary methods of Human Resource Valuation</p> <p>3.6 Human Resource Audit</p> <p>3.7 Meaning, definition and objectives of Human Resource</p>	<ul style="list-style-type: none"> • To make students aware of the meaning, need and objectives of HR Accounting. • To list the advantages and identify the disadvantages of HR Accounting. • To study the methods of Human Resource Valuation. • To define Human Resource Audit and outline its scope.

	Audit, 3.8 Areas and levels of Human Resource Audit	
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Teaching Methodology

Teaching Hours Theory + Project Practical –as applicable	Innovative methods to be used	Expected Outcome
Unit 1- 12 hours	<ul style="list-style-type: none"> • Traditional classroom lectures • Preliminary presentation from students. • Role-plays • Assignment. • Caselets solution 	<ul style="list-style-type: none"> • Great gains in content knowledge, skill acquisition, and overall confidence and comfort for understanding the basic concept of Employee Engagement. • Students active participation in an understanding strategy of Employee Engagement.
Unit 2- 12 hours	<ul style="list-style-type: none"> • Traditional classroom lectures • Role-plays • Group Discussion • Computer lab practice • Personnel Research Questionnaire preparation, data collection and analysis activity 	<ul style="list-style-type: none"> • The shift towards student-centeredness significantly enhanced students' learning through computer lab to understand the use of computer in HRIS. • Interactive small group activities and a high level of discussion and interaction. • Exposure of hidden skills and talent of students.
Unit 3- 12 hours	<ul style="list-style-type: none"> • Traditional classroom lectures • Guest Lecture from HR manager on HR Accounting and HR Audit. • Computer lab practice • Caselets solution 	<ul style="list-style-type: none"> • Practical Knowledge Acquisition about HR Accounting and HR Audit. • A better understanding of different methods of HR valuation through computer lab practice and Expert's Guest Lecture.

Project	<ul style="list-style-type: none"> Project-based on internship – referee separate guidelines 	1 Learning By doing
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Evaluation

Unit Number	Internal Evaluation		External Evaluation
	Evaluation of students based on	Marks	
Project Report	Project Report preparation, submission and VIVA.	50	25% MCQ 35% short notes 40% long answers
Total –		50	50

Suggested references

Sr. No.	Title of the Book	Author/s	Publication
1	Employee Engagement for Dummies	Bob Kelleher	Wiley Publications
2	Engage! Co-creating Organizational Vitality and Individual Fulfillment	Sunil Maheshwari	Sage Publications India
3	Employee Engagement: A Recipe to Boost Organisational Performance	Vipul Saxena	Notion Press
4	Human Resource Management	L. M. Prasad	Sultan Chand & Company Ltd.
5	Human Resource Management	K. Ashwathappa	Tata McGraw Hill
6	Personnel and Human Resource Management	A. M. Sharma	Himalaya Publication House
7	Human Resource Management (text and Cases)	S. S. Khanna	S. Chand

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Question paper Pattern 2019 for TY BBA
University Examination Sub: Recent Trends & HR Accounting + Project
Course code C 606
Credit 6

Q. No.	Nature of Question Project – SPPU external 50 marks	Total Marks - 50 marks Objectives - Compulsory Question Solve any 3 out of 5 Solve any 4 out of 6
	50 marks – Project Viva	50 SPPU

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TYBBA Semester VI (CBCS)
Pattern2019
Course: Global Tourism and Hospitality Management
CourseCode–DSE D605SM
Credit3+1=4

Depth of the Course –Reasonable working knowledge

Course Objectives:

1. To create awareness related to health care management and services.
2. To enables students to understand the various healthcare services & other developments in the Indian health care service sector.
3. To provide students insight into the Functions & Role of modern healthcare services offered to cater for the current needs.

Unit No.	Unit Title	Contents	Purpose and skills to be developed
1	Introduction to Tourism Industry	1.1 Basic components of tourism, Travel agency- 1.2 History, Operation/Functions and Types. Tour Operators- Functions and Types. 1.3 Accommodation Industry- Types and Classification, Air Transportation Industry, objectives of ITDC, Poshtel tourism.	<ul style="list-style-type: none"> • To understand tourism and its components • Ability to understand operations, functions, tour operator and industry.
2	Growth and Development Modern Tourism	2.1 Global Tourism, 2.2 Factor influencing the growth of tourism, 2.3 New product development, travel Organisation in India and European countries, 2.4 Effect of tourism on employment, economic development,	<ul style="list-style-type: none"> • To understand global tourism, the effect of tourism on economic and regional development.

		regional development, 2.5 World tourism and travel council. Events and tourism.	
3.	Hospitality Management	3.1 Hospitality: Classification & Categorization of Hotels- 3.2 Hotel Ownership. A brief account of Commercial Hotels- Residential Hotels, Resort Hotels, Airport hotels, Bed & Breakfast Hotels, Convention hotels, Casino Hotels, and Motels. 3.3 Emerging trends in Accommodation- Time, share. Condominium- Home Stays, Tree Huts, Houseboats, Capsule hotel. Major Hotel chains in India. Incredible India.	<ul style="list-style-type: none"> • To understand hospitality management, Emerging trends in hospitality management. • Ability to understand changing scenario of hospitality management.
4.	Value Chain:	4.1 Definitions: Hospitality and Hotel. The link between Hospitality and Travel and Tourism industry, safety and Hygiene, 4.2 virtual reality tours, 4.3 Travelers at rest, Home away from Home, 4.4 Hospitality culture Atithi Devo Bhavah, 4.5 Expectations of the guest.	<ul style="list-style-type: none"> • To understand the link between hospitality and travel industry, needs and wants of prospects, and hospitality culture.

Teaching Methodology

Teaching Hours Theory + Tutorials /Project	Unit & teaching Hours	Innovative methods to be used	AV Applications	Project	Expected Outcome

Practical					
Unit 1- 12 hours	I-(14)	Presentation on tour operators, tourism industry. Presentation on identifying different needs of travel and tourist operators, their management.	Short films on role of tour operator, air industry, transport industry	Tours and travel, tourism management Agencies working in India.	To understand the management of tours, travels and tourism.
Unit 2- 12 hours	II-(13)	Comparative analysis of tour operators and their management,	Films on different agencies meeting different needs of customers. Scale of operations	Developing a suitable plan of short and long tours.	To understand the importance of the tourism industry for the development of the nation.
Unit 3- 12 hours	III-(11)	Presentation on the different type of Hoteliering	Films on Incredible India	A report on tourism industry, tour operators, tour packages	To understand hospitality management, Emerging trends in hospitality management. to understand changing of hospitality management.
Unit 4 - 12 hours	IV – (10)	Presentation of emerging trends in hospitality management	Films on virtual reality tours. Postel tourism	A report link between travel and hospitality management	To understand the link between hospitality and travel industry, needs and wants of prospects, and hospitality culture.

Evaluation Method

Unit No	Internal evaluation	Internal Evaluation	External Evaluation
	Evaluation of students based on		
Unit-I Unit-II Unit-III Unit-IV	1. Role Play 2. Chart Preparation and Presentation 3. Debate 4. Group Discussion	30	25% MCQ 35% Short notes 40% Long answer
Project/ Practical	1 Project Submission. 2. Presentation.	20	
	Total	30 +20	50

Suggested References

Sr. No	Title of the Book	Author
1	Travel & Tourism	Cottman
2	Tourism development- Principles and practices	A.R. Bhatia.
3	Introduction to Hospitality - I & II	Dennis Foster
4	Encyclopedia of Hotel & Hospitality Management	R.K Arora,
5	Hotel Operation	Chakravarty, Dr. Barun Kumar
6	Tourism and Hoteliering.	Negi J.M.S,
7	Accommodation Operation Management.	S. Kaushal, S.N Gowthan
8	Delivering Quality Service: Balancing Customer Perceptions expectations	Zeithmal, Parsuraman, Berry

**SavitribaiPhule Pune University
Question Paper Pattern**

Course: Global Tourism and Hospitality Management

**Code SM 605
Credits-4**

Q. No.	Compulsory / Choice	Nature of Question	Marks Internal	Total Marks- External
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	10	Objective Type Questions Short & Long Answer Questions
		Match the Pairs		
		Answer in one sentence		
		Fill in the blanks		
2	Solve any 3 out of 5	Short & Long Answer Question	20	
3	Mini project	Mini project	20	
	Total		50	50

SavitribaiPhulePune University
TYBBASemesterVI(CBCS)Pattern2019
Course : Recent Trends In Services + Project
Course Code DSE D 606 SM
Credit :2+4=6

Depth of the Course–Reasonable working knowledge

Course Objectives:

1. To create awareness related to recent trends in services.
2. To enables students to understand the changes taking place in the service sector.
3. To provide students insight into recent developments in the service sector

Unit No.	Unit Title	Contents	Purpose and Skills to be developed
1	Overview of current trends in service industries	Understanding of Current Trends and development in Service Industries: Financial, Hospitality, Health, Telecom, Consultancy, Logistics, Education, Agriculture services, Insurance, ITES (IT-enabled Services), development of innovative tourism, e-Services and retail Services, business development services, impact on Indian economy	• To understand current trends of different types of service industries
2	Technology in Services	Technology in services, the emergence of self-service, infotainment Automation in services, Technological innovations in services: Challenges of adopting new technology in service, Managing the new technology adoption process, multimedia development as service enterprises	• To understand the use of technology in services challenges of adopting new technology in services

3.	Globalization of Services	Meaning and importance of globalization of services, Globalization and Indian services, Domestic growth and expansion strategies – focused service, focused network, clustered service and diversified network, Franchising – meaning, nature, benefits and issues, Global service strategies – Multi-country expansion, importing customers, following your customers,	<ul style="list-style-type: none"> To understand differences between global services and Indian services, growth of services, global service strategies
4.	Case Study -	Case study analysis based on - Financial, Hospitality, Health, Telecom, Consultancy, Logistics, Education, NGO, Public Utilities, ITES (IT-enabled Services), Travel & Tourism, e-Services and Professional Services., rural service enterprises	<ul style="list-style-type: none"> Designing and delivering services

Teaching Methodology

Unit & teaching Hours	Innovative methods to be used	AV Applications	Project	Expected Outcome
I-(14)	Presentation on current trends in various service segments	Short films on service industries	Current trends in service industries	To understand the service needs of society and how industry fulfilling the needs of societies
II-(13)	Poster presentation on technological inventions in the field of service management	Films on different Technological advances in the service sector	Comparative analysis of old and new service requirement	To understand advances in different service segment.

III- (11)	Presentation on the globalization of services, global service strategies	Filmsonglobal service strategy	A report on Current trends in service industries, Comparative analysis of old and new service requirement	To understand the difference between global service and Indian service strategies.
IV – (10)	Presentation and discussion on emerging trends in financial, Hospitality, Health, Telecom, Consultancy, Logistics, Education, NGO, Public Utilities, ITES (IT-enabled Services), Travel & Tourism, e-Services and Professional Services.	FilmsonITES (IT-enabled Services), Travel & Tourism, e-Services and Professional Services.	AreportonIT applications in Health, Telecom, Consultancy, Logistics, Education, NGO, Public Utilities.	To have the right understanding of how the modern service business is changing and what are the new trends in the industry.

Evaluation Method

Unit No	Internal evaluation	External Evaluation	External Evaluation
	Evaluation of students based on		
Unit-I Unit-II Unit-III Unit-Iv Project/ Practical	1 Project Submission. 2. Presentation. Refer internship guidelines	50	25% MCQ 35% Short notes 40% Long answer
	Total	50	50

Suggested References

Sr.No	Title of the Book/Reference	Author	Publication	Place
1	Emerging Trends in Service Sector	Editor-G.U.K.Rao	NI for MSME Enterprises	Hyderabad
2	Service Marketing	P.K.Sinha and S.C. Sahoo	Himalaya Publishing House	New-Delhi
3	Delivering Quality Service: Balancing Customer Perceptions expectations	Zeithmal, Parsuraman, Berry	Simon and Schuster Inc.	New-York

3	Media reports, Press releases, Department of industrial policy and promotions (DIPP) Statistics, Department of Information and Technology			
4	Quality Management in Hospitals	S.K. Joshi	Jaypee Brothers Medical Publishers	New-Delhi
5	Hospital Information Systems	Kelkar S.A.	Cloudtail India	
7	Financial Services and Markets	Dr. S.Gurusamy	Thomson	Delhi

Savitribai Phule Pune University
TY BBA Semester VI (CBCS) Pattern 2019
Course Title: Agricultural Export
Course Code DSE E605 ABM
Credit – 3+1 = 4

Depth of the Course: Basics and Overall Perspective of Agriculture Export

Course Objectives:

1. To introduce the concept of Agriculture Export
2. To develop practical insight in enhancing business Processes of Agriculture Export and international markets.
3. To expose students to a systematic framework of international markets and institutional infrastructure.
4. To enhance agriculture export skills in students

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Introduction	1.1 -Introduction to agriculture 1.2 -forms of agriculture production 1.3 -need for import and export 1.4 -analysis of marketable surplus and marketed surplus 1.5 -analysis of import and export 1.6 -statistics of agricultural products in India	Purpose:- - To learn various forms of agricultural exports. - Better understanding of agricultural products of India. Skills to be developed:- - Developing Conceptual and Analytical ability related to agricultural exports - Innovation & creativity.

2	Introduction to world agricultural trade	<p>2.1 Overview of world agricultural trade</p> <p>2.2 Issues impacting international agricultural trade</p> <p>2.3 Agricultural policy</p> <p>2.4 Technology advancement on agricultural products</p>	<p>Purpose:-</p> <ul style="list-style-type: none"> -To understand global agricultural trade -To understand agricultural policy related to exports -To understand recent trends and technologies in agricultural products <p>Skills to be developed:-Positive approach towards agricultural exports, Identifying opportunities foreign markets by agricultural exports</p>
3	Market Identification	<p>3.1 Identifying foreign markets for agriculture export</p> <p>3.2 marketing plan for exports</p> <p>3.3 export documents and procedure</p> <p>3.4 terms of payment and export finance legal dimensions</p>	<p>Purpose:-</p> <ul style="list-style-type: none"> - To better understand foreign markets. - To gain practical knowledge of marketing in foreign markets. <p>Skills to be developed:- Professional Marketing capabilities about foreign markets.</p>
4	Institutional infrastructure	<p>4.1 Institutional infrastructure for export promotion in India</p> <p>4.2 export assistance</p> <p>4.3 State trading in imports and exports</p> <p>4.4 working of the State trading organisations in India</p>	<p>Purpose:-</p> <ul style="list-style-type: none"> -To get an understanding of Institutional infrastructure for export promotion in India. - To gain knowledge of trading in imports and exports in the agriculture sector. <p>Skills to be developed:- Enhancement of working knowledge Institutions for export promotion in India</p>

Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical	Innovative Methods to be used	Project for 1 credit	Expected outcome
Unit 1- 12 hours	YouTube Videos about agricultural production practices in India for better understanding. Interactive Sessions followed by feedback.	Preparing small reports on field visit experience as assigned by subject faculty	Learning will be more practical based on theory, thereby aid students in better understanding.
Unit 2- 12 hours	Field Visits to various agriculture export-oriented organisations to gain practical knowledge.	Asking students to make a report on any of the agricultural export-oriented organisations guided by the instructor.	Development of interest in agricultural export-oriented organisations and implementation of various concepts in practice.
Unit 3- 12 hours	Use of PPT and preparation of PPT based on fieldwork for agricultural export-oriented Industry.	Assigning students with tasks to identify the right international markets for given agricultural products.	Ability to find a relevant market for given agricultural products.

Unit 4 - 12 hours	Arranging Sessions of experts from government organisations/institutions supporting the export of agricultural products.	Maintaining a record of every session by the students for evaluation by the teachers	Awareness of various government institutions supporting the export of agricultural products.
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Subject: Agriculture Export (605)	Internal Evaluation	External Evaluation	Suggested Add on course
Unit – I	Methodologies like assignment, presentation, GD etc. as decided by college authorities(30 marks)	50 marks Paper	EXIM A-Z: A wholesome Approach to Exports, Imports Business
Unit – II	Class tests, PPT		Flower Exports Management
Unit – III	Case studies and Notes preparation		Cold chain logistics in Export business
Unit – IV	Field visit report for 20 marks		Program in Export-Import Management by Exim
Total	30+20=50 marks	50 marks	

Evaluation: -Internal (30+20=50)/ External – 50 Marks

Suggested References:-

Sr.No	Title Of the Book	Author/s	Publication	Place
1.	Agricultural Geography	S. S. Dhillon	Tata McGraw-Hill	Delhi
2.	Export Potential of Indian Agriculture	Jagdish Prasad	Mittal Publications	Delhi
3.	Agriculture Marketing	Sawalia Bihari Verma	Scientific Publisher	Delhi

4.	Export Promotion in India: The Institutional Infrastructure	S. Bhashyam	Commonwealth Publishers	Delhi
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Question paper Pattern 2019 for TY BBA
University Examination Sub: Agricultural Export
Course Code DSE E 605

Q.No.	Compulsory / Choice	Nature of Question	Marks	Total Marks
1	Compulsory Question	Objective Type Questions Multiple Choice Questions	5	10 Marks
		Match the Pairs	5	
2	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
3	Solve any 1 out of 2	Long Answer Question	1*10 Marks	10 Marks
4	Solve any 4 out of 6	Short Notes	4*5 Marks	20 Marks
	Total			50 Marks

Savitribai Phule Pune University
TY BBA Semester VI (CBCS) Pattern 2019
Course Title: Tourism Development in Rural India + Project
Course Code DSE E606
Credit – 2+4=6

Depth of the Course: Understanding Core Aspects of Tourism Development in Rural India.

Course Objectives:

1. To Understand the concept of Rural Tourism
- 2 To understand the significance and need of Rural Tourism in India
- 3 To know Tourism Resource in rural areas
- 4 To Understand the role of rural tourism in the Indian Economy & Rural Development
- 5 To highlight Sustainable Tourism- Its role in rural areas.

Unit No.	Unit Title	Contents	Purpose & Skills to be developed
1	Introduction to the concept of Rural Tourism	1.1 Definitions, Need, Scope and characteristics of Rural Tourism 1.2 Types and forms of Rural Tourism Rural Territory- It's Potential as a Tourism Product 1.3 The village as a primary tourism product- Showcasing rural life, art, culture and heritage 1.4 Rural Tourism- Indian context	Purpose :- -Learning & understanding the concept of Rural Tourism -Understanding and acquiring knowledge of village as a primary tourism product Skills to be developed:- -Widening scope concerning Rural Tourism in India - Management Skills such as facing challenges, Risk etc.
2	Role of Tourism in	2.1 Importance and Benefits of Rural	Purpose:-

	Economic and Rural Development	<p>Tourism</p> <p>2.2 Costs associated with Rural Tourism Impact of Rural Tourism on the rural community</p> <p>2.3 Rural tourism – Rural and Economic Development of India</p> <p>2.4 Challenges and issues of Rural Tourism in India.</p>	<p>- Understanding the significance of Rural Tourism. -Understanding the challenges faced by Rural Tourism in India. - Availing opportunities available in Rural Tourism in India.</p> <p>Skills to be developed:- -Adaptability to New /Recent trends and Flexibility.</p>
3	Rural Tourism Business Plan	<p>3.1 Feasibility and Execution, Infrastructure,</p> <p>3.2 Marketing and Financial Assistance requisites</p> <p>3.3 The intervention of Professional Agencies - Linkages for development of Rural Tourism in India.</p>	<p>Purpose:- -To gain practical knowledge about framing business plan w.r.t. Rural Tourism. - To gain practical know-how.</p> <p>Skills to be developed:- - Development of Practicality.</p>
4	Recent Trends in Rural Tourism in India	<p>4.1 Sustainable Tourism, Agro Tourism,</p> <p>4.2 Inspirational Tourism</p> <p>4.3 Technology and Innovation-Changing concept of rural tourism</p> <p>4.4 Recent tourism initiatives are taken by Government in India</p> <p>4.5 Tourism projects in India</p> <p>Case Study on rural tourism in India</p>	<p>Purpose:- - Highlighting recent trends in Rural Tourism. - Learning various challenges and problems of rural tourism through the case study.</p> <p>Skills to be developed:- -Analytical ability through Case study analysis.</p>

Teaching Methodology

Teaching Hours Theory + Tutorials /Project Practical	Innovative Methods to be used	Internship Project Report for 4credit(50 Marks)	Expected outcome
Unit 1- 12 hours	Interactive Sessions followed by feedback, E-content reference, Group Discussion for idea generation and sharing	Gathering information on Rural Tourism in Indian, Initiatives taken by Indian Government and Projects of Rural Tourism in India.	Learning will be more practical based, thereby helping students in better understanding of core aspects.
Unit 2- 12 hours	Visits to Tours and Travel agency to gain practical knowledge of Rural tours organised by them and several aspects concerning it and getting consumer feedback.	Preparing report based on a visit in consultation with a subject expert and covering core aspects of Rural tours.	Development of interest in Rural Tourism and highlighting its essential aspects concerning practical implementation.
Unit 3- 12 hours	Use of PPT Use of Microsoft Word and Excel for project preparation	Students are required to prepare a consolidated report including govt. Initiatives and Rural Tourism Projects and appear for viva-voce.	Ability to collect relevant data and its analysis and interpretation.
Unit 4 - 12 hours	Arranging Sessions of experts from the Tourism Industry (Guest lecture series) for availing experience-based knowledge. Case Study on Rural Tourism	Maintaining a record of all the students for evaluation.	Awareness of actual scenario w.r.t. Rural Tourism and its management.

Evaluation :- Internal 50/ External 50

Subject: Service Management (606)	Internal Evaluation Credit 4	External Evaluation Credit 2
Unit – I	Project Report and Viva-Voce (50 marks)	50 marks Paper (Based on Theory)
Unit – II	-Internship based project report.	25% MCQ 35% Short notes 40% Long answer
Unit – III		
Unit – IV		
Total =6	50 Marks	50 Marks

Suggested References:-

Sr.No.	Title Of the Book	Author/s	Publication	Place
1.	Marketing Rural Tourism: Experience and Enterprise	Gunjan Saxena	Edward Elgar Publishing Ltd	India
2.	Tourism in India	Bhatia.T. K.	CABI	Amazon
3.	Rural Tourism And Enterprise 2017	P Robinson, A Oriade	CABI	Amazon
4.	Rural Tourism and Sustainable Business	Derek R Hall , Irene Kirkpatrick, and Morag Mitchell	Channel View Publications	Amazon

Note.

Faculty members are requested to refer to project and internship manual for better execution of the course .Teaching methodology may be modified as per the requirements of students and available resources.

BBA(CA) CBCS 2019 **Pattern**

TYBBA (CA) Sem V **Syllabus**

Savitribai Phule Pune University
T.Y.B.B.A (C.A.) Semester –V
Course Code: CA-501
Subject Name: Cyber Security

Total Hours : 48 lectures

Total Credits: 03

Prerequisites: -

- A course on Computer Networks.

Course Objectives:

- To understand the fundamentals of cyber security.
- To understand various categories of Cybercrime, Cyber-attacks on mobile, tools and techniques used in Cybercrime and case studies.
- To have an overview of the Cyber laws and concepts of Cyber forensics.

Course Outcome:-

- Have a good understanding of Cyber Security and the Tools.
- Identify the different types of Cyber Crimes.
- Have a good understanding of Cyber laws
- To develop Cyber forensics awareness.
- Identify attacks, security policies and credit card frauds in mobile and Wireless Computing Era.

Unit	Topic	No of lectures
1	<p>Chapter 1:- Introduction to Cyber Crime and Cyber Security</p> <p>1.1 Introduction 1.2 Cybercrime: Definition and Origin of the Word 1.3 Cybercrime and Information Security 1.4 Who are Cybercriminals? 1.5 Classifications of Cybercrimes: E-Mail Spoofing, Spamming, Cyber defamation, Internet Time Theft, Salami Attack/Salami Technique, Data Diddling, Forgery, Web Jacking, Newsgroup, Spam/Crimes Emanating from Usenet Newsgroup, Industrial Spying/Industrial Espionage, Hacking, OnlineFrauds, Computer Sabotage, Email Bombing/Mail Bombs, Computer Network Intrusions, Password Sniffing, Credit Card Frauds, Identity Theft 1.6 Definition of Cyber Security 1.7 Vulnerability, Threats and Harmful acts 1.8 CIA Triad 1.9 Cyber Security Policy and Domains of Cyber Security Policy</p>	07
2	<p>Chapter 2 :- Cyber offenses and Cyberstalking</p> <p>2.1 Criminals Plan: Categories of Cybercrime Cyber Attacks: Reconnaissance, Passive Attack, Active Attacks, Scanning/Scrutinizing gathered Information, Attack (Gaining and Maintaining the System Access), Social Engineering, and Classification of Social Engineering. 2.2 Cyberstalking: Types of Stalkers, Cases Reported on Cyberstalking, Working of Stalking 2.3 Real-Life Incident of Cyber stalking 2.4 Cybercafe and Cybercrimes</p>	10

	<p>2.5 Botnets: The Fuel for Cybercrime, Botnet, Attack Vector</p> <p>2.6 Cybercrime: Mobile and Wireless Devices – Proliferation - Trends in Mobility</p> <p>2.7 Credit Card Frauds in Mobile and Wireless Computing Era</p> <p>2.8 Security Challenges Posed by Mobile Devices</p> <p>2.9 Authentication Service Security</p> <p>2.10 Attacks on Mobile/Cell Phones</p>	
3	<p>Chapter 3:- Tools and Methods Used in Cybercrime</p> <p>3.1 Introduction</p> <p>3.2 Proxy Servers and Anonymizers</p> <p>3.3 Phishing</p> <p>3.4 Password Cracking</p> <p>3.5 Keyloggers and Spywares</p> <p>3.6 Virus and Worms</p> <p>3.7 Trojan Horses and Backdoors</p> <p>3.8 Steganography</p> <p>3.9 DoS and DDoS Attacks</p> <p>3.10 SQL Injection</p>	05
4	<p>Chapter 4 :- Cybercrimes and Cyber security: The Legal Perspectives</p> <p>4.1 Introduction</p> <p>4.2 Cybercrime and the Legal Landscape around the World</p> <p>4.3 Why Do We Need Cyberlaws: The Indian Context</p> <p>4.4 The Indian IT Act</p> <p>4.5 Challenges to Indian Law and Cybercrime Scenario in India</p> <p>4.6 Consequences of not Addressing the Weakness in Information Technology Act</p> <p>4.7 Digital Signatures and the Indian IT Act</p> <p>4.8 Amendments to the Indian IT Act</p> <p>4.9 Cybercrime and Punishment</p> <p>4.10 Cyberlaw, Technology and Students: Indian Scenario</p>	07
5	<p>Chapter 5:- Cyber Forensics</p> <p>5.1 Introduction</p> <p>5.2 Historical background of Cyber forensics</p> <p>5.3 Digital Forensics Science</p> <p>5.4 The Need for Computer Forensics</p> <p>5.5 Cyber Forensics and Digital evidence</p> <p>5.6 Forensics Analysis of Email</p> <p>5.7 Digital Forensics Lifecycle</p> <p>5.8 Challenges in Computer Forensics</p>	06
6	<p>Chapter 6:- Cybersecurity: Organizational Implications</p> <p>6.1 Organizational Implications: Cost of cybercrimes and IPR issues</p> <p>6.2 Web threats for organizations</p> <p>6.3 Security and Privacy Implications from Cloud Computing</p> <p>6.4 Social media marketing</p> <p>6.5 Social computing and the associated challenges for organizations, Protecting people’s privacy in the organization</p> <p>6.6 Organizational guidelines for Internet usage and safe computing guidelines and computer usage policy</p> <p>6.7 Incident handling</p>	07

	6.8 Intellectual property in the cyberspace of cyber security.	
7	Chapter 7:- Cybercrime: Illustrations, Examples and Mini-Cases 7.1 Real-Life Examples 7.2 Mini-Cases 7.3 Illustrations of Financial Frauds in Cyber Domain 7.4 Digital Signature-Related Crime Scenarios 7.5 Digital Forensics Case Illustrations 7.6 Online Scams	06

References Books:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives – Nina Godbole, Sunit Belapure, Wiley: April 2011 India Publications Released.
2. Principles of Information Security, -Michael E Whitman, Herbert J Mattord, 3rd Edition, 2011.
3. Computer Security: Principles and Practice -William Stallings and Lawrie Brown, 3rd edition, Pearson, 2015.
4. Cyber Security Essentials- James Graham Richard Howard Ryan Olson

Savitribai Phule Pune University
T.Y.B.B.A.(C.A.) Semester –V
Course Code: CA-502
Subject: Object Oriented Software Engineering

Total Hours: 48

Total Credits: 03

Pre Requisite: Students shall have the Basic Knowledge of Software Engineering

OBJECTIVES:

1. To understand the fundamentals of object modeling
2. To understand and differentiate Unified Process from other approaches.
3. To design with static UML diagrams.
4. To design with the UML dynamic and implementation diagrams.
5. To improve the software design with design patterns.
6. To test the software against its requirements specification.

Outcomes:

1. Students will be able to give Design Specifications for Project.
2. Students will acquire Knowledge in Basic Modeling.
3. Students will acquire Project Management Skills.

Chapter	Course Content	No of lectures
1	Introduction and basics of Software Modelling 1.1 Software Life Cycle Models (Revision of SE) 1.2 System Concepts 1.3 Project Organization 1.4 Communication in Project Management 1.5 Risk management in Project Management	4
2	SRS Documentation 2.1 SRS Specification 2.2 Requirement Elicitation 2.3 Business Engineering	4
3	Introduction to UML 3.1 Concept of UML 3.2 Advantages of UML	2
4	Object Oriented Concepts and Principles 4.1 What is Object Orientation? - Introduction , Object , Classes and Instance , Polymorphism, Inheritance 4.2 Object Oriented System Development- Introduction, Function/Data Methods (With Visibility), Object Oriented Analysis, Object Oriented Construction 4.3 Identifying the Elements of an Object Model 4.4 Identifying Classes and Objects 4.5 Specifying the Attributes (With Visibility)	4

	<p>4.6 Defining Operations 4.7 Finalizing the Object Definition</p>	
5	<p>Structural Modeling 5.1 Classes 5.2 Relationship 5.3 Common Mechanism 5.4 Class Diagram (Minimum three examples should be covered) 5.5 Advanced Classes 5.6 Advanced Relationship 5.7 Interface 5.8 Types and Roles 5.9 Packages 5.10 Object Diagram (Minimum three examples should be covered)</p>	10
6	<p>Basic Behavioural Modeling 6.1 Interactions 6.2 Use Cases and Use Case Diagram with stereo types (Minimum three examples should be covered) 6.3 Interaction Diagram (Minimum two examples should be covered) 6.4 Sequence Diagram (Minimum two examples should be covered) 6.5 Activity Diagram (Minimum two examples should be covered) 6.6 State Chart Diagram (Minimum two examples should be covered)</p>	10
7	<p>Architectural Modelling 7.1 Component 7.2 Components Diagram (Minimum two examples should be covered) 7.3 Deployment Diagram (Minimum two examples should be covered) 7.4 Collaboration Diagram (Minimum two examples should be covered)</p>	6
8	<p>Object Oriented Analysis 8.1 Iterative Development and the Rational Unified Process 8.2 Inception 8.3 Understanding Requirements 8.4 Use Case Model From Inception to Elaboration 8.5 Elaboration</p>	4
9	<p>Object Oriented Design 9.1 The Booch Method, The Coad and Yourdon Method and Jacobson Method and Raumbaugh Method 9.2 The Generic Components of the OO Design Model</p>	4

	9.3 The System Design Process - Partitioning the Analysis Model, Concurrency and Sub System Allocation, Task Management Component, The Data Management Component, The Resource Management Component, Inter Sub System Communication	
	Total	48

Reference Books:

Sr. No.	Title of the Book	Author's Name	Publication
1	The Unified Modeling Language User/Reference Guide,	Grady Booch, James Rumbaugh	Pearson Education Inc
2	The Unified software development Process	Ivar Jacobson, Grady Booch, James Rumbaugh	Pearson Education
3	Agile Software development	Alistair Cockbair	Pearson Education

Savitribai Phule Pune University
T.Y.B.B.A.(C.A.) Semester –V
Course Code: CA-503
Subject: Core Java

Total Hours : 48

Total Credits: 03

Prerequisite:

- Student should know basics of object oriented programming.

Course Objectives:

- To introduce the object oriented programming concepts.
- To understand object oriented programming concepts, and apply them in solving problems.
- To introduce the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes
- To introduce the implementation of packages and interfaces
- To introduce the concepts of exception handling and multithreading.
- To introduce the design of Graphical User Interface using applets and swing controls.

Course Outcomes:

- Able to solve real world problems using OOP techniques.
- Able to understand the use of abstract classes.
- Able to solve problems using java collection framework and I/o classes.
- Able to develop multithreaded applications with synchronization.
- Able to develop applets for web applications.
- Able to design GUI based applications

Unit No.	Topic	No. of Lectures	Reference Books
1	Java Fundamentals 1.1 Introduction to Java. 1.1 Features of Java 1.2 Basics of Java: - Data types, variable, expression, operators, constant. 1.3 Structure of Java Program. 1.4 Execution Process of java Program. 1.5 JDK Tools. 1.6 Command Line Arguments. 1.7 Array and String: 1.7.1 Single Array & Multidimensional Array 1.7.2 String, String Buffer 1.8 Built In Packages and Classes : 1.8.1 java.util:- Scanner, Date, Math etc. 1.8.2 java.lang	8	1,2
2	Classes, Objects and Methods 2.1 Class and Object 2.2 Object reference 2.3 Constructor: Constructor Overloading 2.4 Method: Method Overloading, Recursion, Passing and Returning object form Method 2.5 new operator, this and static keyword, finalize() method 2.6 Nested class, Inner class, and Anonymous inner class	8	1,2

3	<p>Inheritance, Package and Collection</p> <p>3.1 Overview of Inheritance</p> <p>3.2 inheritance in constructor</p> <p>3.3 Inheriting Data members and Methods,</p> <p>3.4 Multilevel Inheritance – method overriding Handle multilevel constructors</p> <p>3.5 Use of super and final keyword</p> <p>3.6 Interface:</p> <p>3.7 Creation and Implementation of an interface, Interface reference</p> <p>3.8 Interface inheritance</p> <p>3.9 Dynamic method dispatch</p> <p>3.10 Abstract class</p> <p>3.11 Comparison between Abstract Class and interface</p> <p>3.12 Access control</p> <p>3.13 Packages</p> <p>3.13.1 Packages Concept</p> <p>3.13.2 Creating user defined packages</p> <p>3.13.3 Java Built inpackages</p> <p>3.13.4 Import statement, Static import</p> <p>3.14 Collection</p> <p>3.14.1 CollectionFramework.</p> <p>3.14.2 Interfaces: Collection, List, Set</p> <p>3.14.3 Navigation: Enumeration, Iterator, ListIterator</p> <p>3.14.4 Classes: LinkedList, ArrayList, Vector, HashSet</p>	10	
4	<p>File and Exception Handling</p> <p>Exception</p> <p>4.1 Exception and Error</p> <p>4.2 Use of try, catch, throw, throws and finally</p> <p>4.3 Built in Exception</p> <p>4.4 Custom exception</p> <p>4.5 Throwable Class.</p> <p>File Handling</p> <p>4.6 Overview of Different Stream (Byte Stream, Character stream)</p> <p>4.7 Readers and Writers class</p> <p>4.8 File Class</p> <p>4.9 File Input Stream , File Output Stream</p> <p>4.10 Input Stream Reader and Output Stream Writer class</p> <p>4.11 FileReader and FileWriter class</p> <p>4.12 Buffered Reader class.</p>	8	1,2,3
5	<p>Applet, AWT, Event and Swing Programming</p> <p>Applet</p> <p>5.1 Introduction</p> <p>5.2 Typesapplet</p> <p>5.3 Applet Lifecycle</p> <p>5.3.1 Creatingapplet</p> <p>5.3.2 Applet tag</p>	14	1,2,3,4

	<p>5.4 AppletClasses</p> <p>5.4.1 Color</p> <p>5.4.2 Graphics</p> <p>5.4.3 Font</p> <p>AWT</p> <p>5.5 Components and container used inAWT</p> <p>5.6 Layoutmanagers</p> <p>5.7 Listeners and Adapterclasses</p> <p>5.8 Event Delegationmodel</p> <p>Swing</p> <p>5.9 Introduction to Swing Componentand Container Classes</p> <p>5.10Exploring Swing Controls- JLabel and Image Icon, JText Field, The Swing Buttons JButton, JToggle Button, JCheck Box, JRadio Button, JTabbed Pane, JScroll Pane, JList, JTable, JComboBox, Swing Menus, Dialogs,JFileOpen,JColorChooser.</p>		
	Total Lectures	48	

Reference Books:

1. Programming with JAVA - EBalgurusamy
2. The Complete Reference – JAVA HerbertSchildt
3. Programming in Java, S. Malhotra, S. Chudhary, 2nd edition, Oxford Univ. Press.
4. Java Programming and Object-oriented Application Development, R. A. Johnson, Ceng

T.Y.B.B.A.(C.A.) Semester –V
Course Code: CA-504
Subject: MongoDB

Total Hours: 48

Total Credits:03

Prerequisites:

- Knowledge of database concepts
- Basic understanding of Big Data platforms

Objectives:

1. Understand importance of NoSQL Databases.
2. Learn various MongoDB commands and MongoDB design goals.
3. Design basic and general-purpose database using MongoDB.

Outcomes:

- Learned to work with MongoDB shell and MongoDB tools.
- Able to do Schema design, Data modelling and all sorts of CRUD Operations.
- Learned to optimize query performance.
- Become capable to analyze the data stored in MongoDB.

Unit	Topic	No. of lectures
1	Introduction to NoSQL Databases 1.1 Introduction to NoSQL Databases 1.2 Difference between NoSQL and RDBMS 1.3 Need of NoSQL Databases 1.4 Application of NoSQL Databases 1.5 Types of NoSQL Databases 1.6 What is MongoDB? 1.7 Features of MongoDB	5
2	MongoDB Basics 2.1 Installing MongoDB 2.2 MongoDB Server and Database, MongoDB tools 2.3 Collection, Documents and Key-Values 2.4 Data Modeling Concepts 2.4.1 Why Data Modeling? Data Modeling Approach 2.4.2 Analogy between RDBMS & MongoDB Data Model, MongoDB Data 2.4.3 Model (Embedding & Linking) 2.4.4 Challenges for Data Modeling in MongoDB 2.4.5 Data Model Examples and Patterns 2.5 Mongo shell Commands to create, delete database, collection & documents 2.6 MongoDB Datatypes 2.7 Inserting and saving documents 2.7.1 Batch Insert 2.7.2 Insert Validation 2.8 MongoDB GUI like compass	12
3	MongoDB CRUD Operations	14

	3.1 MongoDB Development Architecture 3.2 MongoDB Production Architecture 3.3 MongoDB CRUD Introduction, MongoDB CRUD Concepts 3.4 MongoDB CRUD Concerns (Read & Write Operations) 3.5 Concern Levels, Journaling 3.6 Cursor Query Optimizations, Query behaviour in MongoDB 3.7 Distributed Read & Write Queries 3.8 MongoDB CRUD Syntax & Queries	
4	MongoDB Index and Aggregation 4.1 Index Introduction, Index Concepts, Index Types, Index Properties 4.2 Index Creation and Indexing Reference 4.3 Introduction to Aggregation 4.4 Approach to Aggregation 4.5 Types of Aggregation (Pipeline, MapReduce & Single Purpose) 4.6 Performance Tuning.	8
5	MongoDB Administration 5.1 Administration concepts in MongoDB 5.2 Monitoring issues related to Database 5.3 Monitoring at Server, Database, Collection level, and various Monitoring tools related to MongoDB 5.4 Database Profiling, Locks, Memory Usage, No of connections, page fault 5.5 Backup and Recovery Methods for MongoDB 5.6 Export and Import of Data to and from MongoDB 5.7 Run time configuration of MongoDB 5.8 Production notes/ best practices 5.9 Data Managements in MongoDB (Capped Collections/ Expired data from TTL), Hands on Administrative Tasks.	9
Total		48

Reference books:

1. MongoDB Basics by Peter Membrey, David Hows, Eelco Plugge
2. MongoDB Recipes With Data Modeling and Query Building Strategies by Subhashini Chellappan, Dharanitharan Ganesan
3. MongoDB Simply In Depth by Ajit Singh, Sultan Ahmad

Savitribai Phule Pune University
T.Y.B.B.A.(C.A.) Sem-V

Subject Code: 504

Subject: Python

Total Hours :- 48

Total Credits: 03

Prerequisites:

1. Experience with a high level language (C/C++, Java, MATLAB) is suggested.
2. Prior knowledge of a scripting language (Perl, UNIX/Linux shells) and Object-Oriented concepts is helpful but not mandatory.

Course Objectives:

1. To learn and understand Python programming basics and paradigm.
2. To learn and understand python looping, control statements and string manipulations.
3. Students should be made familiar with the concepts of GUI controls and designing GUI applications.
4. To learn and know the concepts of file handling, exception handling.

Course Outcomes: On completion of the course, student will be able

1. Define and demonstrate the use of built-in data structures “lists” and “dictionary”.
2. Design and implement a program to solve a real world problem.
3. Design and implement GUI application and how to handle exceptions and files.

Unit	Details	Lectures
I	Unit 1: Introduction to Python 1.1 History, feature of Python, setting up path, working with python Interpreter, basic syntax, variable and data types, operators 1.2 Conditional statements -If, If-Else, nested if-else, Examples. 1.3 Looping -For, While, Nested loops, Examples 1.4 Control Statements -Break, Continue, Pass. 1.5 String Manipulation -Accessing String, Basic Operations, String Slices, Function and Methods, Examples. 1.6 Lists -Introduction, accessing list, operations, working with lists, function & methods. 1.7 Tuple -Introduction, Accessing tuples, operations working, function & methods, Examples. 1.8 Dictionaries -Introduction, Accessing values in dictionaries, working with dictionaries, properties, function, Examples. 1.9 Functions -Defining a function, calling a function, types of function, function arguments, anonymous function, global & local variable, Examples.	16
II	Unit 2: Modules and Packages 2.1 Built in Modules 2.1.1 Importing modules in python program 2.1.2 Working with Random Modules. 2.1.3 E.g. - built-ins, time, date time, calendar, sys, etc 2.2 User Defined functions 2.2.1 Structure of Python Modules 2.3 Packages 2.3.1 Predefined Packages 2.3.2 User defined Packages	6
III	Unit 3: Classes ,Objects and Inheritance 3.1 Classes and Objects 3.1.1 Classes as User Defined Data Type 3.1.2 Objects as Instances of Classes 3.1.3 Creating Class and Objects 3.1.4 Creating Objects By Passing Values 3.1.5 Variables & Methods in a Class 3.2 Inheritance 3.2.1 Single Inheritance 3.2.2 Multilevel Inheritance	8

	3.2.3 Multiple Inheritance 3.2.4 Hybrid Inheritance 3.2.5 Hierarchical Inheritance 3.2.6 IS-A Relationship and HAS-A Relationship	
IV	Unit 4: Exception Handling 4.1 Python Exception 4.2 Common Exception 4.3 Exception handling in Python (try-except-else) 4.4 The except statement with no exception 4.5 Multiple Exception 4.6 The try-finally clause 4.7 Custom Exception and assert statement	4
V	Unit 5: GUI Programming 5.1 Introduction 5.2 Tkinter programming 5.4 Tkinter widgets 5.5 Frame 5.6 Button 5.7 Label 5.8 Entry	10
VI	Unit 6: Python Libraries 6.1 Statistical Analysis- NumPy, SciPy, Pandas, StatsModels 6.2 Data Visualization- Matplotlib, Seaborn, Plotly 6.3 Data Modelling and Machine Learning- Scikit-learn, XGBoost, Eli5 6.4 Deep Learning- TensorFlow, Pytorch, Keras 6.5 Natural Language Processing (NLP)- NLTK, SpaCy, Gensim	4

Reference Books:

1. Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010
2. Dive into Python, Mike
3. Learning Python, 4th Edition by Mark Lutz
4. Programming Python, 4th Edition by Mark Lutz
5. Python Programming: An introduction to computer, John Zelle, 3rd Edition.

Savitribai Phule Pune University
T.Y.B.B.A.(C.A.) Sem-V
Subject Code: 505

Subject: (DSE) Project

Total Credits: 04

For the evaluation/ conduction of project separate guidelines will be provided.

T.Y.B.B.A.(C.A.) Sem-V

Subject Code: 506

Subject: Computer Laboratory Based on 503 and 504(2 credits each)

Total Credits: 04

For the conduction of practicals, practical assignments are given in the lab book.

Savitribai Phule Pune University

T.Y.B.B.A.(C.A.)Sem-V (CBCS 2019 Pattern)

Subject Code: CA-507

Subject: Internet of Things (IoT)

Total Hours: 30

Total Credits: 02

Prerequisite:

Basic knowledge of Internet, Networking, and Electronics.

Course Objectives:

1. To understand Technical aspects of Internet of things.
2. To describe smart objects and IoT Architecture.
3. To study and compare different Application protocols of IoT.
4. To understand IoT platform using Arduino Uno.

Course Outcomes: Students will be able

1. To explain key technologies, smart objects, IoT Architecture and security in Internet of Things.
2. To illustrate the role of IoT protocols for efficient network communication.
3. To understand IoT platform such as Arduino Uno.

