



Anjuman Khairul Islam's

# POONA COLLEGE OF ARTS, SCIENCE & COMMERCE

- Affiliated to Savitribai Phule Pune University: ID No PU/PN/ASC/023/1970
- Junior College Index No: J-11.15.004
- Government of Maharashtra and Savitribai Phule Pune University Recognized Minority Institute
- UGC - 2(f) & 12 (B) Status • NAAC Re-accredited College • DST - FIST Funded College



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## CRITERION- I

**KEY  
INDICATOR**

**1.3 Curriculum Enrichment**

**METRIC NO.**

**1.3.2**

- Average percentage of courses that include experiential learning through project work/field work/internship during last five years

## COURSES WITH EXPERIENTIAL LEARNING DURING THE ACADEMIC YEARS

**2015-16 to 2019-20**

**University of Pune**  
**Three Year B. Sc. Degree Course in**  
**Botany**

**Principal Dr. Balkrishna N. Zaware**  
Chairman,  
Board of Studies in Botany  
University of Pune, Pune 411 007.

## 1) Title of the Course : B. Sc. Botany

### F. Y. B. Sc. Botany

(To be implemented from Academic Year 2013-14)

#### 2) Preamble:

The well organized curricula including basic as well as advanced concepts in the plant sciences from first year to the third year shall inspire the students for pursuing higher studies in Botany and for becoming an enterpruner and also enable students to get employed in the Botany subject based industries.

#### 3) Introduction:

At **first year of under-graduation** the topics related to the fundamentals of Botany, including exposure to diversity in plant groups and industries related to plant sciences are covered. The practical course is aimed to equip the students with skills required for plant identification, description, classification and also applications of these plants in various industries.

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.

At **third year under-graduation**: Theory papers in each semester shall deal with the further detailed studies of the various plant groups and other branches of Botany such as Plant Genetics, Plant Physiology, Molecular biology etc. The students will also learn about use of Statistics in the plant sciences which will be helpful to students during research in the Botany subject.

#### Objectives:

- To provide thorough knowledge about various plant groups from primitive to highly evolved
- To make the students aware of applications of different plants in various industries
- To highlight the potential of these studies to become an enterpruner
- To equip the students with skills related to laboratory as well as field based studies
- To make the students aware about conservation and sustainable use of plants
- To create foundation for further studies in Botany
- To address the socio-economical challenges related to plant sciences

- To facilitate students for taking up and shaping a successful career in Botany

#### **4) Eligibility:**

- 1 **First Year B.Sc. :** A student who has passed the Higher Secondary School Certificate (10+2) Science stream with Biology or its equivalent examination as per the University of Pune eligibility norms.
- 2 **Second Year B.Sc. :** Keeping terms of First Year of B. Sc. with Botany as one of the subjects. Other students if they fulfill the conditions approved by the equivalence committee of Faculty of Science of the University of Pune are also eligible.
- 3 **Third Year B.Sc.:** Student shall pass all First Year B. Sc. courses and satisfactorily keeping terms of Second Year of B. Sc. with Botany 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.

#### **5 A) Examination Pattern:**

##### **First Year B. Sc. Botany**

Pattern of Examination: Annual

Theory courses	Botany Theory Paper I : Annual
	Botany Theory Paper II : Annual
Practical Course	Annual

Paper/ Course No.	Title	Total Number of lectures/practicals per Term	Standard of passing		
			Internal marks out of <b>20</b>	External marks out of <b>80</b>	Total marks out of <b>100</b>
Theory Paper I BO 111 (First term)	Plant Diversity	Three lectures/Week (Total 36 lectures per term)	08	32	40 *
Theory Paper I BO 111 (Second term)	Plant Morphology and Anatomy	Three lectures/Week (Total 36 lectures per term)			
Theory Paper II BO 112 (First term)	Industrial Botany I	Three lectures/Week (Total 36 lectures per term)	08	32	40 *
Theory Paper II BO 112 (Second term)	Industrial Botany II	Three lectures/Week (Total 36 lectures per term)			
<b>Practical Paper III BO 113 (First &amp; Second Term)</b>	<b>Practical</b>	10 Practicals of 4 lectures in each term (20 practicals / year)	08	32	40 *

\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory (100 + 100 ) = 200 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers given on the basis of internal assessment tests

**Theory examination** will be of three hours duration for each theory course. There shall be 5 questions each carrying equal marks. The pattern of question papers shall be:

Question 1	8 sub-questions, each of 2 marks; answerable in 2 -3 lines and based on entire syllabus
Question 2 and 3	4 out of 6 - short answer type questions; answerable in 8 – 10 lines
Question 4	2 out of 4 – Descriptive answer type questions, answerable in 15 – 20 lines
Question 5	1 out of 2 – Descriptive answer type questions, answerable in 35 – 40 lines

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks in each term. The written test shall comprise objective type questions – Multiple Type Questions, True / False, Definitions, Answer in one or two line questions. There shall be 20 questions.

Practical: Regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02

**Practical Examination:** Practical examination shall be conducted by the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination.

### Second Year B. Sc. Botany

Pattern of examination: Semester

Theory courses BO 211 and BO 212: Semester

BO 221 and BO 222: Semester

Practical Course: Annual

Paper/ Course No.	Title	Total Number of lectures/practicals Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
BO 211	Theory Paper I	Four lectures/Week (Total 48 per semester )	04	16	20 *
BO 212	Theory Paper II	Four lectures/Week (Total 48 per Semester )	04	16	20 *
BO 221	Theory Paper I	Four lectures/Week (Total 48 per Semester )	04	16	20 *
BO 222	Theory Paper II	Four lectures/Week (Total 48 per Semester )	04	16	20 *
Practical paper III (First & Second Semester)	Paper III	12 Practicals of 4 lectures in each Semester (24 practicals / year)	08	32	40**

\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

**\*\*Subject to compulsory passing in external examination and getting minimum 40 marks out of 100**

Notes:

1. Total marks: Theory for each semester (50 + 50 ) = 100 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers given on the basis of internal assessment tests.
4. Internal marks for Practical Course should be a regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02

**Theory examination** will be of two hours duration for each theory course. There shall be 4 questions each carrying equal marks as follows: The pattern of question papers shall be:

Question 1	10 sub-questions, each of 1 marks based on entire syllabus	10 marks
Question 2 and 3	2 out of 3 sub-questions, each of 5 marks; short answer type questions; answerable in 10-15 lines	5 marks each
Question 4	1 out of 2 sub-questions, each of 10 marks; long answer type questions (20-25lines)	10 marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question. There shall be 20 questions. Practicals: Regular assessment as described earlier (regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02)

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination. One of the examiners will be external.

## Third Year B. Sc. Botany

Pattern of examination: Semester

Theory courses:

(Sem III: BO 331 – BO 336) : Semester

(Sem IV: BO 341 – BO 346) : Semester

Practical Course:

(BO 347 – BO 349) : Annual

<b>Theory Papers</b>					
Paper/Course No.	Title	Total Number of lectures Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
<b>SEM III</b>					
BO 331	Paper I	48	4	16	20*
BO 332	Paper II	48	4	16	20*
BO 333	Paper III	48	4	16	20*
BO 334	Paper IV	48	4	16	20*
BO 335	Paper V	48	4	16	20*
BO 336	Paper VI	48	4	16	20*
<b>SEM IV</b>					
BO 341	Paper I	48	4	16	20*
BO 342	Paper II	48	4	16	20*
BO 343	Paper III	48	4	16	20*
BO 344	Paper IV	48	4	16	20*
BO 345	Paper V	48	4	16	20*
BO 346	Paper VI	48	4	16	20*
<b>Practical Papers</b>					
BO 347 (Semester III & IV)	Practical Paper I	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **
BO 348 (Semester III & IV)	Practical Paper II	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **
BO 349 (Semester III & IV)	Project Practical Paper III	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **



\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\*Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester ( $50 \times 6$ ) = 300 marks
2. Total marks per year 600 (Theory) + 300 marks (practicals) = 900 marks
3. Internal marks for theory papers be given on the basis of internal assessment tests.
4. Practicals: Regular assessment as described earlier (regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02)

**Theory examination** will be of two hours duration for each theory course. There shall be 4 questions each carrying marks as per the table. The pattern of question papers shall be:

Question 1	10 sub-questions, each of 1 marks based on entire syllabus	10 marks
Question 2 and 3	2 out of 3 sub-questions, each of 5 marks; short answer type questions; answerable in 10 – 15 lines	5 marks each
Question 4	2 out of 3 sub-questions, each of 10 marks; long answer type questions (20 – 25 lines)	10 marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question. There shall be 20 questions. Practicals: Regular assessment as described earlier (regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02)

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination. One of the examiners will be external.

### **5 B) Standard of Passing:**

- i. In order to pass in the first year theory 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 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 16 marks out of 40 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.)

### **5 C) ATKT Rules:**

While going from F.Y.B.Sc. to S.Y.B.Sc. at least 8 courses (out of total 12) should be passed; however all F.Y.B.Sc. courses should be passed 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 passed (Practical Course at S.Y.B.Sc. will be equivalent to 2 courses).

### **5 D) 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

**5 E) External Students:** There shall be no external students.

### **5 F) Setting question papers:**

**F. Y. B. Sc.:** For theory papers I and II annual question papers shall be set by the University of Pune and assessment done at the respective colleges. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Paper III,

papers shall be set by the University of Pune and assessment done at the respective colleges.

**S. Y. B. Sc. and T. Y. B. Sc.:** For theory papers for each semester and also for the annual practical examination, question papers shall be set by the University of 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. For Practical Papers, papers shall be set by the University of Pune and assessment done by the internal examiner and external examiner appointed by University of Pune.

### **5 G) Verification and Revaluation Rules:**

As per university Statues and Rules for verification and revaluation of marks in stipulated time after declaration of the semester examination result.

### **6) Course Structure:**

**Duration:** The duration of B.Sc. Botany Degree Program shall be three years.

#### **a) Compulsory Papers:**

F. Y. B. Sc.: 2 Theory + 1 Practical (Annual)

S. Y. B. Sc.: 2 Theory per semester + 1 Practical (Annual)

T. Y. B. Sc.: 6 Theory per semester + 3 Practical (Annual)

#### **b) Question Papers :**

##### **F. Y. B. Sc. Theory paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

##### **S. Y. / T. Y. - B. Sc. Theory paper:**

University Examination – 40 marks (at the end of each term)

Internal Examination – 10 marks

##### **F. Y. / S. Y. / T. Y. - B. Sc. Practical Paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

**c) Medium of Instruction:** The medium of instruction for the course shall be **English**.

### 7) Equivalence of Previous Syllabus:

Old Course (2008 Pattern)	New Course (2013 Pattern)
Paper I: Plant Diversity	BO 111: Plant Diversity, Plant Morphology and Anatomy
Paper II: Plant Resources -Utiliation and Management	BO 112: Industrial Botany
Paper III: Practical	BO 113: Practical

**8) University Terms:** Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

**9) Qualification of Teachers:** M.Sc. Botany or equivalent master degree in science with class/grades and NET/SET/Ph.D. as per prevailing University/Government /UGC rules.

**UNIVERSITY OF PUNE**  
**BOARD OF STUDIES IN BOTANY**  
**Proposed Revised Syllabus for F. Y. B. Sc. (Botany)**  
**To be implemented from June, 2013**  
**F. Y. B. Sc. (Botany) New Syllabus**

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- 1. Fundamentals of Botany: PAPER – I**  
**Term- I: Plant Diversity**
  
- 2. Botany Theory Paper II**  
**Term I – Industrial Botany**
  
- 3. Fundamentals of Botany: PAPER - I**  
**Term- II: Morphology and Anatomy**
  
- 4. Botany Theory Paper II**  
**Term- II – Industrial Botany**
  
- 5. F. Y. B. Sc. Botany Practical Paper - III based on Theory Paper I  
and Paper II**

**UNIVERSITY OF PUNE**  
**BOARD OF STUDIES IN BOTANY**  
**Proposed Revised Syllabus for F. Y. B.Sc. (Botany)**  
**To be implemented from June, 2013**

**PAPER – I**

**FUNDAMENTALS OF BOTANY**

**Term – I: Plant Diversity (36 Lectures)**

1. **Introduction:** General outline of plant kingdom, Introduction to plant diversity with reference to following groups:-  
Cryptogams: Thallophyta (Algae, Fungi, Lichens, And Bacteria), Bryophyta and Pteridophyta, Phanerogams: Gymnosperms and Angiosperms. **3L**
2. **Algae:** General characters, Outline classification according to G.M. Smith (1955) up to classes with reasons. Life cycle of *Spirogyra*. **6L**
3. **Fungi:** General characters, Outline classification according to G.M. Smith (1955) up to classes with reasons. Life cycle of *Cystopus (Albugo)*. **5L**
4. **Lichens:** General characters, Nature of Association, Types of Lichens on the basis of thallus morphology, Economic importance of lichens. **3L**
5. **Bryophytes:** General characters, Outline classification according to G.M. Smith (1955) up to classes with reasons. Life cycle of *Riccia*. **5L**
6. **Pteridophytes:** General characters, Outline classification according to G.M. Smith (1955) up to classes with reasons. Life cycle of *Nephrolepis*. **6L**
7. **Gymnosperms:** General characters, Outline classification according to Chamberlain (1934) up to classes with reasons. Life cycle of *Cycas*. **5L**
8. **Angiosperms:** General characters, Causes of evolutionary success of Angiosperms, comparative account of monocotyledons and dicotyledons. **3L**  
(Note: Development of sex organs not expected, for all the above mentioned life cycles)

**REFERENCES:-**

1. **Brodie J. and Lewis J.** (2007). (Ed.) Unravelling the algae: the past, present and future of algal systematics. CRC press, New York, pp 335.
2. **Bellinger E.G. and Sigeo D.C.** (2010). Freshwater algae: Identification and use as bioindicators, Willey-Blackwell, UK, pp. 271.

3. **Cole K.M. and Sheath R.G.** (1990). Biology of the red algae. Cambridge University Press.USA. pp. 503.
4. **Desikachary T.V.** (1959). Cyanophyta. ICAR, New Delhi.
5. **Graham L.E. and Wilcox L.W.** (2000). Algae. Penticce-Hall,Inc, pp. 640
6. **Krishnamurthy V.** (2000). Algae of India and neighboring countries I. Chlorophycota, Oxford & IBH, New Delhi.
7. **Lee R.E.** (2008). Phycology. Cambridge University Press, pp.547.
8. **Misra J.N.** (1996). Phaeophyceae in India. ICAR, New Delhi.
9. **Prescott G.W.** (1969). The algae.
10. **Smith G.M.** (1950). The fresh water algae of the United States, Mc-graw Hill New York.
11. **Srinivasan K.S.** (1969). Phycologia India. Vol. I & II, BSI, Calcutta.
12. **Das Dutta and Gangulee.** College Botany Vol I, Central Book Depot.
13. **Vashista B.R, Sinha A.K and Singh V.P.** (2005). Botany for degree students – Algae, S.Chand's Publication.
14. **Ainsworth, Sussman and Sparrow (1973).** The fungi. Vol IV A & IV B. Academic Press.
15. **Alexopolous C.J., Minms C.W. and Blackwell M.** (1999). (4<sup>th</sup> edn) Introductory Mycology. Willey, New York, Alford R.A.
16. **Deacon J.W.** (2006). Fungal Biology (4<sup>th</sup> Ed.) Blackwell Publishing, ISBN. 1405130660.
17. **Kendrick B.** (1994). The fifth kingdom (paperback), North America, New York Publisher: 3<sup>rd</sup> edn, ISBN- 10: 1585100226.
18. **Kirk et al.** (2001). Dictionary of fungi, 9<sup>th</sup> edn, Wallingford: CABI, ISBN: 085199377X.
19. **Mehrotra R.S. and Aneja K.R.** (1990). An introduction to mycology. New Age Publishers, ISBN 8122400892.
20. **Miguel U., Richard H., and Samuel A.** (2000). Illustrated dictionary of the Mycology. Elvira Aguirre Acosta, Publisher: St. Paul, Minn: APS press, ISBN 0890542570.

21. **Webster J. and Rpland W.** (2007). Introduction to fungi (3<sup>rd</sup> Edn) Cambridge University Press, 978-0-521-80739-5.
22. **Dube H.C.** (2004). An Introduction to fungi. Vikas Publishers.
23. **Sharma O.P.** (2010). A text book of fungi. S.Chand's Publication.
24. **Vashista B.R and Sinha A.K** (2008). Botany for degree students – Fungi, S.Chand's Publication.
25. **Cavers F.** (1976). The interrelationships of the Bryophytes. S.R. Technic, Ashok Rajpath, Patana.
26. **Chopra R.N. and Kumar P.K.** (1988). Biology of Bryophytes. John Wiley & Sons, New York, NY.
27. **Kashyap S.R.** (1929). Liverworts of the Western Himalayas and the Punjab Plain. Part 1, Chronica Botanica, New Delhi.
28. **Kashyap S.R.** (1932). Liverworts of the Western Himalayas and the Punjab Plain (illustrated): Part 2. Chronica Botanica, New Delhi.
29. **Parihar N.S.** (1980). Bryophytes: An Introduction to Embryophyta. Vol I. Central Book Depot, Allahabad.
30. **Prem Puri** (1981). Bryophytes: Morphology, Growth and Differentiation. Atma Ram and Sons, New Delhi.
31. **Udar R.** (1975). Bryology in India. Chronica Botanica, New Delhi.
32. **Udar R.** (1970). Introduction to Bryophytes. Shashidhar Malaviya Prakashan. Lucknow.
33. **Watson E.V.** (1971). Structure and Life of Bryophytes. 3<sup>rd</sup> Edn. Hutchinson University Library, London.
34. **Vashista B.R., Sinha A.K., Kumar A.** (2008). Botany for degree students – Bryophyta, S.Chands Publication.
35. **Agashe S.N.** (1995). Paleobotany. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
36. **Arnold A.C.** (2005). An Introduction to Paleobotany. Agrobios (India). Jodhpur.
37. **Eames E.J.** (1983). Morphology of Vascular Plants. Standard University Press.
38. **Rashid A.** (1999). An Introduction to Pteridophyta. Vikas Publishing House Pvt. Ltd. New Delhi.



39. **Sharma O.P.** (1990). Textbook of Pteridophyta. MacMillan India Ltd. Dehi.
  40. **Smith G.M.** (1955). Cryptogamic Botany Vol II. McGraw Hill.
  41. **Sporne K.R.** (1986). The morphology of Pteridophytes. Hutchinson University Library, London.
  42. **Stewart W.N. and Rothwell G.W.** (2005). Paleobotany and the Evolution of Plants. 2<sup>nd</sup> Edn. Cambridge University Press.
  43. **Vashista B.R., Sinha A.K., Kumar A.** (2008). Botany for degree students – Pteridophyta, S.Chands Publication.
  44. **Gangulee and Kar** (2006). College Botany. New Central Book Agency.
  45. **Sundar Rajan S.** (1999). Introduction to Pteridophyta. New Age International Publishers, New Delhi.
  46. **Surange K.R.** (1966). Indian Fossil Pteridophytes. CSIR., New Delhi.
  47. **Parihar N.S.** (1976). Biology and Morphology of Pteridophytes. Central Book Depot.
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**PAPER – I**  
**FUNDAMENTALS OF BOTANY**  
**Term – II: Morphology and Anatomy (36 Lectures)**

- 1. Morphology:** **4L**  
1.1: Introduction, Definition and Scope.  
1.2: Descriptive and Interpretative.  
1.3: Importance in identification, nomenclature, classification, phylogeny and Plant breeding.
- 2. Morphology of Vegetative Parts:** **8L**  
2.1: **Root:** Types of roots, Modifications of roots: Epiphytic, Respiratory (Pneumatophores), Parasitic and Storage roots (conical, fusiform and napiform) with examples; functions of root.  
2.2: **Stem:** Modifications of Stem: Phylloclade, Runner, Stolon, Suckers, Offsets, Rhizome, Corm, Tuber and Bulb with examples. Functions of stem.  
2.3: **Leaf:** Parts of typical leaf: petiole, lamina; leaf margins and apices. Types of leaves: simple, compound, venation, phyllotaxy. Modifications: tendrils, spines, scale leaves, phyllode, reproductive and trap leaves (mechanism of trapping in *Nepenthes* only) with examples. Functions of leaf.
- 3. Morphology of Reproductive Parts:** **10L**  
3.1: **Inflorescence:** Types of inflorescence: Racemose (raceme, spike, corymb, umbel, catkin, spadix and capitulum), Cymose (solitary, monochasial, dichasial, polychasial), Special types (Verticillaster, Cyathium, and Hypanthodium) Significance.  
3.2: **Flower:** Parts of typical flower, Types of flower (complete, incomplete), symmetry of flower and insertion of floral whorls. Floral whorls: Calyx, corolla, perianth, aestivation, modifications of calyx (pappus, petalloid, spurred), forms of corolla: polypetalous (cruciform and papilionaceous) gamopetalous (infundibuliform, bilabiate), Androecium: structure of stamen, fixation of anthers, cohesion and adhesion; Gynoecium: structure of carpel. Types of placentations.  
3.3: **Fruit:** Types of fruits: Simple and dry: Achene, Cypsela, Legume, Follicle and Capsule, Fleshy: Drupe, berry, Hesperidium and pepo. Aggregate: Etaerio of berries and Etaerio of follicles. Multiple fruits: Syconus and Sorosis.  
3.4: **Seed:** Parts, types, structural modifications for seed dispersal.
- 4. Anatomy:** **2L**  
Introduction, Definition, Importance in taxonomy, physiology, ecological interpretations, pharmacognosy and wood identification.
- 5. Types of tissues:** Outline with brief description. **6L**  
5.1: **Meristmatic tissues:** - Meristem, characters and types based on origin, position and plane of division, functions.  
5.2: **Vascular tissues:-** Components of xylem and phloem, types of vascular bundles, functions.  
5.3: **Epidermal tissues:-** Epidermis, structure of typical stomata, trichomes, motor cells; functions.  
5.4: **Mechanical tissues:-** Collenchyma, sclerenchyma and xylem with functions.

## 6. Internal Organization of Primary Plant Body:

6L

6.1: Internal structure of dicotyledon and monocotyledon root.

6.2: Internal structure of dicotyledon and monocotyledon stem.

6.3: Internal structure of dicotyledon and monocotyledon leaf.

### References:

1. College Botany, 2006, Gangulee and Kar. New Central Book Agency (P) Ltd. Kolkata
2. Taxonomy of Angiosperms, 1994, V. N. Naik, Tata Mc Graw Hill Publishing Comp., New Delhi
3. Systematic Botany, 1988, S. C. Dutta, Wiley Eastern Ltd., New Delhi
4. College Botany, Vol. I. 2002, Gangulee, Das and Datta, New Central Book Agency, Kolkata.
5. Taxonomy of Angiosperms, 2010, V. Singh and D. K. Jain, Rastogi Publications, Meerut.
6. Plant Anatomy 2007, B. P. Pandey, S. Chand and Comp. Ltd. New Delhi.
7. A Text Book of Botany- Angiosperms, 2009, B. P. Pandey, S. Chand and Comp. Ltd. New Delhi
8. An introduction to plant anatomy, 1994, J. Eames, L.H & Mc. Daniels ,Tata Mc Graw Hills Publ. Comp. New Delhi.
9. Plant anatomy, 1974, Fahn , A, Pergamon Press Oxford.
10. Anatomy of seed plants, 2006, Esau K., John Wiley & Sons, New York.
11. Taxonomy of vascular plant, 2012, Lawrence GHM, Scientific Publishers, (India) Jodhpur.
12. Plant Anatomy, 1993, Esau K., Wiley Eastern Ltd. New Delhi.
13. Morphology of the angiosperms, 1961, Eames A.J., Mc. Graw Hill, New York.
14. A Text Book of Practical Botany II, 1993, Ashok Bendre & Ashok Kumar. Rastogi Publ., Meerut.
15. Plant Anatomy, 2006, Pijush Roy. New Central Book Agency (P) Ltd. Kolkata.
16. Plant Anatomy, 1989, Chandurkar, P. J., Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
17. Botany for Degree Students, 2003, A. C. Dutta. Oxford University Press, New Delhi.
18. A text book of Botany: Angiosperms, 2011. V. Singh, P. C. Pande & D. K. Jain. Rastogi publications.

## PAPER- II

### Term I – INDUSTRIAL BOTANY (36 Lectures)

1. **Introduction to Industrial Botany** **2L**
  - 1.1 Concept of Industrial Botany.
  - 1.2 Plant resources and industries: Food, fodder, fibers, medicines, timber, dyes, gum, tannins. (Two examples of each resource and the relevant industries with which they are associated).
2. **Floriculture Industry** **8L**
  - 2.1 Introduction to floriculture.
  - 2.2 Important floricultural crops, open cultivation practices, harvesting and marketing of Tuberose.
  - 2.3 Greenhouse technology: Concept, advantages and limitations.
  - 2.4 Cultivation practices (greenhouse technology), harvesting and marketing of Rose and *Gerbera*.
3. **Plant Nursery Industry** **8L**
  - 3.1 Concept and types of nurseries: ornamental plant nursery, fruit plant nursery, medicinal plant nursery, vegetable plant nursery, orchid nursery, forest nursery (with reference to infrastructure required, outputs, commercial applications and profitability).
  - 3.2 Propagation methods: Seed propagation, natural vegetative propagation and artificial vegetative propagation (Cutting: Stem, Layering: Air layering, Grafting: Stone grafting and Approach grafting, Budding : T-budding).
4. **Plant Tissue Culture Industry** **6L**
  - 4.1 Concept of tissue culture.
  - 4.2 Culture techniques: Types of explants, preparation of media, methods of sterilization, inoculation techniques, incubation and hardening.
  - 4.3 Commercial significance
5. **Agri industries:** **8L**
  - 5.1 Organic Farming: Concept, need of organic farming, types of organic fertilizers, advantages and limitations.

5.2 Seed industries: Importance of seed industries, seed production, seed processing and seed marketing with reference to cotton. Major seed industries and corporations of India.

#### 6. Mushroom Industries:

4L

Mushroom cultivation: Plant resources, cultivation practices of Oyster mushroom, uses of mushrooms, value added products, commercial significance.

#### References:

1. Textbook of Economic Botany, Verma V., Ane Books Pvt. Ltd.
  2. Economic Botany in the Tropics, Kochhar, Macmillan Publisher.
  3. Economic Botany: Principles and Practices, Gerald E. Wickens, Springer Publication.
  4. Floriculture in India, Gurcharan Singh Randhawa and Amitabha Mukhopadhyay, Allied Publishers.
  5. Floriculture Marketing in India, Debashish Sengupta and Raj Kamal, Excel Books.
  6. Floriculture Hand Book, Eiri, Engineers India Research in Publication.
  7. Nursery Management, John Mason, Landlinks Press Publisher.
  8. Plant Nursery Management: How to Start and Operate a Plant Nursery, Ray, P.K., Scientific Publishers.
  9. Introduction to Plant Tissue Culture (2/e), M. K. Razdan, Science Publishers.
  10. Plant Cell and Tissue Culture, Indra K. Vasil, (Eds. - Indra K. Vasil, Trevor A. Thorpe), Springer Publication.
  11. The Complete Book on Organic Farming and Production of Organic Compost, NPCS Board of Consultants & Engineers, Asia Pacific Business Press Inc.
  12. The Organic Farming Manual: A Comprehensive Guide to Starting and Running a Certified Organic Farm, Ann Larkin Hansen, Storey Publications.
  13. Hand Book of Mushroom Cultivation, Processing and Packaging, Engineers India Research In Publishers
  14. Growing Gourmet and Medicinal Mushrooms, Paul Stamets, Ten Speed Press Publishers
  15. Handbook of Seed Science And Technology: Seed biology, Production, and Technology, Amarjit S. Basra, Food Products Press publishers.
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## PAPER- II

### Term- II: INDUSTRIAL BOTANY (36 Lectures)

- 1. Bio-fuel Industry** **6L**
  - 1.1 Introduction and advantages.
  - 1.2 Concept of biofuel and its need.
  - 1.3 Plants used for biofuel production.
  - 1.4 Biodiesel production from Caster.
  - 1.5 Commercial significance.
- 2 Bio-pesticide Industry** **6L**
  - 2.1 Concept of bio-control; Integrated Pest Management (IPM).
  - 2.2 Importance of bio pesticides.
  - 2.3 Types of bio pesticides: Indiara, Azadiractin.
  - 2.4 Commercial significance.
- 3. Industrial Mycology** **6L**
  - 3.1 Introduction
  - 3.2 Important genera of fungi used in various industries and their products.
  - 3.3 Products and applications of *Trichoderma*, *Penicillium*, *Aspergillus* and yeast.
  - 3.4 Commercial significance.
- 4. Bio-Fertilizer Industry** **6L**
  - 4.1 Bio fertilizers : concept and need
  - 4.2 Types of bio-fertilizers: Nitrogen fixing bio fertilizer: *Rhizobium*, Blue green algae. *Anabaena* associated with *Azolla*. Phosphate solubilizing bio-fertilizer: Bacteria and Fungi.
  - 4.3 Commercial significance.
- 5 Fruit Processing Industry** **6L**
  - 5.1 Fruit processing: concept and need
  - 5.2 Cold storage.
  - 5.3 Types of fruit processing (canned fruits, dried fruit chips, fruit pulp, squash, jam, jelly, pickle and ketchups).
  - 5.4 Commercial significance.
- 6 Plant Pharmaceutical Industry** **6L**

6.1 Concept and advantages.

6.2 Types of pharmaceutical products: Churna, Asava and Arishta.

6.3 Drug plants with reference to botanical source, active principles and medicinal uses of *Adathoda zeylanica*, *Tinospora cordifolia* and *Asperagus racemosus*.

6.4 Manufacture of *Churna (Triphala churna)*, *Arishta (Ashokarishta)* and *Asava (Kumariasava)*.

6.5 Concept of nutraceuticals and cosmeceuticals.

6.6 Commercial significance of Amla and Aloe.

### **References:**

1. The Complete Book on Organic Farming and Production of Organic Compost, NPCS Board of Consultants & Engineers, Asia Pacific Business Press Inc.
2. The Organic Farming Manual: A Comprehensive Guide to Starting and Running a Certified Organic Farm, Ann Larkin Hansen, Storey Publications.
3. Deore and Laware (2011). Liquid Organic Fertilizer: An Approach towards Organic Vegetable Production. LAP LAMBERT Academic Publishing (2011)
4. A Pharmacognosy and Pharmacobiotechnology. New Age international (P) Limited, Publishers (formerly Wiley Eastern Limited)
5. Kokate C.K. Practical Pharmacognosy, Vallabh Prakashan, New Delhi,
6. Kokate C.K. Purohit A.P. and Gokhale S.B. Pharmacognosy, Nirali Prakashan Pune
7. Trease G.E. and Evans. W.C. Pharmacognosy ELBS Twelfth Edition
8. Tyler V.E. Brady L.R. and Robbers J.E. Pharmacognosy Lea and Febiger. Philadelphia. 8th edition KM Varghese and Co. Mumbai,
9. Vaidya S.S. and Dole V.A. Bhaishyajakalpana, Anmol Prakashan, pune
10. Wallis T.E. Text books of pharmacognosy CBS publishers and distributors New Delhi (Latest Edition )
11. Pathak, Khatri, Pathak, 2003, Fundamentals of plant pathology, Agrbios
12. Mehrotra, R.S. 1991, Plant Pathology, Tata Mc-Graw Hill Co. Delhi
13. Chatterjee, P.B., 1997, Plant Protection Techniques, Bharati Bhawan, Publ. Patana
14. Agrios, G.N. 2006 Plant Pathology, Elsevier Academic Press.
15. Pandey, B.P. 2009, Plant Pathology, S. Chand Co.

16. Gupta, G.P., 2004, Text book of plant diseases, Discovery Publ. House, New, Delhi
  17. Singh, R.S. 2004, Plant Diseases, Oxford & IBH Publishing Co. Pvt. Ltd., Delhi.
  18. Zhiqiang A.N. (2004) Handbook of Industrial Mycology. CRC Press
  19. Gary Leatham (1993) Frontiers in Industrial Mycology. Springer
  20. Sueli Rodrigues; Fabiano Andre Narciso Fernandes (2012). Advances in Fruit Processing Technologies. CRC Press
  21. Hui. Y. H. (3008) Handbook of Fruits and Fruit Processing John Wiley & Sons, 04-Aug-2008.
  22. A.C. Gaur (Biofertilizers in Sustainable Agriculture. IARI, New Delhi
  23. The Complete Technology Book on Biofertilizer and Organic Farming. NIIR PROJECT CONSULTANCY SERVICES.
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## F. Y. B.Sc. BOTANY PRACTICAL PAPER – III

### Based on Theory Paper I and Paper II

1. Modifications of root and stem. 1P
2. Study of leaf (parts of leaf, types: simple and compound; sessile and petiolate; venation: parallel and reticulate) (Glossary of terminologies be given with the protocol). 1P
3. Study of Inflorescence. 1P
  - a) Racemose: Raceme, Spike, Spadix, Catkin, Umbel and Capitulum.
  - b) Cymose: Solitary cyme, Uniparous cyme: helicoid and scorpiod, Biparous cyme and Multiparous cyme.
  - c) Special type: Verticillaster, Hypanthodium and Cyathium.
4. Study of flower with respect to Calyx, Corolla and Perianth: (Glossary of terminologies is given with the protocol). 1P
5. Study of flower with respect to Androecium and Gynoecium. 1P
6. Study of fruits and seed with suitable examples. 1P

Simple fruit: fleshy – Berry and Drupe; Dry: Achene, Cypsella and Legume

Aggregate fruit: Etaerio of follicles and Etaerio of Berries.

Multiple fruit: Syconus and Sorosis.

Seed: parts of seed and types of seed (monocotyledonous dicotyledonous, albuminous, exalbuminous)
7. Study of internal primary structure of dicotyledonous root, stem and leaf. 1P

e.g. Sunflower.
8. Study of internal primary structure of monocotyledonous root, stem and leaf. 1P

e.g. Maize.
9. Study of *Spirogyra*. 1P
10. Study of *Cystopus (Albugo)* 1P
11. Study of *Riccia*. 1P
12. Study of *Nephorlepis*. 1P
13. Study of *Cycas*. 1P
14. Study of plant resources in industries: food, fodder, fiber, medicine, timber and gum (one example of each) 1P

15. Study of artificial plant propagation: 1P  
 Stem cutting (demonstration of three subtypes)  
 Air Layering, Approach grafting, and T- budding
16. Study of plant tissue culture techniques: Demonstration of various stages. 1P
17. Cultivation of Oyster mushroom and demonstration of value added mushroom products. 1P
18. Study of plant resources used in biopesticides. 1P  
 (Indiara, Azadiractin)
19. Study of industrially important fungi and their products. 1P  
*Ganoderma*: *Ganoderma* tablets, *Aspergillus*: citric acid; *Yeast*: Bakery products; *Penicillium*: Penicillin and *Trichoderma*.
20. Study of types of Biofertilizers: *Rhizobium*, *Azatobacter*, BGA, *Azolla*.  
 Phosphate Solubilizing Bacteria. Green manure (preferably *Crotolaria*/  
*Gliricidia*/locally available material). 1P
21. Preparation of Jam and Squash. 1P
22. A) One botanical excursion to study plant diversity.  
 B) Visit to one of the following industries. (Study/project report is compulsory).  
 1) Floriculture unit 2) Greenhouse 3) Pharmaceutical industry 4) Nursery and  
 5) Mushroom cultivation unit.

**(Note: Visits mentioned in the practical No. 22 (A & B) are compulsory. It carries 10 marks at the time of annual practical examination.)**



University of Pune

## S. Y. B. Sc. [Botany]

Class – S.Y. B .Sc. ( To be implemented From June 2014)		
Paper	Semester - I	Semester – II
I	Taxonomy of Angiosperms and Plant community	Plant Anatomy and Embryology
II	Plant Physiology	Plant Biotechnology
III	Practicals based on Theory courses (Paper I and II)	

### Equivalence of previous syllabus at S.Y.B.Sc. Botany

Paper	2008 Pattern (Implemented from 2009)	2013 Pattern (To be implemented from 2014)
Paper I Semester I	BO-211: Fundamentals of Plant Systematics and Plant Ecology	BO-211: Taxonomy of Angiosperms and Plant community
Paper II Semester I	BO-212: Fundamentals of Plant Physiology	BO-212: Plant Physiology
Paper I Semester I	BO-221: Structural Botany (Anatomy, Embryology and Palynology)	BO-221: Plant Anatomy and Embryology
Paper II Semester I	BO-222: Fundamentals of Plant Biotechnology	BO-222: Plant Biotechnology
Practical Course	Practical based on theory courses (Paper I and Paper II)	Practical based on theory courses (Paper I and Paper II)

**S.Y.B.Sc. Botany**  
**(Semester I, Paper I)**  
**Taxonomy of Angiosperms and Plant Community (48 Lectures)**

- 1. Introduction to Plant Taxonomy** **3L**
- 1.1 Definition, scope, objectives and importance
  - 1.2 Identification, classification, nomenclature
  - 1.3 Concept of Systematics
- 2. Systems of classification** **6L**
- 2.1 Types of systems with their merits and limitations- a)Artificial system- Carl Linnaeus ,  
b)Natural system -Bentham and Hooker, c) Phylogenetic system- Engler and Prantl
- 3. Taxonomic literature** **2L**
- Flora, monograph, revisions, manuals, journals, periodicals and references books.
- 4. Sources of data for Systematics** **6L**
- 4.1 Morphology
  - 4.2 Anatomy
  - 4.3 Cytology
  - 4.4 Embryology
  - 4.5 Phytochemistry
  - 4.6 Molecular biology
- 5. Botanical Nomenclature** **6L**
- 5.1 History
  - 5.2 Binomial nomenclature
  - 5.3 ICBN- principles
  - 5.4 Rules of nomenclature
  - 5.5 Coining of generic names and specific epithets.
  - 5.6 Ranks and endings of taxa names
  - 5.7 Principle of priority
  - 5.8 Effective and valid publications
  - 5.9 Single and double authority citation
  - 5.10 *Nomina conservanda*

## **6. Study of Plant Families**

**11L**

Study of following families with reference to systematic position, salient features, floral formula, floral diagram and any five examples with their economic importance – Annonaceae, Meliaceae, Myrtaceae, Rubiaceae, Solanaceae, Asclepiadaceae, Euphorbiaceae and Amaryllidaceae

## **7. Computer in taxonomy**

**4L**

7.1 Concept of herbarium their advantages and limitations

7.2 Digital /e-herbarium and their advantages

7.3 Data bases: concept and needs.

7.4 Use of computer in plant classification

## **8. Introduction to ecology**

**5L**

8.1 Definition

8.2 Concept

8.3 Autecology and synecology

8.4 Ecosystem and its components: biotic and abiotic.

8.5 Food chain

8.6 Food web

8.7 Ecological pyramids

## **9. Ecological grouping of the plants**

**5L**

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.