Unit No.	Contents Theory	No. of Lectures
1	Fundamentals of IoT 1.1 Basic Concepts of IoT 1.2 Major components of IoT devices 1.3 IOT Architecture 1.4 Pros & Cons of IOT	03
2	Communication Technologies 2.1 Wireless Communication: Bluetooth, ZigBee, WiFi, RF Links 2.2 Wired Communication: Ethernet 2.3 IOT Protocol: MQTT, CoAP, XMPP, OSGi	05
3	Microcontroller Fundamental and Arduino uno 3.1 System on Chip & Microcontroller 3.2 Arduino UNO: Introduction to Arduino, Arduino UNO, Arduino Board, The Anatomy of an Arduino Board 3.3 The Development Environment of Arduino Board 3.4 Writing Arduino Software, The Arduino Sketch 3.5 Fundamentals of Arduino Programming 3.6 Trying the code on an Arduino Emulator 3.7 Arduino Libraries 25 Programming & Interfacing 3.8 Application of IoT 3.9 Case studies: Home Automation, Smart Parking, etc.	07
Total		15
Practical Please Refer Lab Book		15

Reference Books:

1. Learning internet of things by Waher, Peter -Packt Publishing Ltd, 2015
2. "Fundamentals of Wireless Sensor Networks: Theory and Practice" by WalteneusDargie,

Christian Poellabauer

3. Internet of Things (A Hands-on-Approach) by Vijay Madiseti , ArshdeepBahga
4. Designing the Internet of Things by Adrian McEwen, Hakim Cassimally
5. Internet of Things with Arduino Cookbook by Schwartz, M. - Packt Publishing Ltd.
6. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, 1stEdition, Pearson Education (Cisco Press Indian Reprint)
7. "Internet of Things" by Srinivasa K G, CENGAGE Learning India, 2017
8. Computer Networks by Tanenbaum, Andrew S - Pearson Education Pte. Ltd., Delhi, 4th Edition
9. Data and Computer Communications; By: Stallings, William - Pearson Education Pte. Ltd., Delhi, 6th Edition

TYBBA (CA) Sem VI

Syllabus

Savitribai Phule Pune University
T.Y.B.B.A.(C.A.) Sem-VI (CBCS 2019 Pattern)

Subject Code: CA-601

Subject: Recent Trends in IT

Total Hours: 48

Total Credits: 3+1=4

Prerequisites:

1. Basic knowledge of related programming and database concepts.

2. Fundamentals of Mathematical logic & Data structures.

Course Objectives

1. To introduce upcoming trends in Information technology.
2. To study Eco friendly software development concepts.
3. To provide a strong foundation of fundamental concepts in Artificial Intelligence.
4. To evaluate the performance of various data mining task.
5. To understand Data analytics using Spark Programming.

Course Outcomes: On completion of the course, student will be able

1. To discuss the basic concepts AI.
2. To apply basic, intermediate and advanced techniques to mine the data.
3. To provide an overview of the concept of Spark programming.

Unit No.	Contents	No. of Lectures
1	Introduction to recent trends 1.1 Artificial Intelligence 1.2 Data Warehouse 1.3 Data Mining 1.4 Spark	02
2	Artificial Intelligence 2.1 Introduction & Concept of AI 2.2 Applications of AI 2.3 Artificial Intelligence, Intelligent Systems, Knowledge –based Systems, AI Techniques 2.4 Early work in AI & related fields. 2.5 Defining AI problems as a State Space Search 2.6 Search and Control Strategies 2.7 Problem Characteristics 2.8 AI Problem: Water Jug Problem, Tower of Hanoi, Missionaries & Cannibal Problem	08
3	AI Search Techniques 3.1 Blind Search Techniques: BFS, DFS, DLS, Iterative deepening Search, Bidirectional Search, and Uniform cost Search 3.2 Heuristic search techniques: Generate and test, Hill Climbing, Best First search, Constraint Satisfaction, Mean-End Analysis, A*, AO*	08
4	Data Warehousing 4.1 Introduction to Data warehouse 4.2 Structure of Data Warehouse 4.3 Advantages & uses of Data Warehouse 4.4 Architecture of Data Warehouse 4.5 Multidimensional data model	08

	4.6 OLAP Vs. OLTP 4.7 OLAP Operations 4.8 Types of OLAP Servers: ROLAP versus MOLAP versus HOLAP	
5	Data Mining 5.1 Introduction to Data Mining 5.2 Data mining Task 5.3 Data mining issues 5.4 Data Mining versus Knowledge Discovery in Databases 5.5 Data Mining Verification vs. Discovery 5.6 Data Pre-processing – Need, Data Cleaning, Data Integration & Transformation, Data Reduction 5.7 Accuracy Measures: Precision, recall, F-measure, confusion matrix, cross-validation, bootstrap 5.8 Data Mining Techniques 5.9 Frequent item-sets and Association rule mining: Apriori algorithm, FP tree algorithm 5.10 Graph Mining: Frequent sub-graph mining 5.11 Software for data mining : R, Weka, Sample applications of data mining 5.12 Introduction to Text Mining, Web Mining, Spatial Mining, Temporal Mining	12
6	Spark 6.1 Introduction to Apache Spark 6.2 Spark Installation 6.3 Apache Spark Architecture 6.4 Components of Spark 6.5 Spark RDDs 6.6 RDD Operations: Transformation & Actions 6.7 Spark SQL and Data Frames 6.8 Introduction to Kafka for Spark Streaming	10
Total		48

Reference Books:

1. Artificial Intelligence by Elaine Rich, Kevin Knight - Tata McGraw Hill, 2nd Edition
2. Artificial Intelligence: A new Synthesis, Nilsson, Elsevier, ISBN 9788181471901
3. Data Mining Concepts and Techniques, by Jiawei Micheline Kamber, Morgan Kaufmann Publishers.
4. Advanced Analytics with Spark by Sandy Ryza Publicatio O'REILLY
5. Apache Spark for Data Science Cookbook by Padma Priya Chitturi

Savitribai Phule Pune University

T.Y.B.B.A.(C.A.) Sem-VI (CBCS 2019 Pattern)

Subject Code: CA-602

Subject: Software Testing

Total Hours: 48

Total Credits: 3

Prerequisite:

1. Students shall have basic Knowledge of Software Engineering.
2. Students shall have basic Knowledge of OOSE.

Objectives:

1. To provide learner with knowledge in Software Testing techniques.
2. To understand how testing methods can be used as an effective tool in providing quality assurance for software.
3. To provide skills to design test case plan for testing software.

Outcomes:

1. Students will be introduced to testing tools.
2. Students will acquire Knowledge of Basic SQA.
3. Students will be able to design basic Test Cases.

Chapter	Course Content	No of lectures
1	Introduction 1.1 Introduction, Nature of errors, 1.2 Testing Objectives 1.3 Testing principles 1.4 Testing fundamentals, 1.5 Software reviews, Formal Technical reviews, 1.6 Inspection and walkthrough 1.7 Testing Life Cycle	10
2	Approaches to Testing –Testing Methods 2.1 White Box Testing and types of white box testing 2.2 Test Case Design 2.3 Black Box Testing and types of black box testing 2.4 Gray Box Testing	5
3	Software Testing Strategies &Software metrics 3.1 Software Testing Process 3.2 Unit Testing 3.3 Integration- Top-down ,Bottom up 3.4 System Testing 3.5 Acceptance Testing (alpha, Beta testing) 3.6 Validation and Verification 3.7 Big Bang Approach 3.8 Sandwich approach 3.9 Performance Testing 3.10 Regression Testing 3.11 Smoke Testing 3.13 Load Testing	10
4	Software metrics 4.1 Introduction 4.2 Basic Metrics –size-oriented metric, Function –oriented metric 4.3 Cyclometric Complexity Metrics Examples on Cyclometric Complexity	10
5	Testing for Specialized Environments 5.1 Testing GUI's 5.2 Testing of Client/Server Architectures 5.3 Testing Documentation and Help Facilities 5.4 Testing for Real-Time Systems	5

6	Testing Tools& Software Quality Assurance (Introduction) 6.1 JUnit, Apache JMeter, Win runner 6.2 Load runner, Rational Robot 6.3 Quality Concepts, Quality Movement, Background Issues, SQA activities 6.4 Formal approaches to SQA 6.5 Statistical Quality Assurance 6.6 Software Reliability 6.7 The ISO 9000 Quality Standards 6.8 SQA Plan 6.9 Six sigma 6.10 Informal Reviews	8
Total		48

Reference Books:

Sr. No.	Title of the Book	Author's Name	Publication
1.	Software Engineering – A Practitioner's approach	Roger S Pressman	7th Edition Tata McGraw-Hill
2.	Effective Methods of Software Testing.	William E Perry	Wiley Publishing Inc
3.	Software Testing Principles and Practices	Srinivasan Desikan, Gopalswamy Ramesh	Pearson Publication
4.	Total Quality Management	DaleH. Besterfield,	Prentice Hall, 2003

Savitribai Phule Pune University

T.Y.B.B.A.(C.A.) Sem-VI (CBCS 2019 Pattern)

Subject Code: CA-603

Subject: Advanced Java

Total Hours: 48

Total Credits: 3

Prerequisite: Students should know basic programming concepts.

Objectives -:

1. To know the concept of Java Programming.
2. To understand how to use programming in day to day applications.

3. To develop programming logic.

Outcomes:

1. Students will know the concepts of JDBC Programming.
2. Students will know the concepts of Multithreading and Socket Programming.
3. Students will know the concepts of Spring and Hibernate.
4. Students will develop the project by using JSP and JDBC.
5. Students will develop applications in Spring and hibernate.

Sr. No	Topic	Number Of Lectures
1.	JDBC 1.1 Introduction 1.2 JDBC Architecture. 1.3 JDBC Process 1.4 Working with ResultSet Interface.	8
2	Multithreading: 2.1 Introduction to Multithreading. 2.2 Thread creation: Thread Class, Runnable Interface. 2.3 Life cycle of Thread. 2.4 Thread Priority. 2.5 Execution of Thread Application. 2.6 Synchronization and Interthread communication.	12
3	Networking: 3.1 Overview of Networking. 3.2 Networking Basics: Port Number, Protocols and classes. 3.3 Sockets, Reading from and Writing to a Socket.	5
4	Servlet and JSP 4.1 Introduction to Servlet 4.2 Types of Servlet: Generic Servlet and Http Servlet 4.3 Life cycle of servlet 4.4 Session Tracking. 4.5 Servlet with database. JSP 4.6 Introduction to JSP. 4.7 JSP Life Cycle. 4.8 Components of JSP. 4.9 JSP with Database.	12
5	Spring & Hibernate Spring: 5.1 Introduction 5.2 Applications and Benefits of spring 5.3 Architecture and Environment Setup 5.4 Hello World Example 5.5 Core Spring- IoC Containers, Spring Bean Definition, Scope, Lifecycle Hibernate 5.6 Architecture and Environment 5.7 Configuration, Sessions, Persistent Class 5.8 Mapping Files, Mapping Types 5.9 Examples	11

Reference Books:

1. The Complete Reference – JAVA Herbert Schildt
2. Professional Hibernate, by Eric Pugh, Joseph D. Gradecki by Wiley Publishing, Inc., ISBN: 0- 7645-7677-1
3. Spring In Action, Craig Walls, Ryan Breidenbach, Manning Publishing Co., ISBN: 1-932394- 35-4
4. Head First Servlets and JSP: Passing the Sun Certified Web Component Developer Exam -2nd Edition-Bryan Basham, Kathy Sierra, Bert Bates- O'REILLY.

Savitribai Phule Pune University

T.Y.B.B.A.(C.A.) Sem-VI (CBCS 2019 Pattern)

Subject Code: CA-604

Subject: Android Programming

Total Hours: 48

Total Credits: 3

Pre-requisite:

1. Concepts of OOP's.
2. Basic Knowledge About JAVA Programming

Objective:

1. To understand the Android Operating System and develop applications using Google's Android open-source platform.
2. To understand the issues relating to Wireless applications.

Outcome:

1. Student will be able to write simple GUI applications, use built-in widgets and components, work with the database to store data locally, and much more.
2. Demonstrate their understanding of the fundamentals of Android operating systems
Demonstrate their skills of using Android software development tools

Unit	Topic	No. of lectures
1	INTRODUCTION TO Android Programming 1.1 What is Android? 1.2 History and Versions 1.3 Android Architecture 1.4 Basic Building Blocks 1.5 Android API Levels 1.6 Application Structure 1.7 First Hello World Program	04
2	ACTIVITY, INTENT AND LAYOUT 2.1 Introduction to Activity 2.2 Activity life cycle 2.3 Introduction to Intent 2.4 Types of Intent(Implicit and Explicit Intent) 2.5 Layout Manager 2.5.1 View and View Group 2.5.2 Linear Layout 2.5.3 Relative Layout 2.5.4 Table Layout 2.5.5 Grid Layout 2.5.6 Constraint Layout 2.5.7 Frame Layout 2.5.8 Scroll Layout	07
3	BASIC UI DESIGN 3.1 Button(Push Button, Check Box, Radio Button, Toggle Button, Image Button) 3.2 Text Fields 3.3 Spinner 3.4 List View 3.5 Toast 3.6 Scroll View 3.6 ProgressBar View 3.7 Auto Complete Text View 3.8 Dialog Box 3.8.1 Alert Dialog. 3.8.2 DatePicker Dialog. 3.8.3 TimePicker Dialog. 3.8.4 Custom Dialog.	10
4	ADAPTER AND MENU 4.1 Base Adapter 4.2 Array Adapter 4.3 ListView using Adapter 4.4 GridView using Adapter 4.5 Photo Gallery using Adapter	05

	<p>4.6 Using Menu with Views</p> <p>4.6.1 Option Menu</p> <p>4.5.2 Context Menu</p> <p>4.5.3 Popup Menu</p>	
5	<p>THREADS AND NOTIFICATION</p> <p>5.1 Worker thread</p> <p>5.2 Handlers & Runnable</p> <p>5.3 AsynTask (in detail)</p> <p>5.4 Broadcast Receiver</p> <p>5.5 Services</p> <p>5.5.1 Service life Cycle</p> <p>5.5.2 Bounded Service</p> <p>5.5.2 Unbounded Service</p> <p>5.6 Notification</p> <p>5.7 Alarm</p> <p>5.8 Accessing Phone services(Call,SMS)</p>	06
6	<p>CONTENT PROVIDER</p> <p>6.1 Content Providers</p> <p>6.2 SQLite Programming</p> <p>6.3 SQLiteOpenHelper</p> <p>6.4 SQLiteDatabase</p> <p>6.5 Cursor</p> <p>6.6 Searching for content</p> <p>6.7 Adding, changing, and removing content</p> <p>6.8 Building and executing queries</p> <p>6.9 Android JSON</p>	08
7	<p>LOCATION BASED SERVICES AND GOOGLE MAP</p> <p>7.1 Display Google Maps</p> <p>7.1.1 Creating the project</p> <p>7.1.2 Obtaining the Maps API Key</p> <p>7.1.3 Displaying the Map</p> <p>7.1.4 Displaying the Zoom Control</p> <p>7.1.5 Changing Views</p> <p>7.1.6 Navigating to a specific location</p> <p>7.1.7 Adding Markers</p> <p>7.1.8 Getting the location that was touched</p> <p>7.1.9 Geocoding and Reverse Geocoding</p> <p>7.2. Getting Location Data</p> <p>7.3. Monitoring a Location</p>	08
Total Lectures		48

Reference Books:

1. Beginning Android4 Application Development, By Wei-Meng Lee WILEY India Edition WROX Publication
2. Professional Android 4 Application Development, By Reto Meier WROX Publication
3. The official site for Android developers - <https://developer.android.com>

Savitribai Phule Pune University
T.Y.B.B.A.(C.A.) Sem-VI (CBCS 2019 Pattern)
Subject Code: CA-604
Subject: Dot Net Framework

Total Hours: 48

Total Credits: 3

Course Prerequisites:

Student should have basic knowledge of:

- Visual Basic
- HTML
- Object Oriented concepts
- Ms-Access, Mysql, SQL Server

Course Objectives:

- To learn Microsoft framework architecture.
- Understand development of windows application.
- To learn data access mechanism.
- Create and consume libraries.
- Create a web application.
- To develop the website and application.

Course Outcome:

- Use the features of Dot Net Framework along with the features of VB, C# and ASP
- Design and develop window based and web based .NET applications.
- Design and develop a Website.
- Design and Implement database connectivity using ADO.NET for VB, C# and ASP.

Sr.No	Chapter Name	No.of Lectures
1	Introduction to DOT NET FRAMEWORK 1.1 What is Framework? 1.2 Architecture of Dot Net Framework 1.2.1 Common Language Runtime 1.2.2 Common Type System(CTS) 1.2.3 Common Language Specification(CLS) 1.2.3 JIT Compilers 1.2.3 Base Class Library 1.3 IDE (Integrated Development Environment) 1.4 Event Driven Programming	5
2	Introduction to VB.Net 2.1 Basics of VB.Net 2.1.1 Operators 2.1.2 Data Types 2.1.3 Control Structures 2.2 Build Windows Applications 2.2.1 Controls: Form, TextBox, Button, Label, CheckBox, ListBox, ComboBox, RadioButton, DateTimePicker, MonthCalender, Timer, Progressbar, Scrollbar, PictureBox, ImageBox, ImageList, TreeView, ListView, Toolbar, StatusBar, Datagridview 2.2.2 Menus and PopUp Menu 2.2.3 Predefined Dialog controls: Color, Save, File, Open, Font 2.2.4 DialogBox - InputBox(), MessageBox, MsgBox()	11
3	Introduction to C# 3.1 Language Fundamentals 3.1.1 Data type and Control Constructs 3.1.2 Value and Reference Types, Boxing 3.1.3 Arrays 3.1.4 String class and its various operations 3.1.5 Functions 3.2 Object Oriented Concepts 3.2.1 Defining classes and Objects	12

	3.2.2 Access modifiers 3.2.3 Constructors 3.2.4 Inheritance 3.2.5 Interface 3.2.6 Abstract Class 3.2.7 Method Overloading and Overriding 3.2.8 Delegates	
4	Introduction to ASP.NET 4.1 What is ASP.NET? 4.2 ASP.NET Page Life Cycle 4.3 Architecture of ASP.NET 4.4 Forms, WebPages, HTML forms, 4.5 Request & Response in Non-ASP.NET pages 4.6 Using ASP.NET Server Controls 4.7 Overview of Control structures 4.8 Functions 4.9 HTML events 4.9.1 ASP.NET Web control events 4.9.2 Event driven programming and postback 4.10 Introduction to Web forms 4.10.1 Web Controls 4.10.2 Server Controls 4.10.3 Client Controls 4.10.4 Navigation Controls 4.10.5 Validations 4.10.6 Master Page 4.10.7 State Management Techniques	10
5	Architecture of Ado.Net 5.1 Basics of Ado.net 5.1.1 Connection Object 5.1.2 Command Object 5.1.3 Dataset 5.1.4 Data Table 5.1.5 Data Reader Object 5.1.6 Data Adapter Object 5.2 Data gridview & Data Binding: Insert, Update, Delete records 5.3 Navigation Using Data Source	10
Total		48

Reference Books:

- Beginning Visual C#, Wrox Publication
- **Beginning ASP.NET 3.5**, Wrox Publication
- **Programming ASP.NET 3.5** by Jesse Liberty, Dan Maharry, Dan Hurwitz, O'Reilly
- Programming Microsoft Visual Basic .NET – Francesco Balena
- The Complete Reference - Visual Basic .NET – Jeffrey R. Shapiro
- ADO.NET Examples and Best Practices for C# Programmers, By Peter D, Blackburn, William
- VB.NET database programming with ADO.NET - Anne Prince and Doug Lowe

Savitribai Phule Pune University
T.Y.B.B.A.(C.A.) Semester-VI
Subject: Project
Course Code : DSE– 605
Total Credits: 04

For the evaluation / conduction of project separate guidelines will be provided.

T.Y.B.B.A.(C.A.) Semester-VI
Subject: Computer Laboratory Based on 603 and 604(2 credits each)
Course Code: 606
Total Credits: 04

For the conduction of practical's, Practical Assignments are given in the Lab book.

Savitribai Phule Pune University
T.Y.B.B.A.(C.A.) Semester-VI
Subject: Soft Skill
Course Code : CA – 607

Total Hours: 30

Credit:02

Prerequisite:

1. Basic Writing Skills in English including grammar.
2. Basic knowledge in communication and a good understanding of English.
3. Ready to adhere the new techniques.

Objectives:

1. It helps participants to communicate effectively and to carry themselves confidently.
2. They also learn how to identify and overcome the barriers in interpersonal relationships.

3. To improve oral and written communication, teamwork, leadership, problem-solving and decision-making skills, to gain best results.
4. This course is useful for landing a great job, building a career and also finding employment as soft skills trainers.

Outcomes:

1. Understand the significance and essence of a wide range of soft skills
2. Learn how to apply soft skills in a wide range of routine social and professional settings.
3. Learn how to employ soft skills to improve interpersonal relationships.
4. Learn how to employ soft skills to enhance employability and ensure workplace and career success.

Unit	Topics	No. of Lectures
1	Introduction to Soft Skills 1.1 An Introduction to Soft skill - 1.1.1 Definition and Significance of Soft Skills 1.1.2 Soft skill Process 1.1.3 Uses of Soft Skill Development.	02
2	Communication Skills 2.1 Introduction - Components of communication process, Communication process , Effective communication process. 2.2 Types of communication – 2.2.1 Verbal Communication – • Punctuation • Meaning & opposites , vocabulary • Real Life conversations 2.2.2 Non – Verbal Communication - • Facial Expression , Posture , Gesture , Eye contact • appearance (dress code) , Body Language, listening skills • essential formal writing skills	04
3	Skills Development 3.1 Interview Skills – Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview. Tips for Success. 3.2 Presentation Skills - Types, Content, Audience Analysis, Essential Tips Before, During and After, Overcoming Nervousness. 3.3 Etiquette and Manners - Social and Business 3.4 Time Management - Concept, Essentials, Tips 3.5 Personality Development - Meaning, Nature, Features,	05

	Stages, Models, Learning Skills, Adaptability Skills.	
4	<p>Skill Implementation</p> <p>4.1 Resume writing –</p> <p>4.1.1 How to write your resume.</p> <ul style="list-style-type: none"> • Contact details. • Opening statement. • List of key skills. • List of technical/software skills. • Personal attributes/career overview. • Educational qualifications. • Employment history /volunteering/work placements. • References/referees. <p>4.1.2 Types of resume</p> <p>4.2 Group Discussion - Importance, Planning, Elements, and Skills assessed, Effectively disagreeing, Initiating, Summarizing and Attaining the Objective.</p> <p>4.3 Teamwork and Leadership Skills - Concept of Teams, Building effective teams, Concept of Leadership and honing Leadership skills , A Good Leader, Leaders and Managers , Types of Leaders , Leadership Behaviour.</p>	04
Total		15
Practical Please Refer Lab Book		15

Reference Books :

1. Managing Soft Skills for Personality Development – edited by B.N.Ghosh, McGraw Hill India, 2012.
2. English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010.
3. Soft skills Training – A workbook to develop skills for employment by Fredrick H. Wentz .
4. Personality Development and Soft skills, Oxford University Press by Barun K. Mitra
5. The Time Trap : the Classic book on Time Management by R. Alec Mackenzie

Savitribai Phule Pune University, Pune
Revised syllabi (2019 Pattern) for three years B. Com. Degree course
Credit Base Choice System (CBCS)

Syllabus for T.Y.B. Com. Semester –V

Subject Name: Business Regulatory Framework

Course code: - 351

Credit - 3

Depth of the program – Fundamental Knowledge

Preamble

Savitribai Phule Pune University and UGC has initiated several measures to bring efficiency and quality education to the students. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The Business Regulatory framework course provides the student with basic information about the Indian legal system and dispute resolution, and their impact on business. The understanding of legal system is a prerequisite for better decision making. The course gives exposure to students in the areas of legal principles of business contract, aspects in the formation, running and winding up of partnership and LLP, the scope and the issues associated with partnerships, application of sale of goods act and E Contract regulations in India. This course focuses on orientation of students to legal studies from the point of view of basic concepts of business law and legal system in India. The course will be useful to the commerce students to understand and apply the business laws in commercial situations.

Objectives of the Program

1. To provide conceptual knowledge about the framework of business Law in India.
2. To orient the students about the legal aspect of business.
3. To create awareness among the students about legal environment relating to the Contract Law, Partnership Act, Sale of Goods Act in India.
4. To understand the emerging issues relating to e-commerce, e-transaction issues and E Contracts

5. To seek the career opportunity in corporate sector relating to business law in India.
6. To acquaint students with the basic concepts, terms & provisions of Mercantile and Business Laws.

Course Contents

nit No	Unit Title	Contents	Purpose Skills to be developed
1	The Indian Contract Act, 1872	<ol style="list-style-type: none"> 1. The nature of the contract, General Principles 2. Definitions and elements of Contract- consideration, other essential elements of a valid contract, 3. Legality of object and consideration. , Void Agreements. , Discharge of contract. 4. Performance of the contract and breach of contract and remedies (Including damages, meaning, kinds and rules for ascertaining damages) 	Understand the concept of Contract and its contents. Equip the students with knowledge of nature and performance and breach of Contracts.
2	The Indian Partnership Act, 1932	<ol style="list-style-type: none"> 1. General Nature of Partnership , Rights, and duties of partners, Types of partner 2. Registration and dissolution of a firm 3. Limited Liability Partnership Act 2008: Limited Liability Partnership (LLP); Concept, Nature and Advantages, Difference between LLP and Partnership Firm, Difference between LLP and company 4. Incorporation of LLP, Partners and their relations, Liability of LLP and Partners (Section 27). Financial Disclosure by LLP, Contributions (Section 32), Assignments and Transfer of Partnership Rights (Section 42) Conversation to LLP (Section 55), Winding-up and dissolution (Section 63 & 64) 	Understand the nature of partnership ,Rights and duties of Partner Handling the registration and dissolution of the partnership. Aquint Knowledge about LLP

3	The Sale of Goods Act, 1930	<ol style="list-style-type: none"> 1. Formation of the contract of sale , Concept and Essentials. Sale and agreement to sale. 2. Goods – Concept and kinds ,Conditions and Warranties 3. Transfer of ownership and delivery of goods 4. Unpaid seller and his rights and Remedial Measures. 	Compressive understanding about the sale of Goods Act. Acquaint knowledge about ownership and delivery of goods.
4.	Arbitration and Conciliation:	<ol style="list-style-type: none"> 1. Concept of Arbitration & Conciliation. 2. Definition & Essentials of Arbitration Agreement. Power and Duties of Arbitration. Conciliation proceeding. (Provisions of Arbitration & Conciliation Act,1996 in nutshell with Amendment of 2021 to be covered.) 	To give Comprehensive insight about the emerging trend of Arbitration and conciliation and its regulatory mechanism

[Note: Recent amendments in the Acts and relevant Landmark cases decided by courts are expected to be studied]

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	20	Indian Contract Act , Document , PPT, Narration, Case Study	You Tube about Contract Act	Report Review	Acquaint knowledge and maturity to understand Contract Law.
2	09	Project making, Street play, slogan , Quiz Competition,	Use of You tube, Review of Movie	New Emerging Issues in Principle documents of Partnership Deed	To Acquaint knowledge and application of Partnership Deed.

3	14	Case study, Poster making, jingles, Survey Analysis Article review	Case Analysis, Mute court	Recent amendments and silent feature Sale of Goods Law	To get training to face emerging issues relating Sale of Goods Act.
4	05	Virtual Learning, Group Discussion, Assignments on E signature Interview of Arbitrator.	Film on Arbitration and conciliation	Project on Arbitration and conciliation	To give Comprehensive insight about the emerging trend of Arbitration and conciliation and its regulatory mechanism

Methods of Evaluations

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Continuous Evaluation,, MCQ, Assignment, Oral examination	As per University Guidelines	Seminar on Contract Act and Case study
Unit – II	Written examination, Qui, Presentations, Projects , Assignments , Tutorials g. Oral examination	As per University Guidelines	Awareness program

Unit – III	Continuous Evaluation, MCQ, Assignment.	As per University Guidelines	Visit to company secretary's office
Unit – IV	Continuous Evaluation, Case Study, Literature Review , E procedure, Oral examination.	As per University Guidelines	Seminar on Arbitration and conciliation

References

- 1) Business and Corporate Law: - Dr. Kaur Harpreet, Lexis Nexis (2013)
- 2) Laws for Business, Sulphery M.M.&Basheer, PHI Learning Pvt. Ltd., Delhi. (2013)
- 3) Business Laws: - Kuchhal M.C.&KuchhalVivek, Vikas Publishing House (2013)
- 4) Business and Commercial Laws:-Sen And Mitra , The World Press Pvt. Ltd.(2018)
- 5) An Introduction to Mercantile Laws:-N.D.Kapoor , Sultan Chand and Sons,(2014)
- 6) Business Laws: - N.M.Wechlekar , Everest Publishing House (2016)
- 7) Business Regulatory Law, Chaudhari,Zalte, Bhawari,Dagade, Prashant Publication (2021)
- 8) Arbitration & Conciliation Act, 1996 (Lawmann's), Kamal Publishers (2017)
- 9) <https://www.indiacode.nic.in/bitstream/123456789/2187/1/A1872-9.pdf>
- 10) https://legislative.gov.in/sites/default/files/A1930-3_0.pdf
- 11) https://www.mca.gov.in/Ministry/actsbills/pdf/Partnership_Act_1932.pdf
- 12) <https://egazette.nic.in/WriteReadData/2021/225832.pdf>

Revised Syllabus (2019 Pattern) for three years B. Com. Degree Course (CBCS)

T. Y. B. Com. (Semester- V)

Paper: ADVANCED ACCOUNTING – I

Code: 352

No. of lectures: 48

Preamble

In today's modern age, the Corporate, Banking and Investment sectors are the major contributors towards development of Indian Economy. In the last two decades, these sectors have seen the largest and fastest growing sectors and enormous growth in Indian economy. In this growth, accounting plays an energetic role and to ensure safeguard of the interest of the stakeholders and the society. It is, therefore, important to educate the students of commerce in the accounting practices adopted by different organizations. It helps stakeholders make better business decisions and deal with problems by providing them with accurate financial information. By studying the Learning Path in Accounting – Advance Concepts you will gain a deeper understanding of the accounting process and what it involves.

Objectives of the course

1. To acquaint the student with knowledge about various concepts, objectives, and applicability of some important accounting standards.
2. To develop the knowledge among the students about reorganization of business regarding restructuring the capital.
3. To update the students with knowledge for preparation of final accounts of a Banking Companies with the provisions of Banking Regulation Act 1949.
4. To empower to students with skills to prepare the investment account in simple and summarized manner.

Objectives of the Program

1. To instill the knowledge about accounting procedures, methods and techniques.
2. To impart students' knowledge of various Advanced Accounting Concepts.

Depth of the program – Fundamental Knowledge

CONTENTS

Unit No.	Unit Title	Contents	Purpose skills to be developed
1	Accounting Standards & Financial Reporting	<ul style="list-style-type: none"> - Brief Review of Indian Accounting Standards - Introduction to AS- 3, AS-12 and AS-19 with simple numerical. - Introduction to IFRS - Fair Value Accounting. 	<ul style="list-style-type: none"> - To develop conceptual understanding about various Accounting Standards and its applicability and also introduce the students about IFRS – Fair Value Accounting.
2	Accounting for Capital Restructuring (Internal Reconstruction)	<ul style="list-style-type: none"> - Meaning and Concept of Capital Restructuring, Types of Capital Restructuring, Meaning & of Internal Reconstruction - Accounting Entries: Alteration of Share Capital, Reduction of Share Capital, Reduction in Liabilities, Cancellation of Expenses, Losses etc. - Preparation of Balance Sheet after Internal Reconstruction 	<ul style="list-style-type: none"> - To develop conceptual understanding about accounting for capital restructuring in the form of internal reconstruction. - To develop the skill & upgrade the knowledge regarding reorganization of venture capital and it's recording.
3	Final Accounts of Banking Companies	<ul style="list-style-type: none"> - Introduction of Banking Company, Legal Provisions regarding Non-Performing Assets (NPA) - Reserve Fund - Acceptance, Endorsements & Other Obligations - Bills for Collection – Rebate on Bills Discounted – Provision for Bad and Doubtful Debts - Vertical form of Final Accounts as per Banking Regulation Act 1949. - Simple Numerical on Preparation of Profit & Loss A/c and Balance Sheet in vertical form. 	<ul style="list-style-type: none"> - To understand the various legal provisions regarding banking companies. - To understand the procedure regarding preparation of final accounts of banking companies.
4	Investment Accounting	<ul style="list-style-type: none"> - Meaning & Introduction, Classification of Investments, - Meaning & Calculation of the Concept of Acquisition Cost & Carrying Cost of Investment, - Calculation of Profit/loss on disposal of investments. 	<ul style="list-style-type: none"> - To understand the meaning of different costs incurred in investment business. - To develop the knowledge and skill regarding Investment Accounting.

Teaching Methodology

Unit No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	10	Use of e- contents, online lectures and PowerPoint Presentations	Lectures of experts available on YouTube and other digital platforms	Individual assignment report	Developing understanding on applicability of various Accounting Standards
2	12	Use of e- contents, online lectures and MCQ based Quiz, PowerPoint Presentations	Lectures of experts available on YouTube and other digital platforms	Individual assignment of solving practical problems	Knowledge about of the Accounting for Capital Restructuring
3	16	Use of e- contents, online lectures, MCQ based Quiz, PowerPoint Presentations	Study of the Final Accounts of Banking companies from its Annual Report	Individual assignment of solving practical problems	Conceptual Clarity and Practical understanding of preparation of final accounts of banking companies.
4	10	Use of e- contents, online lectures and PowerPoint Presentations	Lectures of experts available on YouTube and other digital platforms	Individual assignment of solving practical problems	Developing knowledge about Investment Accounting

Method of Evaluation

Unit	Internal Evaluation	External Evaluation	Suggested Add on Course
1	MCQ / Small Practical Problem	As per University norms	--
2	Practical Problem	As per University norms	--
3	Practical Problems written Test / MCQ	As per University norms	--
4	MCQ / Small Practical Problem	As per University norms	Certificate Course on Share Trading

References:

❖ List of Books Recommended:

1. Advanced Accounts: By M.C. Shukla & S.P. Grewal (S.Chand & Co. Ltd.)
2. Advanced Accountancy: By S. P. Jain & K.N. Narang (Kalyani Publishers)
3. Advanced Accountancy: By R. L. Gupta & M. Radhaswamy (Sultan Chand & Sons)
4. Company Accounts: By S.P. Jain & K.L. Narang
5. Advanced Accounts: By Paul Sr.
6. Corporate Accounting: By Dr. S. N. Maheshwari & S.K. Maheshwari
7. Corporate Accounting: By Mukharji & Hanif
8. Accounting Standards –as issued by Institute of Chartered Accountants of India

❖ List of Videos Recommended:

Unit	Topic Name	Links
1	Accounting Standards & Financial Reporting	https://youtu.be/zxSaR3JNQzE https://youtu.be/d8QaGSKWkuU https://youtu.be/HmAzVMIYf5U https://youtu.be/g40Po3TbHcM https://youtu.be/6d7wrVPmaPs https://youtu.be/OVNO8qHIs?list=TLQOMDEwNjIwMjGQcQyNjkn5tw https://youtu.be/mvbpTW9WUPk

2	Accounting for Capital Restructuring (Internal Reconstruction)	https://youtu.be/MWca2VO8D7o https://youtu.be/6ZBxQJobApI https://youtu.be/Ta2tUaTJ5t4?list=RDCMUCILLZnneWNoJYW8iSqbuECw
3	Final Accounts of Banking Companies	https://youtu.be/nF_P5dxGZCI https://youtu.be/TVrj-tJo3qs
4	Investment Accounting	https://youtu.be/pMe8ymUs2gc https://youtu.be/ghCZzJCgFd8

Savitribai Phule Pune University, Pune
Third Year, B.Com. (Core Course)
Revised Syllabi for Three Years B. Com. Degree Course
(CBCS-2019 Pattern) (w.e.f. 2021-22)

Semester - V

Course Code: 353

Subject: Indian & Global Economic Development

Total Credits: 3

Preamble:

An approach to Indian and Global Economic Development is to examine the Indian economic development policies in context with global economies. This paper aims to provide knowledge about economic development of India, economic development policies that are applied for development of economy in general and development of various sectors in particular. It also aims to develop ability of the students to analyze the development of Indian economy as compared to global economies through the comparison of different sectors like agriculture, Industry, service and availability of resources and its quality.

Scope of the Programme –

Knowledge related to development policies of Indian Economy as compared to World Economies.

Objectives:

1. To develop ability to analyze economic development process of India.
2. To impart knowledge about the relevance of economic practices in modern competitive world.
3. To help the students develop a sound theoretical foundation for their future academic ventures.

Course Outcomes:-

1. Students will be able to understand present Economic Scenario of Indian Economy as well as World Economy.
2. Students will be able to understand the various aspects of development in Agricultural, Industrial and service sector in India.
3. Student will be able to critically evaluate the role of India in international economy.
4. Students will be able to evaluate the working of international financial organization and institutions.

Unit No.	Topic	Purpose & Skills to be Developed
Unit 1	Indian and Global Economy	<p>Purpose: To make the students aware of concept of Development. To help the students compare Indian Economy with other developed and competitive economies.</p> <p>Skills: Analyze & think critically, develop writing skills.</p>
	1.1 Economic Development: Meaning and Indicators	
	1.2 Developed and Developing Countries: Meaning	
	1.3 Characteristics of Indian Economy as an Emerging Economy	
	1.4 Comparison of the Indian Economy with World Economy with reference to: National Income, Population, Agriculture, Industry and Service Sector	
Unit 2	Agricultural Development In India	<p>Purpose: To give the knowledge about varied aspects of agricultural sector in India.</p> <p>Skills: Analyze & think critically, developing critical and analytical writing skills.</p>
	2.1 Indian Agriculture: Role and Progress	
	2.2 Low Productivity of Indian Agriculture: Causes and Measures	
	2.3 Agricultural Finance: Need and Sources	
	2.4 Agricultural Marketing: Problems and Measures	
	2.5 New Farm Act 2020	
	2.6 Organic Farming and Contract Farming: Meaning and Advantages	
Unit 3	Industrial Development in India	<p>Purpose: To give the knowledge about importance and status of Industrial Development in Indian Economy. To update the students about the latest policies for Industrial development in India.</p> <p>Skills: Analyze & think critically, developing critical writing skills.</p>
	3.1 Role of Industrialization in Indian Economic Development	
	3.2 New Industrial Policy 1991	
	3.3 Role of Micro, Small and Medium Scale Enterprises (MSMEs) in India	
	3.4 Role and Problems of Public Sector Enterprises in India	

	3.5 New Schemes for Industrial Development: Make in India, Start- up India and Stand up India	
Unit 4	Service Sector and Infrastructural Development in India	<p>Purpose:To provide the knowledge about importance and status of Service Sector and Infrastructure Development in Indian Economy</p> <p>Skills: Analyze & think critically, developing critical writing skills.</p>
	4.1 Role and Growth of Service Sector in India	
	4.2 Meaning and Effects of Digital Economy, E Commerce and E-Finance	
	4.3 Role of Infrastructure in Economic Development of India	
	4.4 Role of Public and Private Sector in Infrastructural Development	

Teaching Methodology:

Unit No.	No. of Lectures	Innovative methods to be used	Film Shows and AV Applications	Project	Expected Outcome
1	10	<ul style="list-style-type: none"> Open Book discussion Digital lectures Reading Projects 	You Tube lectures on Development Theories and Indian Economic Development	Difference in goals of developed and developing economies	<ul style="list-style-type: none"> Students will understand basic concepts of Development. Will be able to analyze and interpret critically
2	14	<ul style="list-style-type: none"> Group discussion Case studies Problem solving based learning 	<ul style="list-style-type: none"> You Tube lectures, Lectures on SWAYAM Portal 	<ul style="list-style-type: none"> Difficulties in Agricultural development in India. Features of Agricultural Policy 	<ul style="list-style-type: none"> Will know Difficulties in agricultural development in India. Will understand the sources of agro finance marketing
3	12	<ul style="list-style-type: none"> Pair learning Group discussion Open book 	<ul style="list-style-type: none"> Teacher oriented PPTs. You tube lectures 	<ul style="list-style-type: none"> Critical evaluation of Industrial Policy Analysis of Indian Industrial sector 	<ul style="list-style-type: none"> Will understand New Industrial Policy Able to interpret the features of Indian Industrial Sector

		discussion			
4	12	<ul style="list-style-type: none"> • Group discussion • Teacher driven power point presentation 	<ul style="list-style-type: none"> • You tube lectures • Online PPTs 	<ul style="list-style-type: none"> • Changing trends of Service Sector • Role of Infrastructure Development in economic development 	<ul style="list-style-type: none"> • Will understand the Role of service sector in economy • Will know the importance of Infrastructural Development in Indian Economy

Recommended Books:

1. Misra S.K. and Puri V.K. Indian Economy, Himalaya Publishing House, Delhi.
2. Black and Sundaram, International Business Environment, Prentice Hall India.
3. Tayebmonis H., The Global Business Environment, Sage Publication, New Delhi.
4. Charles Hill, International Business, Competing in the Global Market place, Arunkumar Jain, Tata McGraw Hill.
5. Gupta K.R, Sharma Manoranjan, Indian Economic Policies and Data, Atlantic Publishers and Distributers (P) Ltd.
6. Ann Larkin Hansen, The Organic Farming Manual, Storey Publishing, North Adams.
7. Jhingan M.L., International Economics, Vrinda Publications, Delhi.
8. RuddarDatta and K.P.M. Sundaram, Indian Economy, S. Chand and Co., New Delhi.
9. Agarwal A.N., Indian Economy, Problems of Development and Planning, New Age International Publishers.
10. Bhole, L.M., impacts of Monetary Policy, Himalaya Publishing House, New Delhi.
11. Kayndepatil, G.V, Agricultural Economies: Theory & Policy, Chaitanya Publi. Nasik
12. Bajpai A.D.N., Caubey S.K. et al, Leading Issues of Indian Economy, Atlantic Publishers and Distributers.
13. Brics development bank launched, first president to be from India, Times of India July 16, 2014
14. Ministry of Finance, Government of India (Oxford Press), Economic Survey 2020.
15. Arun Kumar, International Business- competing in the Global Marketplace- Charles Hill.
16. World Bank, World Development Report
17. Magazines / Journals Reports,
18. Web sites:
 - www.mospi.gov.in/national-sample-survey-office-nssso (Ministry of Statistics and Programme Implementation, GoI)
 - <https://www.toppr.com/ask/question/economic-development-is-characterized-by-which-of-the-following/>
 - <https://www.economicdiscussion.net/economic-development/role-of-agriculture-in-the-economic-development>
 - <https://www.iedunote.com/foreign-trade>
 - <https://www.vedantu.com/commerce/liberalisation>
 - <https://ncert.nic.in/textbook/pdf/keec103.pdf>

OR

**Savitribai Phule Pune University, Pune
Third Year, B.Com. (Core Course)
Revised Syllabi for Three Years B. Com. Degree Course
(CBCS-2019 Pattern) (w.e.f. 2021-22)**

Semester - V

Course Code: 353

Preamble:

An approach to International Economics is to examine the International Trade on the basis of trade theories. International Economics is subject that is ever dynamic and relevant in the current context. International Economics provides a framework on international trade and finance in the theoretical context, along with economic analysis as well as practical applications. This paper aims to provide knowledge about International Economics that includes trade theories, trade practices and their implications. It also aims to make students familiar about the various concepts of international economics, international trade and other concepts related to international economics

Scope of the Programme:

Knowledge of trade theories, trade policies and other subject matters related to international economics.

Objectives:

1. To acquaint the students with the basic theories of international trade and international economics.
2. To help the students evaluate the working and functions of international organizations and institutions.
3. To develop a foundation in the subject that will help the students in their future academic and professional ventures.

Course Outcomes:-

1. Students will be able to understand present Economic Scenario of Indian Economy as well as World Economy.
2. Students will understand the working of foreign trade market and foreign exchange market.
3. Students will be able to comprehend trade policies and concepts related to trade policies.