### **References-**

1. Chopra G.L.- Angiosperms
2. Cronquist, A. 1968. The Evolution and Classification of Flowering Plants. Thomas Nel and Sons Ltd. London.
3. Datta S.C.- A Hand Book of Systematic Botany
4. Davis P.H and V.H Heywood 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd London.
5. Gurucharan Singh 2005- Systematics theory and practice (Oxford IBH)
6. Heywood V.H 1967. Plant Taxonomy, London.
7. Lawrence, G.H.M 1951. Taxonomy of Vascular Plants. N.Y.

8. Lawrence G.H.M 1955. An Introduction to Plant Taxonomy N.Y.
9. Naik V.N.- Taxonomy of Angiosperms.
10. Pande B.P 1997. Taxonomy of Angiosperms. S.Chand.
11. Priti Shukla and Shital Mishra- An introduction to Taxonomy of angiosperms
12. Rendle A.B. 1925. The Classification of flowering plants. 2 Vols. London.
13. Santapau H. 1953. The Flora of Khandala on the Western Ghats of India.
14. Singh V. and D.K Jain, 1981 Taxonomy of Angiosperms. Rastogi Publication, Meerut.
15. Sharma O.P, Plant taxonomy (Tata Mc grow Hill)
16. Stewart W.N. and Rathwell G.W. 1993. Paleobotany and the Evolution of plants. Cambridge University Press.
17. Swingle D.B. 1946. A Text book of Systematic Botany. Mc Graw Hill Book Co. New York.
18. Takhtajan A. 1969. Flowering Plants; Origin and Disposal.
19. Theodore Cooke(1903)- The flora of The Presidency of Bombay Vol. I, II, III
20. V.V.Shivrajan-Introduction to Principles plant taxonomy
21. Yadav S.R. and Sardesai M.R.- Flora of Kolhapur District.

**S. Y. B. Sc. [Botany]**  
**(Semester I, Paper II)**  
**Plant Physiology (48 Lectures)**

- 1. Introduction to Plant Physiology** **2L**  
Brief history, Scope and applications of plant physiology
- 2. Plant – water relations** **8L**
  - 2.1 Physico-chemical properties of water
  - 2.2 Membrane structure, permeability and aquaporin
  - 2.3 Diffusion – Definition, factors affecting diffusion, importance of diffusion in plants
  - 2.4 Osmosis – Definition, types of solutions – hypotonic, hypertonic and isotonic, endosmosis and exosmosis, concept of osmotic pressure (OP), turgor pressure (TP), wall pressure (WP), Diffusion pressure deficit (DPD), relation between OP, TP and DPD, role of osmosis in plants.
  - 2.5 Plasmolysis – Definition, mechanism, deplasmolysis, significance of plasmolysis
  - 2.6 Imbibition – Concept, mechanism and significance
- 3. Absorption of water** **3L**
  - 3.1 Role of water in plants
  - 3.2 Concept of water potential and capillary water
  - 3.3 Mechanisms of water absorption
  - 3.4 Factors affecting rate of water absorption
- 4. Ascent of sap** **4L**
  - 4.1 Introduction and definition.
  - 4.2 Theories of ascent of sap
  - 4.3 Vital theories: Jamin – Chame theory and Bose theory
    - 4.3.1 Physical force theories: a) Capillary theory, b) Imbibitional theory, c) Atmospheric pressure theory,
    - 4.3.2 Transpiration pull or cohesion-tension theory, evidences and objections
  - 4.4 Factors affecting ascent of sap
- 5. Transpiration** **6L**
  - 5.1 Definition
  - 5.2 Types of transpiration – cuticular, lenticular and stomatal
  - 5.3 Structure of stomata

- 5.4 Mechanism of opening and closing of stomata –Steward’s hypothesis, active  $K^+$  transport mechanism
- 5.5 Factors affecting the rate of transpiration
- 5.6 Significance of transpiration
- 5.7 Antitranspirants
- 5.8 Guttation
- 5.9 Exudation
- 6. Plant growth and plant growth regulators 6L**
- 6.1 Introduction
- 6.2 Phases of growth
- 6.3 Measurement of growth- Arc auxanometer, Bose crescograph, fresh and dry weight method
- 6.4 Factors affecting growth
- 6.5 Plant Growth Regulators- Introduction and definition
- 6.6 Properties and practical applications of auxins, cytokinins, gibberellins, ethylene and abscisic acid
- 7. Nitrogen metabolism 8L**
- 7.1 Introduction
- 7.2 Biological nitrogen fixation
- 7.2.1 Symbiotic nitrogen fixation, nitrogenase enzyme- structure and function
- 7.2.2 Non-symbiotic nitrogen fixation
- 7.3 Denitrification, ammonification and nitrification
- 7.4 Reductive amination and transamination
- 7.5 Role of nitrogen in plants
- 8. Seed dormancy and germination 4L**
- 8.1 Definition and types of seed dormancy
- 8.2 Methods to break seed dormancy
- 8.3 Metabolic changes during seed germination
- 9. Physiology of flowering 7L**
- 9.1 Photoperiodism – Concept, definition, short day plants, long day plants and day neutral plants, photoperiodic induction, phytochrome and flowering
- 9.2 Phytohormones and initiation of flowering
- 9.3 Applications of photoperiodism



9.4 Vernalisation – concept and definition, mechanism of vernalisation, applications of vernalisation, devernialization

**References:**

1. Bidwell, R.G.S. 1974. Plant Physiology. Macmillan Pub. Co., N.Y.
2. Devlin, R.M. And F.H. Witham. 1983. Plant Physiology. Willard Grant Press. U.S.A.
3. Hans-Walter Heldt. 1997. Plant Biochemistry And Molecular Biology. Oxford University Press, New York. Usa.
4. Moore, T.C. 1979. Biochemistry And Physiology Of Plant Hormones. Springer-Verlag. Berlin.
5. Raman, K. 1997. Transport Phenomena In Plants. Narosa Publishing House. New Delhi.
6. Jain, V.K. (2000): Fundamentals Of Plant Physiology, S.Chand&Co, New Delhi.
7. Pandey, S.N. (1991): Plant Physiology, Vikas Publishing House (P) Ltd., New Delhi, India.
8. Verma, V. (2007): Text Book Of Plant Physiology, Ane Books India, New Delhi.
9. Nobel, P.S. 2009. Physicochemical and Environmental Plant Physiology. 4<sup>th</sup> edition Academic Press, UK
10. Taiz, L. and Zeiger, E. 2006. Plant Physiology. 4th Edition. Sinauer Associates, Saunders land, Massachusetts, USA
11. Salisbury F.B. and Ross C.B. 2005. Plant Physiology. 5th Edition. Wadsworth Publishing Co. Belmont CA.
12. Helgi O'Pik, Stephen A. Rolfe, Arthur J. Willis. 2005. The Physiology of Flowering Plants, Cambridge University Press, UK
13. Kirkham, M.B. 2004. Principles of Soil and Plant Water Relations. Elsevier, Amsterdam, Netherlands.
14. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. 1997. Plant Metabolism. 2nd Edition. Longman Group, U.K.
15. Fitter, A. and Hay, R.K.M. 2001. Environmental Physiology of Plants. Academic Press, UK.
16. Press, M.C., Barker, M.G., and Scholes, J.D. 2000. Physiological Plant Ecology, British Ecological Society Symposium, Volume 39, Blackwell Science, UK.

**S. Y. B. Sc. [Botany]**  
**(Semester II, Paper I)**  
**Plant Anatomy and Embryology (48 Lectures)**

**Plant anatomy:**

- 1. Introduction** **2L**  
Definition, scope of plant anatomy and types of tissues
- 2. Epidermal tissue system** **4L**  
Structure and function of epidermal tissue system, uniseriate and multiseriate epidermis, stomata: structure, types and functions, epidermal outgrowth: glandular and non-glandular
- 3. Mechanical tissue system** **4L**  
Principles involved in distribution of mechanical tissues – inflexibility, incompressibility, inextensibility and shearing stress, tissues providing mechanical support, their distribution in leaf, stem and root of dicots and monocots.
- 4. Vascular tissue system** **4L**  
Structure and function of xylem, phloem and cambium
- 5. Normal secondary growth** **5L**  
Introduction, cambium and its role, process in stems of *Helianthus annuus* and *Annona squamosa*, extrastelar and intrastelar secondary growth, annual rings, periderm, bark, tylosis and lenticel
- 6. Anomalous secondary growth** **5L**  
Introduction, causes, anomalous secondary growth in dicot stem (*Bignonia*) dicot root (*Raphanus*) and monocot stem (*Dracaena*).

**Plant Embryology**

- 7. Introduction** **1L**  
Definition and scope of plant embryology
- 8. Microsporangium and male gametophyte** **5L**
- a. Microsporangium: structure of tetrasporangiate anther, types of tapetum, sporogenous tissue.
  - b. Microsporogenesis: process and its types, types of microspore tetrad.
  - c. Male gametophyte: structure and development of male gametophyte.

**10. Megasporangium and female gametophyte: 7L**

- a. Megasporangium: structure, types of ovules – anatropous, orthotropous, amphitropous, campylotropous, circinotropous.
- b. Megasporogenesis: tenuinucellate and crassinucellate ovules, types of megaspore tetrads.
- c. Female gametophyte: structure of typical embryo sac, types of embryo sacs with examples – monosporic, bisporic and tetrasporic.

**11. Fertilization: 5L**

Mechanism of pollination- entomophily, anemophily, hydrophily, zoophily, germination of pollen grain, double fertilization (syngamy and triple fusion) and its significance.

**12. Endosperm and embryo 6L**

- a. Endosperm: Types – nuclear, helobial and cellular.
- b. Embryogeny: structure of dicot and monocot embryo and seed formation.

**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, Newyork
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]**  
**(Semester II, Paper II)**  
**Plant Biotechnology (48 Lectures)**

- 1. Introduction** **2L**
  - 1.1 Biotechnology- Definition, concept and scope
  - 1.2 Interdisciplinary nature of biotechnology
- 2. Enzyme Technology** **7L**
  - 2.1 Introduction, definition and properties of enzymes.
  - 2.2 Classification of enzymes
  - 2.3 Industrial applications of enzymes.
  - 2.4 Production of amylase, proteases and lipase enzyme
  - 2.5 Enzymes immobilization - concept and techniques of immobilization
- 3. Fermentation Technology.** **7L**
  - 3.1 Introduction.
  - 3.2 Liquid and solid state fermentations
  - 3.3 Principles of microbial growth
  - 3.4 Bioreactors used in fermentations- stirred tank and tubular tower and digestive tank fermenters
  - 3.5 Media composition for liquid and solid state fermentations
  - 3.6 Industrial applications of fermentation
  - 3.7 Downstream processing- citric acid production.
- 4. Single cell protein** **5L**
  - 4.1 Introduction
  - 4.2 Need of proteins in diet
  - 4.4 Production of SCP from algae (*Spirulina*) and fungi (Yeast)
  - 4.5 The economic implications of SCP
  - 4.6 Acceptability of SCP
- 5. Environmental Biotechnology** **6L**
  - 5.1 Introduction
  - 5.2 Phytoremediation- definition and concept
  - 5.3 Methods of phytoremediation- Rhizofiltration, phytoextraction, phytostabilization, phytovolatilization, phytodegradation,
  - 5.4 Environmental sustainability

- 6 . Basics of plant genetic engineering** **7L**
- 6.1 Introduction and structure of DNA
- 6.2 Structure of gene in prokaryotes and eukaryotes- Promoter, coding region and terminator
- 6.3 General method of gene isolation from the plants-DNA isolation, restriction enzymes, restriction digestion of DNA, DNA electrophoresis, southern hybridization, ligation of DNA fragments
- 6.4 Gene cloning- vectors used for gene cloning
- 7. Methods of gene transfer in plants** **8L**
- 7.1 Direct gene transfer methods- Electroporation, biolistic gene transfer, liposome mediated transfer.
- 7.2 Vector mediated gene transfer- *Agrobacterium* mediated gene transfer in plants, Ti-plasmid: structure and functions, Ti plasmid based vectors, advantages.
- 8. Application of plant genetic engineering in crop improvement.** **4L**
- 8.1 Introduction
- 8.2 Insect pest resistance, abiotic stress tolerance, herbicide resistance, storage protein quality
- 9. Nano-biotechnology** **2L**
- 9.1 Definition and concept
- 9.2 Applications of nanotechnology in agriculture (fertilizers and pesticides).

**REFERENCES:**

1. Nanobiotechnology, Concepts, Applications and perspectives, C.M. Niemeyer and C.A. Mirkin ; 2004; WILEY-VCH,.
2. Bionanotechnology: concepts, Lessons from Nature”, David.S. Goodsell, 2004 Wiley-Liss
3. Nanobiotechnology Protocols; Sandra J Rosenthal, David W Wright 2005, Humana Press Inc
4. Nanoscale Technology in Biological Systems; R.S. Greco, F.B.Prinz and R.L.Smith 2005 CRC press,.
5. Fundamental Molecular Biology ; Allison LA; 2007
6. Recombinant DNA, Watson et al ; 5th Ed; 2006
7. Techniques for Engineering Genes ; Curell BR et al;2004
8. Techniques for Molecular Biology ; Tagu D & Moussard C; INRA; 2006
9. Gene Cloning and DNA Analysis ; 5th Ed ; Brown TA ; 2006
10. Analysis of Genes and Genomes ; Reece RJ ; Wiley; 2004
11. Recombinant DNA and Biotechnology ; 2nd Ed ; Kreuzer H and Massey A ;ASM;2006
12. Text book of biotechnology, R.C.Dubey, 2009, S.Chand, Delhi

**S. Y. B. Sc. [Botany] Paper III**

**Practicals Based on Theory Paper I and II**

**a) Taxonomy of Angiosperms and Plant Community**

1. Description of flowering plant in botanical terms (01 P)
2. Study of plant families (any four) (03 P)
3. Study of ecological adaptations in Hydrophytes with any two examples (01P)
4. Study of ecological adaptations in Xerophytes with any two examples (01P)
5. Study of vegetation by list count quadrat method. (01P)
6. Study of tools of taxonomy and ecological instruments (any four each ) (01P)

**b) Plant Physiology**

1. Determine water holding capacity (WHC) and pH of soil (pH by pH meter.) (01 P)
2. Study of plasmolysis in suitable plant material (01 P)
3. Determination of Diffusion Pressure Deficit (DPD). (01 P)
4. Determine rate of transpiration under different conditions of Sunlight, Shade and wind (01 P)
5. Demonstration Experiments. (Compulsory Practical) (01 P)
  - a. Curling Experiment
  - b. Imbibition in seeds
  - c. Arc Auxanometer
  - d. Effect of auxins on rooting
  - e. Transpiration pull
  - f. Spectrophotometer
  - g. Portable leaf area meter
  - h. Conductivity meter
  - i. Centrifuge
6. Assessing seed viability by TTC method (01 P)

**c) Plant Anatomy and Embryology**

1. Study of epidermal tissue system – non-glandular and glandular trichomes, multilayered epidermis, typical stomata (dicot and monocot). (01 P)
2. Study of mechanical tissues and their distribution in root, stem and leaves. (01 P)
3. Study of normal secondary growth in dicot stem – *Annona /Moringa*. (01 P)  
(Double stained temporary preparation).

4. Study of anomalous secondary growth in *Bignonia* and *Dracaena* stem. (01 P)  
(Double stained temporary preparation).
5. Study of tetrasporangiate anther and types of ovules. (01 P)
6. Study of dicot and monocot embryo. (01 P)

**b) Plant Biotechnology**

1. Production of citric acid by *Aspergillus niger* and estimation of citric acid by titration method. (02 P)
2. Production of single cell protein production i.e. *Spirulina* / yeast and study of commercial products (01 P)
3. Demonstration of fermentation and fermentation products (01 P)
4. Demonstration of separation of plasmid DNA by agarose gel electrophoresis (01 P)
5. Demonstration of enzyme immobilization (01 P)

***N.B. Botanical excursion tour and submission of at least five correctly identified wild plant photographs is compulsory.***

**SAVITRIBAI PHULE UNIVERSITY OF PUNE**

**T. Y. B. Sc. Botany Revised Syllabus**

Theory Courses New Syllabus to be implemented from June 2015				
Paper	Course	Semester III	Course	Semester IV
I	BO. 331	<b>Cryptogamic Botany</b>	BO.341	<b>Plant Physiology and Biochemistry</b>
II	BO. 332	<b>Cell and Molecular Biology</b>	BO.342	<b>Plant Ecology and Biodiversity</b>
III	BO. 333	<b>Genetics and Evolution</b>	BO.343	<b>Plant Pathology</b>
IV	BO. 334	<b>Spermatophyta and Palaeobotany</b>	BO.344	<b>Medicinal and Economic Botany</b>
V	BO. 335	<b>Horticulture and Floriculture</b>	BO.345	<b>Plant Biotechnology</b>
VI	BO. 336	<b>Computational Botany</b>	BO.346	<b>Plant Breeding and Seed Technology</b>

**Practical Based on theory Courses**

Practical No	Course	Practicals Based on
<b>Practical I</b>	<b>BO.347</b>	BO.331: Cryptogamic Botany BO. 332: Cell and Molecular Biology BO.341: Plant Physiology & Biochemistry BO.345: Plant Biotechnology
<b>Practical II</b>	<b>BO.348</b>	BO.333: Genetics and Evolution BO.334: Spermatophyta and Palaeobotany BO.342: Plant Ecology and Biodiversity BO.346: Plant Breeding and Seed technology
<b>Practical III</b>	<b>BO.349</b>	BO.335: Horticulture and Floriculture BO.336: Computational Botany BO.343: Plant Pathology BO.344: Medicinal and Economic Botany



**Equivalence of the T.Y.B.Sc. Botany Revised Syllabus  
Semester III**

<b>Theory Courses New Syllabus to be implemented from June 2015</b>				
<b>Paper</b>	<b>Course</b>	<b>Semester III (New Syllabus)</b>	<b>Course</b>	<b>Semester III ( Old Syllabus)</b>
<b>I</b>	BO. 331	<b>Cryptogamic Botany</b>	BO. 331	<b>Algae, Fungi and Bryophytes</b>
<b>II</b>	BO. 332	<b>Cell and Molecular Biology</b>	BO. 332	<b>Molecular Biology</b>
<b>III</b>	BO. 333	<b>Genetics and Evolution</b>	BO. 333	<b>Angiosperms and Evolution</b>
<b>IV</b>	BO. 334	<b>Spermatophyta and Palaeobotany</b>	BO. 334	<b>Genetics and Plant Breeding</b>
<b>V</b>	BO. 335	<b>Horticulture and Floriculture</b>	BO. 335	<b>Biometry and Computer Applications</b>
<b>VI</b>	BO. 336	<b>Computational Botany</b>	BO. 336	<b>Cell Biology and Seed Technology</b>

**Semester IV**

<b>Theory Courses New Syllabus to be implemented from June 2015</b>				
<b>Paper</b>	<b>Course</b>	<b>Semester IV (New Syllabus)</b>	<b>Course</b>	<b>Semester IV (Old Syllabus)</b>
<b>I</b>	BO.341	<b>Plant Physiology and Biochemistry</b>	BO.341	<b>Plant Physiology and Biochemistry</b>
<b>II</b>	BO.342	<b>Plant Ecology and Biodiversity</b>	BO.342	<b>Plant Pathology</b>
<b>III</b>	BO.343	<b>Plant Pathology</b>	BO.343	<b>Pteridophytes , Gymnosperms and Palaeobotany</b>
<b>IV</b>	BO.344	<b>Medicinal and Economic Botany</b>	BO.344	<b>Plant Biotechnology</b>
<b>V</b>	BO.345	<b>Plant Biotechnology</b>	BO.345	<b>Botanical Techniques</b>
<b>VI</b>	BO.346	<b>Plant Breeding and Seed Technology</b>	BO.346	<b>Pharmacognosy</b>

**Proposed Syllabus from 2015-2016 in Botany**  
**T. Y. B. Sc. Semester III**  
**Paper- I: BO : 331 Cryptogamic Botany**  
**(Algae, Fungi, Bryophytes and Pteridophytes)**

**1. Introduction:** Cryptogams- meaning. Types- Lower Cryptogams and Higher Cryptogams, brief review with examples. **02L.**

**Algae:** **(11L)**

2. Algae: General characters, economic importance and Classification (Chapman and Chapman, 1973) up to classes. **03L.**

3. Study of life cycle of algae with reference to taxonomic position, occurrence, thallus structure, and reproduction of *Nostoc*, *Chara*, *Sargassum* and *Batrachospermum*.

**08 L.**

**Fungi:**

**(11L)**

4. Fungi: General characters, economic importance and Classification. (Alexopoulos, 1979) up to classes. **03L.**

5. Study of life cycle of fungi with reference to taxonomic position, thallus structure, and reproduction of *Rhizopus*, *Saccharomyces*, *Puccinia* and *Cercospora*. **08**

**L.**

**Bryophytes:** **(12L)**

6. Bryophytes: General characters, economic importance and Classification. (G.M. Smith, 1955) up to classes. **03L.**

7. Study of life cycle of Bryophytes with reference to taxonomic position, thallus structure (Morphology and anatomy), reproduction and sporophyte structure of *Marchantia*, *Anthoceros* and *Polytrichum*.

**09 L.**

**Pteridophytes:** **(12L)**

8. Pteridophytes: General characters and economic importance and Classification. (K.R. Sporne, 1975) up to classes. **03L**

9. Study of life cycle of Pteridophytes with reference to taxonomic position, Morphology, anatomy, reproduction, gametophytes and sporophyte of *Psilotum*, *Selaginella* and *Marsilea*.

**09 L.**

**(Development of sex organs and sporophyte is not expected.)**

**Reference Books :**

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. Vashishta B.R. et al., Botany for degree students- Fungi
5. Sharma, P.D.-The Fungi
6. Sharma, O.P.-Fungi
7. Chopra G.L. and Yadav D.L. A Text book of Bryophytes.

8. **Parihar, N.S.** An introduction to Embryophyta: Bryophyte-I
9. **Puri Prem.** Bryophytes, Atmaram and Sons. Delhi.
10. **Vashishta B.R.** Botany for degree students Bryophytes- Vol-III
11. **Parihar N.S.** 1991. Bryophyta. Central Book Depot, Allahabad.
12. **Puri P.** 1980. Bryophytes. Atma Ram and Sons, Delhi.
13. **Alexopoulos C.J , Mims C.W. and Blacwel M.I** 1996. Introductory Mycology. John Wiley and Sons Inc.
14. **Kumar H.D.** 1988. Introductory Phycology. Affiliated East-West Press Ltd., New Delhi.
15. **Sporne K.R.** 1991. The Morphology of Pteridophytes. B.I Publishing Pvt. Ltd. Bombay.

### **Practicals - 06**

**(Finalize the practicals after discussion in workshop).**

1. Study of **Algae** with respect to systematic position thallus structure and reproduction of *Nostoc*, *Chara*, *Sargassum* and *Batrachospermum*.
2. Study of **Fungi** respect to systematic position thallus structure and reproduction of *Rhizopus*, *Saccharomyces* and *Puccinia*.
3. Study of **Bryophytes** with respect to systematic position thallus structure and reproduction of *Marchantia*, *Anthoceros* and *Polytrichum*.
4. Study of **Pteridophytes** with respect to systematic position, sporophyte - morphology and anatomy, reproductive structures of *Psilotum*, *Selaginella* and *Marsilea*.
5. Excursion tour.

## **Paper II: BO.332: CELL AND MOLECULAR BIOLOGY**

### **Chapter 1 Cell Biology: An Introduction**

**2L**

1. Definition and brief history
2. Units of measurement of cell
3. Prokaryotic and Eukaryotic Cell
4. Cell biology and other Biological Sciences

### **Chapter 2 Cytoplasmic Matrix**

**2L**

1. Physical nature of cytoplasmic matrix
2. Chemical organisation- organic and inorganic compounds of cytoplasmic matrix

### **Chapter 3 Plant Cell- Cytoplasmic Constituents**

**15L**

Morphology, Ultrastructure, Chemical composition, Functions of Cell wall, Plasma membrane, Endoplasmic Reticulum, Golgi apparatus, Lysosomes, Microbodies, Mitochondria, Plastids, Vacuoles, Ribosomes

#### **Chapter 4 Plant Cell- Nucleus and Chromosomes**

**5L**

**Nucleus-** Morphology, Ultrastructure, Nucleoplasm, Nucleolus, Functions

**Chromosome-** Number, Morphology, Structure, Karyotype and ideogram, Chemical composition, Euchromatin and Heterochromatin, Giant chromosomes

#### **Chapter 5 Molecular Biology**

**1L**

Definition, History, Scope and Importance, Central Dogma of Molecular Biology

#### **Chapter 6 Nature of Genetic Material**

**5L**

Characteristics of genetic material, Physical and Biological evidences to prove DNA as genetic material, Chargoff's Law, Franklin and Wilkion's Work, Watson and Cricks Model of DNA, Forms of DNA- A, B and Z, C-Value Paradox, RNA as genetic material-TMV

#### **Chapter 7 DNA Replication**

**3L**

Introduction and types, Messelson and Stahl's Experiment, Molecular mechanism of DNA replication

#### **Chapter 8 DNA Damage and Repair**

**2L**

Introduction, Causes and types, DNA repair system- Photoreactivation, Dark excision repair,

#### **Chapter 9 Gene Organization**

**3L**

Promoter-structure and function in prokaryotes and eukaryotes, Terminators, Units

of Gene, Enhancers, Split genes, jumping genes

### **Chapter 10 Transcription**

**3L**

Structure and role of m-RNA, r-RNA, t-RNA, Transcription apparatus, Mechanism of Transcription in Prokaryotes,

### **Chapter 11 Genetic Code and Translation**

**4L**

**Genetic Code-** Definition, Concept, Work of Nirenburg and Khorana, Properties of Genetic code, Translation- Definition, Mechanism of translation- Initiation, Elongation and Termination

### **Chapter 12 Gene Action and Regulation**

**3L**

Relation of Gene and Enzymes- One gene one enzyme hypothesis, regulation of metabolism, Inducible and Repressible enzymes, Gene regulation- in prokaryotes (Lac Operon Model) and eukaryotes (Britten and Davidson's Model)

#### **Practicals:**

1. Cytological techniques-preparation of Fixatives, preparation of stains (Aceto-carmine and Aceto-orcein).
2. Study of various stages of mitosis and meiosis
3. Study of Chromosomes Morphology (from colchicines pretreated Onion root tip cells)
4. Maceration technique for study of plant tissues
5. Study of polytene chromosome from Chironomus larvae
6. Plant Genomic DNA extraction from Cauliflower
7. Estimation of Plant DNA by DPA Method
8. Extraction and estimation of RNA by Orcinol Method

#### **References:**

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, 4<sup>th</sup> 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.

### **Paper III: BO: 333: Genetics and Evolution**

- 1. Genetics- Introduction 1L**  
 Definition, Concept of heredity and variations, Branches and Applications of Genetics
- 2. Mendelism 4L**  
 Genetical terminology, Selection of experimental material , Monohybrid cross, Law of dominance, Incomplete dominance, Law of segregation/law of purity of gametes, Dihybrid cross, Law of independent assortment, Back cross and Test cross
- 3. Interactions of genes 6L**  
 Non-epistatic genetic interactions- complementary genes (9:7), Duplicate Genes (15:1), Epistatic genetic interactions- Masking genes (12:3:1), Supplementary genes (Recessive epistasis) (9:3:4), Inhibitory genes(13:3), Lethal genes (2:1)-Concept, Inheritance of coat colour in mice, Inheritance of sickle cell anemia
- 4. Multiple alleles 2L**  
 Definition, Concept, Characters of multiple alleles, Examples of multiple alleles – inheritance of blood group in human, self-incompatibility in **Nicotiana** and eye colour in **Drosophila**
- 5. Linkage and Crossing over 4L**

Linkage- Definition and Types, Crossing over: Definition and Types, Construction of a linkage map by two point test cross and three point test cross

**6. Quantitative and Cytoplasmic Inheritance**

**4L**

Concept of quantitative inheritance, Difference between qualitative and quantitative traits, 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

**7. Sex linked inheritance**

**5L**

Concept of Sex chromosomes and autosomes, Inheritance of X- linked genes - eye colour in **Drosophila**, Inheritance of colour blindness in humans, Inheritance of Y- linked genes - Holandric genes in humans, Sex influenced genes – baldness in humans Sex-limited genes - feathering in domestic fowl

**8. Euploidy and Aneuploidy**

**5L**

Numerical changes in chromosomes- Euploidy and Aneuploidy, Euploidy- Monoploidy, Origin and production, morphology and uses. Polyploidy -Concept and Characteristics of polyploids, Autopolyploidy- Origin and production, effects of autopolyploidy, uses. Allopolyploidy- Concept, synthesized allopolyploidy (wheat and cotton) Evolutionary significance of polyploidy –Aneuploidy, Monosomy and nullisomy- origin and cytology, Trisomy in **Datura** and humans

**9. Chromosomal Abberations**

**5L**

Types of structural changes in chromosomes, Deletion: types, cytology and genetic effects, Duplication: types and cytology, position effect and bar eye phenotype in **Drosophila**, Inversion: types and their cytology, Translocation: types, translocation complexes, Variation in chromosome morphology: Isochromosomes, ring chromosomes and Robertsonian translocation

**10. Evolution – Introduction and Theories of Evolution**

**4L**

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

## 11. Evidences of Evolution

3L

Direct evidences and conclusions from fossil records, Indirect evidences, Evidences from Genetics, Evidences from bio-geographical relations

## 12. Population Genetics and Evolution

5L

Concept of Mendelian population, Gene pool and its models, Hardy-Weinberg law of gene frequencies, Factors affecting allelic frequency, Genetic polymorphism

### Practicals based on Genetics

1. Study of structural heterozygotes (multiple translocations) in *Rhoeo* 1P
2. Induction of tetraploidy in onion root cells and preparation of squash for observation of tetraploid cells 1P
3. Preparation of salivary gland chromosomes in *Chironomus* larvae 1P
4. Estimation of frequency of PTC taste sensitivity, earlobe and rolling tongue in known population 1P
5. Genetic problems on gene mapping using three point test cross data 1P

## Paper IV: BO.334: SPERMATOPHYTA AND PALAEOBOTANY)

### GYMNOSPERMS: (12L)

1. Introduction, general characters, economic importance and classification according to Chamberlain (1934). (2L)

2. Study of life cycle of *Pinus* and *Gnetum* with reference to distribution, morphology, anatomy, reproduction, gametophyte, sporophyte, seed structure and alternation of generations. (10 L)

(Developmental stages of sex organs are not expected)

### ANGIOSPERMS (24L)

1) Origin of angiosperms: (3 L)

Origin with reference to time, place and ancestry-

1) Pteridosperms theory 2) Bennettitalean theory 3) Gnetalean theory

### 2. Classification

Review of artificial, natural and phylogenetic systems (general account), (4 L)

Hutchinson systems with reference to outline and assumptions, merits and limitations, Advanced Phylogenetic Group system-III (APG-III).

3) Study of following families according to Bentham and Hooker's System: (14 L)

With reference to systematic position, distinguishing characters, economic importance, general floral formula, floral diagram of following families: Magnoliaceae, Capparidaceae, Rhamnaceae, Leguminosae (Fabaceae), Asteraceae, Acanthaceae, Apocynaceae, Lamiaceae, Nyctaginaceae, Orchidaceae and Cannaceae

4) Plant identification

(3 L)



Latin diagnosis and recent trends, use of flora, Practicing indented and bracketed keys, Preparation of artificial keys, Plant authentication.

### **PALAEOBOTANY : (12 L)**

1. Geological time scale, Form genera concept. (1L)
2. **Fossil**- Definition, process of fossil formation, types of fossils.-Impression, Compression, Petrification, Pith cast and Coal ball. (3L)
3. **Study of following fossil groups.** (08 L)
  - a) **Psilopsida**- Salient features of order Psilophytales, external and internal morphology of *Rhynia*.
  - b) **Lycopsida**- Salient features of order Lepidodendrales, external and internal morphology of *Lepidodendron*,
  - c) **Sphenopsida**- Salient features of Calamitales, external and internal morphology of *Calamites*
  - d) **Pteridosperms**- External and internal morphology of *Lyginopteris oldhamia*.
  - e) **Pentoxylae**- Salient feature, external and internal morphology of stem [*Pentoxylon*], Leaf [*Nipaniophyllum*].

### **References:-**

1. **Sporne K.R.** 1991. The Morphology of Pteridophytes. B.I Publishing Pvt. Ltd. Bombay.
2. **Stewart W.N. and Rathwell G.W.** 1993. Paleobotany and the Evolution of plants. Cambridge University Press.
3. **Bhatnagar S.P and Moitra Alok** 1996. Gymnosperms. New Age International Pvt. Ltd. Publishers, New Delhi, 470 pp.
4. **Biswas C and Johari B.M** 2004. The Gymnosperms Narosa Publishing House, New Delhi. 497 pp.
5. **Sporne K.R** 1965. The Morphology of Gymnosperms London, pp. 216.
6. **Bierhorst D.W.** 1971. Morphology of Vascular Plants. New York and London.
7. **Chamberlain C.J** 1934. Gymnosperms-Structure and Evolution, Chicago.
8. **Coulter J.M. and Chamberlain C.J.** 1917. Morphology of Gymnosperms, Chicago.
9. **Foster A.S and Gifford E.M** 1959. Comparative Morphology of Vascular Plants. San Francisco.
10. **Maheshwari P. and Vasil, Vimla** 1961. Gnetum, Delhi.
11. **Blatter E and W.S Millard.** 1929. Some Beautiful Indian Trees J.Bom. Nat Hist Soc. 33:624-635.
12. **Bor N.L** 1943. Manual of Indian Forest Botany. London.
13. **Vashishta P.C., A.R. Sinha, Anil Kumar.** 2006. Gymnosperms. S.Chand.
14. **Vashishta P.C.** 2006. Pteridophytes. S. Chand.
15. **Parihar N.S.** 1996. Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
16. **Arnold C.R.**-An Introduction to Palaeobotany
17. **E.H.N.Andrews**-Studies in Palaeobotany (Botany for Degree Students Vol.-V)
18. **Shukla A.C. and Mishra S.P.**- Essentials of Palaeobotany.

19. **Stewart W.N. and Rathwell G.W.** 1993. Paleobotany and the Evolution of plants. Cambridge University Press.
20. **Cronquist, A.** 1968. The Evolution and Classification of Flowering Plants. Thomas Nel and Sons, Ltd. London.
21. **Davis P. H. and V. H. Heywood** 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd London.
22. **Heywood V.H** 1967. Plant Taxonomy, London.
23. **Lawrence, G.H.M** 1951. Taxonomy of Vascular Plants.
24. **Lawrence G. H. M** 1955. An Introduction to Plant Taxonomy
25. **Rendle A.B.** 1925. The Classification of flowering plants. 2 Vols. London.
26. **Santapau H.** 1953. The Flora of Khandala on the Western Ghats of India.
27. **Singh V. and D.K Jain,** 1981 Taxonomy of Angiosperms. Rastogi Publication, Meerut.
28. **Swingle D.B.** 1946. A Text book of Systematic Botany. Mc Graw Hill Book Co. New York.
29. **Takhtajan A.** 1969. Flowering Plants; Origin and Disposal.
30. **Pande B.P** 1997. Taxonomy of Angiosperms. S.Chand.
31. **Gurucharan Singh 2005-** Plant systematics
32. **Naik V.N. -** Taxonomy of Angiosperms.
33. **Yadav S.R. and Sardesai M.R.-** Flora of Kolhapur District.
34. **Bhagat R.B., Shimpale V.B. and Deshmukh R.B.** Flora of Baramati
35. **Shivrajan V.V. -**Introduction to Principles plant taxonomy
36. **V. V. Sivarajan, N. K. P. Robson** 1991. Introduction to the Principles of Plant Taxonomy II<sup>nd</sup> Edi.
37. **Theodore Cooke (1903)-** The flora of The Presidency of Bombay Vol. I, II, III
38. **Chopra G.L.-** Angiosperms
39. **Datta S.C.-** A Hand Book of Systematic Botany
40. **Priti Shukla and Shital Mishra-** An introduction to Taxonomy of angiosperms.
41. **Sharma O.P.** Plant Taxonomy Tata McGraw-Hill Education
42. **Singh, N.P. and S.Karthikeyn** (2000) B.S.I. Calcutta. Flora of Maharashtra State, Dicotyledons. Vol. I and II
43. **Sharma B.D., Karthikeyan. S. and N P. Singh** (1996) B.S.I., Calcutta Flora of Maharashtra State, Monocotyledons -
44. *Botanical Journal of the Linnean Society*, 2009, 161, 105–121.
45. <http://www.mobot.org/MOBOT/research/APweb/>

#### **Practical based Gymnosperm Paper IV: BO.334 (1P)**

1. Study of *Pinus* with the help of permanent slides and plant material.

i) External morphology, ii) T. S. of stem( Temporary double stained preparation), iii) T. S. of needle( Temporary double stained preparation), iv) Morphology of male cone – T. S. & L. S. Permanent slide, mounting of pollen grains.

v) Morphology of female cone – T. S. & L. S. Permanent slide, vi) Mounting of pollen grains.

vii) V. S. of mature ovule(Permanent slide)

2. Study of *Gnetum* with the help of permanent slides and plant material.

i) External morphology, ii) T. S. of stem

- iii) T. S. of leaf (permanent slide), iv) Morphology of male cone
- vi) Morphology of female cone
- vii) V. S. of mature ovule
- 3. Study of at least any eight families as per theory course (3P)
- 4. Identification of plants with the help of regional/local/suitable flora. (1 P)
- 5. Preparation of an artificial key based on multiple characters/ androecium/gynoecium/ vegetative characters (at least two keys) (1P)
- 6. Study of the following with the help of slides and/ or specimens.
  - i) Impression ii) Compression iii) Petrification iv) Coal ball v) *Rhynia*
  - vii) *Lyginopteris* viii) *Pentoxylon* ix) *Nipaniophyllum* x) *Lepidodendron*

## **Paper –IV BO.335: HORTICULTURE AND FLORICULTURE**

### **Chapter 1 Horticulture- Introduction 4L**

Definition, branches, scope and economic importance of horticultural crops, export and import potential of horticultural crops, Horticultural zones of India and Maharashtra, Global and national scenario of horticulture

### **Chapter 2 Horticultural Plants 4L**

Nutritive value of fruits and vegetables, Classification of horticultural crops, Classification of Vegetables, Fruits, Ornamental plants, Spices and Flowers

### **Chapter 3 Horticulture- Methods of Plant Propagation 6L**

- A. Sexual propagation- importance, seed viability and treatments
- B. Artificial Vegetative Propagation – Importance, Methods- cutting. Layering, grafting and budding.
- C. Physiological and Anatomical basis of rooting
- D. Role of growth regulators in horticulture

### **Chapter 4 Special Practices in Horticulture 6L**

Training and Pruning- objectives, types, systems of trainings  
 Fruit crops- Special practices like Bahar treatment, Girdling, Notching, Ringing, Bending, Vegetable crops special practices- Earthing up, Staking, Blanching

### **Chapter 5 Fruits and Vegetables Production Technology 8L**

Introduction, soil and climate requirements, commercial varieties, special practices- harvesting and post harvest management, plant protection methods of following

Fruits- Banana, Mango, Vegetables- Tomato, peas, Beans

**Chapter 6 Ornamental Horticulture** **5L**

Introduction, Origin and History of Gardens, Famous Indian Gardens, Gardening styles- English garden, Italian Garden, Mughal Garden, Japanese garden, Landscape gardening

**Chapter 7 Floriculture** **8L**

Introduction, Concept, Definition, Scope and Importance of floriculture, Important floriculture crops and methods of cultivation for cultivation of Aster, Gladiolus, Orchids, Tagetus

**Chapter 8 Flower Industry** **7L**

A- **Dry Flowers** - Introduction, Indian market of dry flowers, Selection of material, Techniques of drying- Air drying, sun drying, press drying, dessicants, oven and microwave drying methods. Preservation methods, bleaching, dyeing and painting, storage , care of dried flowers, etc.