4. Students will be able to use the subject knowledge in their future academic and professional ventures.

Unit No.	Topic	Purpose & Skills to be Developed
Unit 1	International Economics	<p>Purpose: To make the students aware of concepts in international economics</p> <p>Skills: Analyze & think critically, developing writing skills.</p>
	1.1 Meaning and Scope of International Economics	
	1.2 Importance of International Economics	
	1.3 Inter-regional Trade and International Trade	
	1.4 Role of International Trade in Economic Development	
1.5 Trade Problems Facing LDC's		
Unit 2	Theories of International Trade	<p>Purpose: To give the knowledge to students about trade theories in international economics</p> <p>Skills: understand theories of international trade, developing writing skills.</p>
	2.1 Theory of Absolute Cost Advantage	
	2.2 Theory of Comparative Cost Advantage	
	2.3 Theory of Factor Endowment (Heckscher-Ohlin)	
	2.4 Leontief Paradox	
2.5 Recent Development in Theories- 2.5.1 New Trade Theory (Zeala- Harrison) 2.5.2 Product Life Cycle Theory (Vernon)		
Unit 3	Trade Policy	<p>Purpose: To give the knowledge about trade policies.</p> <p>Skills: Analyze & think critically, developing writing skills.</p>
	3.1 Free Trade Policy – Meaning, Arguments for and Against	
	3.2 Protection Policy – Meaning, Arguments for and Against	
	3.3 Tools of Protection: Meaning and Types 3.3.1 Tariffs 3.3.2 Quotas	
	3.4 Dumping: Concept and its Effects	
Unit 4	Terms of Trade	<p>Purpose: To make the students aware of concept of terms of trade.</p>
	4.1 Meaning and Importance of Terms of Trade	

	4.2 Types of Terms of Trade A) Gross Barter Terms of Trade B) Net Barter Terms of Trade C) Income Terms of Trade D) Single Factorial Terms of Trade	Skills: Analyze & think critically, developing writing skills.
	4.3 Factors affecting Terms of Trade	
	4.4 Causes of Unfavourable Terms of Trade to Developing Countries	

Teaching Methodology:

Unit No.	No. of Lectures	Innovative methods to be used	Film Shows and AV Applications	Project	Expected Outcome
1	10	<ul style="list-style-type: none"> Open book discussion Digital lectures Reading Projects 	You tube lectures on International economics	Difference in Inter-regional and International trade Role of international trade in economic development of country	<ul style="list-style-type: none"> Students will understand concepts of international economics Will be able to analyze and interpret
2	14	<ul style="list-style-type: none"> Group discussion Case studies 	You tube lectures, Lectures on SWAYAM Portal	<ul style="list-style-type: none"> Critical evaluation of trade theories. Comparison between different trade theories Recent development in trade theories 	Will know various theories of international trade. Will understand the difference between classical and modern approaches of trade theories
3	12	<ul style="list-style-type: none"> Pair learning Group discussion Open book 	<ul style="list-style-type: none"> Teacher oriented PPTs. You tube 	<ul style="list-style-type: none"> Critical evaluation of Free Trade Policy Protection policy 	Will understand the difference between Free Trade Policy

		discussion	lectures	• In present context	Protection policy Able to interpret means of protection and free trade
4	12	<ul style="list-style-type: none"> • Group discussion • Teacher driven • Games and simulation 	<ul style="list-style-type: none"> • You tube lectures • Online PPTs 	<ul style="list-style-type: none"> • Different concepts of terms of trade • Causes of unfavourable terms of trade for India 	Will understand the concept of terms of trade Will know the factors affecting on terms of trade

Recommended Books:

1. Dr.D.M.Mithani – International Economics (Himalaya Publishing house ltd)
2. Bo Sodersten, Geoffrey Reed, International Economics (3rd Edition) Publisher Red Globe Press
3. Z.M.Jhingan : International Economics (Vrinda Publication)
4. Robert Feenstra, Alan M Taylor, International Trade (5th Edition) Publisher Worth
5. Dr.Mrs.NirmalBhalerao&S.S.M.Desai – International Economics (Himalaya Publishing house ltd)
 1. Kenan, P.B. (1994), The International Economy, Cambridge University Press, London.
 2. Kindlberger, C.P. (1973), International Economics, R.D. Irwin, Homewood.
 3. Krugman, P.R. and M. Obstgeld (1994), International Economics: Theory and Policy, Glenview, Foresman.
 4. Salvatore, D.L. (1997), International Economics, Prentice-Hall, Upper Saddle River, N.J.
 5. Sodersten, Bo (1991), International Economics, Macmillan Press Ltd., London.
 6. International Economics , M.L. Jhingan
 7. Bhagwati, J. (Ed.) (1981), International Trade, Selected Readings, Cambridge University Press, Mass.
 8. Greenaway, D. (1983), International Trade Policy, Macmillan Publishers Ltd., London.
 9. Joshi V. and I.M.D. Little (1998), India's Economic Reforms, 1999-2001, Oxford University Press, Delhi.
 10. Panchmukhi, V.R. (1978), Trade Policies of India: A Quantitative Analysis, Concept Publishing Company, New Delhi.
 11. Patel, S.J. (1995), Indian Economy towards the 21st Century, University Press Ltd., India.
 12. DeminicSalvatove – International Economics
 13. Francis Cherunilam – International Economics, McGraw Hill publications
 14. Francis Cherulliom - International Economics (Prentice hall)
 15. L.M.Bhole – Financial Institutions Markets (Tata McGraw Hill)
 16. H.R.Macharaju – Internathttps://saylordotorg.github.io/text_international-trade-theory-and-policy/s07-01-factor-mobility- verview.htmlional Financial

Markets and India (Wheeler Publication)

17. <https://princonkedi.files.wordpress.com/2015/08/international-economics-francis-cherunilam-pdf.pdf>
18. <https://www.emerald.com/insight/content/doi/10.1108/00251749710160214/full/html>
19. https://www.economicsonline.co.uk/Global_economics/Terms_of_trade.html
20. https://en.wikipedia.org/wiki/Main_Page
21. https://saylordotorg.github.io/text_international-trade-theory-and-policy/s07-01-factor-mobility-overview.html
22. <https://www.worldbank.org/en/publication/global-economic-prosp>https://www.academia.edu/23377962/International_Trade_and_Factor_Mobility_Theorissects
23. <https://openknowledge.worldbank.org/handle/10986/2140>
24. <https://www.imf.org/en/About#:~:text=The%20IMF%20was%20established%20in,staff%20drawn%20from%20150%20nations.>
25. <https://infobrics.org/>

Faculty of Commerce & Management
T Y B Com (Semester V)
(Choice Based Credit System)
Revised Syllabus (2021-22)

CORE COURSE – I

Course Code: 354

Subject: Auditing

Total Credits: 04 (Theory 03 + Practical 01=04)

Objectives of the Course:

1. To acquaint themselves about the Definition, Nature, Objectives and Advantages of Auditing, Types of Audit, Errors and Fraud, Audit Program, Notebook, Working Paper, Internal Control, Check.
2. To get knowledge about concept of Checking, Vouching, Verification and Valuation, Types of Audit Report and Auditing Assurance Standard.
3. To understand the provision related Qualification, Disqualification, Appointment, Removal, Rights, Duties and Liability of Company Auditor and Provisions regarding Tax Audit as per Income Tax Act 1961 (Section 44 AA to 44AE).
4. To know the various new concepts in computerized system and Forensic Audit.

Unit No	Unit Title	Contents	Skills to be developed
1.	Introduction to Principles of Auditing and Audit Process	Definition, Nature-objects-Advantages of Auditing-Types of errors and frauds Various Classes of Audit. Audit programme, Audit Note Book, Working Papers, Internal Control-Internal Check-Internal Audit.	i) Understanding the concept of Auditing, Various type of Audit ii) Help to Find out Errors frauds and help to improve internal control system in business organization.
2.	Checking, Vouching and Audit Report	Test checking-Vouching of Cash Book-Verification and Valuation of Assets and Liabilities. Types of Audit Report-Audit Certificate-Difference between Audit Report and Audit Certificate. Auditing and Assurance Standards. (AAS- 1,2,3,4,5)	i) Know the procedure of vouching, Verification, and Valuation use for audit. ii) To know the terms used in Audit Report, Certificate and Auditing Assurance Standard.
3.	Company Audit and Tax Audit	Company Audit Qualification, Disqualifications, Appointment, Removal, Rights, Duties and liabilities of Company Auditor	i) Understanding provisions for Work as Company Auditor as per Companies Act 2013. ii) Enhance Provisions under Income Tax Act 1961 used

		<p><u>Tax Audit</u> Provisions under Income Tax Act 1961 (Sec 44AA, 44AB, 44AD, 44ADA, 44AE) Recent Amendment made as applicable as per Income Tax Act 1961</p>	for Conduct Tax Audit.
4.	Audit of Computerized Systems & Forensic Audit	<p><u>Auditing in an EDP Environment</u> General EDP Control – EDP Application Control- Computer Assisted Audit Techniques (Factors and Preparation of CAAT)</p> <p><u>Forensic Audit</u> Definition, Importance of Forensic Auditor, Services Render by Forensic Auditor, Process of Forensic Auditing and Forensic Audit Techniques and Forensic Audit Report</p>	<p>i) Enhance the knowledge of Computerized Systems ii) Forensic Audit used for new techniques applicable for new business trends.</p>

Teaching Methodology:

Unit No	Total lectures	Innovative Methods to be used	Film Shows and A.V. Applications	Projects / Practical's	Expected Outcome
1	16	Introduction to Principles of Auditing and Audit Process	Lectures of experts available on You Tube About Errors, Frauds, Types of Audit.	Individual assignment of solving practical problems, report review	Acquaint with knowledge and maturity to understand concept of Auditing, types of Audit and Audit Process.
2	12	Checking, Vouching and Audit Report	Lectures of experts available on YouTube and other digital platforms.	Individual assignment of solving practical problems, report review	Conceptual Clarity and Practical understanding of Vouching Verification and valuation and Types of Audit Report.

3	10	Company Audit and Tax Audit	Lectures of experts available on YouTube and other digital platforms. Website Review	Individual assignment of solving practical problems, report review	Practical knowledge about appointment, reappointment and other related provision. Practical knowledge about Tax Audit as per I.T. Act 1961 (Form 3CA, 3CB & 3CD)
4	10	Audit of Computerized Systems & Forensic Audit	Lectures of experts available on YouTube and other digital platforms.	Individual assignment of solving practical problems, report review	Understanding new concepts under Audit of Computerized Systems & Forensic Audit

Method of Evaluation:

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit-I	MCQ/ Assignment/ Written test/PPT	As per University norms	--
Unit-II	MCQ/ Quiz/ Written test	As per University norms	--
Unit-III	Practical Problems/ written Test/MCQ/PPT	As per University norms	--
Unit-IV	MCQ/ Assignment/ Written test/PPT	As per University norms	--

Reference books:

Sr. No	Title of Book	Author/s	Publication
1	Practical Auditing	Spicer and Peglar	Allied, 1975, H.F.L., 1978
2	A Handbook of Practical Auditing	B.N. Tondon	S Chand & Co Ltd

3	Auditing assurance standards	The Institute of Chartered Accountants of India	ICAI
4	Company Accounts & Audit	The Institute of Cost Accountants of India	ICMAI
5	Fundamentals of Accounting and Auditing	The Institute of Company Secretaries of India	ICSI

Guidelines for completion of Practical's:

Sr. No	Title of Practical	Objective of the Practical	Outcomes	Methodology
1	A study of Audit Procedure of organisation	i) To study the meaning & Definition of Audit ii) To study the nature, scope & objective of Audit iii) To study the Audit Procedure of Organisation.	Acquaint with knowledge and maturity to Understand concept of Auditing, Know the concept of Audit Process.	Report based on visit to Individual assessee and collection of documents know the audit process
2	A study of Procedure of Vouching in Auditing	i)To study the concept of voucher and its contain ii) To study the concept of vouching and precautions to be taken by Auditor while vouching iii) To conduct vouching of representative vouchers	ConceptualClarity and Practicalunderstanding of Vouching	Report based on visit to a Businessman or professionals and documents collected
3	A study of Audit Report	i)To study the concept of Audit report ii)To study the types and features of Audit Report iii) To study forms of Audit Report	Understand concept of Audit Report and its types Know the various forms of Audit Report	Report based on visit to a Businessman or professionals and documents collected

4	A Study of Tax Audit	i) To study the meaning of Tax Audit ii) To Study scope of Auditor's Role under Income Tax Act iii) To Study criteria for Compulsory Tax Audit iv) To study Formats for Tax Audit (Form 3CA, Form 3CB, Form 3CE & Form 3CD)	Acquaint Practical knowledge about Tax Audit as per I.T. Act 1961 (Form 3CA, 3CB & 3CD)	Practical example in Guest Lecture /seminar / workshop and Report based on visit to a Businessman or professionals and documents collected
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1. For each semester minimum three practicals should be completed.
2. Two practicals are compulsory from the above table.
3. Teachers are allowed to choose one practical according to the situation in their local area.
4. If a student fails to complete minimum number of practical's, then the student shall not be eligible for appearing at the practical examination.

Revised syllabi (2019 Pattern) for three years B.Com. Degree course (CBCS)

Semester : - V (T.Y.B.Com)

Subject Code :- 355 (a)

Subject : - Business Administration – II (Human Resource Management)

Preamble

Human resource management is centered around developing a strategic approach to find, train, recruit and retain the right professionals, for the right job, and at the right time, such that they become future leaders to further the organizational goals, keeping in mind the company's most important asset – IT'S PEOPLE.

This is possible if the organization embraces the idea of building effective management of its human resource management department. As such, human resources enables institutions and businesses to create a well-structured team with a distinctive organizational culture. With this, the workforce stands a high chance of getting engaged or developed with whatever activity they are doing. In simple language, effective human resource management helps the organization to enhance productivity. Study of Human Resource Management not only helps you work on the theory but also enables you to discover your own style of managing people.

Human resource management plays a crucial role in any organization and has a range of functions that it undertakes. The scope of HR is vast and diverse, as well as hugely impactful. To comprehensively know about its entire scope, all the disciplines and subdisciplines, one must pursue any of the credible human resource management courses. Going through those will give you insights not only into the theories that define the human resources framework but also the application of those concepts

Objectives of the course

1. To acquaint the student with knowledge about various Concepts , Objectives of the Human Resource Function , to identify the difference between Human Resource Management and Human Resource Development
2. To update the students on the emerging trends in the area of Human Resource Management
3. To develop understanding among the students the process of Recruitment and Selection, understanding the various means and methods associated with the Recruitment and Selection function
4. To educate the students on the importance of Training and Development and its impact on Career Planning and Development

5. To acquaint the students on the concept of Performance Appraisal ,d the process for effective Performance appraisal and imbibe the values of Ethical Performance appraisal among the students

Depth of the program – Fundamental Knowledge

Unit No	Unit Title	Contents	Skills to be developed
1	Introduction to Human Resource Function of Management	<p>1.1 Meaning, Objectives and Functions of Human Resource , , Difference between Human Resource Management and Human Resource Development</p> <p>1.2 Organization, Scope and functions of Human Resource Department in Modern Business.</p> <p>1.3 Human Resource Planning – Nature and Scope, Job analysis - Job description - Job specification.</p> <p>1.4 Human Resource Planning – Role of Human Resource Planning, Steps in Human Resource Planning , Factors influencing Human Resource Planning. Essentials of a Good Human Resource Planning , Job Analysis – Process , Tools and Techniques , Job Description & Job Specification – Meaning and Distinguish between Job Description & Job Specification.</p> <p>1.5 Emerging Concept of H.R.D.</p> <p>Quality Circles ,Kaizen ,Talent Management and Leadership Development ,HRD as a Business Partner ,Visionary and Transforming Leadership, E- Learning: Integration of IT and HR , HRIS (Human Resource Information Systems) ,Incorporation of career development ,Internal consultancy and Linkage to knowledge management</p>	<p>Conceptual Understanding</p> <p>Critical thinking skills</p> <p>Accessing and analyzing information skills</p> <p>Imaginative thinking</p> <p>Awareness on the latest in the trends</p>

2	Recruitment and Selection	<p>1.1 Recruitment – Meaning, Purpose/ Importance, Sources of Recruitment, and Factors Governing Recruitment Process</p> <p>1.2 Selection – Meaning, Importance of selection procedure, Tools of Selection and selection Process</p> <p>1.3 Distinguish between Recruitment and Selection</p> <p>1.4 Types of Employment tests, Types of Interviews</p>	<p>Conceptual Understanding</p> <p>Analytical skills</p> <p>Accessing and analyzing information</p> <p>Imaginative thinking</p>
3	Training and Development	<p>1.1 Meaning ,Need , Objectives of Training and Development, Benefits/ Importance of Training to the organisation and employees.</p> <p>1.2 Types of Training , Methods of Training and Development, Process/ Procedure for effective Training.</p> <p>1.3 Career Development , Steps in Career Development , Stages of Career Development , Advantages and Limitations of Career Development, Career Development Cycle , Career Counselling and Self Development</p>	<p>Conceptual Understanding</p> <p>Analytical Skills</p> <p>Technical skills</p> <p>Critical thinking</p>
4	Performance Appraisal Management	<p>1.1 Introduction, Meaning, Need and Importance of Performance Appraisal</p> <p>1.2 Process of Performance Appraisal</p> <p>1.3 Merits and Limitations of Performance Appraisal</p> <p>1.4 Methods and Techniques of Performance Appraisal</p> <p>1.5 Ethical Performance Appraisal</p>	<p>Conceptual Understanding</p> <p>Analytical skills</p> <p>Accessing and analysing information</p> <p>Value Education</p>

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	10	PPT , Lectures by experts from Industry experts,	Online Videos of Human Resource Managers. Live online session by Industry Experts	Interview Report of Human Resource Manager/s of business of various sizes and sectors	Developing Conceptual understanding and Conceptual Clarity Learning of the Latest development in Human Resource
2	12	PPT , Lectures by experts from Industry experts and Placement Agency Managers, Role Play , Mock Interview , Demonstrations	Online Videos	Interview Report of Placement Agency Personnel , Detailed Project report on any 3 Sources of Recruitment	Conceptual Clarity and Practical understanding Hands on Experience Technical Knowledge
3	18	PPT, Videos of Various Products from inception till date , Demonstration	Videos of various Multi Product Line Manufacturers	Creation of Short Video of Innovative Product Development, Pricing, Market Launch Strategy	Conceptual Clarity and Practical understanding Creative and Imaginative Skills Innovation
4	08	PPT , Lectures by Experts from the field of Media , Comparative Case study of Ethical and unethical Performance Appraisal Practices	Online Videos of Tata Group of Industries	Study of Performance Appraisal System of various organisations And Study of Performance Appraisal System of Domestic, Multinational and International companies	Analytical skills Decision making skills Creative and Imaginative Skills I

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	MCQ, Field Visit Report , Interview Report	As per University norms	Certificate Course in Best Practices in Human Recourse Development
Unit – II	MCQ, Assignments, PPT	As per University norms	Certificate course in Ethical Leadership Development
Unit – III	MCQ, Interview Report with Placement Agencies, Case Study , Project on Need and Importance of Campus Placement Office and Campus Interviews	As per University norms	Certificate Course in Ethics in Human Resource Management
Unit – IV	MCQ , Case study , Project	As per University norms	

References:

List of Books Recommended: -

- Personnel and Human Resource Management – A M Sharma (Himalaya Publishing House)
- Personnel Management and Industrial Relations- R S Davar (Vikas Publishing House)
- Human Resource Development and Management- Biswanath Ghosh (Vikas Publishing House)
- Personnel Management – C.B. Mamaria, S V Gankar (Himalaya Publishing House)
- Human Resource Management – AShwathappa
- Human Resource Management - *Gary Dessler*
- HR from the Outside In: Six Competencies for the Future of Human Resources - Dave Ulrich, Jon Younger, Wayne Brockbank, Mike Ulrich
- The HR Scorecard - *Brian Becker, Mark Huselid, Dave Ulrich*
- Victory Through Organization - ***Dave Ulrich, David Kryscynski, Wayne Brockbank, Mike Ulrich***
- Investing in people. Financial Impact of Human Resource Initiatives - *KirsWayne Cascio, John Boudreau*
- Work Rules! -*Laszlo Bock*
- HR Rising!!: From Ownership to Leadership -***Steve Browne***
- The Practical Guide to HR Analytics: Using Data to Inform, Transform, and Empower HR Decisions - ***Shonna D. Waters, Valerie N. Streets, Lindsay McFarlane, and Rachael Johnson-Murray***

Revised syllabi (2019 Pattern) for T.Y.B. Com Degree course (CBCS)
SPECIAL ELECTIVE COURSE (Special Course – II)
Banking and Finance-Special Paper II (Semester-V)
(Financial Markets and Institutions in India – I Course code: 355-B)
Total Credits: 04 (Theory 03 + Practical 01=04)

- **Objectives:**
- 1. To acquaint the students with Indian Financial System and its various segments.
- 2. To make the students aware about Indian Money Market.
- 3. To analyse and understand the functions of Indian Capital Market.
- 4. To enable the students the functioning of Foreign Exchange Market.

Unit No.	Topic	Number of Lectures	Teaching Method	Proposed skills to be developed
01	1. Indian Financial System: 1.1 Meaning and Definition of Financial System in India. 1.2 Structure of Indian Financial System 1.3 Functions of financial system in India 1.4 Role of financial system in Economic Development 1.5. Indicators of Financial Development	10	Lecture, PPT, Group and Panel Discussion, Library Work, Assignments	Understanding the Indian Financial System. Understanding the meaning, structure and role of Financial System in India.
02	Indian Money Market : 2.1 Meaning and definition of Indian Money Market 2.2 Functions of Indian Money Market 2.3 Participants in Indian Money Market 2.4 Credit Instruments used in Indian Money Market 2.5 Deficiencies of Indian Money Market. 2.6 Recent development in Indian Money Market	14	Lecture, PPT, Group and Panel Discussion, Library Work, Assignments	Understanding the meaning, functions, credit instruments, deficiencies and recent development in Money Market in India.

03	Indian Capital Market: 3.1 Meaning and definition of Indian Capital Market 3.2 Functions of Indian Capital Market 3.3 Participants in Indian Capital Market 3.4 Credit Instruments used in Indian Capital Market 3.5 Deficiencies of Indian Capital Market. 3.6 Recent development in Indian Capital Market	12	Lecture, PPT, Group Discussion, Library Work Book Assignment, Use of internet	Understanding the meaning, definition functions, credit instruments, deficiencies and recent development in Capital Market in India
04	Foreign Exchange Market: 4.1. Meaning and definition of foreign exchange market 4.2. Functions of Foreign Exchange Market 4.3 Participants in Foreign Exchange Market 4.4. Determination of Exchange Rate 4.5 Recent development in Foreign Exchange Market	12	Lecture, PPT, Group and Panel Discussion, Library Work, Assignments	Understanding the meaning, definition functions, participants and recent development in Foreign Exchange Market.
Total		48		

- **References:**

- 1. Avadhani V.A. (2019), 'Investment and Securities Markets in India', Himalaya Publishing House
- 2. Bhole L.M. (2004), 'Financial Institution and Markets' McGraw Hill Education
- 3. Khan M.Y. (2019), 'Indian Financial System' 11th Edition, McGraw Hill Education
- 4. Kohok Mukund, 'Business Finance and Financial Services'
- 5. Kumar, Gupta and Kaur (2021), 'Financial Markets and Institutions' Taxmann
- 6. Meir Kohn (2000), 'Financial Institutions and Markets', Tata MC Graw-Hill Publication
- 7. Michael Brandl (2016), 'Money, Banking, Financial Markets and Institutions', CENGAGE Learning Custom
- 8. Mittal Anand (2003), 'Economic Reforms and Capital Markets in India', Galgotia Publishing Company, New Delhi.
- 9. Pathak Bharti V. (2018), "The Indian Financial System", Pearson Education [India] Ltd.

SYLLABUS FOR T.Y.B.COM UNDER CBCS PATTERN 2019
SEMESTER-V
PAPER- II
SUBJECT NAME: - BUSINESS LAWS AND PRACTICE PAPER II (BLP-II)

COURSE CODE - 355-(c)

Objectives of the course:

To develop an understanding of the significant provision of selective Business & labour Laws.

To acquaint the students to address a basic business legal application-oriented issues.

Depth of the program:

Basic to application based knowledge.

Objectives of the Subject:

- To impart the students with the fundamental understanding of important business laws.
- To study & acquaint students an application based knowledge of various Business & Labour Laws.
- To familiar the students with legal Business Environment of India.
- To develop & strengthen students through the legal practical knowledge and their importance to the Indian Business organizations.

Unit . No.	Unit Title	Contents	Purpose skills to be developments
1	An Introduction to Labour Laws in India	1.1 History and Evolution of Labour Laws in India 1.2 Labour Policy of India 1.3. Classification of Labour Laws and an overview of labour laws. 1.4 Unfair Labour Practices	Understanding of evolution & historical legal framework of Labour Laws in India.

		1.5 Labour Laws in the unorganized sector 1.6 Authorities under the Labour Laws in India (Ministry of Labour & Employment –Government of India, Chief Labour Commissioner Labour Courts / Industrial Tribunals, (Appointment, Qualification, Disqualification, Rights & duties)	
2	The Factories Act, 1948 (Sections 1-50)	1.1 Introduction, Objectives & Key Definitions, Approval, 1.2 Licensing and Registration of Factories, 1.3 The Inspecting Staff, Provisions Regarding Worker's Health, 1.4 Provisions Regarding Safety and Welfare of Workers. Recent amendments (If any)	Students will get the basic knowledge about various provisions under factories Act 1948.
3	The Employees State Insurance Act,1948	3.1 Scope, Application and Definitions 3.2 Chapter II of the Act(ESI Corporation, Standing Committee, Medical Benefit Council, Principle Officers) 3.3 Chapter III of the Act(Finance & Audit) 3.4 Chapter IV-(Contributions, Recovery of Contribution,) 3.5 Chapter V(Benefits) 3.6 Chapter VI(Adjudication of Disputes & Claims) 3.7 Chapter VII(Punishment)	It will help the students to gain insights of the Employees State Insurance Act,1948.
4	The Employees Provident funds and Miscellaneous Provisions Act, 1952	5.1 Introduction, Objectives and scope of the Act, 5.2 Applicability and Constitutional validity of the Act., 5.3 Definitions, Employees' Provident Fund Scheme, 5.4 Employees' pension scheme and Employees Deposit Linked Insurance scheme Authorities - Under the Act, and their workings, penalties, offences and protection.	To learn various provisions & applications of the Employees Provident funds & Miscellaneous Provisions Act, 1952.

Teaching Methodology

Topic No.	Total Lectures	Innovative Methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	<ul style="list-style-type: none"> ➤ Group Discussion ➤ Article Reviews 	<ul style="list-style-type: none"> ➤ E-Content on Evolution of Labour laws provided by UGC/University/MOO C etc. to be analyzed. ➤ Other open E-Content Internet Sources. 	Project report shall be prepared on Development of labour laws as per their necessity.	Understanding the actual requirement of legal framework in India.
2	08	<ul style="list-style-type: none"> ➤ Benefits of Factories Act to be discussed in Group. ➤ Internet Sources. ➤ Discussion on legal requirements. 	<ul style="list-style-type: none"> ➤ E-Content on Factories Act provided by UGC/University/MOO C etc. to be analyzed. 	Project report can be prepared on applications of Factories Act 1948.	Understanding the major insights of Factories Act 1948.
3	08	<ul style="list-style-type: none"> ➤ Benefits of Insurance to be discussed in Group. ➤ Internet Sources. ➤ Discussion on various Provisions of the Act. 	<ul style="list-style-type: none"> ➤ You tube E-Content Sources. ➤ E-Content on the Employees State Insurance Act provided by UGC/University/MOO C etc. to be analyzed. 	Project report can be prepared on benefits of Employees State insurance Act.	Make students aware about Employees State Insurance Act.
4	10	<ul style="list-style-type: none"> ➤ Benefits of The Employees Provident funds and Miscellaneous Provisions Act, 1952 to be discussed in Group. ➤ Internet Sources. ➤ Discussion on various Provisions of the Act. 	<ul style="list-style-type: none"> ➤ You tube E-Content Sources. ➤ E-Content on the Employees Provident funds and Miscellaneous Provisions Act, 1952 provided by UGC/University/MO OC etc. to be analyzed. 	Project report can be prepared on benefits of The Employees Provident funds and Miscellaneous Provisions Act, 1952	Make students aware about The Employees Provident funds and Miscellaneous Provisions Act, 1952

References

Sr. No.	Title of the Book	Author/s	Publication
1	Labour Laws	Taxmann	Taxmann
2	Labour & Industrial Laws	S N Misra	Central Law Publication
3	Labour and Industrial Laws	M.N. Mishra	Central Publicaions
4	Business & Commercial Laws	Sen & Mitra	--
5	Business Law for Management	Bulchandani K.R.	--

Practical for Semester - III

Topic	Mode of Practical
Applications of Factories Act 1948	Overview & Presentation can be taken.
Evolution of labor policies in India	Group Discussion & Survey can be conducted.
Benefits of Employees state insurance Act.	Online data analysis with library sources.
Overview of Employees Provided fund & Miscellaneous provisions Act.	Applications to studied.

Revised Syllabi (2019 Pattern) for Three years B.Com Degree Course (CBCS)

Semester -V

Course Code- **355 (d)**

Subject: --: Co-operation & Rural Development ((Special Paper-II)

Total Credits: - 04 (Theory 03 Internship 01=04)

Preamble:

Cooperative learning requires students to engage in group activities that increase learning and adds other important dimensions. The positive outcomes include academic gains, improved race relations and increased personal and social development. The purpose of this course is to impart knowledge of concept of cooperative marketing, consumer cooperative and marketing of other cooperative organisations. This course enables students to acquire in-depth knowledge of cooperative marketing.

Objectives of the Course:

- 1) To create awareness among students about co-operative marketing
- 2) To develop the capability of students for knowing different types Marketing.
- 3) To create awareness about the role of National Agricultural Co-operative Marketing Federation (NAFED)

Unit No.	Unit Title	Contents	Skills to be developed
1	Introduction to Marketing	1.1 Meaning and definition 1.2 Elements of marketing 1.3 Objectives of marketing 1.4 Importance of marketing 1.5 E- marketing for co-operatives 1.6 Recent trends in co-operative marketing	Understanding Basic Marketing and its importance
2	Co-operative Marketing	2.1 Basic concepts and features of co-operative marketing	Understanding basic concepts of co-operative Marketing, Cooperatives

		<p>2.2 Structure of cooperative marketing</p> <p>2.3 Primary Co-operatives Marketing Societies- Objects, Functions and Progress.</p> <p>2.4 District and State Co-operatives marketing societies / Federations objectives, Functions and Progress.</p> <p>2.5 Development and Evaluation</p>	<p>federations, their functions, objectives etc.</p>
3	Consumer Co-operatives	<p>3.1 Meaning, Need and Importance</p> <p>3.2 Structure of consumers Co-operatives</p> <p>3.3 Primary Co-operative Consumer Stores, Student Consumer Stores.</p> <p>3.4 Wholesale Co-operative Stores & Super markets</p> <p>3.5 State Co-operative Consumer Federation & National Co-operative Consumer Federation</p> <p>3.6 Problems of consumer co-operatives</p> <p>3.7 Evaluation and development</p>	<p>1) Creating awareness about consumer co-operatives, its needs and structure.</p> <p>2) Understanding about problems of consumer co-operatives, their evaluation and development</p>
4	Other Co-operative Organizations and It's Marketing	<p>4.1 Dairy Co-operatives</p> <p>4.2 Poultry Co-operatives</p> <p>4.3 Sugar Co-operatives.</p> <p>4.4 Cotton processing (Ginning, Spinning Mills) Pricing</p> <p>4.5 Meaning and Objectives of Pricing</p> <p>4.6 Competitive and Co-operative Pricing</p> <p>4.7 Agricultural Cost and Price Commission (ACPC)</p>	<p>Creation of awareness about different cooperative originations and their marketing strategies</p>

Teaching Methodology:

Topic No.	Total Lectures	Innovative Methods to be used	Film Shows and A.V. Application	Project	Expected Outcome
1	12	Lecture, PPT Presentation Poster Presentation, Group Discussion, Library visit ,Home Assignment ,Pre reading, Class discussion , library visit , internet resources	Relevant You Tub Videos, Relevant slide show, online Video Short Film Show	Individual assignment report	Understanding of basic knowledge of Marketing
2	12	Pre reading, Class discussion, internet resources, Lecture, Expert Lecture, PPT / Poster Presentation, Group Discussion, Library /Home Assignment ,Internal Assignment, case study	Relevant You Tub Videos , Short Film Show, A.V Application ,	Visit to Office of co- operative society	Understanding the importance and Essentials co-operative Marketing
3	12	Lecture, PPT Presentation Poster Presentation, Group Discussion, Library visit ,Home Assignment ,Pre reading, Class discussion , library visit , internet resources ,students Seminar/Workshop ,case study	Relevant You Tub Videos.PPT AV Application, online video	Presentation	1) To acquire the fundamental knowledge consumer co-operative institutions 2) To understand the function of state and National consumer federations
4	12	Guest Lectures of eminent Personalities , Group Discussion, Library visit ,Home Assignment, case study	Online Videos, Relevant slide show , Short Film Show	Visit to co-operative organization & Presentation on it.	To understand elements different co-operative organization and their pricing policies and pricing policies.

Method of Evaluation:

Subject	Internal Evaluation	External Evaluation	Suggested Add-on Course
Unit- I	Attendance, Continuous Assessment Test, Assignment /Quiz/Course project, Seminar and Discussion	As per University norms.	Certificate Course on Cooperation and Rural Development
Unit-II	Attendance, Continuous Assessment Test, Assignment /Quiz/Course project, Seminar and Discussion	As per University norms.	
Unit-III	Attendance, Continuous Assessment Test, Assignment /Quiz/Course project, Seminar and Discussion	As per University norms.	
Unit-IV	Attendance, Continuous Assessment Test, Assignment /Quiz/Course project, Seminar and Discussion	As per University norms.	

References:

Sr. No	Title of Book	Author/s	Publication	Place
1	New Dimensions of Co-operative management	G.S.Kamat	Himalaya Publication House,	Mumbai
2	Co-operative Management principals and techniques	Dr.Nakkiran S.A.-	Himalaya Publication House,	Mumbai
3	Co-operative Management and Administration	Goel B.B	Deep and Deep Publication	New Delhi.
4	Co-operation and Rural Development	Principal Dr.Nitin Ghorpade	Success	Pune
5	Human Resource Management Practices in Co-operative sector	Principal Dr.Shaikh Aftab Anwar	Idea Publication	New Delhi
6	Theory & Practice of Co-operation,	Dr. Dhiraj Zalte &Others –	Prashant Publication	Jalgaon
7	C.A State and C-operative Movement			
8	https://www.bhagirathgram.org/			
9	Journal of Commerce and Management Thought(JCMT)			

SPPU, Pune

Revised Syllabi (2019pattern) for three years B.Com. Degree Course CBCS

T.Y. B.Com. (Semester V)

Subject Name :- Cost and Works Accounting. Special Paper II

Subject Title :-Overhead and Accounting for Overheads

Course Code :- 355 – e

Objectives:

1. To provide knowledge about the concepts and principles of overheads.
2. To Introduce the cost accounting standards and the cost accounting standard board.
3. To understand the stages involved in the accounting of overheads.
4. To build an ability towards strategic overhead accounting under Activity Based Costing

Unit No.	Unit Title	Contents	Skills to be developed
1	Overheads	1.1 Meaning and definition of overheads. 1.2 Classification of overheads 1.3 Introduction to Cost Accounting Standard, Cost Accounting Standard Board 1.4. Introduction to of CAS 3, CAS 11, CAS 15 1.5 Cost Accounting Standard 3: Production and operation Overheads	a. Ability to understand the concept of Overhead and classification of overheads. b. Students will be able to relate the cost Accounting Standard with respective overheads.
2	Accounting of Overheads (Part-I)	2.1 Collection and Allocation of overheads. 2.2 Apportionment and Reapportionment of overheads 2.3 Simple problem of primary distribution of Overhead	a. To understand the stages in the process of accounting overheads. b. Students will be able to calculate total departmental overheads after implementing Primary and Secondary

		2.4 Simple Problem of Secondary distribution of overheads (Repeated & Simultaneous Equation method only)	Distribution.
3	Accounting of Overheads (Part-II)	3.1 Absorption - Meaning, Rate and Methods of Overhead Absorption 3.2 Under and Over Absorption of overheads- Meaning, Reasons and Accounting treatment 3.3 Simple problems on the accounting treatment of under and overabsorption of Overheads	a. Conceptual understanding of under and over absorption. b. Enable the learner with accounting treatment for under and over absorption.
4	Activity Based Costing	4.1 Definitions-Stages in Activity Based Costing 4.2 Purpose and Benefits of Activity Based Costing 4.3 Cost Pools and Cost Drivers 4.4 Problems on Activity Based Costing [Simple Problems only]	a. Students will be able to identify overheads as per various activities.

Teaching Methodology

Unit No.	Total Lectures	Innovative Methods to be used	Films Shows and AV Applications	Practical	Expected Outcome
1	08	Powerpoint Presentations	Relevant Youtube Links	Group discussion	To remember and understand the concept of overhead and classification of overheads
2.	16	Group Discussion		Visit small units and make a list of overheads of the respective units.	Understanding the significance of overheads in the total cost of product/service.

3	12	Quiz		Powerpoint Presentations	1)Ability to understand the stages in the process of accounting overheads. 2) Application of accounting treatment for under and over absorption.
4	12	Expert lecture		Case Study	Knowledge about detection of overheads to different activities

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add-On Course
Unit I	Multiple Choice Questions, Written Test, Internal Examination, Powerpoint Presentations, Orals, Assignments, Tutorials etc.	SPPU	Two industrial visits and subsequent reports on the visits.
Unit II			
Unit III			
Unit IV			

References

Sr. No	Title of the Book	Author	Publisher	Place
01	Practice in Advanced costing and Management Accounting.	Prof. Subhash Jagtap	Nirali Prakashan	Pune
02	Advanced Cost Accounting and Cost Systems	Ravi Kishor	Taxman's Allied Service Pvt. Ltd.	New Delhi
03	Cost Accounting Principles and Practice.	S.P. Iyengar	Sultan Chand & Sons Accounting, Taxman's	New Delhi
04	Students Guide to Cost Accounting	Ravi Kishor	Taxman's, New Delhi.	New Delhi
05.	Cost Accounting Principles and Practice	M.N. Arora	Vikas Publishing House Pvt. Ltd.	New Delhi.
06	Cost Accounting, Theory and Problems,	S.N. Maheshwari and S.N. Mittal	Mahavir book Depot	New Delhi
07	Theory and Techniques of Cost Accounting.	B.L. Lall and G.L. Sharma	Himalaya Publishing House	New Delhi.

08	Cost Accounting – Textbook.	V.K. Saxena and Vashista	Sultan Chand and Sons	New Delhi.
09	Cost Audit and Management Audit.	V.K. Saxena and Vashista	Sultan Chand and Sons	New Delhi
10	Cost Accounting Principles and Practice.	Jain and Narang	Kalyani Publishers	Kolkata
11	Principles and Practice of Cost Accounting	N.K. Prasad	Book Syndicate Pvt. Ltd.	Kolkata
12	Advanced Cost Accounting Syndicate Pvt Ltd., Calcutta.	N.K. Prasad	Book Syndicate Pvt. Ltd.	Kolkata
13	Practical Costing.	R.K. Motwani	Pointer Publisher	Jaipur
14	Cost Accounting.	R.S.N. Pillai and V. Bhagavati	Sultan Chand and Sons	New Delhi.
15	Advanced Cost Accounting	Dr D. M. Gujarathi	Idol Publication	Pune

Web References

Sr. No	Lectures	Films	PPTs	Articles	Others
For all the units.	Guest Lectures by Field Personnel such as working executives from industries and of practising Cost and Management Accountants.	YouTube films showing the working of different industries.	Relevant PowerPoint presentations are available on all these topics.	Articles from professional journals such as The Management Accountant, The Chartered Accountant, The Chartered Secretary, The Institute of Chartered Financial Analyst of India	https://icmai.in www.globalcma.in eclm.unpune.ac.in

Notes: The breakup of marks in the Examination will be as follows:

- 50 % of the marks for Theory & 50 % of the marks for Practical Problems (Simple Problem Only)

Areas of Practical Problems

- ▶ Accounting & Control of Overhead. [Part I]
Primary and Secondary Distribution of Overheads(Repeated & Simultaneous equation methods only)
- ▶ Accounting & Control of Overhead. [Part II] Problems of Machine Hour Rate Only.
- ▶ Problems of Activity Based Costing [Simple Problems only]

Revised syllabi (2019 Pattern) for three years B. Com. Degree course (CBCS)

Syllabus for **B. Com. Semester: - V**
Subject Name: - **Business Statistics II**
Course code: - 355(F)
Credit 3

Preamble to the syllabus:

Tools and techniques learned in Statistics give a precise way of formulating and analyzing a problem and to make logical conclusions. Concepts and tools introduced in this course are useful to students for higher studies and career in any branch of Economics, Commerce and Management. Professionals working in these fields, wishing to upgrade their knowledge, will also benefit. The stress of the course will be on building the concepts and their applications.

In modern times, Statistics is viewed not as a mere device for collecting numerical data but as a means of developing some techniques for their handling and analysis and drawing valid inferences from them. Statistics provides tools for making decisions when conditions of uncertainty prevail. So it is very useful in various fields like agriculture, business, management, economics, finance, insurance, education, biotechnology and medical science etc.

Depth of the Course – Basic Knowledge of Probability Theory

Objective of the Course

1. To understand and Master the concepts of Probability.
2. To understand the concepts of discrete probability distributions.
3. To make students to understand the art of applying statistical techniques to solve some real life problems.
4. To gain knowledge of Statistical Computations.

Unit No.	Unit Title	Contents	Purpose/Skills to be developed
1	Probability	Definition of permutation and combination of distinct objects; Relationship between nPr and nCr , Statement of binomial theorem for positive integral index (without proof); Sample space - Definitions of sample space, event, sure event, null event, Complimentary events, Equally likely events, Simultaneous occurrence of the two events, Occurrence of at least one of the two events; Probability - Definitions of probability using classical and axiomatic	<ol style="list-style-type: none">1. To understand the concepts of probability2. To apply the concepts of probability to real life business problems.

		approach; Addition and multiplication laws of probability; Conditional probability - $P(A B)$, $P(B A)$ Where A and B are any two events defined on same sample space, independence of two events, Bayes Theorem (statement only); Examples and problems related to business.	
2	Univariate and Bivariate Discrete Probability Distribution	Random Variable - Meaning of a random variable, discrete random variable; Probability distribution of a discrete random variable; Probability mass function (p.m.f); Expected value, variance and S.D, Examples and problems related business based on finite sample space. Bivariate discrete random variable; Joint probability distribution of a bivariate discrete random variable; Marginal probability distribution of a discrete random variable; Independence of two discrete random variables, Examples and problems related to business.	<ol style="list-style-type: none"> 1. To understand the concept of random variable 2. To understand the concepts of univariate and bivariate probability of distribution 3. To apply the concept of random variables and probability distribution to real life business problems.
3	Some standard discrete probability distributions	Bernoulli distribution - Bernoulli trials, Probability mass function, Expected value, variance and S.D; Binomial distribution - Probability mass function, Expected value, variance and S.D (Formulae only) statement of additive property (without proof), Problems to calculate probabilities, Expected value and parameters of binomial distribution, Relation with Bernoulli distribution, Real life situations; Poisson distribution - probability mass function, Expected value, variance and S.D (Formulae only) statement of additive property (without proof), problems to calculate probabilities, expected value and parameter of Poisson distribution, Real life situations.	<ol style="list-style-type: none"> 1. To understand the concepts of different discrete probability distributions 2. To apply concepts of discrete probability distributions to real life business problems.
4	Inventory Control	Meaning and necessity of inventory control; Deterministic inventory Model: - Economic order quantity for instantaneous replenishment with uniform demand and a) shortages not allowed, b) shortages allowed; Lead time, Re - order level and Buffer stock; Probabilistic Inventory Model : - Single period probabilistic model without set up costs.	<ol style="list-style-type: none"> 1. To understand the concept and Inventory control 2. To apply the concept of inventory control to real life business models.

List of Practicals

Sr. No	Name of the Experiment
1.	Applications of Binomial distribution using
2.	Application of Poisson distribution
3.	Application of Bivariate discrete probability distributions

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	ICT	NA	NA	Students will be able to understand and apply concepts probability to real world business problems.
2	14	ICT	NA	NA	Students will be able to understand and apply the concepts of discrete probability distributions to real world business problems.
3	14	ICT	NA	NA	Students will be able to understand and apply some standard probability distributions to real world business problems.
4	08	ICT	NA	NA	Students will be able to understand and apply the concept of inventory control to real world business problems.

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Unit wise distribution of Marks (Final Examination)	Suggested Add on Course
Unit – I	30%	70%		
Unit – II	30%	70%		
Unit – III	30%	70%		
Unit – IV	30%	70%		
Total				

Notes: -

1. Internal evaluation is continuous assessment.
2. Internal evaluation shall have following components: -
 - a. At least one test of 20 marks involving objective questions of following type: - multiple choice, true or false, state definitions/concepts, one line answer etc.
 - b. At least one assignment of 05 marks.
 - c. If time and resources permit then there can be power point presentation of group or individual (this component is not compulsory).
 - d. Final score will be average score of all components.

References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Business Mathematics and Statistics	N.G. Das & Dr. J.K. Das	McFraw Hill	New Delhi
2	Fundamentals of Business Mathematics	M. K. Bhowal	Asian Books Pvt. Ltd	New Delhi
3	Mathematics for Economics and Finance: Methods and Modeling	Martin Anthony and Norman Biggs	Cambridge University Press	Cambridge
4	Statistical Methods	Gupta S. P.	Sultan Chand and Sons	New Delhi
5	Applied Statistics	Mukhopadhyaya Parimal	New Central Book Agency Pvt. Ltd.	Calcutta.
6	Fundamentals of Statistics	Goon A. M., Gupta, M. K. and Dasgupta, B.	World Press	Calcutta.
7	Fundamentals of Applied Statistics	Gupta S. C. and Kapoor V. K.,	Sultan Chand and Sons	New Delhi
8	Statistics for Business and Financial Economics	Cheng-Few Lee, John C. Lee and Alice C. Lee	Springer	New York

9	Fundamentals of Statistics	S. C. Gupta	Himalaya Publishing House	New Delhi
10	Statistics for Business and Economics	J. S. Chandan	Vikas Publishing House	New Delhi
11	Business Statistics	S. P. Gupta and M. P. Gupta	Sultan Chand and Sons	New Delhi
12	Quantitative Techniques	N. D. Vohra	McGraw Hill Education	New Delhi
13	Business Statistics	S. C. Gupta and Indra Gupta	Himalaya publishing House	New Delhi
14	Complete Business Statistics	Amir Aczel, J. Sounderpandian, and P. Saravanan	McGraw Hill Education	New Delhi
15	Fundamentals of Statistics	D. N. Elhance	Kitab Mahal	New Delhi

Revised Syllabi (2019 Pattern) for Three years B.Com Degree Course (CBCS)

Semester V (T.Y.B.Com)

Subject code -: 355 (g)

Subject -: Business Entrepreneurship (Special Paper II)

Total Credits: - 04 (Theory 03 Internship 01=04)

Preamble:

Entrepreneurs create jobs, increase innovation, raise competition and are responsive to changing economic opportunities and trends. Youth entrepreneurship is also attractive to policy makers because of the high rates of latent entrepreneurship amongst young people. Entrepreneurship education aids students from all socioeconomic backgrounds to think outside the box and nurture unconventional talents and skills. It creates opportunities, ensures social justice, instills confidence and stimulates the economy. Entrepreneurship is the capacity to not only start companies, but also to think creatively and ambitiously. Hence it is very important to be included in curriculum.