B- **Cut Flowers** – Introduction, Species and cultivars of Orchids, **Anthuriums** and **Heliconias**, Harvesting - Techniques, mode of harvesting, post harvest handling- conditioning , precooling, pulsing and impregnation, grading, bunching, wrapping packing and cold storage of cut flowers, Indian market of Cut flowers

**Practicals**

1. Phenology of any two of each: fruit, vegetables and flowering crops
  2. Study of garden tools and implements- Sprayer, Duster, Pruning knife, Sprinkler, Micro-irrigation system,
  3. Study of garden containers and filling of pots and pits and plantation any one plants of each fruit, vegetable and flowering crops
  4. Study of cutting, layering, budding and grafting
  5. Study of technique of training and pruning
  6. Methods of harvesting of cut flowers and their preservation methods
  7. Methods of making dry flowers
- Visit to any one Nursery unit, Commercial Orchards, fruit market, floriculture

**Industry and submission of report in Practical Examination**

**Reference Books-**

1. Horticulture: V. L Sheela, MJP Publications

2. Plant Propagation, Principles and Practices: Hartmann and Koster's
3. Principles of Horticulture and Fruit Growing by Y. N Kunte, M.P Kawathalkar and K.S Yawalkar (Agri- Horticultural Publication House, Nagpur)
4. Arora J. S *Introductory Ornamental Horticulture* Kalyani Publications
5. Bose T. K & Yadav L. P *Commercial Flowers* Naya Prokash
6. Singh B. D *Plant Breeding* Kalyani Publications
7. Chadha K. L & Pareek O. P *Advances in Horticulture* Vol. IV Malhotra Publications
8. Sudheer K. P and Indira V *Post Harvest Technology of Horticultural Crops* New Delhi Publications
9. Adams C. R. Principles of Horticulture, 4<sup>th</sup> Edt. Elsevier Publication, 2004

## **PAPER V: BO 336 - COMPUTATIONAL BOTANY**

### **13. Introduction to Biostatistics 3L**

- a. Definition
- b. Statistical terms : Population, sample, primary and secondary data, qualitative and quantitative data, parameter and statistics, attributes, variables, discrete and continuous variables, statistical error, linear and non-linear functions of statistics, frequency, and its distribution
- c. Scope, applications and uses of biostatistics

### **14. Sample and sampling 4L**

- a. Definition
- b. Sampling unit, sample and population
- c. Types of sampling
  - i. Random sampling – with replicates, without replicates, systematic sampling, stratified sampling
  - ii. Non-random sampling- Purpose, quota sampling
- d. Need of randomness
- e. Achieving randomness
  - i. Lottery methods
  - ii. Use of random number table
- f. Merits and limitations of sampling

### **15. Collection and representation of data 5L**

- a. Classification of data
  - i. Meaning and need of classification
  - ii. Objectives of classification

- iii. Classification according to class interval
- iv. Overlapping and non-overlapping frequency table
- b. Methods of representation of statistical data
  - i. Essential features of tabular presentation
  - ii. Advantages of tabular presentation
  - iii. Graphic representation of data and its advantages
  - iv. Types of graphic representation
    - 1. Histogram
    - 2. Frequency polygon
    - 3. Frequency curve
    - 4. Scatter or dot diagram
  - v. Merits and limitations of graphic representation
  - vi. Diagrammatic representation of data
    - 1. Line diagram
    - 2. Bar diagram
    - 3. Pie diagram

**16. Measures of central tendency of grouped and ungrouped data** **4L**

- a. Simple arithmetic mean, its merits and limitations
- b. Averages of position: Median and mode, their merits and limitations

**17. Measures of dispersion** **4L**

- a. Meaning of dispersion
  - i. Range: Computation in individual, discrete and continuous series, coefficient of range, merits and limitations
  - ii. Mean deviation and standard deviation: computation for grouped and ungrouped data, merits and limitation
  - iii. Variance: Definition, coefficient of variance

**18. Correlation and regression** **4L**

- a. Definition and types of correlation
- b. Coefficient of correlation and its properties
- c. Methods of studying correlation: Scatter diagram and Karl Pearson's coefficient of correlation
- d. Coefficient of determination ( $r^2$ )
- e. Regression analysis
  - i. Definition and types of regression
  - ii. Linear regression

**19. Probability and types of theoretical probability distribution** **4L**

- a. Concept of probability
- b. Binomial distribution
- c. Poisson distribution
- d. Normal distribution
  - i. Normal distribution curve
  - ii. Relationship between normal curve area and standard deviation
  - iii. Properties of normal distribution curve

**20. Tests of significance of mean 4L**

- a. Introduction
- b. Statistic and its standard error
- c. Meaning of statistical hypothesis, level of significance, null hypothesis and alternative hypothesis
- d. Student's 't' test: unpaired and paired test
- e.  $\chi^2$  test as a test of goodness of fit and its significance

**21. Computation of seed testing and plant growth indices 10L**

- a. Seed germination and early seedling growth.
  - i. Germination percentage
  - ii. Mean germination time (MGT)
  - iii. Germination index (GI)
  - iv. Germination speed (GS)
  - v. Vigor index (VI)
- b. Seed germination and early seedling growth under stress
  - i. Promptness index (PI)
  - ii. Germination stress tolerance index (GSI),
  - iii. Plant height stress tolerance index (PHSI)
  - iv. Root length stress tolerance index (RLSI)
  - v. Dry matter stress tolerance index (DMSI)
- c. Plant growth indices
  - i. Absolute Growth Rate (AGR)
  - ii. Crop Growth Rate (CGR)
  - iii. Relative Growth Rate (RGR)
  - iv. Leaf Area Index (LAI)

**10. Analysis of data on vegetation studies 6L**

- a. Data obtained from quadrates and transects methods
  - i. Frequency
  - ii. Percent frequency
  - iii. Relative frequency

- iv. Density
  - v. Relative density
  - vi. Abundance
  - vii. Dominance
- b. Computation of crop/vegetation biomass using satellite data
- i. Simple Ratio (SR) or Ratio Vegetation Index (RVI)
  - ii. Difference Vegetation Index (DVI),
  - iii. Normalised Difference Vegetation index (NDVI) or greenness index

**NOTE – For Biostatistics, emphasis be given on methodology and numerical problem solving rather than derivations and proofs.**

### **Practicals**

1. Computation of mean, mode, median, variance and standard deviation from the given data 1P
2. Representation of data by various graphical methods 1P
3. Statistical problem solving based on Student's 't' test and  $\chi^2$  test 2P
4. Statistical problem solving based on data for correlation and regression 2P
5. Germination of various seed lots and analysis of data with various seed germination indices 1P
6. Analysis of vegetation data obtained from list count quadrat method for frequency, density, abundance, relative dominance and importance value index. 1P
7. Analysis of satellite data collected on biomass for RVI, DVI, NDVI, TNDVI, and PVI. 1P

**OR**

### **Projects (Equivalent to 6 practicals)**

1. Study effect of agrochemicals/ mutagens/ plant extracts/ fertilizers/etc/ on seed germination and early seedling growth, analyze data statistically. **OR**
2. Study varietal variation to abiotic stress based on seed germination and early seedling growth analyze data statistically. **OR**
3. Study vegetation by list count quadrat / line/belt transect method and analyze data statistically. **OR**
4. Collect satellite data on vegetation/biomass and compute RVI, DVI, NDVI, TNDVI, and PVI.

### **References:**

1. Introduction to biostatistics, Pranab Kumar Banerjee.
2. Fundamentals of biostatistics, Khan and Khanum
3. Methods in Biostatistics for medical students and research workers, B K Mahajan



4. ABC of Research Methodology and Applied Biostatistics, M N Parikh and Nithya Gogtay
5. Biostatistics in brief, K Viswesara Rao
6. Introduction to Biometry, S G Purohit, V D Ranade and A V Dusane
7. Biostatistics-Basic Concepts and Methodology for the Health Sciences, Wayne W Daniel
8. Basic statistics, B L Agarwal
9. Biostatistics – Principle and Practice, B Antonisamy, Soloman Chrostopher and P Prasanna Samuel
10. Introduction to biostatistics and research methods, PSS Sundar Rao and J Richards
11. Drought stress in peanut, Lambert Publication , Laware And Shinde

## **SEMESTER IV**

### **Paper I: BO. 341: PLANT PHYSIOLOGY AND BIOCHEMISTRY**

#### **Plant Physiology**

- 1) **Photosynthesis:** Structure of a chloroplast, photosynthetic pigments and their role, Photosystems, Light reaction, electron transport chain, Cyclic and Non-cyclic photophosphorylation, Path of carbon in photosynthesis - Calvin cycle, HSK pathway: Salient features of C4 plants, metabolic pathway, CAM pathway, Photo-respiration, Significance of photosynthesis. **(10)**
- 2) **Respiration:** Structure of a mitochondrion, Respiratory substrates, Types of respiration, Mechanism of aerobic respiration – Glycolysis, TCA cycle. Electron transport system, Chemi-osmotic hypothesis of ATP synthesis, Balance sheet of ATP generation in respiration. Significance of respiration. **(7)**
- 3) **Translocation of organic solutes:** Definition, Path of translocation, Evidences for phloem transport, Mechanism of translocation – Pressure flow theory, Diffusion, Source to sink relationship, Phloem loading and unloading. **(4)**
- 4) **Stress Physiology :** Concept of abiotic , biotic and xenobiotic stresses. Types of stresses – Salinity, drought. Effect of stresses on the plant growth. **(3)**

#### **Biochemistry**

- 1) **Carbohydrates:** Definition and classification Properties and functions of carbohydrates. Synthesis and breakdown of starch. (4)
- 2) **Amino acids and proteins:** Definition, synthesis and properties of amino acids. Role of amino acids. Classification of proteins on the basis of structure, properties and functions of proteins. (5)
- 3) **Lipids:** Definition , classification, properties and functions of lipids. Synthesis of lipids,  $\beta$ -oxidation. (4)
- 4) **Enzymology:** Definition and nature of enzymes, active site, Classification (IUB) and properties of enzymes, Co-enzymes. Mechanism of enzyme action- Lock and key hypothesis, Induced fit theory. Factors affecting enzyme activity – pH, temperature, substrate concentration, enzyme concentration. Enzyme inhibitors – Competitive, uncompetitive, non-competitive. (6)
- 5) **Secondary Metabolites:** Definition, Types, Metabolic pool and biosynthesis of secondary metabolites through – malonic, mevalonic and shikimic acid pathways. Role of secondary metabolites. (5)

**References: -**

**S. N. Pandey and B. K. Sinha (2014).** Plant Physiology, Vikas Publishing House Pvt. Ltd., India.

**Buchanan B.B, Gruissem W. and Jones R.L (2000).** Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists Maryland, USA.

**Salisbury F.B and Ross C.W (1992).** Plant physiology (Fourth Edition) Wadsworth Publishing Company, California,USA.

**William G. Hopkins (1995)** Introduction to Plant Physiology, Published by – John Wiley and Sons, Inc.

**Lincoln Taiz and Eduardo Zeiger (2003).** Plant Physiology (3rd edition), Published by – Panima Publishing Corporation

**R. G. S. Bidwell (revised edn.)-Plant Physiology**

**Verma S.K. and Verma Mohit (2007).** A.T.B of Plant Physiology, Biochemistry

and Biotechnology, S.Chand Publications.

**Leninger A.C** (1987). Principles of Biochemistry, CBS Publishers and Distributors (Indian Reprint)

**Dennis D.T., Turpin, D.H. Lefebvre D.D. and Layzell D.B. (eds)** 1997. Plant Metabolism (Second Edition) Longman, Essex, England.

**Galstone A.W.** 1989. Life processes in Plants. Scientific American Library, Springer Verlag, New York, USA..

**Moore T.C.** 1989. Biochemistry and Physiology of Plant Hormones Springer – Verlag, New York, USA.

**Singhal G.S., Renger G., Sopory, S.K. Irrgang K.D and Govindjee** 1999. Concept in Photobiology; Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi

**Taiz L. and Zeiger E.** 1998. Plant Physiology (Second Edition). Sinauer Associates, Inc. Publishes, Massachusetts, USA.

**Verma S.K. and Mohit Verma** 2007. A.T.B of Plant Physiology, Biochemistry and Biotechnology, S.Chand Publications.

**Practicals based on Paper I: BO. 341: Plant Physiology and Biochemistry:-**

1. Estimation of chlorophyll-a and chlorophyll-b by spectrometric or colorimetric method.
2. Separation of photosynthetic pigments by TLC/Paper chromatography.
3. To determine diurnal fluctuation in TAN values of CAM plants.
4. Estimation of soluble proteins by Lowery *et. al.* method.
5. Separation of amino acids by paper chromatography.
6. Demonstration of
  - a. Ringing experiment for path of solute translocation.
  - b. Hill reaction

- c. Qualitative tests for alkaloids, tannins, glycosides, starch, lipids and proteins.
- d. Enzyme activity: catalase

## **Paper II: BO.342: PLANT ECOLOGY AND BIODIVERSITY**

### **Plant Ecology (24L)**

#### **1. Ecology (8L)**

Introduction, Interrelationship between the living world and the environment, components and dynamism of Ecosystem, homeostasis.

Impact of human activities on environment – Causes, Prevention and control of – Air, water and Soil Pollution

Brief account of environmental toxicology – Eutrophication, bioaccumulation and biomagnifications

#### **2. Environmental Crisis (3L)**

Desertification, Ozone depletion and Global warming

#### **3. Environmental Impact Assessment (3L)**

Process, objectives of EIA, Hierarchy in EIA, Historical Review of EIA, Concepts related to EIA, Basic data collection for EIA

#### **4. Environmental Audit (3L)**

Meaning, need, Audit Protocol, Processing, Certification, personnel environmental Audit.

#### **5. Ecology and Economics (3L)**

Man and Biosphere concept.

Relation between ecology and economics

#### **6. Remote Sensing (4L)**

Definition, basic principles,

Process of data acquisition and interpretation,

Global positioning System

Application of Remote Sensing in ecology.

## **Biodiversity (24L)**

### **Introduction to Biodiversity (02 L)**

Introduction, Concept, Aims and objectives,  
Scope and values of Biodiversity.

### **Characterization of Biodiversity: (05 L)**

Introduction, need for characterization, various disciplines of Biodiversity- Genetics, Species and Ecosystem. Concept of endemism and phylogeography.

### **Biodiversity Loss: (03 L)**

Loss of Species and Genetic Diversity: Introduction, Factors causing loss of species and genetic diversity, Founder Effects, Genetic Drift, Inbreeding Depression, IUCN Categories (RET plants)

### **Inventorying and Monitoring of Biodiversity: 03 L)**

Introduction, Necessity, planning and approaches to inventorying and monitoring, capacity building.

### **Conservation of Biodiversity: (11L)**

Current Practices in Conservation,

***In-situ Conservation:*** International efforts and Indian initiatives; protected areas in India, Concept of Biosphere Reserves and National Parks.

***Ex-situ Conservation:*** Germplasm Collections, Botanical Gardens, Seed Banks, Gene Banks, Pollen Banks, DNA Banks, Wetlands, mangroves and coral reefs. Enlist national agencies playing role in conservation (BSI, NBPGR, ICAR, CSIR, DBT),

***Social Approach to Biodiversity Conservation:*** Sacred Groves, Sthalavrikshas, Chipko Movement, Role of Universities and other Educational Institutions in Biodiversity Conservation

### **References:**

1. **M. Anji Reddy** Textbook of Remote sensing and GIS (Third edition, 2006) by BS Publication, Hyderabad

2. **George Joseph** Fundamentals of remote sensing (Second edition, 2005) by Universities press (India) Private Ltd., Hyderabad.
3. **John R. Jensen** Remote sensing of the environment (2000), Dorling Kindersley India Pvt. Ltd,
4. Current sciences special issue remote sensing for national development Volume 61 numbers 3 and 4 August 1991
5. **Larry W. Canter**," Environment Impact Assessment", McGraw-Hill Book Company, New York
6. **G.J. Rau and C.D. Weeten**, "Environmental Impact Analysis Hand book, McGraw Hill, 1980.
7. **E.P. Odum. 1996.** Fundamentals of Ecology. Natraj Publishing, Dehradun.
8. **Daubenmire.R.F. 1974.** Plants and Environment- A Text Book of Plant Ecology (3rd edition). John Wiley & Sons. New York.
9. **Kendeigh.S.C. 1980.** Ecology with Special Reference to Animals and Man. Prentice Hall of India Pvt. Ltd., New Delhi.
10. **Kumar.H.D. 1996.** Modern Concepts of Ecology (3rd edition). Vikas Publishing House Pvt., Ltd. Delhi.
11. **Kumar.H.D. 1997.** General Ecology. Vikas Publishing Pvt. Ltd., Delhi.
12. **KermondyF.J. 1996.** Concepts of Ecology. Prentice Hall of India Pvt. Ltd., New Delhi.
13. **Smith.L.R. 1996.** Ecology and Field Biology (5th edition). Harper Collns College Publishers, USA.
14. **Weaver. J.E. and Clements. S.E. 1966.** Plant Ecology. Tata McGraw Publishing Co. Ltd. Bombay.
15. **Smith L.R. and Mith T.M. 1998.** Elements of Ecology. (4th edition). An imprint of Addison Wesley, Longman ink., California.
1. **K.V. Krishnamurthy** (2003). An Advanced Textbook on Biodiversity- Principles and Practice, Oxford and IBH Publ. New Delhi
2. **Michael J. Jeffries** (2005). Biodiversity and Conservation, Routledge, London
3. **Shailaja Ravindranath and Sudha Premnath** (1997). Biomass Studies – Field Methods for Monitoring Biomass Oxford and IBH, New Delhi.
4. **William J. Sutherland**(1997). Ecological Census Techniques – A Handbook Cambridge Uni. Press.
5. **Magurran Anne** (1988). Ecological Diversity and Its Measurement Chapman and Hall India
6. **Michael P.** (1984). Ecological Methods for field and Laboratory investigations TMH Co. ltd. Bombay.
7. **Uma Shaanker, R. Ganeshiah, KN. and Bawa KS** (2001), (Eds). Forest Genetic Resources: Status, Threats and Conservation Strategies Oxford and IBH, New Delhi
8. **Heywood and Watson** (1995), Edt. Global Biodiversity Assessment UNEP, Cambridge University Press.