Objectives:

- 1) To Develop understanding of MSME and its formation
- 2) To Develop Knowledge and understanding in creating and managing new venture.
- 3) To Equip students with necessary tools and techniques to set up their own business venture
- 4) To help students to bring out their own business plan.
- 5) To make students aware about business crises and sickness.

Depth of Programme: - Basic knowledge of Business Entrepreneurship

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	MICRO SMALL AND MEDIUM ENTERPRISES (MSME) POLICY 2020:	Introduction, Definition, Investment and Annual Turnover, Key Announcements of Atma Nirbhar Bharat Abhiyan, Criterion, Classification of Enterprises, Government Schemes for MSME in India, Covid impact on MSME	1) To understand the concept of MSME 2) To study the government schemes related to MSME

2	FORMATION OF MSME:	Business opportunity, scanning the environment for opportunities, evaluation of alternatives and selection based on personal competencies. Registration under MSME, Udyam Registration Portal, MSME Development and Service covered under MSME, Limits of MSME, and Eligibility for MSME.	<ol style="list-style-type: none"> 1) To study the procedure of formation of MSME 2) To study the Development and Service covered under MSME 3) To study Limits of MSME and Eligibility for MSME.
3	BUSINESS PLAN PREPARATION AND PROJECT REPORT:	<p>Meaning and importance - objectives - Selection of suitable form of organization - Precautions to be taken by an entrepreneur while preparing Business Plan.</p> <p>Meaning, Concept and classification of project</p> <p>Project for Retail store, Oil Mill, Cold Storage, Eco friendly Bag production- Reasons for failure of project</p> <p>Project Appraisal - Break - Even Analysis and Ratio Analysis : Debt : Service Coverage Ratio - Gross Profit : Net Profit Ratio and Return on Investment (ROI), Project Audit</p>	<ol style="list-style-type: none"> 1) To understand the concept and various aspects of Business Plan and Project Report 2) To study the concept of project appraisal and its related aspects
4	PROJECT ASSISTANCE:	Financial assistance through State Financial Corporation's (SFC's), District Industries Centre (DIC), Maharashtra Industrial Development Corporation (MIDC), National Institute for Entrepreneurship and Small Business Development (NIESBUD), National Institute of Small Industry Extension Training (NISIET), Small Industries Development Organization (SIDO), Small Industrial Development Bank of India (SIDBI), Technical Consultancy Organization (TCO), Commercial	<ol style="list-style-type: none"> 1) To study the role of various institutions in Project assistance 2) To study the scheme of assistance and incentives of various institutions

		Banks, Industrial Finance Corporation of India (IFCI) - Non-financial assistance from District Industries Centre (DIC), Small Industries Service Institute (SISI), Khadi and Village Industries Commission (KVIC) - Financial incentives for Small Scale Industries (SSI's) and <i>Tax</i> Concessions - Assistance for obtaining Raw Material, Machinery, Land and Building, Venture Capital and Technical Assistance	
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Teaching Methodology:

Topic No.	Total Lectures	Innovative Methods to be used	Film Shows and A.V. Application	Expected Outcome
1	12	Group Discussion, Quiz	Related Videos and PPTs	Understanding the concept and government schemes related to MSME
2	12	Power Point Presentation, Survey Analysis	Related Videos and PPTs	Gaining practical knowledge related to formation of MSME
3	14	Poster Making, Article Review, Practical based learning, Problem solving based learning	Project Reports of Companies, Related Videos and PPTs	Students will be able to prepare business plan and formulate project report
4	10	Power Point Presentation, Case study	Annual Reports of Companies Related Videos and PPTs	Understanding the role and schemes of various institutions in Project assistance

Method of Evaluation:

Topic No.	Internal Evaluation	External Evaluation	Suggested Add On Course
1	MCQ, Assignment	As per University Norms	1) MSME Entrepreneurship
2	Project, Presentation	As per University Norms	2) Professional Entrepreneurship Courses
3	Project, Quiz, Tutorials	As per University Norms	3) Entrepreneurship: Launching an Innovative Business
4	MCQ, Assignment	As per University Norms	4) Essentials of Entrepreneurship: Thinking and Action

References:

- 1) Pandey G.N. - 'A Complete Guide to Successful Entrepreneurship' Vikas Publishing House Pvt Ltd.
- 2) Maharashtra Centre for Entrepreneurship Development - 'Project Profile', 'Profile for SSI Projects.'
- 3) Edward D. Boao - 'Opportunities'.
- 4) Prof. John Mullins - 'The New Business Road Tests' - Pearson.
- 5) Prof. Rajeev Roy - 'Entrepreneurship' Oxford University Press.
- 6) Rashmi Bansal - 'Stay Hungry Stay Foolish' - CIIFIM, Ahmedabad.
- 7) Dr. Patel V.G. - 'When The Going Gets Tough' - Tata McGraw Hill, New Delhi.
- 8) Mark. J. Dollinger, Entrepreneurship - Strategies and Resources, Pearson Edition.
- 9) Udai Pareek and T.V. Rao, Developing Entrepreneurship
- 10) S.V.S. Sharma, Developing Entrepreneurship, Issues and Problems
- 11) Srivastava, A Practical Guide to Industrial Entrepreneurs
- 12) Anil Kumar: Small Business and Entrepreneurship I.K. International Publishers
- 13) Government of India, Report of the committee on Development of small and medium entrepreneurs, 1975
- 14) Bharusali, Entrepreneur Development
- 15) **23 Vidya Hattangadi : Entrepreneurial**

- 16) Dr. Venkataramanappa : : Entrepreneurship Development
- 17) B. Janakiraman , Rizwana M: Entrepreneurship Development
- 18) N.V.R Naidu : Entrepreneurship Development, I.K. International Publishers
- 19) Business Entrepreneurship – Dr. M. B. Sonawane
- 20) Business Entrepreneurship –Dr. S. L. Shirgave.

Web References:

- 1) <https://msme.gov.in/>
- 2) <https://www.startupindia.gov.in/>

T.Y. B.Com. (Semester -V) (2019 Pattern)

Special Paper-II

Marketing Management-II

Course code – 355 (h)

Objectives:

- The objective of this course is to facilitate understanding of the conceptual framework of marketing and its applications in decision making under various environmental constraints.
- The course will make learners understand how to make effective marketing decisions, including assessing marketing opportunities and developing marketing strategies and implementation plans.

Unit No	Topic	No. of Lectures	Teaching Method	Proposed skills to be developed
1	<u>Market Demand and Sales Forecasting</u> What is Demand? Definition Meaning Determinants Understanding Needs, Wants and Demands in Marketing. Types of Demands in Marketing Meaning of Sales Forecast, Sales Budget and Sales Quota Sales Forecasting Methods Forecasting Techniques	12	Conceptual Learning, Power Point Presentation, Library Work, Assignment.	To equipped with a comprehensive understanding of the key factors in demand and sales forecast.

2	<p><u>Marketing of Non-Profit Organization</u></p> <p>Non-Profit Organization-Concept, Characteristics Types Problems Need of Marketing of Non-Profit Organization Non-Profit Organization in India</p>	12	Conceptual Learning , Visit Assignment.	Familiarizing the students with the application of the concept & need of marketing in Non-profit organization.
3	<p><u>Changing Role of Marketing Organizations</u></p> <p>Meaning of Marketing Organization Types of Marketing Organizations Factors Affecting on Marketing Organization Essentials of an effective Marketing Organizations The changing role of marketing and marketers.</p>	12	Conceptual Learning, Power Point Presentation, Library Work, Case Study.	Understanding marketing organization and its changing role.
4	<p><u>Brand Building Strategy</u></p> <p>Concept of Brand Strategy Importance of Building a Brand Strategy Brand Building Strategy key concepts and Steps Various types of Brand Building Strategies Reviewing Brand Building Strategies</p>	12	Conceptual Learning, Power Point Presentation, Group Discussion, Assignment.	Understanding the concept and importance of Building Brand Strategy, as well as its relationship in reviewing to competitive advantage.
	Total	48		

References

Sr.No	Title of the Book	Author/s	Publication
1	Marketing Management	Philip Kotler	Pearson Publication
2	Marketing Management	Rajan Saxena	McGraw Hill Education
3	Marketing Management	V. S. Ramaswamy & S. Namakumari	Macmillan Publication
4	Strategic Brand Management, Building, Measuring and Managing Brand Equity.	Keller .K	Pearson Publication
5	Marketing Management	Dr.K.Karunakaran	Himalaya Publishing House
6	Agriculture Marketing	J.W.Barker	Oxford University Press
7	Sales Forecasting Management: A Demand Management Approach	John T.Mentzer & Mark A. Moon	Sage Publications
8	Global Marketing	Carlyle Farrell	Sage Publications

Savitribai Phule Pune University, Pune
Third Year, B.Com.
Revised Syllabi for Three Years B. Com. Degree Course
(CBCS-2019 Pattern) (w.e.f. 2021-22)

Semester - V

Subject: Agricultural and Industrial Economics II

Paper-II

Course Code: 355 (i)

Total Credits: 4

Objectives:

1. To understand the concept of Agricultural Marketing and related Issues.
2. To impart adequate knowledge role of Agricultural Processing in India.
3. To understand the Role, Importance and Growth of Major Industries in India.
4. To get acquainted with the role and problems of Public sector Enterprises in India.

Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Content	Purpose Skills to be Developed
1	Agricultural Marketing	1.1 Nature, Scope and Role of Agricultural Marketing in India 1.2 Organisation and Functions of Agricultural Marketing in India 1.3 Problems of Agricultural Marketing, 1.4 Present Status of Food Retail Marketing System in India 1.5 Recent Agricultural Marketing Policies in India, 1.5.1 National Agriculture Market (e-NAM) 1.5.2 Model APLM Act, 2017	<ul style="list-style-type: none"> ▪ To apprise students regarding various aspects of Agricultural marketing. ▪ To understand the functions and Problem of Agricultural Marketing. ▪ To impart knowledge about Policies of Agricultural Marketing.
2	Agricultural Processing	2.1 Role and Growth of Agricultural Processing in India 2.2 Scope & Importance of Agricultural Processing. 2.3 Problems & Remedial Measures of Agricultural Processing. 2.4 Governments Schemes for Development Agro-Processing Industries	<ul style="list-style-type: none"> ▪ To understand the role of Agricultural Processing. ▪ To make the students know about Problems & remedial measures of Agricultural Processing.
3	Major Industries in India	The Role, Importance, Growth and Problems of... 3.1 Agro-Industries 3.1.1 Textiles and Jute Industry 3.1.2 Sugar Industry	To understand the Role, Importance and Growth of Agricultural Industry, Textiles and Jute Industry, Sugar Industry, Service Industry, Information Technology Industry,

		3.2 Service Industry 3.2.1 Information Technology Industry 3.2.2 Health Sector	Health Sector
4	Public sector Enterprises	4.1 Role of Public Sector in Economic Development of India. 4.2 Government Policy towards Public Sector. 4.3 Problems of Public Sectors, Issues Regarding Deregulation 4.4 Disinvestment and Future of Economic Reforms	<ul style="list-style-type: none"> ▪ To understand the role of the Public sector ▪ To get acquainted with Government Policy towards Public Sector. ▪ To understand the problems of the Public sector in India

Teaching Methodology:

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	14	Lecture, PPT/ Group Discussion, Library, Problem-solving based learning, Case study, Jigsaw reading, Practical based learning	Relevant videos, Consortium for Educational Communication- SWF E-Content	<ul style="list-style-type: none"> ▪ Visit any Agriculture Marketing Committee and Identify the problem of Agricultural Marketing. 	<p>After completing this topic, the student will be able to understand</p> <ul style="list-style-type: none"> ▪ The Meaning and Role of Agricultural Marketing ▪ Various aspect of Agricultural Marketing In India. ▪ Agricultural Marketing Policies in India
2	10	Lecture, PPT/ Group Discussion, Library, Problem-solving based learning, Case study, Jigsaw reading, Practical based learning	Relevant videos, Consortium for Educational Communication- SWF E-Content	<ul style="list-style-type: none"> ▪ the importance of Agro-Processing in India. 	<ul style="list-style-type: none"> ▪ Role of Agricultural Processing in India ▪ Scope & Importance of Agricultural Processing. ▪ Problems & remedial measures of Agricultural Processing. ▪ Scheme for Agro-Processing Industries
3	12	Lecture, PPT/ Group Discussion, Library, Problem-solving based learning, Case study,	Relevant videos, Consortium for Educational Communication- SWF	<ul style="list-style-type: none"> ▪ Identify the Problems of the Sugar Industry. 	<ul style="list-style-type: none"> ▪ The role, Importance and Growth of Iron & Steel Industry, Textiles and Jute Industry, Sugar Industry,

		Jigsaw reading, Practical based learning	E-Content		Cement Industry, Automobile Industry
4	12	Lecture, PPT/ Group Discussion, Library, Problem-solving based learning, Case study, Jigsaw reading, Practical based learning	Relevant videos, Consortium for Educational Communication- SWF E-Content	<ul style="list-style-type: none"> ▪ Importance of Public sector in India. 	<ul style="list-style-type: none"> ▪ Role of Public Sector ▪ Government Policy towards Public Sector, problems associated with Privatization, issues regarding Deregulation, Disinvestment and future of Economic Reforms.

Recommended Books:

1. Acharya and Agarwal, 1987, Agricultural Marketing in India, Oxford & IBH Publishing Company.
2. Bhalla, G. S. and Singh G., 2001, Indian Agriculture: Four Decades of Development, Sage Publications
3. Acharya and Agrawal (1992), Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd.
4. Crawford (1997), 'Marketing and Agribusiness Texts', FAO.
5. Jelen P. (1985), Introduction to Food Processing. Reston Publishing.
6. Potly, V.H. and M. J. Mulky (1993), Food Processing. Oxford & IBH
7. Datt R. & K.P.M Sundharm (2007) Indian Economy, S.Chand&Co.Ltd.Delhi.
8. Misra S.K. & V.K.Puri, (2017) Indian Economy, Himalaya Publication house Mumbai.
9. Kavimandan Vijay, (2009) KrushiArthshastra, Shri Mangesh Prakashan, Nagpur.
10. Barthwal R.R (2204) Industrial Economics Introductory Text Book, New Age International Limited, Kanpur.
11. Govind Bhattacharjee (2020) Public Sector Enterprises in India, Evolution, Privatization and Reforms, Sage Publication, Delhi

Web reference

1. <https://www.youtube.com/user/cecedusat>
2. <https://www.swayamprabha.gov.in/>
3. <http://14.139.13.96:8080/> - UGC CEC E Contain on Agricultural Economics
4. <http://14.139.13.96:8080/> - UGC CEC E Contain on Industrial Economics

Savitribai Phule Pune University
Faculty of Commerce & Management
T Y B Com (Semester V)
(Choice Based Credit System)
Revised Syllabus (2019 Pattern)

SPECIAL ELECTIVE COURSE – I

Course Code: 355 (j)

Subject: Defence Budgeting Finance and Management special paper - II

Total credits:

Objectives:

1. Understanding the importance of Defence Budget
2. To know the latest development of Indian Defence Industry.
3. To know the concept financial management regarding defence.
4. Understanding Defence Expenditure.

Unit No.	Topic	No. of lectures	Teaching Method	Proposed Skill to be Developed
1	Defence budgeting A) Budget as Instrument of financial Direction & control B) Ingredients of Budgeting C) Defence budgeting-it cost Effectiveness	12	Lecture group Discussion library work assignment field visit	.Understanding how the defence Budget is used as instrument of financial direction & Control.
2	Development of Indian defence Industry A) Indian Defence Industry : A Historical overview B) Policy changes in Defence Industry C) India's offset Policy to encourage	12	Lecture group Discussion library work assignment field visit	Understanding the development of Indian Defence Industry and growth opportunities in the Indian defence industry.

	domestic production D) Growth opportunities in the Indian Defence Industry			
3.	Financial management A) Purpose, planning, control & need. B) Salient features of India's Economic system	12	Lecture group Discussion library work assignment field visit	Understanding of propose, planning control, need and of defence financial management.
4	Defence Expenditure Trends A) Defence Expenditure as a production of the GDP B) Calculating Defence Expenditure C) Characteristics of defence Spending	12	Lecture group Discussion library work assignment field visit	Understanding Defence Expenditure proportion with GDP & know the calculating system of defence Expenditure & also characteristics of Defence Expenditure.

Reference:

- 1) Raju G. C. Thomas(1978), 'The Defense of India: A Budgetary perspective', MacMillan Publication, New Delhi
- 2) Subramanyam K. (1991), 'India's security perspective – Policy and Planning' Lancer books, New Delhi.
- 3) Nanda Ravi, (1991), 'National Security Perspective, policy planning', Lancer Books, New Delhi.
- 4) Khanna D. D. and Malhotra P N. (1993), 'Defense vs Development: A Case study of India', Indus publication company, New Delhi.
- 5) Kennedy Gavin (1983), 'Defense Economics' Gerald Duckworth & Co. Ltd.
- 6) Ghosh Amiya (1996), "India's Defense Budget & Expenditure Management in Wider Context", Lancer Publication and Span Tech, Delhi
- 7) Dutta Meena and Sharma Jai Narayan, 'Defence Economics', Deep and Deep Publication, New Delhi.
- 8) Deger s. & Sen S. (1986), 'Military Expenditure in the Third World countries: The Economic effects', Routlet & Kegan Paul.
- 9) S. Sandeep (col ret'd), 'Funding for Defence & Development', Published by Sumit Enterprises, New Delhi.
- 10) Annual report, Ministry of Defence, government of India.
- 11) Report of the finance Commission, government of India.

T.Y. B.Com. (Semester -V) (2019 Pattern)

Special Paper-II, Course Code - 355(k)

Insurance, Transport & Tourism-I

(Insurance)

Objectives:

- To acquaint the students with basic insurance terminology.
- To aware about risk management and develop proper understanding in insurance.
- To study the various pricing elements and its importance.
- To review the various legislations and its application to insurance business in India

Unit No	Topic	No. of Lectures	Teaching Method	Proposed skills to be developed
1	Insurance Terminology- Common for both Life and Non-Life Insurance First Premium- Renewal- Mode- Limited Payment- Policies- Single Premium- convertible- Days of Grace- Lapse- paid Up Policy- Revival- Deferment Period- Nomination- Assignment- Bonus- With Profit— Participating- Non-Participating or Without Profit- Surrender Value	12	Lecture, PPT, Group Discussion, Library Work, Assignment, Visit to institutions etc.	Understanding the basic terminology in Life and Non-life insurance
2	Risk Management: Concept of Risk, Uncertainty, Perils and Hazards, Definition of Risk – classification of risk□ Personal, Property & Liability Risk, Insurance and Risk Management Technique□Risk sharing and Risk Transfer, Risk prevention & avoidance.	12	Lecture, PPT, Group Discussion, Library Work, Assignments, etc.	Understanding the risk management in insurance.
3	Pricing Elements – Pricing Objectives, Pricing elements- Probability & Mortality Tables, Time value of	12	Lecture, PPT, Group Discussion,	Understanding the pricing elements and its

	Money, Loading & benefits promised, Rate computation-single premium plan, level premium plan, flexible premium plan, yearly renewable plan, saving & investment aspect of life insurance, Methods of rating.		Library Work, Assignments, tests, etc.	importance.
4	Other Legislations Applicable to Insurance Business in India: Motor Vehicles Act 1988, Marine Insurance Act 1963, Consumer Protection Act 1986, Public Liability Insurance Act 1991, The Insurance Laws (Amendment) Act 2015.	12	Lecture, PPT, Group Discussion, Library Work, Assignment, Visit to institutions, tests, etc.	Understanding various legislations and its application to insurance business
	Total	48		

References:

1. Sharma M.N. (2006), 'Insurance Principles and Practice (in Hindi), Apex Publishing House, 1st edition.
2. Vinayakam N. Radhaswamy and Vasudevan S. V., 'Insurance Principles & Practice', S. Chand & Co. New Delhi,
3. M. Arif Khan (2016), 'Theory and Practice of Insurance', Educational Book House, Aligarh ,
4. Malhotra R. P. 'Elements of Insurance' , Macmillan Publisher
5. M. N. Mishra & S.B. Mishra (2016), 'Insurance Principles and Practices', S. Chand & Company, New Delhi.
6. Panda G. S. (2011), 'Principles & Practice of Insurance, Kalyani Publisher,

Savitribai Phule Pune University, Pune (T.Y. B.Com.)

Computer Programming and Application Special Paper II

Subject Name: Computer Networking and E-Commerce-I.

Course Code: 355(L).

Course Objectives:

1. To know about computer network.
2. To understand different topologies used in networking
3. To learn different types of network.
4. To understanding the use of connecting device used in network.

Unit No.	Name of the Topic	No. of Lectures	Ref. Books
1	Computer Networks. Introduction Computer Network, Topology, Types of Networks Communication Types Serial, Parallel Modes of Communication : Simplex, Half Duplex, full Duplex, Server Based LANs & Peer-to-Peer LANs, Comparison of both Protocols and Standards	12	Book No 1,3
2	Network Models ISO-OSI Reference Model : Layers in the OSI Model, Functions of each layer SAP Terminology Internet Model (TCP/IP) Comparison of ISO-OSI & TCP/IP Model Addressing : Physical Addresses, Logical Addresses, Port Addresses IP Addressing : Classful addressing, Classless addressing Transmission Media Guided Media (Wired) : Coaxial cable, Twisted Pair Cable, Fiber Optic cable Unguided Media(Wireless):- Radio Transmission, Microwave Transmission, Infrared Transmission	14	Book No 1,3

3	Types Of Networks IEEE Standards Wired LANs : Ethernet Ethernet Types Standard Ethernet (MAC Sublayer, Physical layer), Fast Ethernet(MAC Sublayer, Physical layer). Gigabit Ethernet(MAC Sublayer, Physical layer) Network Interface Cards (NIC):- Components of NIC, Functions of NIC, Types of NIC. Wireless LANs IEEE802.11 (Architecture, MAC Sub layer, Frame Format, Frame Types, Addressing Mechanism) Bluetooth (Architecture Piconet and Scatter net Applications)	12	Book No 1,3
4	Case Studies of E-Commerce Amazon, Flipkart ,Google Pay ,Phone Pay, Paytm,.....etc.	10	Book No 4,5
Total No of Lectures		48	

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
Unit – I	12	Use ICT or presentation on Computer Networks.	U–tube Tutorial on Computer Networks.	-	Familiar with Computer Networks.
Unit – II	14	Use ICT or presentation on Network Models	U–tube Tutorial Network Models	-	Familiar with Network Models
Unit – III	12	Use ICT or presentation on Types Of Networks	U–tube Tutorial Types Of Networks	-	Familiar with Types Of Networks
Unit – IV	10	Use ICT or presentation on Case Studies of E-Commerce	U–tube Tutorial Case Studies of E-Commerce	Case Study on E-Commerce	Familiar with Case Studies of E-Commerce

Recommended Books:

1. Computer Networks - Andrew Tanenbaum (III Edition)
2. Data Communications & Networking - Behrouz Ferouzan (III Edition)
3. Complete Guide to Networking - Peter Norton
4. E-Commerce, Strategy, Technologies And Applications : David Whiteley, Tata Mcgraw Hill
5. E-Commerce & Mobile Commerce Technologies: Pandey, Saurabh Shukla, S. Chand

Revised syllabi (2019 Pattern) for three years B.Com. Degree course (CBCS)

Semester : - V (T.Y.B.Com)

Subject Code :- PR- 356 (a)

Subject : - Business Administration – III (Finance)

Preamble

Financial management is one of the most important aspects in business. In order to start up or even run a successful business. Financial management deals with directing, controlling, planning and strategically organizing financial projects or accounts of an organization. Financial management education involves using management rules for the finances of an organization. Study of financial management opens up lot of diverse career opportunities for students in the private and public sector such as include investment banking, entrepreneurship, financial analysis, financial and managerial accounting, and strategic financial management. It also serves larger benefit to young entrepreneurs who aspire to set up their own ventures.

Objectives of the course

1. To acquaint the student with knowledge about Corporate Finance and the structure if the Indian Financial Market
2. To develop the Financial Planning Skills among the Students by introducing them to the process of efficient Financial Planning
3. To educate the students on the importance of Capitalisation and the importance to maintaining an optimum capital structure
4. To create awareness among the students in the various sources of Finance available for raising corporate capital

Depth of the program – Fundamental Knowledge

Unit No	Unit Title	Contents	Skills to be developed
1	Introduction to Corporate Finance and Indian Financial System	<p>1.1 Meaning, Features, Need, Importance of Corporate Finance, Finance Functions (Executive and Routine Functions)</p> <p>1.2 Meaning , Objectives , Scope of Financial Management</p> <p>1.3 Indian Financial Market – Meaning and Structure (Money Market & Capital Market)</p> <p>1.4 Stock Exchange – Meaning , Features ,Functions.</p> <p>1.5 Bombay Stock Exchange , National Stock Exchange of India , Dematerialisation of Securities</p> <p>1.6 Securities Exchange Board of India – Objectives , Powers and Functions</p> <p>1.7 Credit Rating Agencies – Function/ Role and Advantages .</p> <p>Overview of Credit Rating Information Services of India Limited (CRISIL)</p> <p>Investment Information and Credit Rating Agency of India (ICRA) Limited</p> <p>Credit Analysis and Research (CARE) Limited.</p>	<p>Conceptual Understanding</p> <p>Accessing and analyzing information skills</p> <p>Technical Knowledge</p>
2	Financial Planning	<p>1.1 Financial Planning – Meaning, Nature and Characteristics , Scope , Importance, Advantages and Limitations ,</p> <p>1.2 Steps in Financial Planning</p>	<p>Conceptual Understanding</p>

		<p>1.3 Factors Influencing Financial Plan Formulation</p> <p>1.4 Methods of Estimating Financial Requirement</p>	<p>Analytical skills</p> <p>Technical Knowledge</p>
3	Capitalization and Capital Structure	<p>1.1 Capitalization and Capital Structure</p> <p>1.2 Capitalization – Concept, Factors governing capitalization, Over and Under capitalization - Causes and effects, Fair Capitalization.</p> <p>1.3 Capital Structure- Meaning, Concept and Principles of capital structure, Factors influencing the pattern of capital structure.</p> <p>1.4 Trading on equity- Concepts and effects.</p>	<p>Conceptual Understanding</p> <p>Analytical Skills</p> <p>Technical skills</p>
4	Sources of Corporate Finance	<p>1.1 Types of Capital – Fixed and Working, Owned and Borrowed, Short Term , Medium Term and Long Term</p> <p>1.2 Sources of Capital – Bank Overdraft, Trade Credit Accrual Accounts, Financial Lease , Operating Lease , Hire Purchase , Bank Loan , Merchant loan , Debentures , Equity Shares , Preference Shares Stock Dilution and Flotation</p> <p>1.3 Concept Cost of Capital and Concept of Risk and Return</p>	<p>Conceptual Understanding</p> <p>Analytical skills</p> <p>Accessing and analysing information</p>

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	10	PPT , Lectures by experts from Industry experts, Visit to Stock Exchange	Online Videos ,	Project Report on SEBI and Credit Rating Agencies	Conceptual understanding and Conceptual Clarity
2	12	PPT , Lectures by Finance Managers	Online Videos	---	Conceptual Clarity and Practical understanding Technical Knowledge
3	18	PPT	Online Videos	----	Conceptual Clarity and Practical understanding
4	08	PPT , Lectures Finance Experts, Case Study , Study of Capital Structure of organisations from Annual Reports	Online Videos	Project Report on Study of Capital Structure of organisations from Annual Reports of 3 companies	Analytical skills Decision making skills Technical skills

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	MCQ / Project	As per University norms	Certificate course of SEBI for Investor Awareness
Unit – II	MCQ, Assignments, PPT	As per University norms	Certificate course in Collaboration with Credit Rating Agencies for Financial Statement Analysis
Unit – III	MCQ, Project and Assignment	As per University norms	
Unit – IV	MCQ , Case study , Project Report	As per University norms	

References:

List of Books Recommended: -

- Capital Market and Financial System in India ,Asheesh Pandey (Author),Ingram short title
- CAPITAL MARKET ,S Gurusamy (Author),McGraw Hill Education
- Indian Financial System: Financial Markets, Institutions and Services,Siddhartha Sankar Saha (Author),McGraw Hill
- Capital Marketing and Securities Law ,Kumar Rajnish ,Commercial law Publication
- Investment Analysis and Portfolio Management ,Chandra Prosanna,Tata McGraw-Hill Education Private Limited
- An Introduction to International Capital Markets: Products, Strategies, Participants ,Andrew M. Chisholm,willey
- Capital Markets in India ,Rajesh Chakrabarti (Author),SAGE Response
- Financial Accounting for Management (Author: N Ramchandra and published by Tata Mgraw Hill).
- Industrial Finance (Author: R. Vishwanthan and published by Macmillian).
- Fundamentals Of Financial Management (Author: Vyuptakesh Sharan and published by Dorling).
- Financial Management (Author: Sheeba Kapil and published by Pearson).

Revised syllabi (2019 Pattern) for T.Y.B. Com Degree course (CBCS)
Semester – V
SPECIAL ELECTIVE COURSE (Special Course – III)
Banking and Finance-Special Paper III (Sem.V)
(Banking Law and Practices in India – I Course code: 356-B)
Total Credits: 04 (Theory 03 + Practical 01=04)

Objectives:

1. To familiarize the Banking Laws and Practice in correlation to the Banking System in India.
2. To understand the legal aspects of Banking transactions and its implication as a Banker and as a customer.
3. To familiarize the students with the Banking Laws and Practices in India.
4. To make students capable of understanding and applying the legal and practical aspects of banking to help them technically sound in banking parlance.

Unit No.	Topic and Contents	No. of Lectures	Teaching Method	Skills to be developed
1.	<p>Banking Regulation Act, 1949: Introduction the objectives and selective provisions : 1.1 Definition of word Banking (Sec 5B) and Bank (Sec 5C) 1.2 Management (sec 10)- Capital (Sec. 11)- Reserve Fund (Sec. 16) - Bank Licensing (Sec. 22) -Branch Licensing (Sec. 23)- Liquid Assets (Sec. 24) 1.3 Profit and Loss Account and Balance Sheet- (Sec.10 A, 10 B, 29 and 30). 1.4 Powers of Reserve Bank of India- Sec.35 and 36</p>	14	Lectures, PPT, Group and Panel Discussion, Library Work, Assignments	Understanding the Banking Regulation Act 1949 with Objectives and selective Provisions.

	<p>1.5 Voluntary Amalgamation (Sec. 44A) - Compulsory Amalgamation (Sec. 45)- Liquidation (Sec.45 R)</p> <p>1.6 Banking Regulation Act, 1949 applicable to Cooperative Banks- The Banking Regulation (Amendment) Bill, 2020-Features.</p>			
2.	<p>Negotiable Instruments Act, 1881:</p> <p>2.1 Introduction-Definition-Meaning- Features of Negotiable Instruments.</p> <p>2.2 Types of Negotiable Instruments- Promissory Note, Bill of Exchange and Cheque</p> <p>2.3 Parties in Negotiable Instruments</p> <p>2.4 Negotiation-Presentment-Concepts of Dishonour of Negotiable Instruments</p> <p>2.5 Noting and Protesting</p>	12	Lectures, PPT, Group and Panel Discussion, Library Work, Assignments	Understanding the Provisions of Negotiable Instruments Act, 1881
3.	<p>Insolvency and Bankruptcy Code, 2016</p> <p>3.1 Objectives and importance of IBC, 2016</p> <p>3.2 Applicability</p> <p>3.3 Important definitions: (Sect. 3) Board, Corporate Person, Corporate debtor, Creditor, default, Financial Information, Insolvency Professional, Corporate Applicant, Corporate Guarantor, Insolvency and Bankruptcy.</p> <p>3.4 Corporate Insolvency Resolution Process (Sect.6,7,12,13,14)</p> <p>3.5 Liquidation Process (Sect. 33, 34, 35)</p> <p>3.6 Voluntary Liquidation of Corporate Person (Sect.59)</p> <p>3.7 Fast Track Corporate Insolvency Resolution Process (Sect. 55, 56, 57)</p>	14	Lectures, PPT, Group and Panel Discussion, Library Work, Assignments	Understanding the Objectives, Importance, Selective Definitions and Provisions Insolvency and Bankruptcy

	<p>3.8 Offence and Penalty regarding Corporate (Sect. 68 to 71)</p> <p>3.9 Bankruptcy Order for Individual and Partnership Firm (Sect.121, 125, 126,128, 138, 139)</p> <p>3.10 Offence and Penalties regarding Individual (Sect.184 to 187)</p> <p>3.11 The framework of Insolvency and Bankruptcy Board of India (Sect.188, 196)</p>			
4	<p>Banking Ombudsman Scheme-2006</p> <p>4.1 Objectives of Banking Ombudsman Scheme-2006</p> <p>4.2 Important Definitions: Banking Ombudsman, Appellate Authority, Authorised Representative, Complaint, Secretariat</p> <p>4.3 Appointment and Tenure of Ombudsman</p> <p>4.4 Power and Duties of Ombudsman</p> <p>4.5 Procedure for Redressal of Grievance</p>	8	Lectures, PPT, Group and Panel Discussion, Library Work, Assignments	Understanding the details Banking Ombudsman Scheme, 2006
	Total	48		

References:

1. Bangia R.K. (2015), 'Banking Law and Negotiable Instruments', Allahabad Law Agency
2. Banking Regulation Act- 1949, Universal Law Publishing
3. Banking Ombudsman Scheme, 2006 Reserve Bank of India, Mumbai.
4. Insolvency and Bankruptcy Code, 2016- The Gazette of India, New Delhi.
5. Kandasami K.P. (2010), 'Banking Law and Practice', S. Chand Publication
6. K. Natarajan , Yefim Gordon, (2007), 'Banking: Theory, Law and Practice' Himalaya Publishing House
7. Kothari Vinod (2017), 'Tannan's Banking Law and Practice in India' Lexis Nexis Publisher
8. Varshney P.N. (2014), "Banking Law and Practices", Sultan Chand and Sons

SYLLABUS FOR T.Y.B.COM UNDER CBCS PATTERN 2019
SEMESTER-VI
PAPER- II
SUBJECT NAME: - BUSINESS LAWS AND PRACTICE PAPER II (BLP-II)

COURSE CODE – 356 (c)

Objectives of the course:

To develop an understanding of the significant compliances under various Laws.

To gain the ability of students to address a basic business legal application-oriented issues.

Depth of the program:

Basic to application based

Objectives of the Subject:

- To impart the students with the fundamental understanding of rules & regulations under various business laws.
- To study & acquaint students an application & overview based knowledge of Laws.
- To make the students aware about legal Business Environment of India.

Unit . No.	Unit Title	Contents	Purpose skills to be developments
1	Historical Development of Company Law in India :	1.1 Historical Overview, Development of various concepts and trends in company law, Social responsibilities of companies, Development of company law administration. 1.2 Need based (Major) amendments from inception to till the date.	Understanding the historical development of Company law.

2	Prevention of Oppression and Mismanagement.	2.1 Meaning of oppression, who can apply to court, Rule of Majority, protection of minority interest, remedies and rights of minority shareholders, 2.2 Prevention of oppression and mismanagement, powers of the court	It will help the students to gain insights of prevention of oppression & mismanagement.
3	Inspection, Investigations, Compromise and Arrangement:	3.1 Inspection and investigation suo-moto - Investigation by Government. 3.2 Rights and duties of Inspector - Report by an Inspector. 4.1 Schemes for Compromise and Arrangement - Persons entitled to apply for sanction of court. 4.2 Powers of court - Conditions for sanction of compromise - Effect of sanction	To create awareness among the students about Inspection and Investigations. To study & understand the Compromise and Arrangement in detail.
4	Rules of Corporate Governance :	5.1 Meaning & Concept of corporate Governance, History of Corporate Governance – Cadbury Committee Report 5.2 Principles of Morality and business ethics –Code of conduct for professionals.	Understand the rules of Corporate Governance in detail.

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	10	➤ Internet Sources.	➤ You tube videos on Historical Development of Company Law in India ➤ E-Content provided by	Project report should be prepared on Historical	Understanding the Historical Development of Company Law in

			UGC/University/MOOC /You tube etc. to be studied.	Development of Company Law in India	India
2	12	<ul style="list-style-type: none"> ➤ Group Discussion. ➤ Internet Sources. 	<ul style="list-style-type: none"> ➤ E-Content on Prevention of Oppression and Mismanagement provided by UGC/University/MOOC etc. to be studied & analyzed. 	Project report can be prepared on overview of Prevention of Oppression and Mismanagement.	Understanding in detail Prevention of Oppression and Mismanagement.
3	10	<ul style="list-style-type: none"> ➤ Internet Sources. ➤ Presentation can be taken. 	<ul style="list-style-type: none"> ➤ E-Content on Inspection and investigation provided by UGC/University/MOOC/You Tube etc. to be Watched & analyzed. 	Project report can be prepared on Inspection and investigation	Understanding the Inspection and investigation.
3	10	<ul style="list-style-type: none"> ➤ PPT Method can be used. ➤ Group Discussion 	<ul style="list-style-type: none"> ➤ E-Content on Compromise and Arrangement provided by UGC/University/MOOC/You Tube etc. to be Studied & analyzed. 	Project report can be prepared on Compromise and Arrangement.	Understanding Compromise and Arrangement in detail.
4	06	<ul style="list-style-type: none"> ➤ Internet Sources. ➤ Presentation can be taken. 	<ul style="list-style-type: none"> ➤ E-Content on Corporate Governance provided by UGC/University/MOOC/You Tube etc. to be Studied & analyzed. 	Project report can be prepared on benefits of Corporate Governance.	Understanding the Corporate Governance in detail.

References

Sr. No.	Title of the Book	Author/s	Publication
1	Company Law	Dr. Avtar Singh	Eastern Book Co. (EBC)
2	Lexis Nexis's Guide to the Companies Act	RAMAIYA	Generic book
3	Taxmann's Companies Act with Rules	Taxmann	Taxmann
4	The Companies Act 2013 Bare Act	Government of India	Educreation Publishing
5	Adjudication of Companies Act matters under NCLT	Rajender Kumar	Urmila Publication House
6	Taxmann's Company Law Ready Reckoner	Taxmann	Taxmann

Practical for Semester – IV

Topic	Mode of Practical
Historical Overview, Development of various concepts and trends in company law	Library Assignment
Prevention of Oppression and Mismanagement	Applications with library & Online sources.

Inspection and Investigations	Library Assignment.
Corporate Governance	Review of Research Papers/Articles, News Paper Articles etc.

1. Mercantile Law – P.L. Malik
2. Industrial Law – P.L. Malik
3. Labour and Industrial Law – M.N. Mishra (Central Publication Allahabad)
4. Company Law – Avtar Singh (Eastern Book Comp. Lucknow)
5. Secretarial Practice – M.C. Kuchhal
6. Company Law - A.K.Mujumdar (Taxmann Publication Pvt.Ltd.)
7. Corporate Law – Dilip Shinde, Kiran Nerkar, Abhishek Sahu

Revised Syllabi (2019 Pattern) for Three years B.Com Degree Course (CBCS)

Semester -V

Course Code- 356 (d)

Subject: --: Co-operation & Rural Development ((Special Paper-III)

Total Credits: - 04 (Theory 03 Internship 01=04)

Preamble:

Cooperative learning requires students to engage in group activities that increase learning and adds other important dimensions. The positive outcomes include academic gains, improved race relations and increased personal and social development. The purpose of this course is to impart knowledge of concept of Cooperative Management and its related dimensions.

Objectives of the Course:

- 1) To acquaint students with the Co-operative Management.
- 2) To study the Co-operative Organization and Management

Unit No.	Unit Title	Contents	Skills to be developed
1	Introduction to Co-operative Management	1.1 Meaning, Nature and Scope of Co-Operative Management 1.2 Objectives of Co-operative Management. 1.3 Principles of Co-operative Management.	1) Conceptual clarity and understanding the Meaning, Characteristics and Importance cooperative management

		<p>1.4 Functions of Co-operative Management</p> <p>1.5 Ethics in co-operative Management</p>	<p>2) To understand the Principles and Process of management</p> <p>3) To understand functions of cooperative management</p>
2	Role of Co-operative Management	<p>2.1 Evaluation of Co-operative Management</p> <p>2.2 Levels of Management.</p> <p>2.3 Board of Directors and Executives Duties, Responsibilities</p> <p>2.4 Role in Co-operative Management.</p> <p>2.5 Professionalization of Management- Need and Significance.</p>	<p>1) To understand the importance and role of co-operatives.</p> <p>2) To understand need of professional management in co-operatives</p>
3	Human Resource Management and Co-operative Organizations	<p>3.1 Human Relationship in Co-operative.</p> <p>3.2 Co-operative Philosophy and H.R.D.</p> <p>3.4 Recruitment</p> <p>3.4 Training and Managerial Development</p> <p>3.5 Appraisal and Evaluation</p>	<p>1) To acquire the fundamental knowledge about human resource in co-operative institutions</p> <p>2) To understand the Elements of Human resource management</p>
4	Decision Making and Co-operative Management	<p>4.1 Decision Making – Meaning and Importance</p> <p>4.2 Decision Making Process, Steps Involved</p> <p>4.3 Measures to overcome the defects in Co-Operative Management.</p> <p>4.4 Trends in Co-operative Management in Global Scenario</p>	<p>To understand elements of decision making, process of decision making in co-operative management</p>

Teaching Methodology:

Topic No.	Total Lectures	Innovative Methods to be used	Film Shows and A.V. Application	Project	Expected Outcome
1	12	Lecture, PPT Presentation Poster Presentation, Group Discussion, Library visit ,Home Assignment ,Pre reading, Class discussion , library visit , internet resources	Relevant You Tub Videos, Relevant slide show, online Video, Short Film Show	Individual assignment report	Understanding of basic knowledge of co-operation
2	12	Pre reading, Class discussion, internet resources, Lecture, Expert Lecture, PPT / Poster Presentation, Group Discussion, Library /Home Assignment ,Internal Assignment, case study	Relevant You Tub Videos, Short Film Show, A.V Application	Visit to Office	Understanding the importance and Essentials role of co-operation
3	12	Lecture, PPT Presentation Poster Presentation, Group Discussion, Library visit ,Home Assignment ,Pre reading, Class discussion , library visit , internet resources ,students Seminar/Workshop ,case study	Relevant You Tub Videos PPT, AV Application, online video	Presentation	1) To acquire the fundamental knowledge about human resource in co-operative institutions 2) To understand the Elements of Human resource management
4	12	Guest Lectures of eminent Personalities , Group Discussion, Library visit ,Home Assignment, case study	Online Videos, Relevant slide show, Short Film Show	Individual Resume, Bio–Data Writing	To understand elements of decision making, process of decision making in co-operative management

Method of Evaluation:

Subject	Internal Evaluation	External Evaluation	Suggested Add-on Course
Unit- I	Attendance, Continuous Assessment Test, Assignment /Quiz/Course project, Seminar and Discussion	As per University norms.	Certificate Course on Cooperation Management
Unit-II	Attendance, Continuous Assessment Test, Assignment /Quiz/Course project, Seminar and Discussion	As per University norms.	
Unit-III	Attendance, Continuous Assessment Test, Assignment /Quiz/Course project, Seminar and Discussion	As per University norms.	
Unit-IV	Attendance, Continuous Assessment Test, Assignment /Quiz/Course project, Seminar and Discussion	As per University norms.	

References:

Sr. No	Title of Book	Author/s	Publication	Place
1	New Dimensions of Co-operative management	G.S.Kamat	Himalaya Publication House,	Mumbai
2	Co-operative Management principals and techniques	Dr.Nakkiran S.A.-	Himalaya Publication House,	Mumbai

3	Co-operative Management and Administration	Goel B.B	Deep and Deep Publication	New Delhi.
4	Co-operation and Rural Development	Principal Dr.Nitin Ghorpade	Success	Pune
5	Human Resource Management Practices in Co-operative sector	Principal Dr.Shaikh Aftab Anwar	Idea Publication	New Delhi
6	Theory & Practice of Co-operation,	Dr. Dhiraj Zalte &Others –	Prashant Publication	Jalgaon
7	C.A State and C-operative Movement			
8	https://www.bhagirathgram.org/			
9	Journal of Commerce and Management Thought(JCMT)			

T.Y. B.Com.

B.Com Degree Course Revised 2019 Pattern (CBCS)

Cost and Works Accounting Special Paper III

Name -: Techniques of Cost Accounting

Course Code -: 356 –E (SEM-V)

Objectives:

1. To prepare learners to understand the basic techniques in Cost Accounting
2. To understand the learner, application of Cost Accounting techniques in cost control and decision making.
3. To enable the learners to prepare various types of Budgets.
4. To learn the basic concept of Uniform Costing and Inter-firm comparison
5. To enhance the knowledge of students about MIS and Supply Chain Management.