9. **Global Biodiversity: Status of the Worlds Living Resources** (1992); WCMC; Chapman and Hall, London
10. **David Hill, Matthew Fasham, Graham Tucker, Michael Shewry and Philip Shaw** (2004) Edt. Handbook of Biodiversity Methods – Survey, Evaluation and Monitoring; Cambridge
11. **Handbook of the Convention on Biological Diversity** (2001), Secretariat of the Convention on Biological Diversity. Earthscan publ., London
12. **Avise J.C.** (1994), Molecular Markers, Natural History and Evolution; Chapman and Hall, London
13. **Barbier E.B., Burgess J.C. and Folke C.** (1994). Paradise Lost? The Ecological Economics of Biodiversity; Earthscan, London
14. **Hajra P.K. and V. Mudgal** (1997) Edt. Plant Diversity Hotspots in India – An Overview, BSI
15. **John E. Weaver and F.E. Clement** (1938). Plant Ecology McGraw-Hill.
16. **Orians G.H., Brown G.M., Kunin W.E. and Swierbinski J.E.** (1990). Preservation and Valuation of Biological Resources Univ. Washington Press
17. **Bowles M.L. and Whelan C.J** (1996) edt. Restoration of Endangered Species - Cambridge Univ. Press.
18. **T.V. Ramchandra, R. kiran, N. Ahalya** (2002). Status, Conservation and Management of Wetlands, Allied Publ. New Delhi.
19. **Gadgil M. and Guha R** (1992). This Fissured Land: An Ecological History of India Oxford University Press, New Delhi
20. **Ashish Kothari** (1997) Understanding Biodiversity- Life, sustainability and Equity; Orient Longman

### **Practicals-Plant Ecology**

1. Study of polluted water body with ref. to BOD.
2. Study of physicochemical properties of water body by using Sacchi disc, pH meter and electric conductivity meter.
3. Acquisition of ecological data of particular locality by using GPS/ altimeter/geographic maps etc
4. Study of suitable ecosystem by line/belt transect method/ nested quadrat method.
5. Visit to near by locality to study biodiversity and submission of report

### **Practicals-Biodiversity**

1. Study and application of diversity indices to suitable ecosystem/ area.
2. To measure the latitude, longitude and altitude by using GPS

3. Visit to near by conservation institutes/sacred groove and report writing.

## **PAPER III BO.343:: PLANT PATHOLOGY**

### **1 Fundamentals of plant pathology**

**5 L**

Introduction, Important terminology- Incitants, Host, Parasite, Pathogen, Inoculum, Penetration, Infection, Incubation, Disease, Disease development, Symptoms, Sign, Endophyte, Predisposition, Suscept, Resistance, Epidemic, Etiology. Economic importance of plant diseases, History of plant pathology, Introduction to Indian Agricultural Research Institute (IARI), International Crop Research Institute for Semi Arid Tropics (ICRISAT), Contribution of Anton DeBary and Prof. B.B. Mundkur.

### **2 Disease Development**

**6 L**

Concept of disease cycle, Inoculation, Prepenetration, Penetration, Infection, Dissemination. Epidemics- Forms, Decline,, Exponential model. Disease forecasting, Measurement of plant disease and yield loss.

### **3 Defence Mechanisms**

**3 L**

Concept and Definition, Types- Preexisting- Structural and chemical, Induced- Structural and Biochemical

### **4 Methods of Studying Plant Diseases**

**5 L**

Macroscopic study, Microscopic study, Koch"s postulates. Culture technique, Media Types and Preparation, Pure culture methods- streak plate, Pour plate, spread plate, Serial dilution.

### **5 Fungal Plant Diseases**

**5 L**

Introduction to fungi as plant pathogens. Study of Diseases- Club root of Crucifers, Downy mildew of Grapes, Head smut of Jowar, Leaf spot of Turmeric, Tikka disease of Groundnut with reference to causal organism, symptoms and signs, disease cycle and control measures.

### **6 Bacterial Plant Diseases**

**3 L**

Introduction to bacteria as plant pathogens, Study of Diseases- Citrus Canker, Black arm of Cotton with reference to causal organism, symptoms and signs, control measures.



## **7 Mycoplasma Plant Diseases**

**3**

**L**

Introduction to Mycoplasma as plant pathogens, Study of Diseases- Grassy shoot disease of sugarcane, Little leaf of brinjal with reference to symptoms and signs, control measures.

## **8 Nematodal Plant Diseases**

**2**

**L**

Introduction to Nematodes as plant pathogens. Study of Diseases- Root knot disease of vegetables, Ear cockle of Wheat with reference to causal organism, symptoms and signs, control measures.

## **9 Viral Plant Diseases**

**3**

**L**

Introduction to Viruses as plant pathogens. Study of Diseases- Tobacco Mosaic Disease, Bunchy top of Banana with reference to causal organism, symptoms and signs, control measures.

## **10 Non Parasitic Diseases**

**4**

**L**

The impact and abiotic causes- Temperature, Soil moisture and relative humidity, Poor oxygen, Poor light, Air pollutants, mineral deficiencies. Herbicide injury, Study of Tip burn of Paddy, Mango necrosis, Black Heart of Potato, Khaira disease of rice.

## **11 Principles of Plant Disease Control**

**5**

**L**

General account, Quarantine, Eradication, cultural control practices, Biological control, Curative measures, Chemical control, Use of Effective Microorganism Solution (EMS), Microbial Pesticides, IPM

## **12 Molecular Diagnostics and Transgenic in Crop Protection**

**4 L**

Introduction, Classical approaches, Use of antibodies, Pathogen derived resistance against bacterial and fungal diseases, Expression of vaccines in plants.

### **Practicals**

1. Preparation of any one culture media for isolation of plant pathogens.
2. Study of Koch's Postulates
3. Culture technique - Streak plate methods, Pour plate methods, Spread plate and Serial dilution method for preparation of pure culture.

4. Study of any two of each fungal, bacterial and mycoplasma diseases.
5. Study of any two viral and non-parasitic diseases of plants.
6. Study of any two of each fungicides and microbial pesticides
  - Visit to any Agricultural Research Institute and Plant Pathology Laboratory and submission of report

### References:

1. Fungi and Plant Diseases by B. B. Mundkur
2. Plant Pathology, R. S. Mehrotra
3. Principles of Plant Pathology, R. S. Singh
4. Plant Pathology, P. D. Sharma
5. Plant Disease, R. S. Singh
6. Plant Pathology, Mandal and Dasgupta
7. Plant Pathology, G. N. Agrios
8. Agricultural Microbiology, Rangaswamy and Bhagyaraj
9. Fundamentals of Plant Pathology by Ravi Chandra
10. Methods of Microbial and Plant Biotechnology, L. N. Nair
11. Molecular Plant Pathology, 2003. Dickinson, Bios Scientific Publication, London, New York

## Paper IV: BO.344: MEDICINAL AND ECONOMIC BOTANY

### Medicinal Botany (36L)

#### 1. Introduction to Pharmacognosy

(3L)

1.1. Origin, history, definition and scope of Pharmacognosy,

1.2. Methods of classification and their significance in the study of drugs of natural origin (alphabetical, biological, chemical, taxonomical, chemotaxonomical and pharmacological)

#### 2. Ayurvedic Pharmacy

(8L)

##### 2.1 Introduction

2.2 Tridosha concept, Humoral, Indigenous Systems of medicine (Ayurveda, Siddha, Unani, Tibi, Chinese etc.)

2.3 Ayurvedic principles- Ras, Guna, Vipaka, Virya, Prabhava,

2.4 Ayurvedic formulations –Asava, Arishta, Kvatha, Churna, Ksharas, Leha, Vatika, Taila, Bhasma,

### **3. Analytical Medicinal botany (6L)**

#### **3.1 Drug adulteration**

**3.2** Methods of extraction (percolation, maceration, Soxhlet extraction etc.) of different classes of phytochemicals from crude drugs.

**3.3** Methods of drug evaluation- Morphological, Microscopic, Chemical and Physical methods.

### **4. Cultivation, collection and processing of herbal drugs from Mentha and Eucalyptus. (3L)**

**4.1** Cultivation- Methods, Factors affecting cultivation

**4.2** Collection and Processing- Collection, harvesting, drying, garbling, packing, storage of crude drugs.

### **5. Study of medicinally important drugs (6L)**

Study of drugs w.r.t. occurrence, distribution cultivation, microscopic characters, constituents and uses of the following.

Root Rhizome drugs :- *Glycyrrhiza*,

Stem drugs: - *Ephedra*,

Leaf drugs: - *Adhatod*,

Flower drugs: - Clove,

Fruit drugs: - Amla,

Unorganized drugs :- Shilajit and *Acacia* gum,

Contraceptive drugs: - *Dioscorea*.

### **6. Applied Medicinal Botany (8L)**

**6.1** Study of drugs with respect to Biological source, Geographical distribution, common varieties, macro and microscopic characters, chemical constituents and therapeutic uses, adulterants of the following plants/drugs *Strychnos nux vomica*-Seeds, *Tinospora cordifolia*-Stem

**6.2** Concept of active principle, and major metabolic Pathway (Carbohydrates and Proteins) leading to the Production of therapeutically active Chemical Constituents

**6.3** Concept, definition and introduction to Biopharmaceutics, Pharmacodynamics and clinical Pharmacokinetics with applications

### **7. Ethnobotany : Definition, principles, scope and ethnic societies in India. (2L)**

#### **Economic Botany (12L)**

**1.** Introduction to economic botany and its scope (2L)

**2.** Important Botanical resources- meaning and Mention of only botanical resources any five for non-wood forest products (NWFPs) such as (4L)

2.1 Paper making and 2.2 Gums

**3.** Origin, evolution, source & uses of Rice, *Curcma longa*, Safflower, Sugarcane, *Butea monosperma*/*Samanea saman*/ *Sclleichera oleosa* and Rose. (6L)

#### **References:-**

1. A Pharmacognosy and Pharmacobiotechnology. New Age international (P)Limited, Publishers (formerly wileyEastern Limited)
2. **Bruncton J.:** Pharmacognosy, Phytochemistry, Medicinal Plants: Intercept Limited.

3. **Harborne, J. B.** (1973): Phytochemical Methods: A guide to Modern Techniques of plant Analysis. Chapman and Hall, London
4. **Khandelwal K. R.**(2008): Practical Pharmacognosy Techniques and Experiments; NiraliPrakashan, Pune.
1. **Kokate C.K.** (2014)Practical Pharmacognosy, Vallabhprakashan, New Delhi, 5<sup>th</sup> edition
2. **Kokate C.K. Purohit A.P. and Gokhale S.B.** Pharmacognosy, NiraliPrakashanpune
3. **Trease G.E. and Evans. W.C.** Pharmacognosy ELBS Twelfth Edition
4. **Tyler V.E Brady L. R and Robbers J.E.** (1976).Pharmacognosy Lea and Febiger. Philadelphia.8th edition KM Varghese and Co.Mumbai,
5. **Vaidya S.S. and Dole.V.A.** Bhaishyajakalpana, AnmolPrakashan, pune
6. **Wallis,T.E.** (2003)Test books of pharmacognosy CBS publishers and distributors New Delhi (Latest Edition )
7. **T. E. Wallis, J. & A. Churchill** Ltd., London, 1960. Textbook of Pharmacognosy
8. **Anonymous** The AyurvedicPharmacopia of India Volume-I and IV, Govt. of India, Ministry of Health and Family Welfare, Department of Ayush Page 41.
9. **P.L. Kochhar(1987)** Tropical Crops: A Textbook of Economic Botany (Macmillan international college edition)
- 10.**Albert F. Hill.** (1952) Economic Botany: A Textbook of Useful Plants and Plant Products McGraw-Hill
- 11.**Vernma V (2009).** Textbook of Economic botany
12. **N.D. Prajapati (2010)**A Handbook of Medicinal Plants: A Complete Source Book
- 13.**Himadri Panda(2002)** The Complete Technology Book On Natural Products (Forest Based)
14. **Pharmacognosy and Phytochemistry -- Vinod Rangari.**

### **Practicals based Paper VI: BO.346: Medicinal and Economic Botany**

1. Study of any six drug plants from theory syllabus (Macroscopic and Microscopic). (2P)
2. Demonstration of Plant extraction methods -Cold and Soxhlet extraction and TLC of any one drug studied in theory. (1P)
3. Study and preparation of ayurvedic formulations - Asav, Arishtha, Churna (1P)
4. Qualitative analysis of Alkaloid, Glycoside and Tannin (1P)
5. Study of stomatal index and vein islet number using suitable plant material using micrometer and camera Lucida. (1P)
6. Survey of local flora with respect their medicinal and economic importance and submission of 10 dry specimens.

## **Paper V: BO. 345 PLANT BIOTECHNOLOGY**

### **1. Introduction to Biotechnology**

**5L**

Introduction and History of plant Biotechnology

Pioneering work and significant achievements in Indian plant Biotechnology

Global Impact and Current excitements of plant Biotechnology - Plant Health care and plant protection.

### **2. Plant Tissue Culture**

**15L**

Brief History, Importance of plant tissue culture

Types of culture, basic technique of plant tissue culture, Concept, technique and applications of callus culture, cell suspension culture, protoplast culture, somatic hybridization and cybrids, Haploid production, Micropropagation, embryo culture-and embryo rescue

### **3. Germplasm and Cryopreservation**

**4L**

**In situ** and **Ex situ** conservation, techniques of cryopreservation, cold storage, low pressure and low oxygen storage, applications

### **4. Transgenic Plants as Bioreactors**

**6L**

Metabolic engineering of starch, cyclodextrins, fructans, Bioplastics, Genetically engineered plants as protein factories, Production of therapeutic proteins from plants.

### **5. Biotechnology of Biological Nitrogen Fixation**

**6L**

Non symbiotic Nitrogen Fixation-Diazotrophs and their ecology, special features,

Mechanism of N<sub>2</sub> Fixation

Nitrogenase and Hydrogenase

Symbiotic N<sub>2</sub> Fixation- establishment of symbiosis,

Factors affecting and mechanism of symbiotic N<sub>2</sub> Fixation

Genetics of Diazotrophs- Nod genes, Nif gene

Biofertilizers- algal, fungal, phosphate solubilising and organic fertilizers

## **6. Biotechnology and Society**

**4L**

Biotechnology- Benefits, GM foods and its safety, patenting of biotechnological inventions, Biotechnology and developing countries, Recombinant foods and religious beliefs, recombinant therapeutic product for human health care, Intellectual property rights

## **7. Bioinformatics**

**4L**

Introduction, Database and its classification, NCBI, Data retrieval tools, INTREZ, OMIN, BLAST, FASTA, Applications of Bioinformatics

## **8. Genomics and Proteomics**

**4L**

Genomics- methods, types and applications, Proteomics- Concept, types and importance

### **Practicals**

1. Preparation of MS Medium

2. Callus Induction using maize embryo

3. Study of application of biofertilizers- Algal, Fungal, Bacterial, Phosphate Solubilizers and Organic Fertilizers

4. Estimation of Nitrate Reductase enzyme from Legume nodules

5. Study of Transgenic plants- Bt Cotton, Bt Brinjal, Bt Tomato, Golden Rice

• Visit to NCBI and Report preparation

### **Reference Books:**

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.

## **Paper VI: BO346: PLANT BREEDING AND SEED TECHNOLOGY**

### **PLANT BREEDING (24 L)**

#### **1. Introduction, scope and importance (2 L)**

#### **2. Conventional techniques, methods and practices of breeding (10 L)**

##### **(a) Plant introduction and acclimatization**

- i. Concept, objectives
- ii. Types of plant introduction
- iii. Advantage, limitations/ Disadvantages and achievements.

##### **(b) Selection methods**

- i. Concept,
- ii. Types of selections –mass selection, pure line selection and clonal selection.
- iii. Advantage and disadvantages/limitations, achievements.

**(c) Hybridization**

- i. Definition and Concept,
- ii. Difficulties in crop hybridization and precaution to be taken during hybridization
- iii. General procedure of hybridization
- iv. Parent selection in a breeding program
- v. Criteria for selecting parents

**Breeding Methodology**

- i. Pedigree method
- ii. Bulk method
- iii. Single-seed descent method
- iv. Backcross method, Achievements

**(d) Heterosis and hybrid vigour**

- i. Concept
- ii. Causes of heterosis- dominance hypothesis
- iii. Applications

**3. Alternative breeding techniques**

**(08 L)**

**(a) Mutation breeding**

Introduction and concept

Types of Mutation

induced mutagenesis

mutagens used -Chemical and physical mutagens

methods of working

Gamma gardens, concept and design

Applications

**(b) Importance of Polyploidy and aneuploidy in crop improvement**

Properties of polyploids,

Methods of obtaining polyploids

Methods used in obtaining haploids

Production of triploids in plant breeding

Applications and achievements

**4. Breeding for stress tolerance**

**(4L)**

Mechanisms and genetic bases of resistance/tolerance to biotic and abiotic stresses in plants,

Breeding for resistance/tolerance.



Molecular Approaches  
Characteristics evaluated for drought tolerance  
Characteristics evaluated for insect/pest tolerance  
Achievements

**SEED TECHNOLOGY (24L)**

**1. Introduction: (2 L)**

Definition of seed,  
Stages of Seed Production,  
Classes of Seed (nucleus seed, breeders seed, foundation seed, certified seed and truthful seed),  
Role of seed technology.

**2. Seed certification: (2 L)**

General procedure of seed certification,  
field inspection,  
observation during inspection,  
field count,  
Duties of seed inspector.

**3. Seed processing:**

Concept (2 L)  
Principle and techniques of processing of seeds

**4. Seed sampling, storage and packaging (6 L)**

Seed sampling,  
Types of seed samples,  
Sampling equipments.  
Factor affecting seed storage and need of seed storage,  
Methods of protection and control,  
Air conditioning and dehumidification,  
Sanitation and fumigation of seed stores.  
Seed sorting and bagging, bag weighing, bag closing, type of bag closer,  
Labelling and maintaining lot identify, lot numbers, seed pellets,  
Handling and stacking,  
Maintenance of seed processing record.

**5. Physical purity analysis (3L)**

Definition of purity components  
Procedure  
ODV test  
Reporting and results.

## 6. Seed Testing

### A. Moisture Testing

(3L)

By air oven method  
Moisture meters.

### B. Germination testing

(3L)

Definition and objectives,  
General principles and requirements,  
Procedure and methods (Paper, Sand and Soil )  
Seedling evaluation.

## 7. Seed Marketing:

(3L)

Marketing- Basic concepts, supply & demand, price equilibrium, seed transportation, storage, cost & returns, cost processing, packing and marketing, Organization for seed marketing, seed markets in India, structure & working.

### Practicals based on Plant Breeding and Seed technology

1. Demonstration of Hybridization Techniques.

2. Effect of chemical mutagens on seed germination and seedling growth.

3. Demonstration of chlorophyll mutation in M<sub>2</sub> generation.

(Photographs)

4. Polyploidy induction in *Allium cepa* by colchicine.

5. Seed moisture testing by hot air oven method.

6. Demonstration of seed sampling equipments with the help of photographs.

7. Visit to seed processing unit / Seed marketing organization.

### References:-

1. **Sadova David** – 2004 (First Indian Edition). Cell Biology, New Delhi.
2. **Giese Arthur** 1979 (Fifth Edition). Cell Physiology, Toppan company Ltd., Tokyo, Japan.
3. **Roy S.C and KKDe** 2005 (Second Edition). Cell Biology, New central Book Agency Private Ltd., Kolkata.
4. **Verma P.S and Agarwal V.K** 2006 Cell Biology, Genetics, Molecular Biology, Evolution, Ecology. S.Chand and Company, New Delhi.
5. **Gerald Karp** 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and Scne Ine., USA.
6. **Verma and Agarwal** – Seed Technology Demand forecasting, Seed pricing, projection of supply and demand for different kind of seeds
7. **Gardner and Simmons Snustad** 2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons, Singapore.

8. **Gupta P.K** (1995) Genetics and Cytogenetics. Rastogi Publications, Meerut .
9. **Sharma J.R** 1994 Principles and practices of Plant Breeding. Tata McGraw-Hill Publishers Company Ltd., New Delhi.
10. **Singh B.D** 1996 Plant Breeding – Principles and methods. Kalyani Publications, Ludhiana.
11. **Pawar C.B** 2003 (First Edition). Genetics Vol. I and II. Himalaya Publishing House, Mumbai.
12. **Strickberger** 2005. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
13. **Allard R.W** 1995. Principles of Plant Breeding. John Wiley and Sons, Inc., Singapore.
14. **Verma P.S. and Agarwal V.K.**(1991), Genetics. S Chand Comp. Ltd. Ramnagar, New Delhi.
15. **Singh B.D** 2004. Genetics. Kalyani Publication, Ludhiana.
16. **Ahluwalia K.B** 2005 (First Edition). Genetics. New Age International Private Ltd. Publishers, New Delhi.
17. Ratan Lal --- Seed Technology
18. Fundan singh Plant Breeding

**University of Pune**

**Three Year B. Sc. Degree Course in  
Chemistry**

## **Title of the Course : B. Sc. Chemistry**

### **F.Y.B.Sc. Chemistry**

**(To be implemented from Academic Year 2013-14)**

### **AIMS AND OBJECTIVES**

- F.Y. B. Sc. Chemistry syllabus has been revised as per BCUD directives.
- The content of the syllabus have been framed as per UGC norms.
- The students are expected to understand the fundamentals, principles, mathematical concepts and recent developments in the subject area.
- The practical course is in relevance to the theory courses to improve the understanding of the concepts.
- It would help in development of practical skills of the students.
- It is expected to inspire and boost interest of the students towards chemistry as the main subject.
- It would enable to develop interdisciplinary approach of the subjects for students opting for specialization in other subjects at latter stages of graduation.

#### **2) Preamble:**

The systematic and planned curricula from first year to the third year shall motivate and encourage the students for pursuing higher studies in various disciplines of Chemistry such as Physical, Inorganic, Organic, Analytical, Drug and Biochemistry. This curriculum also enable student to shoulder the responsibility as Chemist in chemical industry.

#### **3) Introduction:**

At **first year of under-graduation** The basic topics related to the fundamentals of chemistry covered. Since chemistry is an experimental subject, practical courses is intended to achieve the basic skills required for understanding the concepts and authenticating the basic laws and principles of Chemistry.

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. For the development of vertical growth in the subject, advanced level topics are introduced so as to make the student mature enough to pursue the carrer in Chemistry.

At **third year under-graduation**: Theory papers in each semester deal with the further detailed studies of the various branches of Chemistry as well as some specialized topics like Industrial and Environmental Chemistry. Such a designing of course structure enables the student to understand fundamental as well as applied components that are pertinent to Chemistry. Also, practical courses are framed towards development of synthetic as well as analytical skills that are essential for academic and professional life.

#### **Objectives:**

- To provide indepth knowledge of scientific and technological aspects of Chemistry
- To familiarize with current and recent developments in Chemistry
- To enrich knowledge through programmes such as industrial visits, projects etc.
- To train students in skills related to Chemistry for academic and industrial requirement.
- To creat foundation for research and development in Chemistry
- To develop analytical abilities for independent thinking
- To help students build-up a progressive and successful career in Chemistry

#### 4) Eligibility:

- 1 **First Year B.Sc.:** Higher Secondary School Certificate (10+2) Science stream or its equivalent Examination as per the University of Pune eligibility norms.
- 2 **Second Year B.Sc.:** Keeping terms of First Year of B. Sc. with Chemistry as one of the subjects. Other students if they fulfill the conditions approved by the equivalence committee of Faculty of Science of the University of Pune are also eligible.
- 3 **Third Year B. Sc.:** Student shall pass all First Year B. Sc. courses and satisfactorily keeping terms of Second Year of B. Sc. with Chemistry 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.

#### 5 A) Examination Pattern:

##### First Year B. Sc. Chemistry

Pattern of Examination: Annual

Theory courses      C-1: Chemistry Paper I:      Annual  
    C-2: Chemistry Paper II:      Annual

**Practical Course**      **C-3: Chemistry Paper III:**      **Annual**

Paper/ Course No.	Title	Total Number of lectures/practicals per Term	Standard of passing		
			Internal marks out of <b>20</b>	External marks out of <b>80</b>	Total marks out of <b>100</b>
Paper-I (First term)	Physical and Inorganic Chemistry	Three lectures/Week (Total 36 lectures per term)	08	32	40 *
Paper -I (Second term)	Physical and Inorganic Chemistry	Three lectures/Week (Total 36 lectures per term)			

Paper - II (First term)	Organic and Inorganic Chemistry	Three lectures/Week (Total 36 lectures per term)	08	32	40 *
Paper -II (Second term)	Organic and Inorganic Chemistry	Three lectures/Week (Total 36 lectures per term)			
<b>Paper -III (First &amp; Second Term)</b>	<b>Practical</b>	<b>10 Practicals of 4 lectures in each term (20 practicals / year)</b>	08	32	40 *

\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory (100 + 100 ) = 200 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers given on the basis of internal assessment tests and for practicals on internal assessment tests + journals + attendance + **study visit reports/ market survey/hobby projects** etc.

**Theory examination** will be of three hours duration for each theory course. There shall be 5 questions each carrying equal marks. The pattern of question papers shall be:

Question 1	8 sub-questions, each of 2 marks; answerable in 2 -3 lines and based on entire syllabus
Question 2, 3 and 4	4 out of 6– short answer type questions; answerable in 8 – 10 lines
Question 5	4 out of 6 – problem type question; answerable in numerical or analytical fashion

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each term. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain). There shall be 20 questions.

Practical: one internal assessment test + marks for journals + attendance + activity.

**Practical Examination:** Practical examination shall be conducted by the respective college at the end of the academic year. Practical examination will be of 6 hours duration (2-Sessions). Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination.

### 5 B) Standard of Passing:

- i. In order to pass in the first year theory 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 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 16 marks out of 40 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.)

**5 C) ATKT Rules:**

While going from F.Y.B.Sc. to S.Y.B.Sc. at least 8 courses (out of total 12) should be passed.

**5 D )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

**5 E) External Students:** There shall be no external students.

**5 F) Setting question papers:**

**F.Y.B.Sc.:** For theory papers I and II annual question papers shall be set by the University of Pune and assessment done at the respective colleges. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Paper III, papers shall be set by the University of Pune and assessment done at the respective colleges.

**5G) Verification and Revaluation Rules:**

As per university Statues and rules for verification and revaluation of marks in stipulated time after declaration of the semester examination result.

**6) Course Structure:**

**Duration:** The duration of B.Sc. Chemistry Degree Program shall be three years.

**a) Compulsory Papers:**

F.Y.B.Sc. : 2 Theory + 1 Practical (Annual)

**b) Question Papers :**

**F.Y.B.Sc.Theory paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

**F.Y. B.Sc.Practical Paper:**



University Examination	– 80 marks (at the end of 2 <sup>nd</sup> term)
Internal Examination	– 20 marks

c) **Medium of Instruction:** The medium of instruction for the course shall be **English**.

**7) Equivalence of Previous Syllabus:**

<b>Old Course (2008 Pattern)</b>	<b>New Course (2013 Pattern)</b>
Paper I: Physical and Inorganic Chemistry	Paper I: Physical and Inorganic Chemistry
Paper II: Organic and Inorganic Chemistry	Paper II: Organic and Inorganic Chemistry
PaperIII: Practical	PaperIII: Practical

**8) University Terms:** Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

**9) Qualification of Teachers:** M.Sc. Chemistry or equivalent master degree in science with class/grades and NET/SET as per prevailing University/Government /UGC rules.

**Chemistry Paper - I**  
**Physical and Inorganic Chemistry**  
**Term - I**

Chapter 1	States of Matter	08
Chapter 2	Surface Chemistry	08
Chapter 3	Chemical Mathematics	08
Chapter 4	Mole Concept, Stoichiometric and Numerical, Oxidation- reduction	12

**Term - II**

Chapter 4	Atomic Structure	12
Chapter 5	Chemical Thermodynamics	12
Chapter 6	Chemical Bonding	12

## Chemistry Paper - II

### Organic and Inorganic Chemistry

#### Term - I

Chapter 1	Chemical Bonding in Organic Molecules	12
Chapter 2	Chemistry of Hydrocarbons	12
Chapter 3	Chemistry of s-block elements	12

#### Term - II

Chapter 4	Chemistry of Functional Groups	12
Chapter 5	Stereochemistry	12
Chapter 6	Chemistry of p-block elements	12

## **Chemistry Paper - III**

### **Practical Course**

1. Physical Chemistry : 7 experiments
2. Inorganic Chemistry: 7 experiments
3. Organic Chemistry : 7 experiments

# PAPER - I: PHYSICAL & INORGANIC CHEMISTRY

## TERM - I

### Chapter 1: States of Matter

(08)

**Introduction:** States of matter and their properties.

**Gaseous states:** Significance of ideal and kinetic gas equation (no derivation), Real gases- Compressibility factor, van der Waal's equation of state, Isotherms of CO<sub>2</sub>, critical constants, correlation between critical constants and van der Waal's constants.

**Liquid state** – Properties of liquids , Comparison between gaseous and solid state – Experimental determination of vapor pressure by isoteniscope method and viscosity by Ostwald method, liquid crystals and their applications.

#### Aims & Objectives:

- I) This topic makes understanding of behavior of gases, ideal gas as a model system and its extension to real gases. The dependence of physical state on pressure, volume and temperature is being realized.
- II) The existence of liquid state, comparison of its properties with other states is to be perceived. Liquid crystal are essentials in all common and research devices and instruments hence they are introduced briefly.
- III) Student should be able to solve problems regarding van der Waal's and Critical constant and regarding P-V-T relations.
- IV)

### Chapter 2: Surface Chemistry

(08)

**Adsorption:** Types of adsorption, adsorption isotherms, Freundlich isotherm, Langmuir isotherm, adsorption of gases on solids, adsorption of solutes on solids, applications of adsorption,

**Catalysis :** Phenomena of catalysis, types of catalysis-homogeneous and heterogeneous catalysis, gaseous reactions on solid surfaces.

**Colloids:** Definition and classification, preparation of emulsions, gels and sols, properties of suspensions.

Aims & Objectives:

Theoretical basis of adsorption phenomena is integrated. Understanding dynamic nature of surface and its applications in catalysis and in dispersed phases will lead to new area of nanoscience.

### Chapter 3: Chemical Mathematics

(08)

**Functions and variables:** Variables as function , variables used in chemistry

**Derivative:** Rules of differentiation, examples on derivatives of algebraic, logarithmic and exponential functions, partial differentiation, conditions for maxima and minima, problems related to chemistry,

**Integration:** Rules of integration (algebraic, exponential and logarithmic functions), Integration –definite and indefinite, problems related to chemistry.

**Graph:** Plotting graphs of linear, exponential and logarithmic functions and their characteristics, sketching of s and p orbitals.

Aims & Objectives:

Mathematical background required for derivations, depictions and problem solving. This chapter strengthens these aspects.

#### **Chapter 4: Mole Concept and Oxidation-reduction**

**(12)**

Mole concept-Determination of mol. Weight by gram molecular volume relationship, problems based on mole concept. Methods of expressing concentrations, strength, normality, molarity, molality, %w/v, %v/v, ppm, standardization of solutions, primary & secondary standard substances, Preparation of standard solution of acids & bases, problems related to acid base titrations only.

Oxidation & reduction-Definitions to related terms like oxidation, reduction, oxidizing agent, reducing agent, oxidation number, Balancing of redox reactions using oxidation number method & ion electron method, problems based one equivalent weight of oxidant & reductants.

**Ref: 8, 9, 10 & 11**

**Aims and objectives-**

Students should know

- 1) Mole concept
- 2) GMV relationship
- 3) Student should be able to solve problems based on GMV relationship.
- 4) Normality, Molarity, Normal solution, Molar solution, equivalent weight, ppm, %w/v, %v/v & related problems.
- 5) Standard solution, primary & secondary standard substances, standerdisation of solution & related problems.
- 6) Understand the concept of oxidation & reduction, oxidizing agent, reducing agent, redox reaction, oxidation number, Balance the equation by ion electron method & oxidation number method.
- 8) Calculation of Equivalent weight of oxidant & reductant.

## Term - II

### Chapter 4: Atomic Structure

(12)

Introduction, atomic spectrum of hydrogen, Bohr model of hydrogen atom-derivation of atomic radius and energy, energy level diagram of hydrogen atom, Failure of Classical mechanics- black body radiation, photoelectric effect, electron diffraction, atomic spectra, quantization of energy, de Broglie's hypothesis, Heisenberg's uncertainty principle (without proof), wave equation, time independent Schrödinger equation, hydrogen atom (expressions only), wave functions for s and p atomic orbitals,

#### Aims & Objective

Atom being most important micro particle in construction of matter, modern developments of its structure is presented. The quantization of energy and duality of matter in this context is elaborated. Schrodinger equation is the basis of quantum chemistry that has been introduced for simplest system hydrogen atom.

### Chapter 5: Chemical Thermodynamics

(12)

Introduction, first law of thermodynamics and its limitations, Carnot cycle and efficiency, Entropy and second law of thermodynamics, entropy as a state function, Entropy change in isolated system, reversible and irreversible process, entropy change in ideal gases – isothermal, isobaric, isochoric processes, entropy change in physical transitions, entropy change in chemical reactions, statistical definition of entropy, absolute entropy, third law of thermodynamics

#### Aims & Objectives:

Natural changes are understood with the help of second and third laws of thermodynamics. These laws are presented with the help of state function entropy. Entropy changes in various processes and under various conditions have been discussed.

### Chemical bonding

(12)

Attainment of stable configuration, Types of bonds ionic, covalent, co-ordinate & metallic, Types of overlaps: s-s, p-p, s-p, p-d, d-d and their examples, Formation of sigma & pi bonds, Theories of bonding- a) valence bond theory, b) Heitler London theory and c) Pauling Slater theory, Concept of hybridization: Definition & need of hybridization, steps involved in hybridization: explanation of covalency of atoms in the moles based on hybridization, types of hybridization involving s, p, & d orbitals.

Applications of hybridization geometries of molecules like

- i)  $\text{BeH}_2$     ii)  $\text{BF}_3$     iii)  $[\text{MnCl}_4]^{2-}$     iv)  $[\text{Ni}(\text{CN})_4]^{2-}$     v)  $\text{Fe}(\text{CO})_5$   
vi)  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$     vii)  $\text{IF}_7$

VSEPR theory: Assumptions, need of theory, application of theory to explain geometry of irregular molecules

i)  $\text{ClF}_3$  ii)  $\text{Cl}_2\text{O}$  iii)  $\text{BrF}_5$  iii)  $\text{TeCl}_4$  iv)  $\text{XeO}_3$  v)  $\text{XeOF}_4$

**Ref. 12, 13, 14 & 15**

**Aims and objectives:**

**Student should understand:**

1. Basic principle of overlapping of atomic orbital with specific shapes and sizes
2. Fundamental concepts of theories of overlapping of atomic orbitals
3. Concept of hybridization and differentiation with overlap
4. Concept of different types valence shell electron pairs and their contribution in bonding
5. Application of non-bonded lone pairs in shape of molecule
6. Basic understanding of geometry and effect of lone pairs with examples

#### **References books for Physical Chemistry**

1. Physical Chemistry-P.W. Atkins ELBS, 5<sup>th</sup> edition
2. Principles of Physical Chemistry By S. H. Maron and C. F. Prutton ,4<sup>th</sup> edition
3. Physical Chemistry by S. Glasstone.
4. Physical Chemistry – Silbey Alberty, Bawendi, Wielely India .
5. Quantum Chemistry – I. Levine, Fifth edition, Prentice Hall-1999
6. Essentials of Physical Chemistry – Bahl, Tuli., S. Chand and Company Ltd.
7. Physical Chemistry of Surfaces – A. W. Adamson, John Wiley and sons , 5<sup>th</sup> edition.
8. Mathematical preparation of Physical Chemistry by F. Daniel, Mc Graw Hill Publication



## PAPER - II: ORGANIC & INORGANIC CHEMISTRY

### TERM - I

#### Chapter 1: Chemical Bonding, structure and reactivity of Organic Molecules (14)

Covalent bond, Hybridization -  $sp$ ,  $sp^2$  and  $sp^3$  hybridization, Bond length, Bond angle, Bond energy, Inter and Intra molecular forces and their effects, Drawing organic molecules, zig-zag structures, Lewis structure and formal charge, Arrow pushing concept, Structural effects - Inductive effect, Steric effect, Resonance effect, Hyper-conjugation, Tautomerism, Applications of structural effects - Strength of acids and bases,  $pK_a$  and  $pK_b$  values of common organic acids and bases.

#### Ref. 1, 2, 3 & 4

Covalent bond, Hybridization -  $sp$ ,  $sp^2$  and  $sp^3$  hybridization, Bond length, Bond angle, Bond energy, Inter and Intra molecular forces and their effects

#### Ref. 2: Pages 9 - 17, 20 - 29

Drawing organic molecules, zig-zag structures, Lewis structure and formal charge

#### Ref. 1: Pages 31 - 36, 116 - 127

Arrow pushing concept, Structural effects - Inductive effect, Steric effect, Resonance effect, Hyper-conjugation, Tautomerism, Applications of structural effects - Strength of acids and bases,  $pK_a$  and  $pK_b$  values of common organic acids and bases

#### Ref. 1: Relevant Pages between 181 - 201

#### Ref. 2: Pages 33 - 35, 200, 406 - 407

#### Ref. 3: Pages 20 - 28

#### Aims and Objectives:-

The student is expected to know:

1. The fundamental concepts which govern the structure, bonding, properties and reactivities of organic molecules such as covalent character, hybridization, bond angles, bond energies, bond polarities and shapes of molecules.
2. Drawing of organic molecules and arrow pushing concept.
3. Acid-base theories,  $pK_a$  /  $pK_b$  values for common organic acids and bases and factors affecting strength of acids and bases.
4. Structural effects and their applications in determining strength of acids and bases.