Unit No.	Unit Title	Contents	Skills to be developed
1	Marginal Costing	1.1 Meaning and concepts- Fixed cost, Variable costs, Contribution, Profit-volume Ratio, Break-Even Point, Margin of Safety. and Angle of Incidence. 1.2 Cost-Profit-Volume Analysis- Assumptions and limitations of cost-profit volume analysis 1.3 Application of Marginal Costing Technique:- Make or buy decision, Acceptance of export order & Limiting factors.	a. Understanding of important concepts in Marginal Costing. b. It will develop the ability of a the learner to make short-term decisions with the help of Marginal Costing. c. Develop the mindset of the student for making ethical decisions.

		<p>1.4 Ethical and Non-Financial Considerations relevant to decision making.</p> <p>(simple Practical Problems based on concepts excluding decision making)</p>	
2	Budgetary Control	<p>2.1 Definition and Meaning of Budget & Budgetary control</p> <p>2.2 Objectives, essentials, and procedure of Budgetary control</p> <p>2.3 Advantages and Limitations of Budgetary control</p> <p>2.4 Types of Budgets</p> <p>2.5 Zero Base Budgeting</p> <p>(Simple practical problems based on cash and flexible budget only)</p>	<p>a. It will help the learner to understand the basics of Budget and Budgetary Control</p> <p>b. The learner will get an idea of how to prepare different types of Budgets</p>
3	Uniform costing and Inter-firm Comparison	<p>3.1 Meaning, objectives, advantages, and disadvantages of Uniform Costing.</p> <p>3.2 Uniform Cost Manual</p> <p>3.3 Meaning, pre-requisite, advantages, and disadvantages of Inter-firm comparison.</p> <p>(Theory Only)</p>	<p>a. It will acquaint the learner to understand essential concepts of Uniform Costing and Inter-Firm Comparison.</p>

4	MIS and Supply Chain Management	4.1 Management Information System- Introduction, features, and procedure, preparation. 4.2 Supply Chain Management(SCM)- Meaning, features, and Models of SCM. (Theory Only)	a.The student will familiar with MIS and SCM b. The student will understand the basic concept of SCM
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Teaching Methodology

Unit No.	Total Lectures	Innovative Methods to be used	Films Shows and AV Applications	Project	Expected Outcome
1	16	Discussion of related Case studies	Classroom discussion	Visit to small industries for understanding the decision making with the help of Marginal costing	Development of overall outlook of Marginal Costing.
2.	16	Expert Lecture	Observation of annual Budget of Public and Private Companies	Visit small industries to get an idea about functional budgets.	Develop the knowledge about preparation of various types Budgets

3	08	Group Discussion	ICAI cloud campus videos on Uniform costing and Interfirm Comparison	Group discussion about the application of Uniform costing and Interfirm Comparison in industry.	Understand the implementation of Interfirm comparison
4	08	Expert Lecture of Cost Accountant or Industrialist	YouTube clippings on case studies of modern costing environment .	Discussion of various case studies.	Understand the implementation of modern costing environment

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add-On Course
Unit I	Multiple Choice Questions, Written Test, Internal Examination & PPT based presentation, Orals, Assignments, Tutorials, etc.	SPPU	Visit industries and make a report on the visit.
Unit II			
Unit III			
Unit IV			

References

Sr. No	Title of the Book	Author	Publisher	Place
1	Theory and Techniques of Cost Accounting.	B.L. Lall and G.L. Sharma	Himalaya Publishing House	New Delhi.
2	Strategic Cost Management and Performance Evaluation	Board of Studies, ICAI	ICAI	New Delhi
3	Advanced Cost Accounting	Dr. D. M. Gujrathi	Idol Publication	Pune
4	Advanced Cost Accounting	Dr.Kishor. M. Jagtap	Tech-Max Publication	Pune
5	Cost Accounting- Principles & Practices	Dr.M.N. Arora	Vikas Publishing House ,	New Delhi

6	Advanced Cost Accounting	S. P. Jain and K. L. Narang	Kalyani Publication	New Delhi
7	Cost Accounting- Principles & Practices	JawaharLal&SeemaShrivastawa	Tata Mcgraw Hill	New Delhi
8	Advanced Cost Accounting	N.K. Prasad	Book Syndicate Pvt. Ltd.	Kolkata
9	Cost Accounting	P. V. Rathnam and P. Lalitha	Kitab Mahal	Delhi
10	Practice in Advanced costing and Management Accounting.	Prof. Subhash Jagtap	Nirali Prakashan	Pune
11	Practical Costing.	R.K. Motwani	Pointer Publisher	Jaipur

12	Cost Accounting.	R.S.N. Pillai and V. Bhagavati	Sultan Chand and Sons	New Delhi.
13	Advanced Cost Accounting and Cost Systems	Ravi Kishor	Taxman's Allied Service Pvt. Ltd.	New Delhi
14	Cost Accounting, Theory and Problems,	S.N. Maheshwari and S.N. Mittal	Mahavir book Depot	New Delhi
15	Cost Accounting Principles and Practice.	S.P. Iyengar	Sultan Chand & Sons Accounting, Taxman's	New Delhi
16	Cost Audit and Management Audit.	V.K. Saxena and Vashista	Sultan Chand and Sons	New Delhi

Web References

Sr. No	Lectures	Films	PPTs	Articles	Others
For all the units.	Guest Lectures by Field Persons such as working executives from industries and of Practicing Cost and Management Accountants. the	YouTube films showing working of different industries.	Relevant Power Point Presentations are available on all these topics.	Articles from the Professional Journals such as The Management Accountant, The Chartered Accountant, The Chartered Secretary, The Institute of Chartered Financial Analyst of India	https://icmai.in www.globalcma.in <u>n</u> eclm.unpune.ac.in <u>n</u>

Notes: The breakup of marks in the Examination will be as follows:

- 50 % of the marks for Theory & 50 % of the marks for Practical Problems
Areas of practical problems:
 1. Marginal Costing
 2. Cash and Flexible Budget

Revised syllabi (2019 Pattern) for three years B. Com. Degree course (CBCS)

Syllabus for **B. Com. Semester: - V**

Subject Name: - **Business Statistics - III**

Course code: - **356(F)**

Credit 3

Preamble to the syllabus:

Tools and techniques learned in Statistics give a precise way of formulating and analyzing a problem and to make logical conclusions. Concepts and tools introduced in this course are useful to students for higher studies and career in any branch of Economics, Commerce and Management. Professionals working in these fields, wishing to upgrade their knowledge, will also benefit. The stress of the course will be on building the concepts and their applications.

In modern times, Statistics is viewed not as a mere device for collecting numerical data but as a means of developing some techniques for their handling and analysis and drawing valid inferences from them. Statistics provides tools for making decisions when conditions of uncertainty prevail. So it is very useful in various fields like agriculture, business, management, economics, finance, insurance, education, biotechnology and medical science etc.

Depth of the Course – Basic Knowledge of Operations Research and Decision Theory

Objective of the Course

- 1. To understand and Master the concepts of Game Theory.**
- 2. To understand and Master the concepts of Statistical Decision Theory.**
- 3. To understand and Master the concepts of Replacement and Sequencing Problems**
- 4. To understand and Master the concepts of Statistical Quality Control.**

Unit No.	Unit Title	Contents	Purpose/Skills to be developed
1	Game Theory	Meaning, two person zero-sum game, pure and mix strategies, Pay off tables, saddle points, Minimax and Maximin principles, Dominance principles, Algebraic Method to solve 2×2 Game, Graphical Method, Examples and problems.	<ol style="list-style-type: none"> 1. To understand the concepts of game theory 2. To apply the concepts of game theory to real life business problems.
2	Statistical Decision Theory	Introduction, acts, states of nature, pay off, regret, Decision Making Under Risk, Expected Opportunity Loss (EOL) Criterion and Expected Monetary Value (EMV) Criterion, Decision Making Under Uncertainty, Maximin Criterion, Maximax, Minimax Regret Criterion, Laplace Criterion, Hurwitz Criterion, Examples and problems.	<ol style="list-style-type: none"> 1. To learn different statistical methods of decision making. 2. To apply the different statistical methods to real world decision making problems.
3	Replacement and Sequencing problem	Replacement Problem - Introduction, replacement of Item that deteriorates with time when value of money remains same during the period. Sequencing Problem - Assumptions in sequencing model, Basic terminology, n-jobs through two machine problems.	<ol style="list-style-type: none"> 1. To understand the concepts of replacement and sequencing problems. 2. To apply the concepts of replacement and sequencing to real world problems.
4	Statistical Quality Control	Introduction, Chance and assignable Causes of variation, Uses of SQC, Control limits, specification limits, Tolerance limits Process and product control, Control charts for mean, range, P-Chart, C-Chart, Process Capability study, Interpretation of capability index C_p and C_{pk}	<ol style="list-style-type: none"> 1. To understand the concept of statistical quality control. 2. To understand different SQC techniques. 3. To apply SQC techniques to real world problems.

List of Practicals

Sr. No.	Name of Experiment
1	Game Theory
2	Statistical Decision Theory
3	Statistical Quality Control

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	10	ICT	NA	NA	Students will be able to understand and apply concepts game theory to real world business problems.
2	14	ICT	NA	NA	Students will be able to understand and apply concepts of statistical decision theory to real world business problems.
3	10	ICT	NA	NA	Students will be able to understand and apply concepts of replacement and sequencing problems to real world business problems.
4	14	ICT	NA	NA	Students will be able to understand and apply the concept of statistical quality control to real world business problems.

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Unit wise distribution of Marks (Final Examination)	Suggested Add on Course
Unit – I	30%	70%		
Unit – II	30%	70%		
Unit – III	30%	70%		
Unit – IV	30%	70%		
Total				

Notes: -

1. Internal evaluation is continuous assessment.
2. Internal evaluation shall have following components: -
 - a. At least one test of 20 marks involving objective questions of following type: - multiple choice, true or false, state definitions/concepts, one line answer etc.
 - b. At least one assignment of 05 marks.
 - c. If time and resources permit then there can be power point presentation of group or individual (this component is not compulsory)
 - d. Final score will be average score of all components.

References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Operations Research	Harmdy A. Taha	Pearson India Ltd.	New Delhi
2	Operations Research	Kanti Swaroop,P. K. Gupta and Man Mohan	Sultan Chand and Sons	New Delhi
3	Business Mathematics	J. K. Sharma	Vikas Publishing House	New Delhi
4	Statistical Quality Control	D.C. Montgomery	John Wiley and Sons	New York
5	Fundamentals of Mathematical Statistics	S. C. Gupta and V. K. Kapoor	Sultan Chand and Sons	New Delhi
6	Fundamentals of Statistics	S. C. Gupta	Himalaya Publishing House	New Delhi
7	Operations Research	D. S. Hira and P. K. Gupta	S. Chand and Sons	New Delhi

Revised syllabi (2019Pattern) for three years B. Com. Degree course (CBCS)

Semester : - V (T. Y. B. Com)

Course Code : 356 (g)

Subject : - Business Entrepreneurship (Special Paper-III)

Total Credits: - 04 (Theory 03 Internship 01=04)

Preamble:

The purpose of this course is to impart professional knowledge on the theories, models and basic principles of organizational behaviour in the field of entrepreneurship, and teach students how to apply them to entrepreneurial activities. After completing the course, students should improve their decision-making skills. , Leadership and entrepreneurship skills make meaningful contributions to the interests of stakeholders. This course enables students to acquire in-depth entrepreneurial knowledge.

Objectives of the course:

- 1) To acquaint students with knowledge and skills required for organizing and carrying out entrepreneurial activities.
- 2) To develop the ability of analyzing and understanding business situations.
- 3) To study the interdependent, fast-changing and diverse world of entrepreneurship and innovation.
- 4) To familiarize students with various concepts and processes involved in entrepreneurship and business formation and development.
- 5) To provide students with the knowledge, skills and motivation to encourage entrepreneurial approach in a variety of settings.
- 6) To study the application of group dynamics to counseling, personal growth and other psychologically-oriented groups.

Unit No.	Unit Title	Contents	Skills to be developed
1	Organizational Behavior for Entrepreneurship	Organization: Meaning, Definition, Goals, Approaches. Organizational Behavior for Entrepreneurship: Meaning, Definitions, Need, Nature, Importance & Scope, Characteristics, Types, Objectives, Merits	1. To understand the concept Organization. Students should be able to know the organizational behavior required for entrepreneurship. 2. To study the organization and how to balance work and life.

		and Demerits of Organizational Behavior for Entrepreneurship, Organizational Behavior Models. Developing Entrepreneurial Behavior in the Organization: Opportunity Identification, Opportunity Facilitation, Organizational Competencies, And Individual Competencies.	3. To equip the students with various aspects of organizational behavior with organizational models and the culture developed in the organizational entrepreneurship.
2	Individual Behavior and Personality for Entrepreneurship	Individual Behavior for Entrepreneurship: Characteristics, Determinants of individual behavior, Requisites for Individual Behavior in Entrepreneurship. Personality for Entrepreneurship: Meaning, Definitions, Characteristics, Determinants of Personality for Entrepreneurship. Personality Traits, Personality Development, Emotional Intelligence for Entrepreneurship, Entrepreneurial Personality, Difference between Individual Behavior and Group Behavior in Entrepreneurship, Factors of Personality, Role of Personality, Theories of Personality	1. Students will be able to learn how to establish work culture and patterns in an office space or a similar environment. 2. To equip the students with techniques of emotional interaction at work place. 3. To enhance students personal development through soft or technical skills. 4. To develop their competency in a way of learning, by self-analysis on necessary areas for improvement and necessary skills to advance in career or industry. 5. To focus on transferable skills that make one a competitive candidate for any job.
3	The Study of Autobiographies of Entrepreneurs	Autobiographies of Entrepreneurs: 1) Mr. Anand Mahindra (Chairman, Manindra & Mahindra) 2) Mr. Baba Kalyani (MD, Bharat Forge) 3) Mr. Shiv Nadar (Indian Industrialist) 4) Mr. Laxmi Niwas Mittal (CEO, Arcelor Mittal) 5) Mr. Adar Poonawala (CEO, Serum Institute of India, India's Vaccine King) 6) Women Entrepreneurs: Falguni Nayar (The	1. Students will able to develop and adopt some new values, and learn from their hardships, they will also get answers for their dilemmas. 2. Students will be able understand the role of attitude in entrepreneurship. 3. Students will be made aware and learn how the student entrepreneurs in India build their own ventures. 4. Students will also have an idea how these entrepreneurs have lived out their dreams with incredibly big, risks, trials, and tribulations and gone

		founder of Nykaa) 7) Kiran Mazumdar Shaw (Founder of Biocon Ltd)	on to become the top in their businesses.
4	Group and Group Dynamics for Entrepreneurship	Group: Meaning, Definition, Classification, Group Task, Group Size, Group formation process, Group Structure. Group Dynamics for Entrepreneurship: Influence in Group, Types, Principles and Functions of Group Dynamics in Entrepreneurship, Group Cohesion- Helping Behavior, Co-Operation and Competition, Improved Work Group. Role of Entrepreneur.	1. To understand the concept of group and group dynamics for Entrepreneurship. 2. Students will be able to equip the knowledge of Organizing and Planning skills, Decision making skills, Students will get hands on Problem solving skills, Communication skills, Persuasion and influencing skills, feedback skills, skills in chairing meeting, conflict resolution skills for Entrepreneurship.

Teaching Methodology:

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Group discussion and case studies	Related Videos and PPTs	Personal or group project on new business creation.	Capacity to: I. Analyze Individual and group behavior, and understand the implications of organizational behavior on the process of management. ii .Demonstrate the applicability of the concept of organizational behavior to understand the Behavior of people in the organization. iii) Analyze the complexities associated with management of the group behavior in the Organization.

2	12	Completing research or conceptual papers on topics appropriate for the course. Participation in classroom discussion and group exercises.	Related Videos and PPTs	To prepare a detailed report on new age entrepreneurship.	Capacity to: I. Analyze the complexities associated with management of the group behavior in the organization. Ii. Develop the necessary managerial and personal skills which are essential to the current business environment.
3	12	Interactive teaching-learning methods- Process-oriented learning - Learning from mistakes - Interviewing entrepreneurs - Bilateral learning - Group discussion - Networking – Discussion - Problem-oriented learning - Active learning	Biographical videos or CDs of entrepreneurs	Assign small business models, product or project(s) to students to understand them with the 360 degree of the business.	Iii Understanding the new age entrepreneur and will learn each. Understanding to interpret their own business plan.
4	12	Small students group formation	Related Videos, PPTs	Assign small projects in group.	Capacity to- I. Demonstrate understanding of principles of group dynamics, including

					group process components. ii. Become more conscious of his/her personal growth through participation as a group member.
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Method of Evaluation:

Subject	Internal Evaluation	External Evaluation	Suggested Add-on Course
Unit- I	Attendance, Continuous Assessment Test, Assignment /Quiz/Course project, Seminar and Discussion	As per University norms.	Certificate Course on: Business Fundamentals - Entrepreneurship
Unit-II	Attendance, Continuous Assessment Test, Assignment /Quiz/Course project, Seminar and Discussion	As per University norms.	
Unit-III	Attendance, Continuous Assessment Test, Assignment /Quiz/Course project, Seminar and Discussion	As per University norms.	
Unit-IV	Attendance, Continuous Assessment Test, Assignment /Quiz/Course project, Seminar and Discussion	As per University norms.	

References:

- 1) Barringer B.R. and Ireland R.D., 2006. Entrepreneurship: Successfully Launching New Ventures. Pearson: New Jersey.
- 2) Bartlett C.A. and Ghoshal S., 2002. Managing Across Borders: The Transnational Solution. Harvard Business School Press: Boston.
- 3) Failing to succeed: The story of India's first e-commerce company by K.Vaitheeswaran
- 4) Entrepreneurship simplified from idea to IPO by Ashok Soota and S. R .Gopalan
- 5) Cut the crap and jargon by Shradha Sharma and T N Hari
- 6) A thought to million dollars by Salma Moosa and Vivek Srinivasan.
- 7) The manual for Indian Startups by Vijay Kumar Ivaturi, Meena Ganesh, Alok Mittal, Sriram Subramanya & Prof Sadagopan.
- 8) Entrepreneurship Development, Khanna S.S, S. Chand, New Delhi.
- 9) Entrepreneurship Development, Gupta, Shrinivasan, S. Chand, New Delhi

Revised Syllabi (2019Pattern) for T.Y. B. Com. Degree course (CBCS)

Semester - V

SPECIAL ELECTIVE COURSE (Special Course Paper – III)

Marketing Management _ Course Code: 356(H)

Objectives of the Course:

1. To introduce the concept of advertising and advertising media.
2. To provide the students the knowledge about appeals and approaches in advertisement.
3. To acquaint the students to the economic ,social and regulatory aspects of advertising.
4. To make the student understand the role of Brand Management in marketing.
5. To enable the students to apply this knowledge in precisely enhancing their skills in the field of advertising.

Unit No	Unit Title	Contents	Proposed Skills to be developed
1	Introduction to Advertising.	Fundamentals of Advertising: Definition of Advertising, Objectives of Advertising, Functions of Advertising, Types of Advertising, Benefits and Limitations of Advertising, Role of Advertising in Modern Business, Role of Advertising in Marketing Mix. Advertising Media: Definition, Classifications and Characteristics of Different Advertising Media, Factors affecting Selection of Advertising Media, Media Mix, E-Advertising.	<ul style="list-style-type: none">● Conceptual clarity of the meaning of advertising.● To impart the knowledge about Advertising Media.
2	Appeals and Approaches in Advertisement	Appeals: Introduction of Different Appeals and their Significance, Advertising Message, Direct and Indirect Appeal, Relation between Advertising Appeal and Buying Motive,	<ul style="list-style-type: none">● To impart knowledge about the appeals and approaches in Advertisement.

		Approaches: Positive and Negative Emotional Approaches to Advertisement.	<ul style="list-style-type: none"> ● To acquaint the students to direct and indirect appeals.
3	Economic, Social and Regulatory Aspects of Advertising	<p>Economic Aspects-Effects of Advertising on Production Cost, Effects of Advertising on Distribution Costs, Effects of Advertising on Consumer Prices, Advertising and Monopoly, Wastes in Advertising,</p> <p>Social Aspects - Ethics in Advertising, “Truth” in Advertising,</p> <p>Regulatory Aspects-Role of Advertising Standards Council of India (ASCI).</p>	<ul style="list-style-type: none"> ● To make students understand the Effects of Advertising on Production Cost, Distribution Costs and Consumer Prices. ● To help the students to develop the knowledge of Economic and Social and Regulatory Aspects of Advertising.
4	Brands and Brand Management	Meaning & definitions of brand, Characteristics of brands, Types of brands, Advertising and Branding, Brand Extension, Brand identity, Identity Sources – symbols, logos, trademarks, Brand loyalty. Brand Management Process, Challenges in New Branding.	<ul style="list-style-type: none"> ● Conceptual clarity of meaning of brand. ● To impart knowledge about Brand identity, Brand Extension and Brand loyalty.

Teaching Methodology:

Topic No.	Total Lectures	Innovative Methods to be used	Film shows and AV Applications	Expected Outcome
1	14	Power Point Presentation, Survey Analysis	Short Film, AV Application Use of You Tube	<ul style="list-style-type: none"> ● Student will understand the concept of advertising and advertising media ● To enable them to analyze and interpret
2	10	Power Point Presentation, Group Discussion, Survey Analysis	Short Film, AV Application Use of You Tube	<ul style="list-style-type: none"> ● To enable the students to study the Appeals and Approaches in Advertisement

3	12	Power Point Presentation, Group Discussion, Survey Analysis Feld visit	Short Film, AV Application Use of You Tube	<ul style="list-style-type: none"> ● It will help the students to apply the various Economic and social aspects of advertising.
4	12	Group Discussion, Quiz, Poster Making	Short Film, AV Application Use of You Tube	<ul style="list-style-type: none"> ● It will help them to implement this knowledge in practical situations by enhancing their skills in the field of Marketing

Methods of Evaluation:

Topic No	Internal Evaluation	External Evaluation	Suggested Add on Course
1	Quiz, Project, Group Discussion	Practical, Descriptive Questions, Quiz	Certificate Course in Role of Advertising in Modern Business
2	Practical, Presentation	Practical, Descriptive Questions, Quiz	Short Course Advertising Appeal and Buying Motive.
3	Quiz, Group Discussion	Practical, Descriptive Questions, Quiz	Certificate Course in career options in Advertising.
4	Presentation, Group Discussion, Practical	Practical, Descriptive Questions, Quiz	Short Course in Branding.

References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Marketing Management	Philip Kotler	Pearson Publication	New Delhi
2	Marketing Management	Rajan Saxena	McGraw Hill Education	New Delhi
3	Principles of Marketing	Philip Kotler	Pearson Publication	New Delhi
4	Advertising Management	Rajiv Batra	Pearson Publication	New Delhi
5	Marketing Management	V. S. Ramaswamy & S. Namakumari	Macmillan Publication	Noida

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Semester - V

Subject: Agricultural and Industrial Economics III

Paper- III

Course Code: 356 (i)

Total Credits: 4

Objectives:

1. To understand the Features, Role and Recent Trends in Rural Economy.
2. To impart adequate knowledge about the role, types, and Problems of Agricultural Credit.
3. To understand the new Industrial Policy.
4. To acquaint the learner with various aspects of Liberalisation.

Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Content	Purpose Skills to be Developed
1	Rural Economy of India	1.1 Meaning and Features of Rural Economy 1.2 Recent Trends in Rural Economy 1.3 Interdependence of Agriculture and Industry 1.4 Need of Coordination in Agricultural Development and Industrial Development 1.5 Sustainable Agriculture- Concept, Needs, factors leading to Sustainable Agriculture	<ul style="list-style-type: none"> ▪ To understand the meaning and Features of Rural Economy ▪ To make the students know about Role of Agriculture in Rural Development ▪ To impart knowledge about Concept, and Need of Sustainable Agriculture
2	Agricultural Credit	2.1 Role and Importance of Agricultural Credit 2.2 Types and Sources of Agricultural Credit 2.3 Cooperative Credit Organisations and Agricultural Credit 2.4 Financial Sector Reforms and Rural Credit 2.4.1 Micro Finance in Rural Credit- Emergence, Role and Challenges	<ul style="list-style-type: none"> ▪ To understand the Role and Importance of Agricultural Finance, Types and Sources of Rural Credit, ▪ To make the students know about Financial sector reforms and Challenges of Agricultural Credit in

		2.4.1 Financial Sector Reforms and Cooperative Credit 2.5 Challenges of Rural and Agricultural Credit in India	India.
3	Industrial Policy	3.1 Importance of Industrial Policy in Industrial Development 3.2 New Industrial Policy 1991- Broad Features 3.3 Impact of New Industrial Policy 1991 on Indian Economy 3.4. Shortcomings of the New Industrial Policy 1991	<ul style="list-style-type: none"> ▪ To understand the Importance of Industrial Policy in Industrial Development ▪ To make the students know about the Industrial Policy 1991
4	Towards Liberalisation	4.1 Concept and Role of Multinational Corporations (MNCs) 4.2 Concept and Role Foreign Direct Investment (FDI) and Foreign Institutional Investment (FII). 4.3 Special Economic Zones (SEZ)- Concept, Features, Role, Growth and Problems	<ul style="list-style-type: none"> ▪ To make the students know about the Concept and Role of Multinational Corporations, Foreign Direct Investment and Foreign Institutional Investment and SEZ

Teaching Methodology:

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome After completing this topic, the student will be able to understand
1	10	Lecture, PPT/ Group Discussion, Library, Problem-solving based learning, Case study, Jigsaw reading, Practical based learning	Relevant videos, Consortium for Educational Communication-SWF E-Content	<ul style="list-style-type: none"> ▪ Impact of Recent Trends on Agriculture Economy 	<ul style="list-style-type: none"> ▪ Features of Rural Economy ▪ Recent Trends in Agriculture Economy ▪ Agriculture and Industry-Interrelations ▪ Sustainable Agriculture- Concept, Need and factors leading to leading to Sustainable Agriculture.
2	14	Lecture, PPT/ Group Discussion, Library, Problem-solving based learning, Case	Relevant videos, Consortium for Educational Communication-SWF E-Content	<ul style="list-style-type: none"> ▪ Visit to Any Agricultural Credit Society and Make a small project on Functioning of Credit Society 	<ul style="list-style-type: none"> ▪ Role and Importance of Agricultural Credit ▪ Types and Sources of Rural Credit ▪ Financial Sector Reforms and Rural Credit

		study, Jigsaw reading, Practical based learning			<ul style="list-style-type: none"> ▪ Micro Finance in Rural Finance – Emergence, Role, and Challenges ▪ Challenges to Rural and Agricultural Credit in India
3	10	Lecture, PPT/ Group Discussion, Library, Problem-solving based learning, Case study, Jigsaw reading, Practical based learning	Relevant videos, Consortium for Educational Communication-SWF E-Content	<ul style="list-style-type: none"> ▪ Write a note on Importance of Industrial Policy in Economic Development 	<ul style="list-style-type: none"> ▪ Importance of Industrial Policy in Economic Development ▪ Industrial Policy 1991, ▪ Impact of Industrial Policy 1991 on Indian Economy, Shortcomings of the New Industrial Policy,
4	14	Lecture, PPT/ Group Discussion, Library, Problem-solving based learning, Case study, Jigsaw reading, Practical based learning	Relevant videos, Consortium for Educational Communication-SWF E-Content	<ul style="list-style-type: none"> ▪ Make a short Project on Identify the role of MNCs, FDI and SEZ in Economic Development of India 	<ul style="list-style-type: none"> ▪ Concept and Role of Multinational Corporations ▪ Concept and Role Foreign Direct Investment and Foreign Institutional Investment. ▪ Concept and Role, Growth and Problems of Special Economic Zone

Recommended Books:

1. Ramesh Chand, S. K. Srivastava and Jaspal Singh, (2017), Changing Structure of Rural Economy of India Implications for Employment and Growth, NITI Ayog Discussion Paper.
2. Dabesh Roy, Gopakumaran Nair, Gynendra Mani, (2018) Rural India Perspective 2017, Oxford University Press, India.
3. Devonath Narzary, Phanindra Goyari, (2011), Institutional Agriculture Credit in India, LAP Lambert Academic Publishing
4. J. Satyanarayana, (1996), The New Industrial Policy and Its Impact on India's Industrial Economy, Booklinks Corporation,
5. Puri V.K., Misra S.K., Indian Economy (2019), 37th Edition, Himalaya Publishing House.
6. Gardner, B.L. and G.C. Rausser (2001), Handbook of Agricultural Economics, Vol. I., Elsevier.
7. Kavimandan Vijay, (2009) Krushi Arthshastra, Shri Mangesh Prakashan, Nagpur.
9. Kavimandan Vijay, Krushi Arthshastra.
6. Ramesh Singh, Indian Economy, Tata Mc-Graw Hill, Publication

7. Annual Reports, Department of Agriculture, Govt. of India
8. Agricultural Statistics at a Glance 2019, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, New Delhi.

Web reference

- 1) https://niti.gov.in/writereaddata/files/document_publication/Rural_Economy_DP.pdf
 - 2) <https://maitri.mahaonline.gov.in/PDF/Maharashtra%20New%20Industrial%20Policy-2019.pdf>
 - 3) <https://eands.dacnet.nic.in/PDF/At%20a%20Glance%202019%20Eng.pdf>
 - 4) <https://www.youtube.com/user/cecedusat5>
- <https://www.swayamprabha.gov.in/>
[http://14.139.13.96:8080/lectures.aspx?pno=Paper05\(O\)](http://14.139.13.96:8080/lectures.aspx?pno=Paper05(O)) -UGC CEC E Contain on Agricultural Economics
[http://14.139.13.96:8080/lectures.aspx?pno=Paper06\(O\)](http://14.139.13.96:8080/lectures.aspx?pno=Paper06(O)) -UGC CEC E Contain on Industrial Economics

T Y B Com (Semester V)
(Choice Based Credit System)
Revised Syllabus (2019 Pattern)

SPECIAL ELECTIVE COURSE – I

Subject: Defence budgeting finance and Management special paper - III

Total credits:

Course Code: 356 (j)

Objectives:

- 1. To understand the impacts of war & how the economic structure affects**
- 2. To know the elements of war ability**
- 3. To understand the challenges in 21st century against Defence.**
- 4. To Understand the system of financial management in Defence**

Unit No.	Topic	No 'of lectures	Teaching Method	Proposed Skill to be Developed
1	War Impact A) Economic Structure B) Impact on Industry C) Post war Problem	12	Lecture group Discussion library work assignment field visit	Understanding the Impact of war on economy & the post war problem

2	Determinates of war Ability A) Economic Determinates B) Natural Resources and raw Material C) Man power & its utility D) Industrial Capacity E) Foreign Aides contributory Element	12	Lecture group Discussion library work assignment field visit	Understanding the elements of war economy, natural resources, manpower & Industrials capacity and contribution of foreign aid.
3	Military power in 21st century An Analysis A) Sources of military power B) Elements of military power C) Equation to Measure military power D) Nuclear Weapons	12	Lecture group Discussion library work assignment field visit	Understanding the sources of military power the elements of national power and the importance of nuclear weapons
4	Latest contest in Defence & financial management A) System of financial management in defence B) Linkages between planning & Budget C) Arm Impact vs. Indigenisation, pitfans fans & Impact on Defence Budget	12	Lecture group Discussion library work assignment field visit	Understanding the financial management System in defence and the linkages between pit fans & defence Budget.

References

1. Deger s. & Sen S. (1986), 'Military Expenditure in the Third World countries: The Economic effects', Rout let & Kegan Paul.
2. Agarwal Rajesh K. (1978), 'Defence Production and Development', Gulab Vazirani for Arnold Heinemann publishers.

3. Thomas Raju G. C. (1988) 'Indian security policy', Princeton, New Jersey, University press.
4. Robert Loony and David winter ford (1995), 'Economic Causes and consequences of Defence Expenditure in the Middle East and South Asia', University press.
5. Shrinivas V.N. (2008), 'Budgeting for Indian Defence: Issues of contemporary Relevance', KW Publishers Pvt. Ltd. New Delhi.
6. Annual Report, Ministry of Defence, Government of India.
7. Report of the Finance Commission, Government of India

T.Y. B.Com. (Semester -V) (2019 Pattern)

Special Paper-III, Course Code - 356 (K)

Insurance, Transport & Tourism-I

(Insurance)

Objectives:

- To know the insurance customer and their behaviors.
- To understand the principles of underwriting and its process.
- To study the insurance market and its regulators.
- To review the insurance business, challenges and its prospects.

Unit No	Topic	No. of Lectures	Teaching Method	Proposed skills to be developed
1	The Insurance Customer Customers are Different- Different Mind sets, Their Satisfactions-Ethical Behaviours- Risk Management- Avoidance or Prevention-Reduction- Retention- Transfer- The techniques, Separation- Duplication, Diversification- Retention and The Individual.	12	Lecture, PPT, Group Discussion, Library Work, Assignment, Visit to institutions etc.	Understanding the insurance customer and their behaviours.
2	Underwriting – Origin, Definition, Objectives & principles of underwriting, Underwriting process-source of information concerning life insurance risk, special underwriting practices in areas such as non-medical insurance, guaranteed issue insurance, reinstatement & policy changes and highly impaired risk.	12	Lecture, PPT, Group Discussion, Library Work, Assignments, etc.	Understanding the principles of underwriting and its process.

3	The Insurance Market: Life and Non-life Insurers- Reinsurers- Individual and Corporate Agents-Brokers- Surveyors- Medical Examiners- Third Party Administrators- Regulator IRDA- Insurance Councils- Ombudsmen- Educational Institutes- Councils- Tariff Advisory Committee.	12	Lecture, PPT, Group Discussion, Library Work, Assignments, tests, etc.	Understanding the insurance market and its regulators.
4	Insurance Business Current Scenario & Future : Privatization, Foreign Direct Investment in India, Status of Indian Insurance Industry in the context of International Insurance Market, Challenges & Future of Insurance Business in India, Insurance Regulatory Systems in UK and USA. Right to Information Act and Insurance Business	12	Lecture, PPT, Group Discussion, Library Work, Assignment, Visit to institutions, tests, etc.	Understanding insurance business, challenges and its prospects.
	Total	48		

References-

1. M. N. Mishra & S.B. Mishra (2016), 'Insurance Principles and Practices', S. Chand & Company, New Delhi.
2. M. Arif Khan (2016), 'Theory and Practice of Insurance', Educational Book House, Aligarh.
3. S. Balachandran, 'Life Insurance – Insurance Institute of India', Mumbai,
4. G. S. Panda (2011), 'Principles and Practices of Insurances, Kalyani Publishers, Ludhiana.
5. Kothari & Bahal (2019), 'Principles and Practices of Insurance', Sahitya Bhavan, Agra.
6. Dr. Inderjit Singh, Katyal, Sanjay Arora, 'Insurance Principles & Practices', Kalyani Publishers, Ludhiana,
7. K. C. Mishra & C. S. Kumar (2009), 'Life Insurance Principle & Practice' Cengage Learning India Pvt. Ltd, Delhi.
8. Insurance Regulatory Development Act 1999
9. Life Insurance Corporation of India Act, 1956
10. Insurance Act- 1938

Savitribai Phule Pune University, Pune

(T.Y. B.Com.)

Computer Programming and Application Special Paper II

Subject Name: Computer Networking and E-Commerce-II.

Course Code: 356 (L).

Term-II

Unit No.	Topic	No. of Lectures	Ref. Books
1.	Information Security Concepts Information Security Overview: Background and Current Scenario Types of Attacks Goals for Security E-commerce Security Computer Forensics Steganography	12	Book No. 1,2,3
2.	Security Threats and Vulnerabilities Overview of Security threats Weak / Strong Passwords and Password Cracking Insecure Network connections Malicious Code :-Programming Bugs Components of wireless networks Security issues in wireless	12	Book No. 1,2,3

3	Applications of Networks in E Commerce Framework of E-Commerce: Application Services – Interface Layers - Secure Messaging - Middleware Services and Network Infrastructure - Site Security - Firewalls & Network Security TCP/IP – HTTP - Secured HTTP – SMTP - SSL. Applications of Ecommerce: E-Commerce Organization Applications - E- Marketing - E-Advertising - E-Banking - Mobile Commerce - E-Trading - E-Learning - E- Shopping.	14	Book No 4,5
4.	E-MARKETING TECHNIQUES: Introduction - New Age of Information - Based Marketing - Influence on Marketing - Search Engines & Directory Services - Charting the On-Line Marketing Process - Chain Letters - Applications of 5P's (Product, Price, Place, Promotion, People) E-Advertisement - Virtual Reality & Consumer Experience - Role of Digital Marketing.	10	Book No 4,5
Total No. Lectures		48	

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
Unit – I	10	Use ICT or presentation on Information Security Concepts	U–tube Tutorial on Information Security Concepts	-	Familiar with Information Security Concepts
Unit – II	14	Use ICT or presentation on Security Threats and Vulnerabilities	U–tube Tutorial Security Threats and Vulnerabilities	-	Familiar with Security Threats and Vulnerabilities

Unit – III	10	Use ICT or presentation on Applications of Networks in E Commerce	U–tube Tutorial Applications of Networks in E Commerce	-	Familiar with Applications of Networks in E Commerce
Unit – IV	14	Use ICT or presentation on E-MARKETING TECHNIQUES	U–tube Tutorial E-MARKETING TECHNIQUES	-	Familiar with E-marketing techniques

Recommended Books:

1. Computer Networks – Andrew Tanenbaum (III Edition)
2. Data Communications & Networking - Behrouz Ferouzan (III Edition)
3. Complete Guide to Networking - Peter Norton
4. E-Commerce, Strategy, Technologies And Applications : David Whiteley, Tata Mcgraw Hill
5. E-Commerce & Mobile Commerce Technologies: Pandey, Saurabh Shukla, S. Chand



SAVITRIBAI PHULE PUNE UNIVERSITY

Revised Syllabus of Master of Commerce (M.Com.) Semester Pattern with Credit System with effect from June 2019

The M. Com. Syllabus for regular students is being revised from the academic year 2019-20. The course structure is as below:-

1. Objectives :

- a. To equip and train Post Graduate students to accept the challenges of business world by providing opportunities for study and analysis of advanced commercial and business methods and processes.
- b. To develop independent logical thinking and facilitate personality development.
- c. To equip the students to seek suitable careers in management and entrepreneurship.
- d. To acquaint students with significance of research in business.
- e. To impart skills regarding methods of data collection and their interpretations.
- f. To develop communication and analytical skills among students.

2. Duration :

The M.Com. Course will be of Two Years duration consisting of two part. I.e. Part I and Part II. Each part is having Two Semesters.

Thus, the M.Com. Course is of Four Semesters. For each Semester, there will be Four Papers of 100 marks each. M.Com. Degree will be of 1600 marks in aggregate.

3. Duration and Structure of Programme:

The M.Com (Semester pattern with Credit System) degree Programme shall be of 2 years' duration divided into two parts, Part I and Part II, and 4 semesters.

4. Eligibility :

The student who has passed any Bachelors degree of this University or any other recognized University shall be held eligible to be admitted to M.Com. Course.

5. Course Structure:

The M.Com. degree course will be of two year duration consisting of four semesters and of minimum 64 credits as below:

Sr. No.	Semester	Total Credits
1	Semester I	16
2	Semester II	16
3	Semester III	16
4	Semester IV	16
	Grand Total	64

Four extra credits for project work at 4th Semester (This will include credits for fieldwork, data presentation and report writing)

In each Semester, there will be four papers of 100 marks each out of which **40 marks will be for Internal Assessment** (attendance, home assignments, class tests, long term papers, classroom presentation and **60 marks for University Examination**. Thus M.Com. degree examination, four Semesters shall be of 1600 marks.

In addition to the above, students are required to secure following ten credits. These credits are compulsory in nature.

Semester	Human Rights	Introduction to cyber security / information security	Skill development	Total Credits
I	1 credit	1 credit	--	2 credits
II	1 credit	1 credit	--	2 credits
III	--	1 credit	2 credits	3 credits
IV	--	1 credit	2 credits	3 credits
Total Credits	2 credits	4 credits	4 credits	10 credits

- Syllabus and other details regarding 'Human Rights' has been displayed on the home page of the university website.
- Syllabus and other details regarding '**Introduction to cyber security / information security**' has been displayed on the 'syllabi' page of the university website.

6. **The Scheme of Papers:** The following will be the Scheme of papers:

The List of Courses

Semester I

Semester	Subject Types	Course Code	Title of the Paper	Hrs/Week	Credit	Exam. Hours	Maximum Marks			
							Internal	Univ.	Total	
Semester I	Core Compulsory	101	Management Accounting	04	04	03	40	60	100	
		102	Strategic Management	04	04	03	40	60	100	
	Core Elective/ Optional Subjects/ Special Subjects	<i>To choose any one Group of the following</i>								
		Group A (Advanced Accounting & Taxation)								
		103	Advanced Accounting	04	04	03	40	60	100	
		104	Income Tax	04	04	03	40	60	100	
		Group B (Commercial Laws & Practices)								
		105	Information system and E-Commerce Practices	04	04	03	40	60	100	
		106	Intellectual Property Laws	04	04	03	40	60	100	
		Group C (Advanced Cost Accounting & Cost system)								
		107	Advanced Cost Accounting	04	04	03	40	60	100	
		108	Costing Technique Examination s and Responsibility Accounting	04	04	03	40	60	100	
		Group D (Co-operation & Rural Development)								
		109	Co-operative Movement in India	04	04	03	40	60	100	
		110	Rural Development	04	04	03	40	60	100	
		Group E (Business Practices & Environment)								
		111	Organized Traders and Markets	04	04	03	40	60	100	
		112	Business Environment and Policy	04	04	03	40	60	100	
Group F (Business Administration)										
113	Production and Operation Management	04	04	03	40	60	100			
114	Financial Management	04	04	03	40	60	100			
Group G (Advanced Banking & Finance)										
115	Legal Framework of Banking	04	04	03	40	60	100			
116	Central Banking	04	04	03	40	60	100			
Group H (Advanced Marketing)										
117	Marketing Techniques	04	04	03	40	60	100			
118	Consumer Behaviour	04	04	03	40	60	100			

Semester II

Semester	Subject Types	Course Code	Title of the Paper	Hrs/Week	Credit	Exam. Hours	Maximum Marks			
							Internal	Univ.	Total	
Semester II	Core Compulsory	201	Financial Analysis and Control/ Principals of Financial Accounting	04	04	03	40	60	100	
		202	A. Industrial Economics B. Business Statistics	04	04	03	40	60	100	
	Core Elective/ Optional Subjects/ Special Subjects	<i>To choose any one Group of the following</i>								
		Group A (Advanced Accounting & Taxation)								
		203	Specialized Areas in Accounting	04	04	03	40	60	100	
		204	Business Tax Assessment & Planning	04	04	03	40	60	100	
		Group B (Commercial Laws & Practices)								
		205	E- Security & Cyber Laws	04	04	03	40	60	100	
		206	Laws Regulating to Copyrights & Design	04	04	03	40	60	100	
		Group C (Advanced Cost Accounting & Cost system)								
		207	Application Cost Accounting	04	04	03	40	60	100	
		208	Cost Control & Cost System	04	04	03	40	60	100	
		Group D (Co-operation & Rural Development)								
		209	International Co-operative Movement	04	04	03	40	60	100	
		210	Management of Co-operative Business	04	04	03	40	60	100	
		Group E (Business Practices & Environment)								
		211	Modern Business Practices	04	04	03	40	60	100	
		212	Business Environment Analysis	04	04	03	40	60	100	
		Group F (Business Administration)								
		213	Business Ethics & Professional Value	04	04	03	40	60	100	
		214	Elements of Knowledge Management	04	04	03	40	60	100	
		Group G (Advanced Banking & Finance)								
		215	Banking Law & Practices	04	04	03	40	60	100	
		216	Monetary Policy	04	04	03	40	60	100	
		Group H (Advanced Marketing)								
		217	Customer Relationship Management & Retailing	04	04	03	40	60	100	
		218	Services Marketing	04	04	03	40	60	100	

Semester III

Semester	Subject Types	Course Code	Title of the Paper	Hrs/Week	Credit	Exam. Hours	Maximum Marks		
							Internal	Univ.	Total
	Core	301	Business Finance	04	04	03	40	60	100
Semester III	Compulsory	302	Research Methodology for Business	04	04	03	40	60	100
	Core Elective/ Optional Subjects/ Special Subjects	<i>To choose any one Group of the following</i>							
		Group A (Advanced Accounting & Taxation)							
		303	Advanced Auditing	04	04	03	40	60	100
		304	Specialized Auditing	04	04	03	40	60	100
		Group B (Commercial Laws & Practices)							
		305	Laws Relating to International Business	04	04	03	40	60	100
		306	WTO – Norms & Practices	04	04	03	40	60	100
		Group C (Advanced Cost Accounting & Cost system)							
		307	Cost Audit	04	04	03	40	60	100
		308	Management Audit	04	04	03	40	60	100
		Group D (Co-operation & Rural Development)							
		309	Co-operative Credit System	04	04	03	40	60	100
		310	Co-operative Banking System	04	04	03	40	60	100
		Group E (Business Practices & Environment)							
		311	Entrepreneurial Behaviour	04	04	03	40	60	100
		312	Entrepreneurship	04	04	03	40	60	100
		Group F (Business Administration)							
		313	Human Resource Management	04	04	03	40	60	100
		314	Organizational Behaviour	04	04	03	40	60	100
		Group G (Advanced Banking & Finance)							
		315	Foreign Exchange	04	04	03	40	60	100
		316	International Finance	04	04	03	40	60	100
		Group H (Advanced Marketing)							
		317	International Marketing	04	04	03	40	60	100
		318	Marketing Research	04	04	03	40	60	100

Semester IV

Semester	Subject Type	Course Code	Title of the Paper	Hrs/Week	Credit	Exam. Hours	Maximum Marks			
Semester IV	Core Compulsory	401	Capital Market and Financial Services	04	04	03	40	60	100	
		402	Industrial Economic Environment (OR) Operations Research	04	04	03	40	60	100	
	<i>To choose any one Group of the following</i>									
	Group A (Advanced Accounting & Taxation)									
		403	Recent Advances in Accounting, Taxation, Taxation and Auditing	04	04	03	40	60	100	
		404	Project Work/ Case Studies	04	04	03	40	60	100	
	Group B (Commercial Laws & Practices)									
		405	Recent Advances in Commercial Laws and Practices	04	04	03	40	60	100	
		406	Project Work/Case Studies	04	04	03	40	60	100	
	Group C (Advanced Cost Accounting & Cost system)									
		407	Recent Advances in Cost Auditing and Cost System	04	04	03	40	60	100	
		408	Project Work/Case Studies	04	04	03	40	60	100	
	Group D (Co-operation & Rural Development)									
		409	Recent Advances in Co-operative and Rural Development	04	04	03	40	60	100	
		410	Project Work/Case Studies	04	04	03	40	60	100	
	Group E (Business Practices & Environment)									
		411	Recent Advances in Business Practices and Environment	04	04	03	40	60	100	
		412	Project Work/Case Studies	04	04	03	40	60	100	
	Group F (Business Administration)									
		413	Recent Advances in Business Administration	04	04	03	40	60	100	
	414	Project Work/Case Studies	04	04	03	40	60	100		
Group G (Advanced Banking & Finance)										
	415	Recent Advances in Banking and Finance	04	04	03	40	60	100		
	416	Project Work/Case Studies	04	04	03	40	60	100		
Group H (Advanced Marketing)										
	417	Recent Advances in Marketing	04	04	03	40	60	100		
	418	Project Work/Case Studies	04	04	03	40	60	100		

7. Scheme of Examination:

The examination of regular students of M.Com. degree course of the University of Pune admitted in the academic session 2019-20 and after shall be based on:

- (a) Semester Examination
- (b) Continuous Assessment
- (c) Choice Based Credit System, and
- (d) Semester Grade Point Average and Cumulative Grade Point Average System

For each paper of 100 marks, there will be an Internal Assessment (1A) of 40 marks and the University Examination (UE) of 60 marks/ 3 hours duration at the end of each semester. A candidate who will secure at least 40% marks allotted to each paper will be given 4 credits. A candidate who does not pass the examination in any subject or subjects in one semester will be permitted to appear in such failed subject or subjects along with the papers of following semesters.

The Internal Assessment for each paper will be 40 marks, which will be carried out by the department during the term. The Internal Assessment may be in the forms of written test, seminars, term papers, presentations, assignments, orals or any such others. The distribution of internal assessment marks shall be as follows:

Midterm Test	20
Presentation/Role Play	10
Case studies/ Group Discussion	10

There shall be four semester examinations: first semester examination at the middle of the first academic year and the second semester examination at the end of the first academic year. Similarly, the third and fourth semester examinations shall be held at the middle and the end of the second academic year, respectively.

The candidates shall be permitted to proceed from the first semester up to final semester irrespective of their failure in any of the semester examinations subject to the condition that the candidates should register for all the arrear subjects of earlier semesters along with current (Subsequent) semester subjects.

8. Research project work:

There will be a Research Project to be prepared by a student during the fourth semester. The objective of the project work is to introduce students to research methodology in the subject and prepare them for pursuing research in theoretical or experimental or computational areas of the subject. The project work is to be undertaken under guidance of a teacher allotted to a student by the department.

Division of marks	Marks
Synopsis with working bibliography (Internal Assessment)	40 marks
A full project Report (Minimum 50-80 pages)	40 marks
Viva Voce	20 marks

Total	100 marks
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As the Research Project is based on the self-study done by the candidate and evaluated for 100 marks altogether, having four credits. The project may be evaluated by two examiners one internal and one external, selected from the panel of PG examiners of the University. The Viva voce must be conducted by the teachers selected out of the panel of PG examiners maintained by the University.

The candidates have to submit the project 15 days before the commencement of the fourth semester university examination. The project report shall be type-written and submitted in duplicate. A candidate who fails to submit the project may resubmit the same in the subsequent semester examination for evaluation. The project work activities must be duly supported by documentary evidence to be endorsed by the Head or Guide.

9. Standard of passing:

A candidate shall be declared to have passed in the paper provided he/she has secured minimum GP of 4.5 in the UNIVERSITY EXAMINATION and GRADE POINT AVERAGE of 4.0 in aggregate of UNIVERSITY GRADE and INTERNAL ASSESSMENT taken together.

10. Classification of successful candidates:

Candidates who secured not less than 60% of aggregate marks (INTERNAL ASSESSMENT +UNIVERSITY EXAMINATION) in the whole examination shall be declared to have passed the examination in the first class. All other successful candidates shall be declared to have passed in second class. Candidates who obtain 70% of the marks in the aggregate (INTERNAL ASSESSMENT +UNIVERSITY EXAMINATION) shall be deemed to have passed the examination in first class with distinction.

A student who passes in all the courses will be declared to have passed the M.Com. degree with the following honors.

CGPA in (4.00, 4.99)	- Pass Class
CGPA in (5.00, 5.49)	- Second Class
CGPA in (5.50, 5.99)	- Higher Second Class
CGPA in (6.00, 7.99)	- First Class
CGPA in (8.00, 10,00)	- First Class with Distinction

11. Scheme of Credits:

Sixty (60) hours of teaching will lead to four credits (which mean four hours per week teaching in one semester) and long term paper as well as presentation will carry one credit. Each semester shall offer 16 credits or more.

12. Grade Points Scheme:

The term grading system indicates a 10 – points scale of evaluation of the performance of students in terms of marks obtained in the Internal and External Examination, grade points and letter grade. The total performance within a semester and continuous performance starting from the first semester are indicated respectively by Grade Point

Average (GPA) and Cumulative Grade Point Average (CGPA). Candidates who pass all the examinations prescribed for the course in the first appearance itself alone are eligible for Ranking.

The 10-point scale would be used to convert marks out of 100 to grades and grade points according to the following table:

Marks as Percentage	Grade	Grade Point
[75.0, 100]	O	10.0
[70.0, 74.9]	A+	9.0
[65.0, 69.9]	A	8.0
[60.0, 64.9]	B+	7.0
[55.0, 59.9]	B	6.0
[50.0, 54.9]	C+	5.5
[45.0, 49.9]	C	5.0
[40.0, 44.9]	D	4.5
[00.0, 39.9]	F	0.0

13. Structure of Transcript:

At the end of each semester, student will be given a transcript showing the performance and result in each course. The transcript shows, for each course the title of the course, credit values, grade in UNIVERSITY EXAMINATION , grade in INTERNAL ASSESSMENT , grade point index, result as pass or fail. Also, the semester grade point average (SGPA) and cumulative grade point average (CPGA) will be shown. Further the equivalent percentage of marks corresponding to SGPG or CGPA to equivalent percentage is given by:

$$\text{Equivalent percentage marks} = \begin{cases} 10 \times \text{CGPA} & \text{if CGPA /SGPA is in [4.00, 6.00]} \\ 05 \times \text{CGPA} + 30 & \text{if CGPA /SGPA is in [6.00, 9.00]} \\ 25 \times \text{CGPA} - 150 & \text{if CGPA /SGPA is in [9.00, 10.00]} \end{cases}$$

The above formula computes to the following table:

Range in % of Marks	Range of CGRADE POINT AVERAGE	Letter Grade	Division
[75.0, 100]	[9.00, 10.00]	O	First Class with Distinction
[70.0, 74.9]	[8.00, 8.99]	A+	
[65.0, 67.9]	[7.00, 7.99]	A	First Class
[60.0, 64.9]	[6.00,6.99]	B+	
[55.0, 59.9]	[5.50, 5.99]	B	Higher Second Class
[50.0, 54.9]	[5.00,5.49]	C+	Second Class
[45.0, 49.9]	[4.50, 4.99]	C	Pass Class
[40.0, 44.9]	[4.00, 4.49]	D	
[00.0, 39.9]	[0.00, 3.99]	F	Fail

Thus the percentage of Marks can be obtained by using the following table:

CGRADE POINT AVERAGE	% of Marks	CGRADE POINT AVERAGE	% of Marks	CGRADE POINT AVERAGE	% of Marks	CGRADE POINT AVERAGE	% of Marks
4.0	40.0	5.5	55.0	7.0	65.0	8.5	72.5
4.1	41.0	5.6	56.0	7.1	65.0	8.6	73.0
4.2	42.0	5.7	57.0	7.2	66.0	8.7	73.5
4.3	43.0	5.8	58.0	7.3	66.0	8.8	74.0
4.4	44.0	5.9	59.0	7.4	67.0	8.9	74.5
4.5	45.0	6.0	60.0	7.5	67.0	9.0	75.0
4.6	46.0	6.1	60.0	7.6	68.0	9.1	77.5
4.7	47.0	6.2	61.0	7.7	68.0	9.2	80.0
4.8	48.0	6.3	61.0	7.8	69.0	9.3	82.5
4.9	49.0	6.4	62.0	7.9	69.5	9.4	85.5
5.0	50.0	6.5	62.0	8.0	70.0	9.5	87.5
5.1	51.0	6.6	63.0	8.1	70.0	9.6	90.0
5.2	52.0	6.7	63.0	8.2	71.5	9.7	92.5
5.3	53.0	6.8	64.0	8.3	71.0	9.8	95.0
5.4	54.0	6.9	64.0	8.4	72.0	9.9	97.5
						10.0	100.0

14. Distribution of Periods:

There shall be 60 periods for each subject to cover the entire teaching of 4 credits. This will be distributed as follows:

Particulars	Periods
Teaching session per programme	48
Assignment/ Test	04
Role play/ Group Discussion	04
Case studies and presentation	04
Total	60

15. Standard of Passing.

Regular students: - A candidate is required to obtain 40% marks in each of course in both Mid Semesters and Semester end. It means passing separately at Mid-Semester and semester Examinations is compulsory.

16. Award of Class.

- The class in respect of M.Com. Examination will be awarded on the basis of aggregate marks obtained by the candidates in all the sixteen papers at the Semester I, II, III, and IV together.

The Award of class shall be as under:-

Marks Obtained	Class
70% and above	First Class with Distinction.
60% and above but less than 70%	First Class.
55% and above but less than 60%	Higher Second Class.

50% and above but less than 55%	Second Class.
40% and above but less than 50%	Pass Class.
Less than 40%	Fail.

- b. Improvement: - A candidate having passed M.Com. Examination will be allowed to improve the performance. The same is termed as 'Class Improvement Scheme' under which improvement of performance shall be allowed only at the Semester end Examination.
- c. A candidate after passing M.Com. Examination will be allowed to appear in the additional Special Subject after keeping necessary terms in the concerned special subject only, for which a passing certificate will be issued.

17. Medium of Instruction :

The use of Marathi is allowed for writing answers in the examination except for following courses:

- a. Management Accounting
- b. Financial Analysis & Control
- c. Business Statistics,
- d. Advanced Accounting and Taxation
- e. Advanced Cost Accounting and Cost Systems.

18. Qualification of the Teachers :

The Teachers recognized to teach the subjects as per Old Course shall be deemed to be recognized in the corresponding equivalent subjects under Revised Course.

In case of: A) Business Statistics, B) Industrial Economics, C) Co-operation and Rural Development, D) Advanced Banking and Finance and E) Research Methodology and Project Work- Paper-IV of each Special Subject, the following qualifications be made applicable.

- A. Business Statistics :** M.Com, M.Phil with Statistics or Research Methodology as one of the Papers at M.Com /B.Com /M. Phil examination with 5 years degree teaching experience or M.A./M.Sc. With Statistics having 5 years degree teaching experience.
- B. Industrial Economics:** M.Com., M. Phil with Business Economics/Economics of Industries or Economics as one of the papers at B. Com/ M.Com Examination with 5 years degree teaching experience or M.A. Economics with 5 years degree teaching experience.
- C. Co-operation and Rural Development:** M. Com, M. Phil. With 5 years degree teaching experience or M.A. Economics (with Co-operation Rural Economics)
- D. Advanced Banking and Finance:** M. Com., M. Phil., with Banking as one of the papers at B.Com/M.Com examination 5 years degree teaching experience.
- E. Research Methodology and Project Work:** M.Com. M.A (Eco.) M.Phil./Ph.D. with 5 years degree teaching experience.
- F.** Similarly all the changes in qualification as per U.G.C norms and guidelines shall also be applicable as and when the changes come into force (If applicable)

Revised syllabi (2019 Pattern) for two years M. Com. Course (CBCS)

Semester: I

Subject: Management Accounting

Course Code: 101

Depth of the programme: Basic Knowledge with recent advancement and its applicability

Objectives of the Programme:

1. To enhance the abilities of learners to develop the concept of management accounting and its significance in the business.
2. To enhance the abilities of learners to analyze the financial statements.
3. To enable the learners to understand, develop and apply the techniques of management accounting in the financial decision making in the business corporates.
4. To make the students develop competence with their usage in managerial decision making and control.

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Accounting for Emerging Sectors	<ol style="list-style-type: none">1. Limitations of conventional Financial Accounting2. Emergence of Management Accounting and Cost Accounting3. Advantages of Management Accounting and Cost Accounting4. Distinction between Management Accounting and Cost Accounting5. Management Accounting as a decision making tool	To understand the concept of Financial Accounting and its limitations, emergence of Management Accounting and Cost Accounting, its advantages and distinction between Management Accounting and Cost Accounting.
2	Application of Management Accounting Techniques	<ol style="list-style-type: none">1. Marginal Costing and Cost-Volume Profit (CVP) Analysis, Key Factors2. Decision Making through Managerial Cost Accounting (Make or Buy Decision) Purchasing and Leasing3. Techniques and Managerial Cost Accounting4. Standardization of Accounting System<ol style="list-style-type: none">a. Fixed and Variable Cost Analysisb. Application of Fixed and Variable Cost Analysis technique in decision making process	To understand the concept of Marginal Costing, its applications, different techniques of managerial cost accounting and Fixed and Variable Cost Analysis in decision making process.

3.	Budgets as a tool for Decision Making	<ol style="list-style-type: none"> 1. Budget Manual 2. Budget Committee and Budgetary Control 3. Preparation of Budget 4. Master Budget 5. Purchase and Sales Budgets 6. Fixed and Flexible Budget 7. Cash Budget 	To understand the concept of budget and budgetary control, types of budgets and preparation of functional budgets in an organization.
4.	Working Capital Management	<ol style="list-style-type: none"> 1. Concept and definition of working capital, 2. Determination of Working capital, Assessment of Working 3. Capital needs - Study of components of working capital such as cash management 4. Accounts receivable management and inventory management. 	To understand the concept of Working Capital Management, determination of working capital, components of working capital and accounts receivable and inventory management.

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Management Accounting	P.C. Tulsian	Tata McGraw Hill Publishing Company	New Delhi
2.	Management Accounting	A.Mukharji & M. Hanif	Tata McGraw Hill Publishing Company	New Delhi
3.	Management Accounting	S. N. Maheshwari & S.K. Maheshawari	Vikas Publishing House Pvt. Ltd.	New Delhi
4.	Advanced Accounting	M. C. Shukla & S.P. Gerwal	S. Chand and Co. Ltd.	New Delhi
5.	Advanced Accountancy	S.P. Jain & K.N. Narang	Kalyani Publishers	New Delhi

6.	Advanced Accountancy	R.L. Gupta & M. Radhaswamy	S. Chand and Co. Ltd.	New Delhi
7.	Advanced Accounting	Dr. Sadashiv Sirgave	Success Publications	Pune
8.	Principles of Management Accounting	S. N. Maheshwari	Vikas Publishing House Pvt. Ltd.	New Delhi
9.	Management Accounting	I.M. Pandey	Vikas Publishing House Pvt. Ltd.	New Delhi
10.	Advanced Management Accounting	Ravi Kishore	Taxman	New Delhi
11.	Management Accounting	Dr. Arun Gaikwad	Success Publications	Pune
12.	Management Accounting	Dr. Yashodhan Mithare	Success Publications	Pune

Suggested references

Web reference

Sr. No	Lectures	PPTs	Articles
1	Introduction to Cost & Management Accounting: CA Raj K. Agarwal (On youtube)	Management Accounting: An Introduction to concept and Methods: Igor Baranov	How do managers react to a Peer's situation? The influence of environmental similarity on budgetary reporting: James N. Cannon (https://www.sciencedirect.com/science/article/pii/S1044500518300659)
2	Decision Making	Management	The role of cognitive frames in combined decisions about risk and effort: Karla Oblak, Mina Licen and others (https://www.sciencedirect.com/science/article/pii/S1044500517300239)

	in Cost and Management Accounting: CA Naresh Agarwal (On youtube)	Accounting: James T. Mocky and Others	
3	Budget and Budgetary Control: CA Naresh Agarwal (On youtube)	Managerial Accounting: Maher, Stickney and Weil	Identity conflict and the paradox of embedded agency in the management accounting profession: Adding a new piece to the theoretical jigsaw: Kate E. Horton (https://www.sciencedirect.com/science/article/pii/S1044500516300245)
4	Working Capital Management: Shivansh Sharama (On youtube)	Study Material PPT: ICAI,	Regulation and adaptation of management accounting innovations: The case of economic value added in Thai state-owned enterprises: Pimsiri Chiwamit and others (https://www.sciencedirect.com/science/article/pii/S1044500517300100)

Revised syllabi (2019 Pattern) for two years M.Com. Degree course (CBCS)

Semester : - I (M.Com Part – I)

Subject : - Strategic Management

Course Code - 102

Objectives of the course

- To introduce the students to the emerging changes in the modern business environment
- To develop the analytical , technical and managerial skills of students in the various areas of Business Administration
- To empower to students with necessary skill to become effective future managers and leaders
- To develop Technical skills among the students for designing and developing effective Functional strategies for growth and sustainability of business

Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Introduction to Strategic Management	Strategy - Concept and its evolution Strategic Management Characteristics , dimensions and Approaches to strategic Decision Making Strategic Management Process Components of Strategic Management Model – Policies , Role of Top Management Strategic implications of Social and Ethical Issues	Understanding of the concept of Strategic management To understand the process of Strategic Management
2	Strategy Formulation , Strategic Analysis and	Organizational Goals, Mission and Social Responsibility	Understanding the External and Internal Business Environment for effective Strategy

	Strategic Planning	Analysis of Business Environment Internal analysis for Strategic Advantage – Strategic Planning – meaning, steps, alternatives, advantages and Disadvantages. Designing an effective Strategic Plan	formulation analytical skills Strategic Plan Development of Strategic Skills to design an effective
3	Strategic Choices and Strategy Implementation	Generating Strategic Alternatives for Stability, Growth and Sustainable Strategies Evaluation of Strategic Alternatives for developing Product portfolio Models and selection of Suitable Corporate Strategy Implementation issues Planning and allocation of resources Organizational Structures – factors affecting the choice , Degree of Flexibility and Autonomy	Development of Applicability skills for effective plan implementation Developing Technical skills for evaluation of alternatives and analytical skills for choice among alternatives
4	Functional Strategy and Strategic Review	Knowledge and Formulation of Functional Strategy for Marketing Environment Sustainability CSR (Corporate Social Responsibility) Human Resource Finance Logistics Evaluation of Strategic Performance – Criteria and Problems Concept of Corporate Restructuring ,Business Process Reengineering , Benchmarking , TQM and Six Sigma Chankyaniti - A Case study approach	Development of Technical and Analytical abilities for formulation of sound functional Strategy in various areas of business Development of Analytical and Managerial Abilities for critical evaluation

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Power Point Presentation	PPT Online Videos	Report writing	Conceptual Clarity on Strategic management
2	12	PPT and Case Study	Case Study of any Organization	Report writing	Development effective Strategy formulation and analytical ability and Skills to design Strategic Plan
3	12	Guest Lectures by Experts from corporate	--	--	Development of Applicability skills and Technical skills
4	12	PPT , Educational Videos	Online Videos	--	Development of Technical and Analytical abilities

References :

List of Books Recommended :-

1. Strategic Management : the Indian Context – By R.Srivivasan
2. Strategic Management – By Dinesh Madan
3. Concepts in Strategic Management and Business Policy – By Thomas L. Wheelen, J. David Hunger, Alan Hoffman, Charles E. Bamford
4. Strategic Management – By Fred R. David , Forest R. David
5. Strategic Management – By Dr.C.B.Gupta
6. Introduction to Strategic Management – Dr. Arun Ingale, Success Publications.

Revised syllabus (2019 Pattern) for M. Com. Course (CBCS)
Syllabus for M. Com. Semester –I
Grope – A (Advanced Accounting and Taxation)
Subject Name :- Advanced Accounting & Taxation Special Paper I
Subject Title - Advanced Accounting
Course Code :- 103

Depth of the program – Advanced Knowledge

Objectives of the course

1. To lay a theoretical foundation of Accounting & Accounting Standards.
2. To gain ability to solve problems relating to Corporate Accounting.

Unit No.	Unit Title	Contents	Purpose Skills to be developed	Total Lectures
1	Basic Concepts:	Conceptual framework of Accounting - Accounting environment - Concept of accounting theory - Role of accounting theory - Classification of accounting theory - Approaches to accounting theory - Accounting Standards - Generally Accepted Accounting Principles - Selection of Accounting Principles - Professional Development of Accounting in India. Introduction to IFRS & IND-AS.	Getting familiar with the Advanced Concepts	10
2	Consolidated Financial Statements:	Consolidated Accounts of Holding and two Consolidated Profit & Loss Accounts - subsidiary Companies Consolidation - Inter Company transactions - Issue of Bonus Shares - Revaluation of Fixed Assets - Debentures and Preference Shares of subsidiary Company- Dividend - (Holding company with two subsidiaries Only to be studied). AS.21.	Understanding the Consolidation of Financial Statements of Holding Companies & two Subsidiary Companies	18

3.	Liquidation of Company:	Preparation of Statement of affairs including deficiency /surplus account.	To Prepare Statement of Affairs of the Companies in Liquidation	10
4.	Valuation of Shares And Goodwill:	<p>A. Valuation of Shares - Need for valuation - Methods of valuation of shares- Net Asserts method, Dividend yield method, Earning yield method, Return on Capital method, Price/Earning method and Fair value method & DCF Method (Discounted Cash Flow Method).</p> <p>B. Valuation of Goodwill - Need for valuation - Methods of valuing Goodwill - Number of Years purchase of average profits method, Capitalization method - Annuity method - Super profits method.</p>	In the today's competitive Corporate World to understand the needs and methods of valuation of Goodwill & Shares	10
		Total Lectures		48

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Advanced Accounts	Shukla and Grewal	S. Chand & Co Ltd. New Delhi	Delhi
2.	Advanced Accounts	Jain and Narang	Kalyani Publishers, Ludhiana	Ludhiana
3.	Accountancy, Volume-I and II	Sr. K. Paul	New Central Book Agency, Kolkata	Kolkata
4.	Accounting Theory	Dr. L. S. Porwal	Tata McGraw Hill	
5.	Accounting Text & Cases	Robert Anthony, D.F.Hawkins & K.A. Merchant	Tata McGraw Hill	

6.	Corporate Accounting	Dr.S.N. Maheshwari:	Viakas Publishing House Pvt. Ltd. New Delhi	New Delhi
7.	Advanced Accounting	Dr. Sadashiv Shirgave	Success Publications	Pune

Revised syllabus (2019 Pattern) for M. Com. Course (CBCS)
Syllabus for M. Com. (Semester – I)
Grope – A (Advanced Accounting and Taxation)
Subject Name: - Advanced Accounting & Taxation Special Paper II
Subject Title - Income Tax
Course Code: - 104

Objective of the Program

- i. To gain knowledge of the provisions of Income - tax including Rules pertaining there to, relating to the following topics.
- ii. To develop ability to calculate taxable Income of 'Individual', 'Hindu Undivided Family' and 'Company' assesses.

Depth of the program – Advanced Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Concepts and Definition	History of Income Tax in India - Introduction, Features, Difference between direct and Indirect Taxes - Fundamental Concepts and definitions under Income Tax Act, 1961 - Rates of taxes - Basis of charge - Residential status and scope of total income -Income Exempt from tax - Capital & Revenue (Theory)	To provide the basic knowledge of Income Tax Act. 1961
2	Heads of Income	a) Income From Salary : Chargeability -Allowances and Taxability - Perquisites - Valuation of perquisites - Provident Funds -	To understand the concepts of Heads of Income and to compute the income under each head.

		<p>Deduction from salaries</p> <p>b) Income from House Property: Annual Value-Self occupied property and let out property -deemed to be let out property - Permissible deductions.</p> <p>c) Income From Business Or Profession : Meaning of Business, Profession and Vocation-deductions expressly allowed Depreciation -Specific disallowances - Method of accounting - Maintenance of Books of Account - Audit of Accounts</p> <p>d)Capital Gains: Meaning, Types and Exemptions</p> <p>e) Income from Other Sources: Chargeability - Deductions - Amounts not deductible.</p> <p>(Theory & Advanced Problems)</p>	
3.	Deductions Under Chapter VIA	<p>Permissible deductions U/s.80 of the Income Tax Act.</p> <p>Rebate U/s. 87A</p> <p>Relief U/s. 89</p> <p>(Theory)</p>	To understand the concept of deductions and provisions of Sec. 80C to 80U

4.	Computation Of Gross Total Income And Assessment Af Companies	Computation of Total Taxable income of an Individual and Hindu Undivided Family and Assessment of Companies. (Advanced Problems)	To Compute the taxable income of an Individual , Hindu Undivided Family and Companies.
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Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Assignments, Tutorials, Group Discussions and Power Point Presentations	Orals, Project VIVA, Theory Examinations	Preparation and Submission of compulsory project by collecting data from minimum 10 assesses of an individual or HUF or minimum one company
Unit – II	Assignments, Tutorials, Group Discussions and Power Point Presentations	Orals, Project VIVA, Theory Examinations	
Unit – III	Assignments, Tutorials, Group Discussions and Power Point Presentations	Orals, Project VIVA, Theory Examinations	
Unit – IV	Assignments, Tutorials, Group Discussions and Power Point Presentations	Orals, Project VIVA, Theory Examinations	

References

Sr. No.	Title of the Book	Author/s	Publication	Place
8.	Direct Taxes, Law and Practice,	Dr. Vinod Singhanian:	Taxman Publication,	New Delhi
9.	Direct Taxes	Dr. Bhagawati Prasad:		
10.	Direct Taxes,	Girish Ahuja and Ravi Gupta:	Bharat Law House,	New Delhi.
11.	Direct Taxes	Gaur V.P. & Narang D.B.	Kalyani Publications	New Delhi
12.	Income Tax (Law & Practice)	Dr. H.C. Mehrotra & Dr. S.P.Goyal	Sahitya Bhavan Publication	Agra
13.	Income Tax (Problems & Solutions)	Dr. H.C. Mehrotra & Dr. S.P.Goyal	Sahitya Bhavan Publication	Agra
14.	Income Tax Act.	Dr. Vinod Singhanian:	Taxman Publication,	New Delhi
15.	Income Tax Rules	Dr. Vinod Singhanian:	Taxman Publication,	New Delhi

Notes:

1. Amendments made prior to commencement of Academic Year in the relevant act should be considered & studied.
2. The breakup of questions in the Examination will be as under:
 - a. Theory questions will carry 30% marks.
 - b. Problems will carry 70% marks.

Revised syllabus (2019 Pattern) for M. Com. Course (CBCS)

Semester: - I (Special Paper I)

Group – B (Commercial Laws & Practices)

Subject Name - Commercial Laws & Practices Paper - I

Subject Title: - Information System and E-Commerce Practices

Course Code - 105

Objectives of the course

- a. To equip and train the students to accept the challenges of emerging Business World with advanced information Systems and emerging E-Commerce by practices.
- b. To analyze the advanced Commercial and business methods and processes in E-Commerce transactions.
- b. To develop independent logical thinking and facilitate personality development with the help of new information systems.
- c. To equip the students for seeking suitable emerging careers in management, entrepreneurship and E-Commerce activities.
- d. To study methods of Data collection and their interpretations.
- e. To develop among students Communication, Study and Analytical and interpretation skills.

Depth of the Programme: – Basic Knowledge with recent advancements and its applicability

Objective of the Programme:

1. To equip and train the students to accept the challenges of Business World by providing opportunities for study and analysis of advanced Commercial and business methods and processes.
2. To develop independent logical thinking and facilitate personality development of the business persons.
3. To equip the students for seeking suitable careers in management and entrepreneurship and E-Commerce transactions..
4. To study methods of Data collection and their interpretations in the field of E-Commerce practices.
5. To develop among students Communication, Study and Analytical skills with critical thinking.

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Introduction to Information Systems	System Concepts, Information Systems Architecture, Definition of a system, Basic Components of a system, Elements and types of a systems, General Model of a system, The model of a Business system. Information systems supporting major business functions. Four major types of systems – Transaction Processing Systems, Management Information systems, Decision Support Systems and Executive Support systems	To understand the fundamentals/ Concept of Information systems and their components, hardware, software, communications networks, and data resources that collects data, transforms it, and disseminates information in a business environment.
2	Introduction to E-Commerce	Meaning and Definition of E-commerce, Benefits of E-Commerce to Businesses, Consumers and Society, Limitations of E-Commerce, Drivers of E-Commerce. Categories of e-Commerce- B2B, B2C, C2C, B2G and G2B. B2B applications, B2C applications and C2C applications.	To understand the concept in relation to business application like Document automation in supply chain and logistics, Enterprise content management, Conversational commerce: e-commerce via chat.
3.	Inter organizational Information Systems and Internet	Internet, Intranet and Extranet, Introduction, Role, benefits and structure of Inter organizational systems. Introduction to Electronic Data Interchange (EDI), Definition, benefits of EDI. EDI transactions and EDI Applications. Electronic Fund transfer. Introduction to Internet, Definition of Internet, Components of Internet, Services offered by Internet. Introduction to Intranet, Definition, advantages and disadvantages of intranet. Introduction to extranet and definition and applications of Extranet.	To understand the inter-organizational information system for managing inter-organizational activities of virtual organizations, extended enterprises, and trans-enterprise systems.

4.	E-Commerce Supporting functions	Purchase and sale Procedures, Supply Chain management, Value Chains in E-Commerce. Electronic Payment Systems, Authentication of payment, Mode of Payments E-Commerce Security. Security Requirements. Security Mechanisms-Encryption, Digital Signature, E-Certificate, Secure electronic transaction protocol. Problems in Taxing of E-Commerce	To equip the students with various E-Commerce functions, electronic payment systems and security mechanism to be followed while completing E-Transactions. Making students aware of significance of digital signatures and security mechanism.
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***All Acts are to be studied with recent amendments**

Teaching methodology:

Topic No.	Total Lectures	Expected Outcome
1.	12	To understand Transaction Processing Systems, Management Information systems, Decision Support Systems and Executive Support systems
2	12	To understand the concept of E-Commerce in relation to various business applications such as Document automation in supply chain and logistics, Enterprise content management, Conversational commerce etc.
3	12	To get knowledge of the inter-organizational information system for managing inter-organizational activities of virtual organizations, extended enterprises, and trans-enterprise systems.
4	12	To understand various e-Commerce functions along with electronic payment systems-Security measures and mechanism of Digital signature.

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Continuous Evaluation (Written tests etc.)	Written Examinations	Certificate Course in E-Commerce

Unit – II	Continuous Evaluation [Class Presentations (PPT) etc.]	Written Examinations	Certificate Course in E-Banking
Unit – III	Continuous Evaluation (Seminar /Group discussions etc.)	Written Examinations	Diploma in Digital Marketing
Unit – IV	Continuous Evaluation (Viva-Voce etc.)	Written Examinations	Certificate Course in E-Security

References

Sr. No.	Title of the Book	Author/s	Publication
1.	E-commerce	Devid Whiteley	McGraw Hill
2.	E-commerce	P.Joseph	PHI
3.	E-commerce – The cutting edge of business	K.Bajaj and Nog	TMH
4.	Text book on Intellectual property rights	N.K. Acharya	Asia Law House,
5.	Guide to Cyber Laws	Rohnay D. Ryder	Wadhwa, Nagpur
6.	Cyber Laws	Justice Yatindra Singh	Universal Law Publishing Co.

Suggested references Web reference

Sr. no	PPTs	Others
1	<p>PPT – Presentation On Electronic Security PowerPoint presentation ...</p> <p>https://www.powershow.com/.../Presentation_On_Electronic_Security_powerpoint_pp...</p>	<p>https://economictimes.indiatimes.com/industry/services/retail/indian-e-commerce-market-to-touch-usd-84-billion-in-2021-report/articleshow/68169239.cms</p>
2	<p>Seminar ppt on digital signature - SlideShare</p> <p>https://www.slideshare.net/jolly9293/seminar-ppt-on-digital-signature</p>	<p>https://www.ibef.org/industry/ecommerce.aspx</p>
3	<p>E-Security:https://slideplayer.com/slide/5139575/</p>	<p>https://www.thebalancesmb.com/electronic-data-interchange-edi-2221329</p>
4	—	<p>UP: What Is Electronic Data Interchange?</p> <p>https://www.up.com/suppliers/order_inv/edi/what_is_edi/</p>

1.

Revised syllabus (2019 Pattern) for M. Com. Course (CBCS)

Semester: - I (Special Paper II)

Group – B (Commercial Laws & Practices)

Subject Name - Commercial Laws & Practices Paper - II

Subject Title: - Intellectual Property Laws: Patents, Trade Marks & Biodiversity

Course Code - 106

1. Objectives of the Course:

- a. To equip the students to deal with the challenges of Contemporary Business World with recent knowledge.
- b. To develop independent logical thinking and problem solving skills.
- c. To sensitise the students regarding suitable careers in management and regulation of IPRs.
- d. To acquaint the students with the methods of Data collection and their interpretations.
- e. To develop among students Analytical and interpretation skills.

Depth of the program: Fundamental Knowledge, Principles and provisions of relevant Statutes and understanding of its applicability

Objectives of the Program:

1. To equip and train the students to accept the challenges of existing business environment.
2. To develop independent logical thinking and facilitate students to enhance their personality.
3. To equip the students for seeking suitable careers in management and entrepreneurship in the field of IPRs.
4. To study methods of Data collection and its interpretations.
5. To develop among students Communication and critical thinking skills.

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Intellectual Property	<p>Intellectual Property Rights (IPR): Origin and Concept, Commercial and cultural dimensions, types of IPR,</p> <p>International Conventions and Organizations;</p> <p>WTO, WIPO, GATT, TRIPS Paris Convention, PCT, Budapest Treaty</p>	<ul style="list-style-type: none"> • Acquainting students with historical aspects of IPR and International Conventions and organizations regarding IPRs.
2	Patents	<p>Patents: Definition, concept, types, patentable & non- patentable inventions, Applications for patents, complete procedure for obtaining patents. (Chapters 1 to 8 of Patents Act, 1970 as amended), Patents of Additions, surrender & revocation of patents. Working of Patents, Compulsory licenses and revocation, use of patents for government purposes and acquisition of patents, Infringement of patents - acts of Infringement and defenses, remedies for Infringement - suits, appeals.</p> <p>Offenses and penalties [Chapters 16 to 20 of Patents Act, 1970 as amended]</p> <p>Patents Offices, establishment, Controller of Patents: functions and powers, Patent Agents, International arrangement [Chapters 14 & 21, 22 of the Act], Issues and concerns in patent regime</p> <p>Important Judgments To Be Studied:</p> <p>1) <i>Bajaj Auto Limited v. TVS Motor Company Limited</i> JT 2009 (12) SC 103</p> <p>2) <i>Novartis v. Union of India</i> (2013) 6 SCC 1</p> <p>3) <i>Dr Snehlata C. Gupte v. Union of India & Ors</i> [W.P. (C) No 3516 and 3517 of 2007] Delhi HC</p> <p>4) <i>Bayer Corporation v. Union of India</i> 162(2009) DLT 371</p>	<ul style="list-style-type: none"> • Acquiring conceptual and procedural know-how of Patents, Patents office and Remedial measures in case of infringements of patents.

3	Trade Marks	<p>Trade Marks: Definition, concept, types, Registration of Trade Marks - Procedure, duration, effect.</p> <p>Appellate Board - Establishment, Composition, qualifications, procedure and powers, disposal of appeals.</p> <p>Assignments and Transmission of Trade Marks, Provisions relating to collective & certification Trade Marks, textile goods, Infringement of Trade Marks and remedies, Offenses and Penalties.</p> <p>Important Judgments To Be Studied :</p> <p>1) <i>The Coca-Cola Company v. Bisleri International Pvt. Ltd</i> Manu/DE/2698/2009</p> <p>2) <i>Clinique Laboratories LLC and Anr. v. Gufic Limited and Anr.</i> MANU/DE/0797/2009</p> <p>3) <i>Yahoo!, Inc. v. Akash Arora & Anr</i> [1999 (19) PTC 201 (Del)]</p> <p>4) <i>Cadila Health Care v. Cadila Pharmaceutica Ltd.</i> [2001 PTC (SC) 561]</p>	<ul style="list-style-type: none"> • Acquiring conceptual and procedural knowledge of Trade mark and its registration. Appellate Board, Remedial measures in case of infringements of Trade mark.
4	Biodiversity Act, 2002	<p>Important relevant definitions of the terms like Biodiversity, Biological Resources, Benefit Claims, Commercial Utilization, Fair & Equitable Benefit Sharing, Sustainable Use—Regulation of Access to Biodiversity [Ss 3 to 7], Functions & Powers of National Biodiversity Authority & State Biodiversity Board [Ss 18 to 25]</p>	<ul style="list-style-type: none"> • Identifying need and Significance Biodiversity along with its regulatory framework .

***All Acts are to be studied with recent amendments**

Method of Evaluation:

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Continuous Evaluation (Written Test etc.)	Written Examination	Diploma in IPR
Unit – II	Continuous Evaluation [Class Presentation (PPT)etc.]	Written Examination	Diploma in Patents
Unit – III	Continuous Evaluation (Seminar/Workshops etc)	Written Examination	Diploma in Trade Marks
Unit – IV	Continuous Evaluation (Viva-Voce etc.)	Written Examination	Online Courses of WIPO,Moocs etc

References:

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Intellectual Property Law	P. Narayan	Eastern Law House.	New Delhi
2.	Text book on Intellectual Property Rights	N.K. Acharya	Asia Law House	Hyderabad
3.	Law Relating to Intellectual Property	Dr. B.L. Waderha	Universal Law Publishing Co.	New Delhi
4.	Intellectual Property Rights, (2011)	Dr. Sreenivasulu N. S.	Regal Publications	New Delhi

5.	Intellectual Property Law in India (2006)	Justice P. S. Narayana	Goigia Law Agency	Hyderabad
6.	Law of Intellectual Property	Dr. S. R. Mynei	Asia Law House	Hyderabad
7.	Intellectual Property Rights – Heritage, Science & Society Under International Treaties	A.Subbian	Deep & Deep Publications Pvt. Ltd	New Delhi
8.	Intellectual Property Laws	Bextly & Sherman,	Asia Law House	Hyderabad

Revised syllabus (2019 Pattern) for M. Com. Course (CBCS)
Semester: - I
Group – C (Advanced Cost Accounting and Cost Systems)
Subject Name - Advanced Cost Accounting and Cost Systems Special Paper I
Subject Title: - Advanced Cost Accounting
Course Code: 107

Objectives:

1. To prepare learners to understand the Scope of Cost Accounting in any business activity.
2. To learn the Cost Accounting treatment in relation to Material Cost Accounting, employee cost and overheads.
3. To develop the learners to establish the interface between Cost Accounting Standards and the various elements of Cost.
4. To enable students to learn application of different methods of costing in Manufacturing and Service industries.

Unit No.	Unit Title	Contents	Skills to be developed
1.	Nature and Scope of Cost Accounting	a) Introduction, Meaning, Definitions and Objectives of Cost Accounting, Cost Centres and Cost unit. b) Elements of Cost: Material, Labour and Overheads. Material: Concept, Procurement of Material, Concept of Landed cost of Material in major currencies with special reference to Dollar, Euro, and Pound only c) Preparation of Cost Sheet d.) Storage and Inventory Control Techniques - Perpetual Inventory system, ABC Analysis, Inventory Turnover ratios, Just In Time, Economic Order Quantity. Fixation of inventory Levels. e) Study of CAS 1 (Classification of Cost) and CAS 6 (Material Cost)	<ol style="list-style-type: none"> 1. Ability to understand the classification of costs. 2. Trace the cost to cost centers 3. To be able to prepare cost sheet in various situations 4. To understand the inventory related treatments in Cost Accounting
2.	Employee	a. Meaning, Definitions and Significance of Labour Cost	1. To understand the concept of Employee Cost and its relevance in the total cost of

	Cost	<p>b. Classification of Labour Cost</p> <p>c. Methods of Remuneration-Performance Based Remuneration</p> <p>d. Labour Cost –</p> <ul style="list-style-type: none"> • Idle time-causes and Accounting treatment • Overtime premium-Accounting Treatment & its Control • Treatment of special Labour Cost –Fringe benefits, Bonus, Employees Welfare Costs <p>e. Labour Turnover – concept, causes, Measurement & Cost of Labour Turnover.</p> <p>f.Study of CAS – 7 relating to Employees Cost</p>	<p>product or services.</p> <p>2. To develop Performance Linked Employee Remuneration Systems.</p> <p>3. To relate the CAS 7 to Employee Cost Concepts</p>
3.	Overheads Accounting	<p>a. Meaning & Classification of Overheads, b.Allocation, Apportionment & reapportionment (Repeated distribution Methods & Simultaneous Equations Method) of Overheads</p> <p>c.Absorption of Overheads-Methods, Over and under absorption of overheads</p> <p>d.CAS – 3 (Overheads)</p>	<p>1. To understand the stages in the process of Accounting of Overheads.</p> <p>2. To study CAS 3 in relation to Overheads.</p>
4	Methods of Costing	<p>a. Job Costing and Contract Costing.</p> <p>b. Process Costing</p> <p>c. Operating Costing in Transport, Hospitals & Hotel undertakings.</p>	<p>To develop ability to ascertain cost in different industries.</p>

Teaching Methodology

Unit No.	Total Lectures	Innovative Methods to be used	Films Shows and AV Applications	Project	Expected Outcome
1	12	Use of Published Annual Reports of listed companies to classify various cost elements.	You Tube clippings of cost elements of various industries.	Visit to small industries to develop understanding about various cost inputs	Development of overall outlook of Cost Accounting
2	12	Find out the ratio to employee cost to turnover as evidenced from the published data.	View TV Channels- Sony BBC Earth where the process of manufacturing in various industries is shot.	Visit to such industries where employee cost is prominent in the total cost of product/service	Understanding the related weightage of employee cost in the total cost of product/service
3	12	Ascertain various items of Overheads from Annual Reports	Classroom Discussion	Visit small units and make a list of overheads of the respective units.	Understand the significance of overheads in the total cost of product/service
4	12	Invite the tour operators, Accountant of Hotels & Hospitals in the class room to provide the practical exposure to ascertain the cost thereof. Study of process costing by visiting Bakeries, Papad Rolling Units, Chapati Making on mass scale for supplying to industrial canteens	You Tube clippings of various industries	Visit to Transport, Hospital & Hotel undertakings to find out the methodology applied in cost ascertainment	Understand formats of cost sheets as per Industry Specifications

References

Sr. No	Title of the Book	Author	Publisher	Place
01	Cost Accounting-Principles & Practices	Jawahar Lal & Seema Shrivastawa	Tata Mcgraw Hill	New Delhi
02	Advanced Cost Accounting And Cost Systems	Ravi M Kishor:	Taxmann	New Delhi
03	Cost Accounting Theory And Problems	S. N. Maheshwari	Mittal Shree Mahavir Book Depot.	New Delhi
04	Advanced Cost Accounting	Jain and Narang	Kalyani Publication	New Delhi
05.	Horngren's Cost Accounting-A Managerial Emphasis	Srikant M Datar & Madhav V Rajan	Pearson	Noida Up
06	Cost Accounting-Principles & Practices	Dr.M.N. Arora	Vikas Publishing House	New Delhi
07	Cost Accounting	Dr. Eknath Khedkar	Success Publications	Pune
08	Principles and Practices of Cost Accounting	Dr. Sunita Pokharna	Success Publications	Pune

Web References

Sr. No	Lectures	Films	PPTs	Articles	Others
For all the units.	Guest Lectures by Field Persons such as working executives from industries and of Practicing Cost and Management Accountants. .	You Tube films showing working of different industries. Discovery Turbo Channel	Cost & Its Classification vmouonline •Classification & Types of cost,method of costing part 1 Commerce Guru	Articles from the Professional Journals such as , The Management Accountant, The Chartered Accountant, The Chartered Secretary, The Institute of Chartered Financial Analyst of India	https://icmai.in

Notes: The breakup of marks in the Examination will be as follows:

- 30 % of marks for Theory & 70 % of marks for Practical.Problems
 - Areas of practical problems:
 1. Preparation of Cost Sheet
 2. Inventory turnover ratios
 3. EOQ
 4. Labour Turnover
 5. Primary and Secondary Distribution of Overheads – Repeated Distribution and Simultaneous Equation Method
 6. Methods of Absorption.
 7. Contract Costing, Process Costing and Operating Costing.
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Revised syllabus (2019 Pattern) for M. Com. Course (CBCS)

Semester: - I

Group – C (Advanced Cost Accounting and Cost Systems)

Subject Name – Advanced Cost Accounting and Cost Systems Special Paper II

Subject Title: - Costing Techniques and Responsibility Accounting

Course Code: 108

Objectives:

- 1 To enhance the abilities of learners to develop the concept of Cost and Management Accounting and its significance in the business
- 2 To enable the learners to understand, develop and apply the techniques of costing in the decision making in the corporate world.
- 3 To equip the students with knowledge and skill to design and implement Cost Control through Costing Techniques.

Unit No.	Unit Title	Contents	Skills to be developed
1.	Budgetary Control	<ol style="list-style-type: none">a. Concept of Budget and pre-requisites of preparing budget.b. Types of Budgetsc. Process of preparing Budgets – Flexible Budget, Cash Budget Production Cost ,Quantity Budget & Sales Budgetd. Limiting Factors in preparing Budgetse. ZBB (Zero Based Budget)	Students are expected to understand the role of Budget in the process of Cost Control and Decision Making.
2.	Standard Costing	<ol style="list-style-type: none">a. Concept of Standard Costb. Setting of Standardsc. Variance Analysis – Material, Labour, Overhead, Sales and Profit Variances.	Skills in computation and analysis of various variances
3.	Uniform Costing and Inter-firm Comparison	<ol style="list-style-type: none">a) Reasons for differences in Cost and Costing Practices.b)The application , Advantages and Limitations of Uniform Costing.c)Inter- firm comparison –Meaning, Advantages and Disadvantages	Understand the concepts of Uniform Costing and Inter

			firm Comparison
4	Responsibility Accounting and Reporting	<p>a)Definition, Meaning, Principles, controllable and Non-controllable Costs.</p> <p>b)Centers of control, Cost Centers, Revenue Center, Investment Center, Profit Center</p> <p>c)Performance Measurement of Business Centers.</p> <p>d)Reporting to different levels of Management</p>	Understand the relevance of Cost Accounting Data as a part of monitoring various segments of business.

Teaching Methodology

Unit No.	Total Lectures	Innovative Methods to be used	Films Shows and AV Applications	Project	Expected Outcome
1	15	Start with discussion on Family Budget and extend the principles to Business Budgets	Browse You Tubes on these topics	Preparation of Cash Budget	Understand Budget Preparation Process
2	15	Invite experts from industries and discuss the process of setting the standards.		Analysis of variances	Understand the impact of adverse and favourable variances on cost of a product/service.
3	06	Classroom Discussion		Compare Cost Ratios of different companies in the same sector(e.g Tyre – SEAT, MRF)	Understand the industry specific cost ratios.
4	12	Responsibility Accounting and Reporting		Performance measurement of Business Centres	To understand the importance of various tools to evaluate the business centers.

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested AD-On Course
Unit I	Multiple Choice Questions, Written Test, Internal Examination, PPT based presentation etc.	SPPU	Visit to industries and make a report on the visit.
Unit II			
Unit III			
Unit IV			

References

Sr. No	Title of the Book	Author	Publisher	Place
01	Cost Accounting- Principles & Practices	Jawahar Lal & Seema Shrivastawa	Tata Mcgraw Hill	New Delhi
02	Advanced Cost Accounting And Cost Systems	Ravi M Kishor:	Taxmann	New Delhi
03	Cost Accounting Theory And Problems	S. N. Maheshwari	Mittal Shree Mahavir Book Depot.	New Delhi
04	Advanced Cost Accounting	Jain and Narang	Kalyani Publication	New Delhi
05.	Horngren's Cost Accounting-A	Srikant M Datar & Madhav V Rajan	Pearson	Noida Up

	Managerial Emphasis			
06	Cost Accounting-Principles & Practices	Dr.M.N. Arora	Vikas Publishing House ,	New Delhi
07	Cost Accounting	Dr. Eknath Khedkar	Success Publications	Pune
08	Principles and Practices of Cost Accounting	Dr. Sunita Pokharna	Success Publications	Pune

Web References:

Sr. No	Lectures	Films	PPTs	Articles	Others
For all the units.	Guest Lectures by Field Persons such as working executives from industries and of Practicing Cost and Management Accountants. .	You Tube films showing working of different industries. Discovery Turbo Channel	Responsibility Accounting Dr. Shuchi Singhal vmouonline, Standard Costing Revision CA Praveen Khatod Budgetary Control and Responsibility Accounting, Cori Crews	Articles from the Professional Journal like The Management Accountant, The Chartered Accountant, The Chartered Secretary, The Institute of Chartered Financial Analyst of India	https://icmai.in

Notes: The breakup of marks in the Examination will be as follows:

- 30 % of marks for Theory & 70 % of marks for Practical Problems .
- Area of practical problems:
 1. Cash Budget
 2. Flexible Budget
 3. Material, Labour , Overhead and Sales Variances
 4. Performance Measurement of Business Centers
 5. Responsibility Accounting

Revised syllabus (2019 Pattern) for M. Com. Course (CBCS)

Semester: - I

Group – D (Co-operation & Rural Development)

Subject Name - Co-operation & Rural Development Special Paper I

Subject Title: - Co-operative Movement in Indian

Course Code: 109

Objectives of the course:

1. To acquaint the students with the Co-operative Movement of India
2. To aware the role of State and Central Govt. in development of co-operative sector.
3. To give basic knowledge about formation of Co-operative society and its administration.

Depth of Programme: - Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Co-operative Movement in India:	Evolution of Co-operative Movement in India- Pre and Post Independence, Recent scenario in Co-operative Movement in India , Problems and Challenges of Co-operative movement in India	<ul style="list-style-type: none">• To understand the Evolution of Co-operative Movement in India• To understand the Recent scenario in Co-operative Movement in India• To understand the Problems and Challenges of Co-operative movement in India
2	Study of Co-operative legislations in India	Study of Maharashtra State Co-operative Societies Act 1960 and rules 1961 with updated amendments regarding :- a. Registration b. Members and their Rights. c. Properties and Funds Management. e. Audit Enquiry Inspection & Supervision.	<ul style="list-style-type: none">• To understand the Maharashtra State Co-operative Societies Act 1960• To understand the registration process of Co-operative Society• To understand the Members and their Rights of Co-operative Society

		f. Settlement of Disputes. E.g. Liquidation h. Appeal Revision & Reviews I. 97 th Amendment in co-operative act.	<ul style="list-style-type: none"> To understand the Management of Co-operative Society To understand 97th Amendment in co-operative act.
3	Structure of Co-operatives Department	(a) State Level (b) Divisional Level (c) District Level (d) Rights, Duties and Responsibilities of Registrar of Co-operative Societies	<ul style="list-style-type: none"> To understand structure of co-operative department. To understand the Rights, Duties and Responsibilities of Registrar of Co-operative Societies
4	Support of Various Committees and Institutional to Cooperative Movement	(a) All India Rural Credit Survey Committee (AIRCS), Rural Credit Review , Report Committee on Inauguration of Co-operative Credit CRAFTICAD , Report of Vaidyanthan Committee, Report of Narsimham Committee (b)NABARD & NCDC support to Co-operatives, Co-operative courses	<ul style="list-style-type: none"> To understand the Support of various committees and institutional to co-operative movement To study the Role of NABARD & NCDC support to Co-operatives

Teaching Methodology

Topic No.	Total Lectures	Innovative Methods to be used	Film Shows and AV Application	Project	Expected Outcome
1	12	Pre reading, Class discussion, examples from real life through newspapers and internet resources. Case studies of Co-operative Societies for understand Recent scenario in Co-operative Movement, Debate on Challenges of Co-operative movement in India	Short Film Show on Co-operative Movement, A.V. Application (Audio and Visual Application)	Project on Co-operative Movement in India- Pre and Post Independence	Understanding of basic knowledge of Co-operative Movement in India Understanding the Problems and Challenges of Co-operative movement in India
2	12	Guest Lectures of eminent personalities in co-operative sector, experience sharing, Pre reading, Class discussion, examples from real life	You Tube Video on Indian Co-operative Movement	Project Report on Amendment of Co-operative Societies Act. Project Report on 97 th Amendment in co-operative act.	Understanding of Study of Co-operative legislations in Maharashtra. Learning functioning of

		through newspapers and internet resources, case studies, PPT			Co-operative Society.
3	12	Organise workshop for students, Pre reading, Class discussion, examples from real life through newspapers and internet resources. case studies, Field visit to Co-operative Societies, PPT	Presentation on structure of co-operative department and Rights, Duties and Responsibilities of Registrar of Co-operative Societies	Project on Rights, Duties and Responsibilities of Registrar of Co-operative Societies	Understanding the structure of co-operative department.
4	12	Pre reading, Class discussion, examples from real life through newspapers and internet resources, Guest Lectures of eminent personalities	Presentation on Support of various committees and institutional to co-operative movement	Project on Role of NABARD & NCDC support to Co-operatives	Understanding the role of various committees and institutional for support to co-operative movement

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit-I	Class participation, Assignment, Library Work, Unit Test, Mid-Semester Examination	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Seminar on Co-operative Movement in India:
Unit-II	Seminar, Assignment, Library Work, Unit Test, Mid-Semester Examination	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Study visit to Co-operative Society
Unit-III	Class participation, Assignment, Library Work, Unit Test, Mid-Semester Examination	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	To Organize guest lecture of Co-operative department officer
Unit-IV	Class participation, Case Studies, Assignment, Library Work, Unit Test, Mid-Semester Examination	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Workshop on Support of various committees and institutional to co-operative movement

References

Sr. No	Title of Book	Author/s	Publication	Place
1	Co-operation and Rural Development	Principal Dr.Nitin Ghorpade	Success	Pune
2	New Dimensions of Co-operative Management	G.S. Kamat	Himalaya Publication	New Delhi
3	Cases in Co-operative Management	G.S. Kamat	Himalaya Publication	New Delhi
6	Consumer Co-operation in India	G.S. Kamat		
7	Co-operation	Prof L.P. Wakale and Dr. G.H.Barhate	Sheth Publishing	Mumbai
8	Journal of Commerce and Management Thought(JCMT)			
9	Journal Co-operative Organization and Management , Journal of Co-operative studies			

Revised syllabus (2019 Pattern) for M. Com. Course (CBCS)

Semester: - I

Group – D (Co-operation & Rural Development)

Subject Name - Co-operation & Rural Development Special Paper II

Subject Title: - Rural Development

Course Code: 110

Objectives of the course:

1. To acquaint the students with the Rural Development
2. To study the problems of rural development
3. To study the solution for rural development

Depth of Programme: - Fundamental and deep Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Introduction - Rural development	concept of rural development, Importance of Rural development in Maharashtra, Need of Rural development in Maharashtra, The problems and challenges of rural development in India	<ul style="list-style-type: none">• To understand the Importance of Rural development• To understand the Need of Rural development in Maharashtra• To understand the Problems and Challenges of rural development in India
2	Rural development in Maharashtra	Introduction ,Current scenario of Rural development of Maharashtra, Government schemes and programme for Rural development in Maharashtra The problems of rural development in Maharashtra, The Role of government for Rural development in Maharashtra	<ul style="list-style-type: none">• To understand the Current scenario of Rural development of Maharashtra• To understand the Government schemes and programme for Rural development in Maharashtra• To understand the Role of government for Rural development in Maharashtra

3	Rural development in India	Introduction ,Current scenario of Rural development of India, Central Government schemes and programme for Rural development in India, The problems and Challenges for rural development in India ,The Role of government for Rural development	<ol style="list-style-type: none"> i. To understand the Current scenario of Rural development of India ii. To understand the Government schemes and programme for Rural development in India iii. To understand the Role of government for Rural development in India
4	Rural Development Planning and Management	Concepts, Principles and Approaches: Concept of development: Indicators of development; Conceptual framework, Strategies; Rural development in India: A retrospective; Policies, Programs: Techniques of planning: Detail steps in district and block level planning: Area Development Planning: Definition, purpose, Area development plans, The Role of Management function for Rural development	<ul style="list-style-type: none"> • To understand the Principles and Approaches of rural development • To study the Rural development in India • To understand the Role of Management function for Rural development

Teaching Methodology

Topic No.	Total Lectures	Innovative Methods to be used	Film Shows and AV Application	Project	Expected Outcome
1	12	Pre reading, Class discussion, examples from real life through newspapers and internet resources. Debate on The problems and challenges of rural development in Maharashtra, Poster presentation	Short Film Show on Rural Development e.g. Hivre Bazar Village video	Project on Importance of Rural development in Maharashtra	Understanding of basic knowledge of Rural development in Maharashtra Understanding The problems and challenges of rural development in Maharashtra

2	12	Guest Lectures of eminent personalities in Rural Development , experience sharing, Pre reading, Class discussion, examples from real life through newspapers and internet resources, case studies, PPT, Survey report	You Tube Video on rural development in Maharashtra and India	Project Report on Government schemes and programme for Rural development in Maharashtra	Understanding rural development in Maharashtra and India. Understanding the problems of rural development in Maharashtra
3	12	Organise workshop for students, Pre reading, Class discussion, examples of Various developed Villages, Internet resources. case studies, Field visit ,street play	Presentation on Central Government schemes and programme for Rural development in India	Project on Current scenario of Rural development of India, The Role of government for Rural development	Understanding the problems and Challenges for rural development in India and the Role of government for Rural development
4	12	Pre reading, Class discussion, examples of Villages through Newspapers and internet resources, Guest Lectures of eminent personalities ,PPT	Group discussion on Rural Development Planning and Management	Project on Conceptual framework and Strategies for Rural development	Understanding Rural Development Planning and Management

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit-I	Class participation, Assignment, Library Work, Unit Test, Mid-Semester Examination ,G.D	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Seminar/Workshop on Rural development
Unit-II	Seminar, Assignment, Library Work, Unit Test, Mid-Semester Examination	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Awareness Programme on the problems of rural development in Maharashtra
Unit-III	Class participation, Assignment, Library Work, Unit Test, Mid-Semester Examination, Presentation	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Group discussion on Central Government schemes and programme for Rural development in India ,Field visit
Unit-IV	Class participation, Case Studies, Assignment, field visit , Unit Test, Mid-Semester Examination	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Visit to Panchat Committee/ Z.P office for understanding the scheme of Rural Development

References

Sr. No	Title of Book	Author/s	Publication	Place
1	Co-operation and Rural Development	Principal Dr.Nitin Ghorpade	Success	Pune
2	Human Resource Management Practices in Co-operative sector	Principal Dr. Shaikh Aftab Anwar	Idea Publication	New Delhi
3	Rural development –Principles –Policies and Management	Katar Singh	Sage Publication	New Delhi
4	Rural Society and development	Sambhaji Desai	Prashant Publication	
5	Rural Development in India-Policies and Programme	Abdul Azees NP and S.M. Javed Aktar	Kalpaz Publication	
6	Journal of Rural Development			
7	Journal of commerce and Management			

Revised syllabus (2019 Pattern) for M. Com. Course (CBCS)

Semester: - I

Group – E (Business Practices & Environment)

Subject Name - Business Practices & Environment Special Paper I

Subject Title: - Organized Trades and Markets

Course Code: 111

Objectives of the course:

- 1) To understand the concepts of organized trade and markets, community markets, regulated markets and business.
- 2) To understand service sector and its role.
- 3) To know about FDI
- 4) To understand cooperative marketing.

Depth of Programme: - Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Organized Trade & Markets :	Introduction , Meaning and importance - Features of Organized Commodity Markets and Regulated Markets Business-concept - Objectives - Nature and scope of Business in the modern context – Study of various policies with illustrations – Product Buying, Selling Price and Credit Policies.	<ul style="list-style-type: none">• To understand the nature and scope of modern business• To understand the relevance and working of different types of organised markets, reasons for regulating them and challenges associated with the same.• To understand various types of business policies in modern context
2	Service Sector:	Meaning, Characteristics, Types of services, Role, Importance and development of Service Sector in India - Business Practices with reference to E-Commerce.	<ul style="list-style-type: none">• To understand the nature, role and importance, progress and contribution of service sector in India• To understand the concept of E-Commerce and its need in today's business world
3	State in Trade	FDI – Meaning, importance & objectives, Role of FDI in retail trade with illustrations. Arguments for and against FDI. Concept of State Trading -	<ul style="list-style-type: none">• To gain the fundamental knowledge about FDI and its role in retail trade• To evaluate the performance of FDI in

		Arguments for and against State Trading - Role of State, Trading Corporation (STC) - State and privatization of trading Activities. Mall administration & organization – Super Markets.	<p>development of business sector in India</p> <ul style="list-style-type: none"> To understand the role of State and Trading Corporations in modern trading activities
4	Co-operative Marketing	Objectives:, Need - Features – Structure - Functions – Advantages and Role of co-operative marketing with illustrations in rural areas - Direct Marketing for farmers, Self Help Group ,Rural Development Policy, Central Mall, D Mart, Reliance Mart, Innovative Marketing practices	<ul style="list-style-type: none"> To understand the fundamental knowledge regarding nature and role of cooperative marketing in rural areas To study the need of direct marketing, Self Help Group in context of rural areas To gain fundamental knowledge about Innovative marketing practice and Mall Culture

Teaching Methodology

Topic No.	Total Lectures	Innovative Methods to be used	Film Shows and A.V. Application	Project	Expected Outcome
1	12	Pre reading, Class discussion, examples from real life through newspapers and internet resources. Case studies of prominent Businessmen in India and World	Film Show on Types of Markets Film on Nature of Business and Business Policies	Project on Business Polices Project on Organised Commodity market and Regulated markets	Understanding of basic knowledge of Modern Business and how to start a new business Understanding various markets and its relation in framing business policies
2	12	Guest Lectures of eminent personalities in service sector, experience sharing, Pre reading, Class discussion, examples from real life through newspapers and internet resources, case studies	You Tube Video on Service Sector and E-Commerce	Project Report on Role and Development of Service Sector in India Project Report on Advantages of E-Commerce in modern business context.	Learning the concept of E-Commerce and its practical application in business world Learning functioning of Service Sector and its growth in India
3	12	Debate on Burning and real life economical issues such as FDI, Role of State etc., Pre reading, Class discussion, examples from real life	Presentation on FDI and its positive and negative aspects	Project on FDI with illustration and case studies	Evaluate the performance of FDI in development of business sector in India Understanding the role of

		through newspapers and internet resources.			trading corporations in India
4	12	Pre reading, Class discussion, examples from real life through newspapers and internet resources, case studies, Field visit to Malls	Presentation on Cooperative Marketing, Direct Marketing Mall Culture	Project on Self Help Groups Project report on Mall Culture, Case studies	Understanding the procedure of Co-operative Marketing, Direct Marketing and functioning of Malls

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit-I	Class participation, Assignment, Library Work, Unit Test, Mid-Semester Examination	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Functioning of Commodity Market and Stock Market
Unit-II	Seminar, Assignment, Library Work, Unit Test, Mid-Semester Examination	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	E-Commerce
Unit-III	Class participation, Assignment, Library Work, Unit Test, Mid-Semester Examination	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Mall Administration and Organisation
Unit-IV	Class participation, Case Studies, Assignment, Library Work, Unit Test, Mid-Semester Examination	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	i. Co-operative Marketing ii. Agro Tourism

References

Sr. No	Title of Book	Author/s	Publication	Place
1	Principles of Practice of Marketing	C.B.Mamoria	KitabMahal	New Delhi
2	Commodity Marketing	P.L.Gadgil	Shubhada Sarswat,DistributiveTrade	Pune
3	Business Environment Text & Cases	Francis Cherunilam	Himalaya Publishing House Pvt.Ltd.	Mumbai
4	Regulated Markets	W.R.Natu	Asia Publishing House	Mumbai
5	Financial Derivatives & Risk Management	O. P.Agarwal	Himalaya Publishing House Pvt.Ltd.	Mumbai
6	Principles of business organization	Acharya, Govekar, A.R.Sheth & Co	Bombay A.R. Sheth and Co.	Mumbai

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Semester: - I

Group – E (Business Practices & Environment)

Subject Name - Business Practices & Environment Special Paper II

Subject Title: -Business Environment and Policy

Course Code: 112

Objectives of the course:

- 1) To understand the term business environment and its aspects
- 2) To study the problems of growth of economy and remedies to solve problems
- 3) To know the term pollution and its problems and types
- 4) To understand the term globalization and its effects and challenges

Depth of Programme: - Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Business Environment	Meaning, Nature, Importance Aspects of Environment -Business Environment with reference to India.	<ul style="list-style-type: none">• To understand the nature and Importance, Aspects of Business Environment• To understand the Business Environment with reference to India
2	Problems of growth of Economy	Unemployment, Poverty, Regional Imbalance. Social Injustice, Inflation, Parallel economy, Lack of technical knowledge and information. - Remedies to solve these problems, Opportunities in Environment.	<ul style="list-style-type: none">• To understand the Unemployment, Poverty, Regional Imbalance• To understand the Lack of technical Knowledge and information
3	Pollution	Meaning, Problems of pollution - Types of pollution- Water, Air and Noise- Regulatory mechanism & laws, sources and effects, various policies of Government, Go Green Movement	<ul style="list-style-type: none">• To Understand the Problems of various types of Pollution• To understand the Regulatory Mechanism and Laws• To understand the various policies of Government to go Green Movement.

4	Globalization & its impact	Meaning, objectives, importance & scope of Globalization Effect & challenges of Globalization, Review, Impact and implication Globalization	<ul style="list-style-type: none"> • To understand the fundamental knowledge regarding objectives, importance and scope of Globalisation. • To study the Effects and Challenges of Globalisation. • To gain fundamental knowledge about Impact and implication of Globalisation.
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Teaching Methodology

Topic No.	Total Lectures	Innovative Methods to be used	Film Shows and T.V. Application	Project	Expected Outcome
1	12	Pre reading, Class discussion, examples from real life through newspapers and internet resources. Case studies of Business Environment.	Film Show on Aspects of Environment.	Project on Business Environment with reference to India	Understanding of basic knowledge of nature, Importance and Aspects of Environment
2	12	Guest Lectures of eminent personalities in Business Economy, experience sharing, Pre reading, Class discussion, examples from real life through newspapers and internet resources, case studies	You Tube Video on Unemployment, Poverty, and Regional Imbalance	Project Report on problems and Remedies of Unemployment, Poverty, and Regional Imbalance.	Learning the concept of Unemployment, Poverty, and Regional Imbalance and to find out Remedies of these problems.
3	12	Debate on Burning and real life issues of Pollution such as Water, Air, and Noise pollutions, Pre reading, Class discussion, examples from real life through newspapers and internet resources	Presentation on problems, Regulatory mechanism and laws of Pollution.	Project on various policies of Government for Go Green Movement.	Evaluate the performance of application of Govt.Policies
4	12	Pre reading, Class discussion, examples from real life through newspapers and internet resources, case studies, Field visit	Presentation on Effects and challenges of Globalisation	Project on Review of Impact and implication of Globalisation.	Understanding the importance, scope, effects and challenges of Globalisation.

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit-I	Class participation, Assignment, Library Work, Unit Test, Mid-Semester Examination	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Business Environment in India
Unit-II	Seminar, Assignment, Library Work, Unit Test, Mid-Semester Examination	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Remedies to solve the problems of Growth of Economy
Unit-III	Class participation, Assignment, Library Work, Unit Test, Mid-Semester Examination	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Policies of Government for Pollution and GO Green Movement
Unit-IV	Class participation, Case Studies, Assignment, Library Work, Unit Test, Mid-Semester Examination	Semester Examination-10% MCQ 70% Descriptive Questions 20% Short Notes	Review Impact and implication of Globalisation.

References

Sr. No	Title of Book	Author/s	Publication	Place
1	Global Economy and Business Environment	Francis Cheranilan	Himalaya publishing house	Mumbai
2	Commodity Marketing	P.L.Gadgil	Shubhada Sarswat,DistributiveTrade	Pune
3	Business Environment Text & Cases	Francis Cherunilam	Himalaya Publishing House Pvt.Ltd.	Mumbai
4	Business Environment Chllaaghan	, Elliaon Edward Arnold	Asia Publishing House	Mumbai

Revised syllabus (2019 Pattern) for M. Com. Course (CBCS)

Semester: - I

Group – F (Business Administration)

Subject Name - Business Administration Special Paper I

Subject Title: - Production & Operation Management

Course Code - 113

Objectives of the course

- To understand and develop deep insight of Production & Operation Management.
- To understand & identify business problems involving operational function, planning and control, design development and quality management.
- Demonstrate awareness and importance of application, operation and supply chain management.
- To develop skills necessary to effectively analyze and synthesize the many inter relationship inherent in complex socio-economic productive systems.
- To increase the knowledge and perspective to gain from emerging trends in production and operation management.

Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Production and Operation Management : An Overview	a. <u>Production and Operation Management</u> : Meaning ,importance , Functions , Types of Production Systems – Mass Production /Flow Line , Continuous, Intermittent , Batch Production , Job Lots etc. b. Service Systems – Recent trends in production and service systems c. Plant Layout – Objectives , basic principles and types d. Safety Considerations and environmental aspects	<ul style="list-style-type: none"> • Acquaint the students knowledge about Production and Operation Management. • Recognize the inherent conflict of interest in many business decisions relating to safety consideration and environmental aspects.
2	Supply Chain Management	a. Supply chain Management : Introduction , Scope, Components, Process of Supply Chain Management. b. Tools and Techniques of Supply Chain Management , Performance Measurement and implementation. c. Career opportunities in Supply Chain Management	<ul style="list-style-type: none"> • Understanding the scope and Process of Supply Chain Management • Knowledge on various career opportunities in
3	Production Planning and Control	a. Production Planning : Meaning , Objectives , Importance and its components b. Production Control : Meaning , Objectives, Significance and factors affecting Production Control. c. Product Design and Development – Concept , Process and factors affecting product development	<ul style="list-style-type: none"> • Acquaint the students with knowledge of Production Planning and Control. • Motivate the students to develop and innovate ideas for Product Design and Development

<p style="text-align: center;">4</p>	<p style="text-align: center;">Total Quality Management and Emerging Issues</p>	<ol style="list-style-type: none"> a. Total Quality Management – Meaning , Dimensions , Objectives and importance b. Emerging Issues in Production and Operations Management – <ol style="list-style-type: none"> i. Mobile Accessibility ii. Atomization of Operational Processes iii. Employee empowerment iv. Outsourcing v. Waste Management 	<ul style="list-style-type: none"> • Recognize the importance of Total Quality Management • Identification of emerging issues in Production and operation Management
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Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Article Review , Group Discussion , Quiz	Documentary	Report on the Review of Article	Conceptual Clarity
2	12	Survey Report , Poster Presentation , Guest Lecture	Documentary	Survey Report / Poster Presentation	Awareness on Career opportunities in Supply Chain Management Introduction to Alternative Career opportunities
3	12	Interview , Game , PPT , Narrating	Documentary	Report Writing	Development of Innovative abilities and Application oriented skills
4	12	Project making , street Play , Jingles making	Documentary	Project	Awareness on the recent and emerging areas Change in overall perception towards quality enhancement

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Continuous Evaluation	Written exam	Related Short Term Course/ Seminar/ Workshop
Unit – II	Continuous Evaluation	Written exam	Related Short Term Course/ Seminar/ Workshop
Unit – III	Continuous Evaluation	Written exam	Related Short Term Course/ Seminar/ Workshop
Unit – IV	Continuous Evaluation	Written exam	Related Short Term Course/ Seminar/ Workshop

References :

List of Books Recommended :-

1. Production and Operation Management – By B.S.Goel (Pragati Prakashan)
2. Production and Operation Management – By S.N. Chary (Tata Mcgraw Hill)
3. Modern Production and Operation Management – By Elword Buffa
4. Production Planning and Inventory Control – By Magee Budman (Tata Mcgraw Hill)
5. Essentials of Business Administration – By K.A. Shantappa
6. A Key of Production Management – By Kalyani Publication

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Semester: - I

Group – F (Business Administration)

Subject Name - Business Administration Special Paper II

Subject Title: - Financial Management

Course Code - 114

Objectives of the course

- To acquaint the student with knowledge of various Financial Management terminologies (Investment ,Credit Planning , Working Capital Management
- To understand the concepts relating to Financing & Financial Statement Analysis
- To utilize the information gathered to reach an optimum conclusion by a process of reasoning
- To enable the students to use their learning to evaluate , make decisions and provide recommendations

Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Introduction	Meaning and objectives of Financial Management , Financial systems in India – RBI , SEBI. New trends in Financial Management	<ul style="list-style-type: none">• Understanding Financial Management• Recognizing the Financial System of India.
2	Financial Statements & Financial Analysis	Concept of Financial Statements – Income and Balance Statements Financial Analysis – Types and Techniques	<ul style="list-style-type: none">• Understanding Financial Statements• Analyzing the Financial Statements
3	Investment Decisions	Capital Expenditure, Capital Budgeting, techniques of Capital Budgeting. Investment	<ul style="list-style-type: none">• To enable the students to make Investment Decisions

		Decision Methods – Payback , Net Present Value , A.R.R and I.R.R	<ul style="list-style-type: none"> To study the Capital Budgeting Techniques
4	Working Capital & Credit Management	<p>Meaning and Nature of Working Capital and Factors affecting Working Capital</p> <p>Formulation of Credit Policy , Collection Policy , Accounts Receivable Management, Factoring and Lease Financing</p>	<ul style="list-style-type: none"> To understand the meaning and nature of Working Capital To enable the students to formulate Credit and Collection policy

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Project	Expected Outcome
1	08	Lecture Methods	Individual assignment report	Developing understanding on Financial Management
2	14	Lectures Method Guest Lectures by subject Experts	Case analysis and Discussions	Developing Financial Statement analysis skills
3	14	Case analysis Internet Research	Article Review Survey analysis	Developing Decision making Skills
4	12	Survey analysis , Assignments , Field Visits	Field Visit Article Review	Developing skills for effective Credit and Working Capital Management

Suggested Add on Course
Add on course on share market
Basic Statistical Analysis Certificate Course
Short term course on Capital Budgeting Techniques
Certificate course on Working Capital Management

References :

List of Books Recommended :-

7. Financial Management – By M.Y.Khan and P.K. Jain (Tata Mcgraw Hill)
8. Financial Management – By I.M.Pandey (Vikas Publishing House)
9. Financial Management – By Prasanna Chnadra (Tata Mcgraw Hill)
10. Financial Management – By P.V. Kulkarni (Himalaya Publishing House)
11. Financial Management – By Prasanna Chnadra (Tata Mcgraw Hill)
12. The Indian Financial System – By Bharati Pathak (Dorling Kindersley Pvt. Ltd.)
13. Financial Policy and Management Accountant – By Bhabatosh Banerjee(PHI Learning Pvt. Ltd.)
14. Introduction to Lease Financing – By Rajas Parchure , N. Ashok(Time Research Foundation)
15. Credit Management – By Herbert Edwards (Coles Publishing Co. Ltd.)
16. Financial Management – Dr. Parag Kalkar, Success Publications.

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Semester: - I

Group – G (Advanced Banking & Finance)

Subject Name - Advanced Banking & Finance Paper I

Subject Title:- Legal Framework of Banking

Course Code – 115

Objectives:

1. To acquaint the students with legal framework in which the Indian banking is working today.
2. To make the students aware about the latest developments in the field of banking law.
3. To enable the students to understand modern banking practices.
4. To enable the students to establish a link between the legal provisions and the practical aspects of banking.

Unit No.	Topic	No. of Periods	Teaching Method
01	Banking Regulation Act 1949 Provisions relating to- Definition of bank (Sec. 5B and 5C), Business of Banking Companies (Sec.6), Restrictions on business of banking companies (Sec.8, 19 and 20), Capital Structure(Sec.12), Powers of the RBI (Sec.21, 22and 36 to 36AD), Applicability of the Act to Cooperative Banks (Sec.56), amendments of BRA1949 up to 2012, Banking Regulation (Amendment) Bill 2017	12	Lecture, PPT, Group Discussion, Library Work, Assignment, Use of internet
02	The Negotiable Instrument Act 1881 Provisions relating to: Definition of negotiable Instrument (Sec- 13), Promissory note (Sec -4), Bill of exchange (Sec -5), and Cheque (Sec -6), Comparative Study of Negotiable Instruments Parties to negotiable instrument (Section -7), Holder (Sec -8), Holder in due course (Sec -9), Payment in due course (Sec -10), Negotiation (Sec -14), Endorsement (Sec -15), Dishonour of Negotiable Instruments (Sec -91-92),	12	Lecture, PPT, Group Discussion, Library Work,

	<p>Noting and Protest (Sec -99-104-A), Penalties in case of dishonour of certain cheques for insufficiency of funds in the account (Sec. 138 to 147), Negotiable Instruments (Amendment and Miscellaneous Provisions) Act, 2002: Electronic Cheques/Truncated Cheques</p> <p>Negotiable Instruments (Amendment) Act, 2018- Empowers the Appellate Court to order payment pending the appeal against conviction (Sec.148)</p>		<p>Assignment, Use of internet</p>
03	<p>A. The Reserve Bank of India Act, 1934</p> <p>Provisions relating to: Incorporation, Capital management and Business (Sec 3 to 19), Central Banking functions ((Sec -20 to 45),Regulatory and Supervisory Collection and furnishing of credit information (45 A to 45 G) ,Penalties (Sec 58 B to 58 -G), RBI Act (As Amended By Finance Act 2018)- Monetary Policy Committee (Sec.45 ZA to 45 ZO)</p> <p>B. RBI and Regulation of Digital Financial Services in India, 2012 to 2016.</p>	12	<p>Lecture, PPT, Group Discussion, Library Work, Assignment, Use of internet</p>
04	<p>Securitisation and Reconstruction of Financial Assets and Enforcement of Security Interest Act, 2002</p> <p>Provisions relating to: Preliminary (Section 1 and 2) Regulation of securitisation and reconstruction of financial assets and financial institutions (Section 3 to 12 A) Enforcement of security interest (Section 13 to 19) Central registry (Section 20 to 26) Offences and penalties (Section 27 to 30) Miscellaneous (Section 31 to 41) Relevant amendments between 2004 and 2008 and Amendments in SARFAESI Act in 2016: (Taking possession over collateral: Audit and inspection)</p>	12	<p>Lecture, PPT, Group Discussion, Library Work, Assignment, Use of internet</p>
		Total- 48	

References,

1. Gordon & Natarajan: Banking Theory Law and Practice, Himalya Publishing House
2. Srivastava S. P.; Banking Theory & Practice, Anmol Publications
3. PrakhasM., Bhargabhi R: Banking law & Operation, Vision Book House.
4. Tannan : Banking Law and Practice in India, Indian Law House
5. Sheldon H.P: Practice and Law of Banking.
6. VenkataramanaK., Banking Operations, SHBP.
7. Kothari N. M: Law and Practice of Banking.
8. GulatiNeelam C: Principles of Banking Management.
9. Maheshwari. S.N.: Banking Law and Practice, Vikas Publication
10. Varshaney P.N.:- Banking Law & Practice
11. Justine Paul and Pamalata Suresh; Management of Banking & Financial Services; Second Edition- Published by Dorling Kindersley (Pearson)
12. Compendium on the Insolvency and Bankruptcy Code- 2016
13. Principles and Practices of Banking- By Indian Institute of Banking & Finance- Macmillan Publication
14. www.rbi.org.in
15. Legal and Regulatory Aspects of Banking– Published by Indian Institute of Banking & Finance.
16. All relevant & recent Bare Acts.
17. Banking Law and Practices- Mr. Prakash Misal, Success Publications.

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Semester: - I

Group – G (Advanced Banking & Finance)

Subject Name - Advanced Banking & Finance Special Paper II

Subject Title:- Central Banking

Course Code – 116

Objectives:

1. To acquaint the students with RBI's various functions.
2. To make the students aware about the latest developments in the field of Para banking and NBFCs in India.
3. To enable the students to understand the role of central banking especially in India.
4. To enable the students to acquire sound knowledge of working and techniques of central bank.

Unit No.	Topic	No. of Periods	Teaching Method
01	Changing Role and Need of Central Banking Origin and evolution of Central banking Role of Central Bank in emerging Economies Need and Rationale of Central Bank. Autonomy of Central Banks Evolution of Reserve Bank of India (R.B.I.)	08	Lecture, PPT, Group Discussion, Library Work, Assignment, Use of Internet
02	Functions and Regulations of Reserve Bank of India 2 I. Functions of RBI- A. The Reserve Bank as currency authority:	14	Lecture, PPT, Group

	<p>Issue of currency notes, Asset banking for note- issue, Distribution of currency, Currency chests,</p> <p>Recent developments in currency management.</p> <p>B. The Reserve Bank as banker to Government: Maintenance of Government accounts,</p> <p>Banker to the Central Government and the State governments, Management of public debt</p> <p>C. RBI as a Banker's Bank: Controller of Credit, Lender of Last Resort</p> <p>D. RBI as a Custodian/Manager of Foreign Reserves</p> <p>E. Promotional Functions of RBI</p> <p>2 II. Regulation and Supervision of Reserve Bank over Commercial banks.</p> <p>Regulation and supervision over commercial banks:</p> <p>Licensing of banks, Opening of new banks, Branch Licensing, Foreign banks, Cash reserves and liquid assets, Prudential norms, Capital and reserves, Control over methods of operation, New Banking Licensing Policy</p>		<p>Discussion, Library Work, Assignment, Use of internet</p>
03	<p>Para banking activities Control over management, Annual accounts and audit, Subsidiaries of commercial banks, Credit Information Bureau of India Ltd. (CIBIL) Bank Assurance, Portfolio Management Services, Pension Fund Managers,</p> <p>Mutual Fund Business, Underwriting of Bonds of PSUs,</p> <p>Investment in Venture Capital Funds etc.</p>	14	<p>Lecture, PPT, Group Discussion, Library Work Book Assignment, Use of internet</p>
04	<p>Non Banking Financial Companies (NBFCs) Meaning and types of NBFCs</p>	12	<p>Lecture, PPT,</p>

Role of NBFCs Problems of NBFC Measures for supervision over NBFCs. Revised Regulatory framework for NBFCs		Group Discussion, Library Work, Assignment, use of Internet
	Total- 48	

References,

1. Venugopal Reddy Y.; Monetary & Financial Sector Reforms in India
2. Jhingan M.L., Vrinda; Money, Banking, International Trade And Public Finance- Publications Ltd.
3. Fabozzi Frank J.; Foundation of Financial Markets and Institutions- Dorling Kindersley Pvt. Ltd.
4. Sharma Hemant; Encyclopaedia of Banking and Finance – Cyber Tech Publication, New Delhi
5. Financial Markets and Institutions in India- Dr. Sunil Shete, Success Publications.
6. Indian and Global Economy - Dr. M. U. Mulani, Success Publications
6. rsaaLrajaoMd` 32016´ : BaartIya Aqa-vyavasqaa , sa@saosa piblakoSana , puNao.
7. Govt. of India- Economic Survey
8. R.B.I.: Functions and Working – R.B.I. Publication.
9. R.B.I. Bulletins.
10. R.B.I. Annual Reports.
11. Reports on Trend & Progress of Banking in India- R.B.I. Publication
12. www.rbi.org.in

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Semester: - I

Group – H (Advanced Marketing)

Subject Name - Advanced Marketing Special Paper I

Subject Title:- Marketing Techniques

Course Code -: 117

Objectives of the course

1. To expose the students to various approaches to the study of marketing
2. To create awareness about environmental factors which are affecting marketing environment
3. To provide in-depth knowledge about marketing mix
4. To acquaint students with the importance of public relation in the field marketing
5. To help students understand stake-holders role in marketing mix

Depth of the program – Detailed Knowledge

Objective of the Program

- a. To equip and train Post Graduate students to accept the challenges in the field of marketing by providing opportunities to study and analyze advanced marketing techniques.
- b. To develop students' independent logical thinking and facilitate personality development.
- c. To prepare the students for seeking suitable careers in the field of marketing.
- d. To impart the knowledge about how to collect the data and interpret it.
- e. To develop among students Communication and Analytical skills

Unit No	Unit Title	Contents	Purpose Skills to be developed
01	Marketing Introduction & Marketing Environment	<p>Marketing : Meaning ,Definition,Elements, Objectives, Importance, Advantages and limitations, Evolution and Scope Approaches to the study of Marketing Marketing Environment: Meaning and Definition, Internal and external Environmental factors influencing the marketing environment</p>	To impart the students about Marketing & marketing environment
02	Product Mix and Price Mix	<p>Marketing Mix : Meaning, Definition,Elements, Product Mix: Concept of Product, Product Lines, Product line length, depth, width. Product Mix Width. Product Simplification diversification and elimination Product Management: New product development and Product Life Cycle Brand Management: concept definition and history ofbrand/branding Brand Creation, Rebranding, Brand Positioning, Brand Equity Brand Contract, Brand Factory Labelling: Meaning and importance Price Mix: Price—Meaning, Definition and Elements of price mix. Need, importance and objectives of pricing. Factors influencing pricing. Various Pricing Strategies.</p>	To impart to the students about Product mix and place mix techniques.
03	Place Mix and Promotion Mix	<p>Place – Types of Distribution Channels , Advantages & Limitations, factors affecting selection of channel. Promotion Mix : Meaning, Elements of Promotion Mix,</p>	To impart to the students about place mix and promotion mix technique

		<p>Advertising – Concept, Classification, functions, benefits of advertising, Economic, Social & ethical issues, evaluating advertising effectiveness, Recent trends in advertising,</p> <p>Personal Selling – concept and importance, theories of selling, process of personal selling. Selling Methods, Limitations of personal selling.</p> <p>Publicity: Meaning, difference between advertising and publicity</p> <p>Sales Promotion: Meaning, Objectives and importance. Tools or techniques, Evaluation of sales promotion.</p>	
04	<p>Public Relations, People Process and Physical Evidence</p>	<p>Public Relations— Concept, History, Tools of public relations, Role of Public Relation Officer</p> <p>E- Marketing Promotion – E mails, different types of Web advertising, blog spots, Online Sponsorships. Social Media Marketing,</p> <p>People, Process and Physical Evidence -- People as a part of Marketing Mix, customer interaction, customer service Process as part of the Marketing Mix, Physical evidence/ Packaging</p>	To impart the students to develop public relation skill in marketing

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
01	12	Guest Lecture, Presentation of the students and Lectures available on Youtube	Videos on Youtube	N.A	Students will understand various approaches to study marketing and also get sufficient knowledge about the factors which influencing marketing environment.

02	12	Guest Lecture, Case Study Method, Presentation, Group Discussion	Videos on Youtube	N.A	Students will get in-depth knowledge about Product Mix and Price Mix
03	12	Guest Lecture, Case Study Method, Presentation, Group Discussion	Videos on Youtube	N.A	Students will understand about Place Mix and Promotion Mix
04	12	Guest Lecture, Case Study Method, Presentation, Group Discussion	Videos on Youtube	N.A	Students will aware about various tools of Public Relation and also e-marketing promotion

Method of Evaluation

Subject	Internal Evaluation	External Evaluation
Unit – I	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Written Examination
Unit – II	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Written Examination
Unit – III	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Written Examination
Unit – IV	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Written Examination

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Marketing Management	Arun Kumar, Rachana Sharma.	Atlantic Publishers & Distributors	New Delhi
2.	Marketing Management	Amar Jyoti	Gennext Publishers	New Delhi
3.	Marketing Management	Ranjan Saxena	Tata Mc-Graw Hill Publishers	New Delhi
4.	International Marketing Mix Management	Tobias Richter	Noyos	Berlin
5.	Marketing Management	Russell Winer	Pearson Education	Delhi
6.	Public Relation in Marketing Mix	Jordan Goldman,	NTC Business Books	New York
7.	Public Relation for Marketing Management	Frank Jefkins	The MACMILLAN Press Ltd	London
8.	Marketing Management	Prin. Dr. Babasaheb Sangale	Success Publications	Pune

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Semester: - I

Group – H (Advanced Marketing)

Subject Name - Advanced Marketing Special Paper II

Subject Title:- Consumer Behaviour

Course Code -: 118

Objectives of the course

1. To help students understand the various models of Consumer Behaviour
2. To facilitate students 'awareness about consumer motivation & how to overcome motivational problem
3. To provide in-depth knowledge about consumer personality
4. To acquaint the students with the culture and Social Influences on Consumer Behaviour

Depth of the program – Detailed Knowledge

Objective of the Program

- d. To equip and train Post Graduate students to accept the challenges in the field of marketing by providing opportunities to study and analyze advanced marketing techniques.
- e. To develop students' independent logical thinking and facilitate personality development.
- f. To prepare the students for seeking suitable careers in the field of marketing.
 - d. To impart the knowledge about how to collect the data and interpret it.
 - e. To develop among students Communication and Analytical skills

Unit No	Unit Title	Content	Skills to be developed
01	Consumer Behavior	Meaning and Definition of Consumer Behaviour. Need and Advantages to Study Consumer Behaviour. Models of Consumer Behaviour—Economic, Learning, Sociological and Psychological Models and other relevant Models.	To identify various consumer behavioural traits and patterns.
02	Consumer Motivation.	Introduction , needs , objectives and Scope of Consumer Motivation. Overcoming Problems of Motivational Conflict. Defense Mechanism. Motive arousal, Motivational theories	To discern the motivational gaps among consumers and to use the right type of motivational techniques to fill / reduce the gap.
03	Consumer Personality: Learning Memory and Involvement	Consumer attitudes, beliefs, feelings and Behaviour Consumer Learning attitudes and components of learning Memory system , memory process, concept of involvement , dimensions of involvement	To identify the consumer personality, with regard to attitude, learning , memory and involvement
04	Cultural and Social Influences on Consumer Behaviour	Characteristics of Culture, values, sub cultures, cross cultural and multi-cultural influences on Consumer Behaviour. Social Class and Group influences on Consumer Behaviour with regard to money and other status symbols, conformity to group norms behavior and Influence, family life influences, standard of life and living Influences.	To specifically Identify differences in Consumer Behaviour based on Cultural and Social Influences.

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
01	12	Guest Lecture, Presentation of the students and Lectures available on Youtube	Videos on Youtube	N.A	Students will understand various approaches to study marketing and also get sufficient knowledge about the factors which influencing marketing environment.
02	12	Guest Lecture, Case Study Method, Presentation, Group Discussion	Videos on Youtube	N.A	Students will get in-depth knowledge about Product Mix and Price Mix
03	12	Guest Lecture, Case Study Method, Presentation, Group Discussion	Videos on Youtube	N.A	Students will understand about Place Mix and Promotion Mix
04	12	Guest Lecture, Case Study Method, Presentation, Group Discussion	Videos on Youtube	N.A	Students will aware about various tools of Public Relation and also e-marketing promotion

Method of Evaluation

Subject	Internal Evaluation	External Evaluation
Unit – I	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Written Examination
Unit – II	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Written Examination
Unit – III	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Written Examination
Unit – IV	Class Test, Group Discussion, Presentation, Case Study, Home Assignment	Written Examination

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Consumer Behaviour	Leon G Schiffman, Joseph Wisenblit and S. Ramesh Kumar	Pearson	USA
2	Consumer Behaviour – Insights from Indian Market	RamanujMajumdar	PHI Learning Pvt Ltd	New Delhi
3	Consumer Behaviour—The Indian	S. Ramesh Kumar	Pearson	USA

	Context (Concept and Cases)			
4	Consumer Behaviour	Rodger D Blackwell, Paul W Miniard, James F Engel and Zillur Rahman	Cengage Learning India Pvt Ltd	Delhi
5	International Marketing Mix Management	Tobias Richter	Noyos	Berlin
6	Marketing Management	Russell Winer	Pearson Education	Delhi
7	Public Relation in Marketing Mix	Jordan Goldman,	NTC Business Books	New York
8	Public Relation for Marketing Management	Frank Jefkins	The MACMILLAN Press Ltd	London

Revised syllabi (2019Pattern) M. Com. Degree course (CBCS)

Syllabus for M.Com Part I .Semester – II

Subject Name :- Financial Analysis & Control

Compulsory Subject

Course code :- 201

Objectives of the course

- a. To enable the students to acquire knowledge of financial analysis and control tools
- b. To Make appropriate application and uses of financial analysis and control

Depth of the program – fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Fundamentals of financial analysis and control	Meaning of financial analysis and control, importance, advantages limitations& uses	Understanding basics of financial analysis.
2	Comparative and common size statement	Meaning,, importance, advantages, limitations, uses, Problems on Intra & Inter Company Comparison	To gain knowledge of practically comparing financial results of different years and different companies.
3.	Cash flow and fund flow statements	Meaning,, importance, advantages limitations, uses, Problems on Cash flow and fund flow statements	To understand the importance of cash liquidity in an organization. To understand the computation of cash and fund flows under operating, investing and financing categories.
4.	Ratio analysis and trend analysis	Meaning,, importance, advantages, limitations, uses, Problems on Ratio analysis and Trend analysis	To develop the skill of appropriate use of different ratios to evaluate the financial performance of entities.

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Project	Expected Outcome
1	06	PowerPoint presentations		Application of IT for financial analysis
2	14	Use of MS Excel	Financial analysis of any sector (eg: Software) using common size and comparative statements as a tool of analysis.	Generate interest among students to use and apply Excel as a tool for financial analysis.
3	14	Application through money control, PPT and MS Excel	Financial analysis of any five companies using fund flow and cash flow statement as a tool of analysis	Learn to analyze and identify financially strong and weak companies
4	14		Financial analysis of peer companies using ratio analysis as a tool of analysis	Develop needed understanding and use of various ratios for financial analysis.

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Assignment use of PowerPoint, group discussion	100% based on theory	Functioning of National Stock Exchange
Unit – II	MCQ test	30% theory 70% problems	Financial statement analysis
Unit – III	Problem solving	30% theory 70% problems	
Unit – IV	Case study	30% theory 70% problems	

References

Sr. No.	Author/s	Title of the Book	Publication	Place
1.	Ravi Kishore	Advanced Management Accounting	Taxman	New Delhi
2.	Ravi M. Kishore	Management Accounting & Financial Analysis	Taxman	New Delhi
3.	Dr. Jawahar Lal Dr. Sucheta Guaba	Financial Reporting and Analysis	Himalaya Publication House	New Delhi
4.	P Perm Chand and Madna Mohan	Financial Accounting and Analysis	Himalaya Publishing	Mumbai
5.	M.Y.Khan&P.K.Jain	Management Accounting & Financial Analysis	(Tata McGraw hill)	New Delhi
6.	Advanced Accounting	Dr. Sadashiv Sirgave	Success Publications	Pune
7.	Management Accounting	Dr. Arun Gaikwad	Success Publications	Pune
8.	Management Accounting	Dr. YashodhanMithare	Success Publications	Pune

Suggested references

Web reference

Sr. no	Lectures	Films
1	Financial Statement	https://docs.google.com/spreadsheets/d/e/2PACX-1vRgBO0bXtb52Ocx-aT7yy6j5twA-3GcgWiN5RCGboG3XTD6P5hWpG_jbz8PZA1Aw5YPI2MeEPziCyKm/pubhtml?gid=0&single=true
2	Cash Flow	https://www.investopedia.com/terms/c/cashflowfromfinancing.asp
3	Ratio Analysis	https://www.investopedia.com/financial-edge/0910/6-basic-financial-ratios-and-what-they-tell-you.aspx

M. Com. Part I (Semester II)

Compulsory Subject

Subject :- Industrial Economics

Compulsory Subject

Course Code - 202 A

Objectives of the Course

1. To provide the knowledge to the students about the basic issues of industrial economics.
2. To make aware the students about the industrial profile of India and the industrial policy of government of India.

Depth of the Program – Fundamental Knowledge

Objectives of the Program

1. To make the students understand concepts of industrial economics
2. To help the students know theories of industrial economics
3. To impart students' knowledge about sources of industrial finance and Indian industrial growth

Unit No.	Unit Title	Contents	Purpose skills to be developed
1	Introduction and Concepts	1.1 Meaning, Nature, Scope, Need and Significance of Industrial Economics 1.2 Industrial Combinations- causes, mergers and amalgamations, industrial monopoly-control of monopolies 1.3 Sellers' Concentration, Economies of Scale 1.4 Product Pricing – theories and evidence	<ul style="list-style-type: none">• To give students an overview of industrial economics• To make the students know about the concepts used in industrial economics Skills : Analytical skills, writing skills
2	Industrial Location	2.1 Factors Affecting Location of Industries 2.2 Theories of Industrial Location- Alfred Weber's theory, Sargent Florence Theory 2.3 Industrial Imbalance –Need for balanced regional industrial development-Causes and Measures of Industrial imbalance	<ul style="list-style-type: none">• To make the students understand the theories of industrial location• To impart knowledge about industrial imbalance in India Skills: Problem solving skills, ability to apply knowledge

		2.4 Regional Industrial Imbalance in India – Extent and Government Policy Measures for Balanced Regional Industrial Development	
3	Industrial Productivity, Efficiency and Size of Firm	<p>3.1 Industrial Productivity and Efficiency- Meaning, Norm, Tools and measurement of Industrial Productivity and Efficiency</p> <p>3.2 Factors Affecting Industrial Productivity and Efficiency</p> <p>3.3 Industrial Productivity in India</p> <p>3.4 Causes of Low Industrial Productivity</p> <p>3.5 Remedial measures by the government to improve industrial productivity</p> <p>3.6 Size of Firm- Determinants of Size of Firm</p> <p>3.7 Optimum Size of Firm- Meaning and its Determinants</p>	<ul style="list-style-type: none"> • To help the students know about industrial productivity and efficiency • To know about industrial productivity, size of firms etc. <p>Skills: Understand complex theories and concepts, writing skills, mathematical aptitude</p>
4	Industrial Finance and Indian Industrial Growth	<p>1 Meaning, Scope, Importance of Industrial Finance</p> <p>4.2. Sources of Industrial Finance- private, public and cooperative sector, shares, debentures, bonds, deposits, loans etc.</p> <p>4.3. Foreign Capital- need, government's policy, direct investment, foreign institutional investment,</p>	<ul style="list-style-type: none"> • To impart knowledge about industrial finance and its sources • To help the students understand problems of small and micro industries in India <p>Skills: Critical thinking, analytical thinking, writing skills</p>

		<p>4.4 Form of Foreign Capital : Euro issues, GDR, ADR, External commercial borrowings</p> <p>4.5 Industrial policy : Trends in Industrial Growth since 1991</p> <p>4.6 Performance and Problems of Micro, Small, Medium Enterprises</p>	
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Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	10	<ul style="list-style-type: none"> • Open Book Discussion • Case study 		<ul style="list-style-type: none"> • Mergers and amalgamation of industries • Product pricing practices in India 	<ul style="list-style-type: none"> • Will get an overview of industrial economics • Will know about the concepts used in industrial economics
2	10	<ul style="list-style-type: none"> • Digital lectures • Group discussion 		<ul style="list-style-type: none"> • Extent of regional imbalance in India • Policies to solve industrial imbalance in India 	<ul style="list-style-type: none"> • Students will understand the theories of industrial location • Students will know about industrial imbalance in India
3	14	<ul style="list-style-type: none"> • Teacher driven power point presentation • Jigsaw reading 		<ul style="list-style-type: none"> • Study of productivity in Indian industries • Study of effect of scale 	<ul style="list-style-type: none"> • Students will know about industrial productivity and efficiency • Students will know about industrial productivity,

					size of firms etc.
4	14	<ul style="list-style-type: none"> • Case studies • Interactive learning • Pair learning 		<ul style="list-style-type: none"> • Growth of medium and small enterprises in India • Impact of Industrial policy 1991 	<ul style="list-style-type: none"> • Students will know about industrial finance and its sources • Students will understand problems of small and micro industries in India

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	11	11	Business or industrial economics course
Unit – II	11	11	
Unit – III	14	14	
Unit – IV	14	14	

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Industrial Economics: Indian Perspective	Cherunilam, F.	Himalaya Publishing house.	Mumbai
2	Industrial Economy of India	Sivaya, K.V. and Das	VBM (latest Edition), Sultan Chand	Mumbai

3	Industrial Economics	Sing, A. and A.N.Sadhu	Himalaya Publishing House	Mumbai
4	Industrial Growth in India - Stagnation since Mid-sixties	Ahluwalia, I.J.	Oxford University Press	New Delhi
5	Performance Appraisal of PEs in India: Conceptual Approach", in Public Enterprises in India	Jyotsna and Narayan B	Chug Publications	Allahabad
6	Industrial Economics,	Burthwal, R.R	Wiley Eastern Ltd	New Delhi

Suggested references Web reference

Sr. no	Lectures	PPTs	Articles
1	https://www.economicsnetwork.ac.uk/teaching/Lecture%20Slides/Industrial%20Economics	http://www.powershow.com/view/26979b-MGI2M/INDUSTRIAL_ECONOMICS_powerpoint_ppt_presentation	https://onlinelibrary.wiley.com/journal/14676451
2	https://www.studocu.com/en/document/university-of-nottingham/industrial-economics/lecture-notes/lecture-notes-lectures-1-10/594973/view	http://www.staff.city.ac.uk/~sj355/INDUSTRIAL%20intro.ppt	https://onlinelibrary.wiley.com/loi/14676451
3	https://www.hse.ru/data/2010/10/22/1224130267/BSc4_industrial_en.pdf	https://slideplayer.com/slide/11650124/	https://econpapers.repec.org/article/blajindec/

M. Com. Part I (Semester II)

Compulsory Subject

Subject Name :- Business Statistics

Course code :- 202 B

Objective of the Program

The main objective of this course is to acquaint students with some basic concepts in Statistics. They will be introduced to some statistical methods of analysis of data. The unit wise objectives of this course are as follows:

- 1) To forecasting and the analysis of economic and industrial time series.
- 2) Providing students with a formal treatment of probability theory and fostering understanding through real-world applications.
- 3) To understand the topics binomial, Poisson and normal distribution and of importance in different disciplines.
- 4) To take a random sample from the population to obtain parameter estimates.
- 5) To learn how to interpret the result of a test of hypothesis in the context of the original narrated situation.

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Time Series	Introduction, Definition, Components of Time Series, The Trend, Seasonal variation, Cyclical variation, Irregular variation, Methods of estimating Trends, Moving averages (with periods 3,4,5), Fitting of trendline and second degree curve, Exponential smoothing, Example and problem	Time series analysis is the collection of data of specific intervals over a period of time with the purpose of identifying trends, cycles and seasonal variations to aid in the forecasting of future events.
2	Theory of Probability Distributions : Discrete and Continuous	1.1 Random Variables, discrete random variable, continuous random Variable 1.2 Probability distribution and probability mass function (p.m.f.) of discrete random variable, Probability density function (p.d.f.) of continuous random variable 1.3 Expected value, variance and standard deviation	To classify probability distributions as discrete or as continuous probability distributions depending on whether they define probabilities associated with discrete variables or continuous variables. Examples will clarify the difference between discrete and continuous variables.

		<p>1.4 Marginal, Joint and Conditional distribution</p> <p>1.5 Numerical Problems on finding p.m.f/p.d.f, expected value and variance</p>	
3	Standard Probability Distributions and Parameter Estimation	<p>2.1 Binomial Distribution : p. m. f., mean and variance.</p> <p>2.2 Poisson Distribution : p. m. f., mean and variance</p> <p>2.3 Normal Distribution : p. m. f., mean, variance, properties</p> <p>2.4 Exponential distribution : definition, mean, variance and properties</p> <p>2.5 Limiting relations between these distributions</p> <p>2.6 Numerical problems to calculate probabilities, mean and Variance</p>	<p>Probability distributions are prevalent in many sectors namely insurance, social science, computer science etc. This topic highlighted standard probability distributions which are observed in day-to-day life and explain their applications.</p>
		<p>3.1 Parameter and Statistic</p> <p>3.2 Unbiased estimator</p> <p>3.3 Confidence interval (around unbiased estimator)</p> <p>3.4 Examples and Problems on real life situations</p>	<p>Parameters are descriptive measures of an entire population that may be used as inputs to generate distribution curves. One goal of statistical analysis is to obtain estimates of population parameters along with the amount of error associated with these estimates.</p>
4	Tests of Hypothesis	<p>3.1 Hypothesis, null and alternative hypothesis, two types of errors, teststatistic, critical region acceptance region, level of significance, p-value</p> <p>3.2 Chi square test for goodness of fit</p> <p>3.3 Chi square test for independence of two attributes</p>	<p>The purpose of this topic is to determine whether there is enough statistical evidence in favor of certain belief about the parameter.</p> <p>To learn how to apply the test procedure for test of hypothesis concerning a population mean whom the sample size is small.</p> <p>Larger sample sizes allow researchers to better</p>

	<p>3.4 Small Sample Tests</p> <p>a) One sample test</p> <p>b) Two sample test</p> <p>c) Paired t – test</p> <p>d) F- test</p> <p>3.5 Large sample tests for population mean and population proportion</p> <p>3.1.1 Test for the mean a) one sample b) two samples</p> <p>3.1.2 Test for the proportion a) one sample b) two samples</p> <p>3.6 Numerical Problems</p>	determine the average values of their data and avoid errors.
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Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Expected Outcome
1	15	ICT	Demonstrate advanced understanding of the concepts of time series and their applications to finance and other area.
2	15	ICT	Understand the concept of r.v. Develop problem solving techniques needed to calculate probabilities.
3	15	ICT	To apply discrete and continuous distributions for analyzing the data. To describe the practical applications of various distributions.

			Samples are collected to estimate characterizations of the population of particular interest.
4	15	ICT	Understand problem of statistical inference, problem testing of hypothesis.

Method of Evaluation

Subject	Internal Evaluation (Marks)	External Evaluation (Marks)
Unit – I	12	13
Unit – II	12	13
Unit – III	13	12
Unit – IV	13	12

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Probability and Statistics	R Walpole, S Myers and K Ye	Pearson Education International	London
2	Fundamentals of Mathematical Statistics	S.C. Gupta and V.K. Kapoor	Sultan Chand & Sons	New Delhi
3	Fundamentals of Applied Statistics	S.C. Gupta	Sultan Chand & Sons	New Delhi
4	Statistics for Business and Economics	J.S Chandran	Vikas Publishing	Mumbai
5	Quantitative Techniques for Business	Dr. A.B. Rao	Jaico <i>Publishing</i> House	Mumbai
6	Fundamentals of Statistics	D.N. Elhance	Kitab Mahal	Kanpur

Web reference

1. www.freestatistics.tk(National Statistical Agencies)
2. www.psychstat.smsu.edu/sbk00.htm(Onlinebook)
3. www.bmj.bmjournals.com/collections/statsbk/index.shtml
4. www.statweb.calpoly.edu/bchance/stat-stuff.html
5. www.amstat.org/publications/jse/jse-data-archive.html(International journal on teaching and learning of statistics)
6. www.amstat.org/publications/chance(Chancemagazine)
7. www.statsci.org/datasets.html(Datasets)
8. www.math.uah.edu/stat(Virtual laboratories in Statistics)
9. www.amstat.org/publications/stats(STATS : the magazine for students of Statistics)
10. www.stat.ucla.edu/cases(Case studies in Statistics).
11. www.statsoft.com
12. www.statistics.com
13. www.indiastat.com
14. www.unstat.un.org
15. www.stat.stanford.edu
16. www.statpages.net
17. www.wto.org
18. www.censusindia.gov.in
19. www.mospi.nic.in
20. www.statisticsofindia.in

Group A (Advanced Accounting & Taxation) - Special Paper III

Subject Name:-Specialized Areas in Accounting

Course code:- 203

Depth of the program – Fundamental Knowledge with key competencies amongst the students

Objectives of the Program

1. To understand the application of advanced specialized accounting practices in the field of modern business and profession
2. To gain the knowledge on corporate restructuring which are essentially mean to attain greater market share, acquire additional brand and create new synergies
3. To develop proficiency in new skills expected for future accountants in this changing business environment
4. To acquaint with the amalgamation and reconstruction procedures of companies

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Accounting For Construction Contracts And Introduction to RERA	A. Introduction - Accounting Treatment B. Percentage of Completion Method, Completed Contract Method. C. Provision for foreseeable losses-Principles to be followed while taking credit for profit on incomplete contracts D. Valuation & disclosure of Work-in-progress, Escalation clause E. Preparation of contract accounts as per AS7	To understand the accounting for construction contracts and various terms used in contract accounting and principles to be followed while computing profit on incomplete contracts and valuation and disclosure of WIP and escalation clause
2	Accounting For Corporate Restructuring:	A. Amalgamation B. Absorption C. External reconstruction D. Internal Reconstruction - reparation of Scheme of Internal Reconstruction. (Advanced problems only)	To understand the concept of corporate restructuring, its accounting methods, processes as per accounting standard 14

3.	Services Sector Accounting:	<p>A. Hotel Accounting - introduction - visitors' ledger.</p> <p>B. Hospital Accounting - Introduction- capital and revenue expenditure OPD & IPD Register.</p> <p>C. Transport Undertaking - Introduction - preparation of final Accounts - Accounting of Roadways Preparation of final accounts - Log Book.</p> <p>D. Fund Based Accounting: Introduction - Special Features of Accounting for Educational Institutions, Accounting for Government Grants as per guidance notes issued by the ICAI.</p>	To acquaint with hotel accounting, Hospital accounting, Transport undertakings accounting fund based accounting to create an avenue for employment in the academics and also to benefit Industry
4.	Accounts and Records under GST	<p>A. Accounts & Records</p> <p>B. Compulsorily Audit</p> <p>C. Period for Retention of Accounts</p>	To understand that every registered person to keep and maintain, at his principal place of business (as mentioned in the certificate of registration), a true and correct account along with relevant documents

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	08	02	02	02	Describe how contract accounting is used for performance evaluation and decision making
2	16	06	04	02	Recalls the distinction between Amalgamation in the nature of of purchase and analyses the situation where the Alteration of share capital and internal reconstruction is required
3	16	08	04	04	To develop competency of students to solve problems relating Special areas in accounting including accounting for Services Sector

4	8	06	04	02	To Maintain different types of ledgers, prepare documents such as Invoice, Credit Note and Debit Note, identify the different types of returns and their applicability to the business, Monthly Returns, Quarterly Return
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Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Written Examination	Written Examination	Certificate Course in Financial Accounting
Unit – II	Seminar/ Group Discussion	Written Examination	Certificate Course in Tally with GST
Unit – III	Power Point Presentations (PPT)	Written Examination	Certificate Course in Equity Analysis
Unit – IV	Oral Examination	Written Examination	Certificate Course in Goods and Service tax Accounts Assistant

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Advanced Financial Accounting	ShawarSaleem,	Vikas Publication House	Delhi
2.	Advanced Accounts- Vol.-I.	Shukla, M.C., T.S. T.S. Grewal and S.C. Gupta.	S. Chand & Co.	New Delhi.
3.	Advanced Accountancy	Jain and Narang	Kalyani Publishers	New Delhi
4.	Indirect Taxes	V. S. Datey	Taxman Publication	Mumbai

5.	Advanced Practical Accounts,	Anjan Bhattacharya &SubrataMukerjee	S. Chand & Co.,	New Delhi.
6.	Advanced Accounting	M. C. Shukla & S.P. Gerwal	S. Chand and Co. Ltd.	New Delhi
7.	Advanced Management Accounting	Ravi Kishore	Taxman	New Delhi
8.	Advanced Accounting	Dr. Sadashiv Shirgave	Success Publications	Pune

Suggested references Web reference

Sr. no	Lectures	Films	PPTs	Articles
1	Gst Accounts Records Summary & Documentation, Time Period Of Books Retention-Ca DivyanshuSengar (on youtub)	https://www.youtube.com/watch?v=Ou3qn37BNK4	What is Accounting.Purpose of maintaining Accounts.Accounts& Records in GST	Books of accounts under GST scenario. Vishwanath Bhat & Co Cost Accountants Bangalore (http://icmai.in/upload/Taxation/IDT/PPT/Books-accounts-GST.pdf) (https://www.icsi.edu/media/webmodules/REAL_ESTATE_REGULATION_AND_DEVELOPMENT_ACT.pdf) (http://icmai.in/upload/Students/Syllabus2016/Inter/Paper-11-NEW-GST-Revised.pdf) (http://icmai.in/upload/Taxation/IDT/PPT/Books-accounts-GST.pdf)
2	Accounting for corporate Restructuring-CA AnandBhangariya(on youtube)	(https://www.youtube.com/watch?v=FNBA0R4EW0)	Procedural Aspects Of Merger & Amalgamation Before Nclt By: Cs Nesar Ahmad	Corporate Restructuring, Valuation And Insolvency (https://www.icsi.edu/media/webmodules/publications/Full%20Book%20of%20PP-CRVI-2014.pdf)

3	Accounting - AS 7 - Construction Contract-CA Raj Agrawal (on youtube)	(https://www.youtube.com/watch?v=1Oiu2-KBMAE)	Construction contracts-Kapp Edge Solutions Pvt Ltd	https://www.slideshare.net/gst-trichy/accounts-records-in-gst
4	Hotel Accounting- Guest Charges, Payment, and Check-out	(https://slideplayer.com/slide/1733925/)	Contract Accounting- (https://kalyankaari.files.wordpress.com/2012/04/contract-costing.ppt)	Accounting for Hotels (http://www.yourarticlelibrary.com/accounting/hotel-accounting/accounting-for-hotels-with-accounting-entries-hotel-accounts/68699) (http://jhbwc.org/wp-content/uploads/2013/12/Contract-costing-.pdf)

Group A (Advance Accounting and Taxation) – Special Paper IV

Subject Name :- Business Tax assessment and planning

Course code :- 204

Objectives of the course

1. To provide understanding of Direct Taxes including rules pertaining there to and their application to different business situations.
2. To understand principles underlying the Goods and Service tax
3. To understand basic concepts of Goods Service Tax and Customs Duty.

Depth of the program – fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Assessment of Various entities	1. Assessment of Partnership Firms including LLP 2. Assessment of Co-operative Societies. 3. Assessment of Charitable Trust (Theory & Problems)	To understand the provision for computation of income of various entities.
2	Miscellaneous	Clubbing of income and set off and carry forward of losses (Theory and problems) Income Tax authorities, Return of Income and forms of Income Tax Return, Procedure for assessment – Types of assessment, Appeals & Revision, Tax Deducted at Source. Advance Tax, Interest and Penalties, Offences and Prosecutions, Refund of Tax, Double Taxation Avoidance Agreement (DTAA)	To understand the provisions of returns, assessment and procedure of assessment.

5.	Tax Planning	Concept of Tax Planning and Management, Need, Objectives, Limitations, Types (Short Term, Long Term, permissive, purposive), Difference between Tax exemption, Tax Evasion and Tax Avoidance (theory)	To understand need and importance of Tax Planning and Management
6.	Goods and Service Tax	<p>Concept of GST – Meaning</p> <ol style="list-style-type: none"> 1. Evaluation of GST, Types – CGST, SGST/UTGST, IGST. 2. Procedure for registration under GST, Persons liable for Registration – Compulsory and Deemed registration, cancellation of registration, GST Returns 3. Levi & Collection of Tax, Scope of supply, composite & mixed supply, Time of supply goods & services, Input Tax Credit (Theory & Problem) 4. Customs Duty – Introduction to customs Duty – valuation, Customs Procedure, Classification for customs & Rate of Customs Duty (theory) 	To understand the Basic concept and framework under GST Act & Customs Act.

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications
1	16	Expert Lecture Group Discussion & PPT	ICAI youtube channel ICAI BOS CA Tube
2	10	Expert Lecture Group Discussion & PPT	ICAI youtube channel ICAI BOS CA Tube
3	8	Expert Lecture Group Discussion & PPT	ICAI youtube channel ICAI BOS CA Tube
4	14	Expert Lecture Group Discussion & PPT	ICAI youtube channel ICAI BOS CA Tube

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	PPT, Assignments, Tutorials, GD, Quiz	Solving of practical problems of computation of income	GST Course
Unit – II	PPT, Assignments, Tutorials, GD, Quiz	Solving of practical problems of computation of income	GST Course
Unit – III	PPT, Assignments, Tutorials, GD, Quiz	Solving of practical problems of computation of income	GST Course
Unit – IV	PPT, Assignments, Tutorials, GD, Quiz	Solving of practical problems of computation of income	GST Course

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Direct Tax, Laws & Practice	Dr. Vinod Singhania	Taxman Publication	New Delhi
2	Direct Taxes	Girish Ahuja & Rani Gupta	Bharat Law House	New Delhi
3	Direct Tax, Laws & Practice	Mehrotra H C & Gupta S D	SahityaBhawan Publication	Agra
4	Direct Taxes	Gaur V P & Narang	Kalyani Publications	New Delhi
5	Indirect Taxes	Vinod Singhania	Tasmans Publication	New Delhi
6	Indirect Taxes	H C Mehrotra	SahityaBhawan Publication	Agra
7	Bane Act CGST, SGST, IGST	H C Mehrotra	SahityaBhawan Publication	Agra

Suggested references Web reference

Sr. no	Lectures	Films	Animation	PPTs	Articles	Others
1	ICAI BOS	-	-	-	Management Account Journal Chartered Accountant Journal	

M. Com. Part I (Semester II)

Group B (Commercial Laws & Practices) - Special Paper III

Subject Name: - E-Security and Cyber Laws

Course Code: - 205

Objectives of the course

1. To make the students aware of the cyber wrongs/crimes;
2. To impart knowledge of e-security and Internet Security amongst students
3. To make student familiar with various provisions of cyber Laws and Information Technology Act
4. To make the students acquainted with the regulatory regime in computer field/e-business.

Depth of the Programme: – Fundamental Knowledge with insight to solve practical problems in Cyber laws and related issues

Objective of the Programme:

1. To equip and train Post Graduate students to accept the challenges of Business World by providing opportunities for study and analysis of advanced Commercial and business methods and processes.
2. To develop independent logical thinking and facilitate personality development.
3. To equip the students to opt for suitable careers in management and entrepreneurship.
4. To acquaint the students with methods of Data collection and their interpretations.
5. To develop among students Communication, Study and Analytical skills.

Unit	Unit Title	Contents	Purpose Skills to be developed
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No.			
1	Introduction to Computer crimes	<p>Computer Crimes. Types of Computer crimes, Specific Threats, Attacks on Computer Systems, Major types of Security Problems / Common threats, Computer Frauds and abuse techniques. Characteristics and types of computer frauds.</p> <p>Preventing Computer Frauds and Ethical Considerations. System Vulnerability and abuse – Internet Vulnerability. Protecting Information systems from potential threats. E-Commerce security issues. Risk Involved in E-Commerce. Protecting E-Commerce System.</p>	To understand the nature of different Computer Crimes and ways to protect systems from them and become aware of E-Commerce systems and Issues
2	E-Security	<p>Introduction to E-Security and Security Requirements. Types of Intruders, attacking methods, Hackers and Crackers. Computer Viruses, Spam, Denial of services. Security Policy, Secure E-Transactions. Types of Information Systems Controls- General Controls – Physical Controls, Access Controls, Biometric Controls, data Security Controls and Application Controls. Security Tools and Methods- Password, Authentication, Access Control, Encryption,</p> <p>Firewall, Antivirus Software, Digital Identity and digital Signature, Digital Signature Certificate. Secure Socket Layer and Secure Electronic Transaction Protocols.</p>	To get acquainted with various concepts relating to E-Security and to understand different threats to E-Transactions, security measures, Information System Controls and Secure Electronic Transaction Protocol
3	Cyber Laws (Information Technology Act, 2000) Part-I	<p>Introduction to Cyber Laws—Meaning & scope of Cyber Laws, online contracts, Requirements & legal aspects of e-contracts (offer and acceptance in e-form), Cyber Laws & legal issues (cyber jurisprudence, & sovereignty, net neutrality, freedom of speech in cyber space, governance)</p> <p>Information Technology Act – 2000 Part-I</p> <p>Digital Signature-definition ,meaning, functions,</p>	<ul style="list-style-type: none"> • To introduce Students about Cyber Laws legality of E-Transactions. • To study various legal provisions of the Information Technology Act relating to E-Governance, Digital signatures etc.

		procedure, E- Governance (Ss. 4 to 9), E- Records (Ss 11 to 16), Controller of Certifying Authority (powers, functions u/s 17 to 20), Digital Signature Certificates, License to issue Digital Signature Certificates, (suspension, revocation etc.--Ss.21 to 26), Duties of Certifying Authority (Ss.30 to 34), Provisions relating to Digital Signature Certificates (Ss. 35 to 39), Duties of subscriber	
4	Cyber Laws (Information Technology Act, 2000) Part-II	Penalties for Cyber wrongs and Adjudication (Ss. 43 to 47), Cyber Regulation Appellate Tribunal (Procedure and Powers (Ss.48 to 51, 57 to 64) Cyber Crimes/Offences & punishment (u/s 65 to 79), Offences by Companies (S.85) Amendments effected in IPC 1860, Indian Evidence Act, 1872, Bankers Books Evidence Act, 1891, Reserve Bank of India Act, 1934 pursuant to Ss. 91 to 94 of ITA, 2000.	To get sensitized on various penalties for the cyber wrongs provided in the Information Technology Act, 2000 and relevant amendments in certain other Laws.

***All Acts are to be studied with recent amendments**

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Continuous Evaluation (Written Tests etc.)	Written Examination	Certificate Course in Cyber Laws
Unit – II	Continuous Evaluation [Presentations (PPT) etc.]	Written Examination	Certificate Course in Cyber Security and Cyber Investigation
Unit – III	Continuous Evaluation (Seminars/Group Discussions etc.)	Written Examination	Certificate Course in E-Governance
Unit – IV	Continuous Evaluation (Viva-Voce etc.)	Written Examination	Certificate Course Digital Signature Mechanism

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	E-COMMERCE and ITS APPLICATIONS	Dr. U. S. Pandey, Rahul Srivastava and Saurabh Shukla.	S. Chand & Company	New Delhi
2	Management Information and Control Systems	Dr. Sushila Madan	TAXMANN'S	
3	Electronic Commerce from Vision to Fulfillment	Elias M. Awad	Pearson Education	
4	Text book on Intellectual property rights	N.K. Acharya	Asia Law House	
5	Law of Information Technology (Cyber Law)	D. P. Mittal	TAXMANN'S	
6	Guide to Cyber Laws	Rohnay D. Ryder	Wadhwa,	Nagpur
7	Cyber Laws	Justice Yatindra Singh	Universal Law Publishing Co	New Delhi
8	Law of Information Technology	D.P. Mittal		
9	Cyber Laws	Krishnakumar		
10	Encyclopedia of Cyber Laws	Sujeet Kumar		
11	Handbook of Cyber Laws	Vakul Sharma		

Suggested references

Web reference

Sr. no	Lect ures	Film s	Animat ion	PPTs	Arti cles	Others
1				<p>Cyber law In India: its need & importance – Slide Share</p> <p>https://www.slideshare.net/AdityaShukla7/cyber-law-in-india-its-need-importance</p>		<p>Cyber Laws Ministry of Electronics and Information Technology ...</p> <p>https://www.meity.gov.in/content/cyber-laws</p>
2				<p>Cyber Security & Cyber Law - Digital India</p> <p>https://digitalindia.gov.in/.../files/MeitY_Cyber%20Security_13%20Feb_Final.pdf</p>		<p>Cyber Laws in India</p> <p>http://www.legalserviceindia.com/cyber/cyber.htm</p>

M. Com. Part I (Semester II)

Group B (Commercial Laws & Practices) - Special Paper IV

Subject Name: - **Law Regulating to Copyright and Designs**

Course Code: - **206**

1. Objectives of the Course:

- a. To equip the students with the Concepts of Copyrights, Geographical indications, Plant Varieties and Designs.
- b. To acquaint Students with legal provisions relating to these IPRs.
- c. To sensitise the students to opt for suitable careers in management and regulation of these IPRs.
- d. To make the students acquainted with the regulatory regime in the field of Copyrights, Geographical indications, Plant Varieties and Designs.
- e. To study relevant judicial decisions relating to these IPRs.

Depth of the program: Fundamental Knowledge, Principles and provisions of relevant Statutes and understanding of its applicability

Objectives of the Program:

1. To equip and train the students to accept the challenges of existing business environment.
2. To develop independent logical thinking and facilitate students to enhance their personality.
3. To equip the students for seeking suitable careers in management and entrepreneurship in the field of IPRs.
4. To study methods of Data collection and its interpretations.
5. To develop among students Communication and critical thinking skills.

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	The Copyright Act, 1957	<p>Copyright: Concept and Evolution, Scope and Characteristics of Copyright – Object of Copyright – Works in which Copyright Subsists – Qualification for Copyright Subsistence – Author and Ownership of Copyright- Rights of the Copyright Owner – International Copyright (Ss – 40-43).</p> <p>Term of Copyright (Sections 22 to 29, 37(2), 38(2) – Assignment/ License of Copyright (Sections 18 to 21, 30 To 32) – Registration of Copyright (Sections 44 to 50-A along with rule 16 of chapter VI of Copyright Rules, 1958).</p> <p>Infringement of Copyright - acts which constitute Infringement, acts not Constituting Infringement etc. (Sections 51 to 53 A) – Offences and Penalties,</p> <p>Copyright Societies: Functions and Rights</p> <p>Important Judicial Decisions to be studied :</p> <p>1)<i>The Chancellor, Masters & Scholars of the University of Oxford & Ors. v.Rameshwari Photocopy Services & Ors.</i> [DU Photocopying Case] CS (OS)--2439/2012. Delhi High Court</p> <p>2) <i>Twentieth Century Fox Film Corp v. MCA Inc. and Ors</i> [715 F.2d 1327 (9th Cir. 1983)]</p>	<ul style="list-style-type: none"> • Acquainting students with historical aspects and conceptual framework of Copyrights. • Making them aware of various legal provisions of Copyrights along with few relevant decisions of the Courts.

		<p>3) <i>R. G. Anandv. Deluxe Films</i> [AIR (1978) SC 1613]</p> <p>4) <i>Apple Computer, Inc. v. Microsoft Corporation & Hewlett-Packard Co.</i> [35 F.3d 1435 (9th Cir.1994)]</p>	
2	The Designs Act,2000	<p>Industrial Designs: Introduction, Meaning and Scope – Registerability of a Design, who can file an Application for Registration of a Design (Sections 3 to 10) – Copyright in Registered Designs (Sections 11 to 20) – Infringement (Piracy) of Copyright in Design (Sec. 22) – Defenses which may be set up by the Defendant.</p> <p>Important Judicial Decisions to be studied :</p> <p>1) <i>Micolube India Limited v. Rakesh Kumar</i> 2013 1AD (Delhi) 542; MIPR 2012 (2) 200</p> <p>2) <i>Reckitt Benckiser India Ltd. v. Wyeth Ltd.</i> AIR 2013 Delhi 101;2013 (54) PTC 90 (Del) (FB)</p> <p>3) <u><i>Gopal Glass Works Limited v. Assistant Controller of Patents & Designs & Ors.</i></u> 2006 (3) CHN 188</p> <p>4) <i>AtulNarsibhai Patel v. The Assistant Controller of Patents And Designs And Others.,</i> Calcutta High Court AID No. 3 of 2013 Decided on 17.01. 2017</p>	<ul style="list-style-type: none"> • Introducing students with conceptual framework and scope of Designs. • Making them aware of various legal provisions of Designs Act along with few relevant decisions of the Courts.

3	The Geographical Indications of Goods (Registration and Protection), Act, 1999	<p>Geographical Indications: Introduction, Meaning and Content –</p> <p>Legislative framework :</p> <p>The Geographical Indications of Goods (Registration & Protection) Act, 1999 and the Geographical Indications of Goods (Registration & Protection) Rules, 2002.</p> <p>Procedure for Registrations – Duration, Renewal, Restoration (Section 11 to 18) – Rights Conferred by Registration – Infringement and its Remedies (Section 20-24) – Penalties for Infringement (Section 37 to 54) – Authorities: Registrar, Appellate Board – Certificate of Validity – Powers of Central Government.</p>	<ul style="list-style-type: none"> • Acquainting students with conceptual framework and scope of Geographical indications of goods. • Making them aware of various legal provisions of The Geographical Indications of Goods (Registration and Protection), Act, 1999 along with relevant rules.
4	Protection of Plant Varieties and Farmers Rights Act-2001	<p>Introduction, Objective and Scope of the PPVFR Act, 2001 - Definitions [Plant, Propagating Material, Seed, Germ Plasma, Plant Variety, New Plant Variety, Farmer Etc.] Procedure of Registration, Who may apply? - What can be registered? – What Cannot be Registered - Acceptances and Opposition of Application – Rights and Privileges of Breeders and Researchers – Compulsory License – Period of Validity of Registration – Surrender and Revocation of Certificate – Infringement of Rights and its Remedies - Offences and Penalties – Authorities for Administration</p>	<ul style="list-style-type: none"> • Making students understand with the concept and scope of Plant Varieties and Farmers Rights. • Making them aware of various legal provisions of The Protection of Plant Varieties and Farmers Rights Act, 2001 along with relevant rules.

- All Acts are to be studied with recent amendments

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Continuous Assessment (Written Test etc.)	Written Examination	Diploma in IPRs
Unit – II	Continuous Assessment [Class Presentation (PPT)etc]	Written Examination	Online Courses on Moocs
Unit – III	Continuous Assessment (Seminar etc.)	Written Examination	Certificate course on Copyright
Unit – IV	Continuous Assessment (Viva-Voce etc.)	Written Examination	Certificate course on Geographical indications

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1	Intellectual Property Law	P. Narayan	Eastern Law House	New Delhi
2	Text book on Intellectual Property Rights.	N.K. Acharya	Asia Law House,	Hyderabad
3	Law Relating to Intellectual Property	Dr. B.L. Waderha	Universal Law Publishing Co	
4	Intellectual Property Rights, (2011)	Dr. Sreenivasulu N. S.,	Regal Publications,	New Delhi
5	Intellectual Property Law in India (2006)	Justice P. S. Narayana	Goigia Law Agency,	Hyderabad.
6	Universal's "Intellectual Property Laws" (Bare Acts)		Universal Law Publishing Co. Pvt. Ltd.	
7	Law of Intellectual Property	Dr. S. R. Mynei	Asia Law House,	Hyderabad (2011).

8	Intellectual Property Rights – Heritage, Science & Society Under International Treaties	A. Subbian	Deep & Deep Publications Pvt. Ltd.,	New Delhi
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Suggested references

Web reference

Sr. no	Lectures	Films	Animation	PPTs	Articles	Others
						<p>Important Websites Reference :</p> <ul style="list-style-type: none"> • 1.CIPAM Website-http://cipam.gov.in/ • 2.DIPP Website-http://dipp.nic.in/ • 3.CGPTDM Website-www.ipindia.nic.in/ • Start-Up India Action Plan- http://startupindia.gov.in/uploads/pdf/Action%20Plan.pdf 4.TKDL- http://www.tkdl.res.in/tkdl/langdefault/common/Home.asp?GL=Eng 5.WIPO Website-http://www.wipo.int/about-ip/en/

M. Com. Part I (Semester II)

Group C (Advance Cost Accounting & Cost Systems) - Special Paper III

Subject: Application of Cost Accounting

Course Code: 207

Objectives:

1. To explain the concept of integral and non-integral cost accounting.
2. To study Product Life Cycle costing and Value Chain Analysis
3. To understand the mechanism of Activity Based Cost Management
4. To understand the utility of Cost Accounting data during transfer of product/services from one enterprise to the other either at national or at global level.

Unit No.	Unit Title	Contents	Skills to be developed
1.	Cost Book Keeping and Reconciliation between Cost and Cost financial Accounts	Book - keeping, Cost Ledgers, inter-locking and integral Accounts. Reconciliation of Cost and Financial Accounts, Reasons, needs & Methods.	To conceptualise the need to integrate financial and Cost Accounts.
2.	Product Life Cycle Costing(PLC): & Value Chain Analysis (VCA)	Introduction, Product Life Cycle, Phases and Characteristics of Product Life Cycle, Value Chain Analysis – Approach for Assessing Competitive Advantages – Value Chain Analysis V/S Conventional Management Accounting.	Develop understanding about PLC and VCA Concepts

3.	Cost Allocation and Activity Based Costing	<p>a- Cost Allocation – Meaning ,Types, Relationship between resources, activities, Cost and Cost drivers, Methods of allocating Costs in Cost Centres using Direct Method, Step Down Method and Reciprocal Method.</p> <p>b.Activity Based Costing – Introduction, Steps in ABC Systems, Levels of Activities Advantages & Limitations</p>	<ul style="list-style-type: none"> • Learners are expected to understand the logic behind ABC technique • To prepare cost formats under ABC & to compare such results with the Traditional Overhead Accounting.
4	Strategic Cost Management	<p>A) Transfer Pricing –Introduction, Meaning Advantages and Disadvantages, Setting Transfer Pricing , Methods of Transfer Pricing- Negotiated transfer pricing, Market Price, Cost-Based Price, Negotiated Prices & Dual Prices</p> <p>B) Target Costing – Introduction, Concept, Objectives, Comparison between Target Costing and Cost Plus Pricing.</p>	Students are expected to understand the importance of Transfer Pricing & Target Costing in the changing scenario.

Teaching Methodology

Unit No.	Total Lectures	Innovative Methods to be used	Films Shows and AV Applications	Project	Expected Outcome
1	12	Giving list of items to the students and ask them to identify – Purely Financial, Purely Costing and both	Browse You	Preparation of Reconciliation Statement	Learners must be able to reconcile the cost and financial data.
2	12	Invite experts from industries having technical as well as practical exposure to related		Home Assignment to the students on	Understand the concepts of PLC and VCA.

		industries.	Tubes on these topics	related topics	
3	12	Discuss the concepts of ABC. Ask the students to prepare list of activities involved in the event and identify resources utilised in completion of such activities.		Visit to small units, identify the final product and list out the cost impact of each of such activity.	Understand the Cost Distortions in Traditional Costing and compare it with ABC .
4	12	<ul style="list-style-type: none"> • Explain the national and global issues involved in Transfer Price Mechanism. • Discuss the practical cases on Target Costing e.g. Tata Nano Project. etc 	Ask students to study articles from Management Accountant on these topics.	Get insight into the concept of Transfer Pricing & Target Costing.	

Methods of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested AD-On Course
Unit I	Multiple Choice Questions. Written Test, Internal Examination & PPT based presentation etc.	SPPU	Visit to industries and make a report on it.
Unit II			
Unit III			
Unit IV			

References

Sr. No	Title of the Book	Author	Publisher	Place
01	Cost Accounting- Principles & Practices	Jawahar Lal & Seema Shrivastawa	Tata Mcgraw Hill	New Delhi
02	Advanced Cost Accounting And Cost Systems	Ravi M Kishor:	Taxmann	New Delhi
03	Cost Accounting Theory And Problems	S. N. Maheshwari	Mittal Shree Mahavir Book Depot.	New Delhi
04	Advanced Cost Accounting	Jain and Narang	Kalyani Publication	New Delhi
05.	Horngren's Cost Accounting-A Managerial Emphasis	Srikant M Datar&Madhav V Rajan	Pearson	Noida Up
06	Cost Accounting- Principles & Practices	Dr.M.N. Arora	Vikas Publishing House ,	New Delhi
07	Principles and Practices of Cost Accounting	Dr. SunitaPokharna	Success Publication	Pune