#### Chapter 2: Chemistry of Hydrocarbons (10)

Introduction, Nomenclature, Physical properties, General methods for preparation, Chemical reactions of-Alkanes, alkenes, alkynes and introduction to homocyclic and polycyclic aromatic hydrocarbons (benzene, naphthalene, anthracene), Huckel's rule of aromaticity.

#### Ref. 1, 2, 3 & 4

Alkanes - Introduction, Nomenclature, Physical properties, Preparations, Reactions of alkanes, Analysis of Alkanes

**Ref. 2: Sec. 2.1 – 2.3, Sec. 3.6 – 3.12, Sec. 3.15 – 3.17, Sec. 3.18, 3.19, 3.30, 3.32, Sec. 3.34**

**Pages: 39 – 41, 86 – 94, 97 – 106, 118, 120, 122**

Alkenes - Introduction, higher alkenes, Nomenclature, Physical properties, Preparations, Reactions of alkenes, Analysis of Alkenes

**Ref. 2: Sec. 8.7 to 8.9, 8.11 to 8.13, Sec. 9.1, 9.2, 9.27**

**Pages: 282 – 285, 287 – 293, 309, 317 – 323, 360 - 362**

Dienes - Structure & Properties, Conjugated dienes, Reactions of dienes, Analysis of dienes

**Ref. 2: Sec. 11.17, 11.19, 11.21, 11.22, 11.26**

**Pages: 409 – 417, 421, 422**

Alkynes: Introduction, Nomenclature, Physical properties, Preparation, Reactions & analysis of alkynes

**Ref. 2: Sec. 12.1 - 12.8, 12.14**

**Pages: 425 – 434, 440**

Introduction to homocyclic and polycyclic aromatic hydrocarbons (benzene, naphthalene, anthracene), Huckel's rule of aromaticity, Reactions of benzene, Naphthalene and Anthracene – Sulphonation, Nitration, Halogenation, Friedle Craft reactions

**Ref. 2: Sec. 14.1 - 14.5, 14.10, 14.11, 14.12, Relevant pages from 15.1 – 15.21**

**Pages: 493 – 499, 504, 508 – 511, Relevant pages from 517 - 546**

**Aims and Objectives:-**

The student is expected to know

1. The common and IUPAC names of alkanes, alkenes, alkynes and homocyclic, polycyclic aromatic hydrocarbons.
2. Methods of preparation and chemical reactions of alkanes, alkenes, alkynes and homocyclic, polycyclic aromatic hydrocarbons.
3. Application of Huckel's rule to different organic compounds to find out aromatic /non aromatic characters.
- 4.

### **Chapter 3: Chemistry of s-block Elements**

**(12)**

Recapitulation of periodic table, special position of hydrogen in the long form of the periodic table, properties of s-block elements w.r.t. electronic configuration, extraction, trends and properties, Introduction to crown ethers and cryptans, separation of s-block elements using crown ethers, Compounds of s-block elements: oxides, hydroxides, peroxides, superoxides, Application of s-block elements in industrial, biological and agricultural fields.

**Ref. 6 & 9**

**Aims and objectives:**

Student should learn

1. Skeleton of long form of periodic table
2. Quantum numbers
3. Shells, sub-shells, types of orbital and their shapes
4. Aufbau, Paulin's exclusion principle and Hund's rule
5. Block, group, periodic law and periodicity
6. Name, symbol, electronic configuration, trends and properties
7. Crown ether and cryptands
8. Separation of s-block elements with crown ethers
9. Compounds of s-block elements: oxides, hydroxides, peroxides and superoxides
10. Application of s-block elements: Industrial, biological and agricultural field

## TERM - II

### Chapter 4: Chemistry of functional groups

(14)

Introduction, Nomenclature, Physical properties, General methods for preparation, Chemical reactions of: Alkyl halides, alcohols, phenols, ethers, aldehydes, ketones, carboxylic acids, amines.

#### Ref. 1, 2, 3 & 4

Alkyl halides: Introduction, Nomenclature, Physical properties, General methods for preparation, Chemical reactions, Analysis of alkyl halides

#### Ref. 2: 5.3 – 5.7, 5.24

#### Pages: 167 – 174, 211

Alcohols: Introduction, Nomenclature, Physical properties, General methods for preparation, Chemical reactions, Analysis of alcohols

#### Ref. 2: 6.1 – 6.5, 6.10, 6.11, 6.22

#### Pages: 211 – 218, 222 – 226, 243 – 244

Ethers: Introduction, Nomenclature, Physical properties, General methods for preparation, Chemical reactions, Analysis of ethers

#### Ref. 2: 6.16 – 6.21, 6.23

#### Pages: 237 – 242, 244 - 245

Aldehydes and ketones: Introduction, Nomenclature, Physical properties, General methods for preparation, Chemical reactions, Analysis of aldehydes and ketones

#### Ref. 2: 18.1 – 18.7, 18.20

#### Pages: 657 – 675, 697

Carboxylic acids: Introduction, Nomenclature, Physical properties, General methods for preparation, Chemical reactions, Analysis of carboxylic acids

**Ref. 2: 19.1 – 19.4, 19.6, 19.9, 19.21**

**Pages: 713 – 722, 725 – 728, 744 - 745**

Amines: Introduction, Nomenclature, Physical properties, General methods for preparation, Chemical reactions, Analysis of amines

**Ref. 2: 22.1 – 22.5, 22.8, 23.1 – 23.3, 23.12, 23.19**

**Pages: 821 – 825, 828 – 830, 845 – 849, 866 – 869, 876 - 877**

Phenols: Introduction, Nomenclature, Physical properties, General methods for preparation, Chemical reactions, Analysis of phenols

**Ref. 2: 24.1 – 24.3, 24.7, 24.8, 24.16**

**Pages: 889 – 893, 898 – 902, 912**

**Aims and Objectives:-**

The student is expected to know

1. Structure, nomenclature, preparation and reactions of organic compounds.
2. The characteristic reactions of each functional group which can be used to identify and distinguish that compound from other compounds.
3. Predict the conversion of one functional group into other functional group involving one or more number of steps.
4. Conversion of the given compound into other compound containing more or less number of carbon atoms.
5. Prediction of possible products when reactants are given. In case there are more than one possible products, identify the major and minor products.
6. Suggest the possible reagents to bring about the given conversion.

## **Chapter 5: Stereochemistry**

**(10)**

Concept of isomerism, types of isomers, representation of organic molecules (Projection formulae), conformational isomerism in alkanes (Ethane, propane and n-butane) with energy profile diagrams, Geometrical isomerism - Definition, conditions for geometrical isomers, physical and chemical properties, E/Z nomenclature of geometrical isomers, Optical isomers – Isomer number and tetrahedral carbon atom, chirality, optical isomerism with one asymmetric carbon atom, specific rotation, enantiomerism, R/S nomenclature

**Ref. 1, 2, 3, 4, 11 and 12**

**Ref. 2: Relevant pages from Sec. 3.2 – 3.5, Sec.4.1 – 4.20, Sec. 8.6**

**Ref. 4: Relevant pages from Sec. 12.1 – 12.2 (Pages 318 – 321)**

**Ref. 11: Relevant pages from Sec. 1.1 – 1.3, 1.5 – 1.6, 1.8, 1.10 (Pages 1 – 51)**

**Aims and Objectives:-**

The student is expected to know

1. Concept of isomerism, types of isomers and representation of organic molecules.
2. Conformational isomerism in alkanes with energy profile diagram.
3. Concept of geometrical isomerism with E/Z nomenclature.
4. Understanding of optical activity, isomer number, tetrahedral carbon atom, concept of chirality, enantiomerism, R/S nomenclature for single chiral centre.

**Ref. 1, 2, 3 & 4**

**Chapter 6: Chemistry of p-block elements**

**(12)**

Position of elements in periodic table, electronic configuration of elements trends in properties like atomic size, ionization potential, electronegativity, electron affinity, reactivity, oxidation states, anomalous behaviour of first member of each group.

**Structure and properties of:**

1. Borate
2. Halides of aluminum
3. Allotropes of carbon
4. Classification of silicates
5. Oxyacids of phosphorous and sulphur
6. Inter-halogen compounds

**Ref. 6 – 359 to 633 (relevant pages)**

A student know

- i) To write electronic configuration of any element.
- ii) To give reasons for anomalous behavior of first element of IIIA to VII A groups with other elements in the same group.
- iii) To know the exact position p-block elements in the long form of the periodic table.
- iv) To know the allotropes of carbon.
- v) Basic compounds of boron, aluminum, silicon
- vi) Concept of oxyanions, different than mineral acids, oxyacids of phosphorous & sulphur
- vii) Overlapping of atomic orbitals of halogens, interhalogen compounds

**References**

1. Organic Chemistry-Clayden, Oxford Uni. Press

2. Organic Chemistry-Morrison and Boyd, 6<sup>th</sup> Edn.
3. A guide book to Mechanism in Organic Chemistry-Peter Syke, 6<sup>th</sup> Edn.
4. Stereochemistry of Organic Compounds-Eliel Tata Mc Graw Hill 1989
5. Principles of Physical Chemistry by S.H. Marron & C.F. Pruton, 4<sup>th</sup> Edn.
6. Concise Inorganic Chemistry-J.D. Lee, 2<sup>nd</sup> Edition-Relevant pages.
7. Concept & model of Inorganic Chemistry-Douglas Mc Doniels, 3<sup>rd</sup> Edn.
8. New guide to Modern Valance Theory-G.I. Brown, 3<sup>rd</sup> Edn.
9. Inorganic Chemistry-James Hughey
10. General Chemistry - Raymand Chang

**F.Y.B. Sc.****Chemistry Paper - III****Practical Course**

- |                         |               |
|-------------------------|---------------|
| 1. Physical Chemistry : | 7 experiments |
| 2. Inorganic Chemistry: | 7 experiments |
| 3. Organic Chemistry :  | 7 experiments |

**Physical Chemistry (minimum 7 experiments)**

1. A) Preparation of lyophobic and lyophilic sols, B) purification of prepared sols by hydrolysis
2. To study the role of emulsifying agents in stabilizing the emulsion of different oils
3. Sketch the polar plots of s and p orbitals.
4. Plot the graph of following functions using excel a) exponential function b) logarithmic function c) linear functions
5. To determine the gas constant R in different units by eudiometer method.
6. To determine relative viscosity of given organic liquids by viscometer. ( four liquids)
7. Investigate the adsorption of acetic acid by activated charcoal and test the validity of Freundlich /Langmuir adsorption isotherm.
8. To determine  $\Delta H$  and  $\Delta S$  for the following chemical reactions
  - i)  $\text{Zn(s)} + \text{CuSO}_4 \text{ (aq)} \rightarrow \text{Cu(s)} + \text{ZnSO}_4 \text{ (aq)}$
  - ii)  $3\text{Mg(s)} + 2\text{FeCl}_3 \text{ (aq)} \rightarrow 2\text{Fe(s)} + 3\text{MgCl}_2 \text{ (aq)}$

**Inorganic Chemistry (minimum 7 experiments)****A. Compulsory experiments**

9. Determination of hardness of water from a given sample of water by EDTA method.
10. Analysis of alkali mixture by volumetric method.

**B. Any Three Inorganic qualitative analyses without phosphate and borate removal.**

- 11) Mixture-1 (water soluble)
- 12) Mixture-2 (water insoluble)
- 13) Mixture-3 (water insoluble)

**C-Any one of the following**

- 14) To standardize NaOH solution & hence find the strength of given HCl solution.

15) To standardize  $\text{KMnO}_4$  soln. & hence find strength of the given solution

**D Any One** of the following:

16) Estimation of % purity of a given sample of sodium chloride.

17) Analysis of brass

**Organic Chemistry (Minimum 7 experiments)**

18. Techniques (**any two**) - To be carried out on micro-scale

- i. Thin layer chromatography
- ii. Crystallization with M.P. and % yield of purified compound
- iii. Distillation with B.P. and % yield of purified compound
- iv. Sublimation with M.P. and % yield of purified compound

19. Estimations (**any one**)

- i. To determine amount of acetic acid in commercial vinegar
- ii. To determine amount of aspirin in APC tablets

20. Organic qualitative analysis of single organic compound at least one belonging from each type (**any four**)

Type, Preliminary tests, elements, functional group, physical constants

- a. Benzoic acid, Salicylic acid, Cinnamic acid, Phthalic acid, oxalic acid
  - b.  $\beta$ -Naphthol,  $\alpha$ -naphthol
  - c. Aniline, N,N-Dimethyl aniline
  - d. Naphthalene, Thiourea, Urea, m-Dinitrobenzene, chloroform, ethyl methyl ketone, ethyl acetate, chlorobenzene
-



### Pattern for F.Y.B.Sc. Practical Examination

Sr. No.	Experiment	Marks
1	Physical chemistry OR Inorganic Volumetric OR Organic Estimation	35
2	Inorganic Qualitative Analysis OR Organic Qualitative Analysis and Technique	35
3	Oral	10
4	Internal marks for Journal and Oral	20

**Note:-**

1. At the time of Practical examination in a batch 50 % students must be given Physical Experiments.
3. For Organic Qualitative Analysis 20 marks & for technique 15 marks.
4. For Volumetric Analysis students must prepare standard solutions.
5. External printed material or practical book/ text book is allowed during the practical examination.

## UNIVERSITY OF PUNE

### REVISED SYLLABUS FOR S.Y. B.Sc. CHEMISTRY FROM 2014-2015

(According to Semester system 2014-2015)

**Course structure:** There will be four theory papers of 50 Marks each, (40 marks external + 10 marks internal) and one practical course of 100 marks. (80 marks External + 20 marks Internal). The examination will be held semester-wise for theory papers whereas the examination for practical course CH-223 will be held at the end of **SEMETER-II**

SEMESTER	PAPER	COURSE TITLE	MARKS
I	CH-211	PHYSICAL & ANALYTICAL CHEMISTRY	50
I	CH-212	ORGANIC & INORGANIC CHEMISTRY	50
II	CH-221	PHYSICAL & ANALYTICAL CHEMISTRY	50
II	CH-222	ORGANIC & INORGANIC CHEMISTRY	50

#### Practical Course in Chemistry: CH-223 - 100 Marks

#### Equivalence of Previous Syllabus:

Semester	Old Course (2009-10)	New Course (2014-15)
I	CH-211 : Physical Chemistry	CH-211 : Physical & Analytical Chemistry
I	CH-212 : Organic Chemistry	CH-212 : Organic & Inorganic Chemistry
II	CH-221 : Inorganic Chemistry	CH-222 : Organic & Inorganic Chemistry
II	CH-222 : Analytical Chemistry	CH-221 : Physical & Analytical Chemistry
	CH- 223: Practical	CH- 223: Practical

## **S. Y. B. Sc. (Chemistry) Syllabus**

### **Semester - I**

**Paper 1: CH-211: Physical and Analytical Chemistry**

**Paper 2: CH-212: Organic and Inorganic Chemistry**

### **Semester - II**

**Paper 3: CH-221: Physical and Analytical Chemistry**

**Paper 4: CH-222: Organic and Inorganic Chemistry**

**Practical Course in Chemistry CH-223 (To be conducted**

**during both semesters)**

# SEMESTER – I

## Paper 1: CH-211

### Section – I

#### Physical Chemistry

#### Chapter 1: Elementary Chemical Kinetics [10]

Introduction to Chemical kinetics, molecularity and order of reaction, reaction rates, rate laws, rate constant and its significance, Integrated rate law expression and its characteristics—first order, second order (single reactant, two reactants involved), examples of 1<sup>st</sup> and 2<sup>nd</sup> order reaction, pseudomolecular reactions, factors affecting rate of reaction, measurement of rate of reaction, numericals.

**Aim:** To introduce concept of kinetics at undergraduate level.

**Objectives:** Student should learn

- i. Concept of kinetics, terms used, rate laws, types of order
- ii. Discuss examples of first order and second order reaction
- iii. Pseudo molecular reactions
- iv. Factors affecting on rate of reaction
- v. Techniques of measurement of rate of reaction
- vi. To solve problems

#### Chapter 2: Photochemistry [10]

Introduction, thermal reactions and photochemical reactions, laws of photochemistry, quantum yield, measurement of quantum yield, types of photochemical reactions—photosynthesis, photolysis, photocatalysis, photosensitization, photophysical process—fluorescence, phosphorescence, quenching, chemiluminiscence, numericals.

**Aim:** To impart basic knowledge of photochemistry and its applications

**Objectives:** After studying the chapter student should be able to

- i. Know about photochemistry
- ii. Understand difference between thermal and photochemical reactions
- iii. Understand laws of photochemistry
- iv. Learn what is quantum yield and its measurement
- v. Know Types of photochemical reactions and photophysical process
- vi. Know about quenching and chemiluminence
- vii. To solve numericals

### **Chapter 3: Distribution law**

[04]

Nernst distribution law, Statement and thermodynamic proof for Nernst distribution law, association and dissociation of solute in solvent, application of distribution law, Numericals.

**Aim: To understand Nernst Distribution Law and its applications**

**Objectives:** Students should learn

- i. Concept of distribution of solute amongst pair of immiscible solvents
- ii. Distribution law and its thermodynamic proof
- iii. Distribution law and nature of solute in solution state
- iv. Application – Solvent extraction
- v. To solve numericals

Ref.1: Page no. 298 to 302 and 775-800

## **Section – II**

### **Analytical Chemistry**

#### **Chapter 4: Introduction to Analytical Chemistry**

[3]

Introduction, Chemical analysis, applications of chemical analysis, sampling, types of analysis, Common techniques, Instrumental methods, other techniques, factors affecting on choice of method

**Aim:** To introduce basics of analytical chemistry

**Objectives:** Students should learn

- i. What is Analytical Chemistry
- ii. Chemical analysis and its applications
- iii. Sampling
- iv. Common techniques
- v. Instrumental methods and other techniques
- vi. Choice of method

Ref: Vogel chapter 1 (Page 1 - 11) up to section 1.9 except use of literature.

#### **Chapter 5: Errors in Quantitative Analysis**

[5]

Introduction, Error, Accuracy, precision, methods of expressing accuracy and precision, classification of errors, significant figures and computations, distribution of random errors, mean and standard deviations, reliability of results, Numericals.

**Aim:** To understand errors and its interpretation

**Objectives:** Students should learn

- i. Meaning of error and terms related to expression & estimation of errors
- ii. Methods of expressing accuracy and precision
- iii. Classification of errors
- iv. Significant figures and computations
- v. Distribution of errors
- vi. Mean and standard deviations
- vii. Reliability of results

Ref: Vogel, 5<sup>th</sup> edn chapter 4 (127-137 up to section 4.10) extended up to 4.13

### **Chapter 6: Inorganic Qualitative Analysis [8]**

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.

**Aim:** To study the theory underlying Inorganic Qualitative analysis

**Objectives:** A student should know

- i. Basic principles in qualitative analysis
- ii. Meaning of common ion effect
- iii. Role of common ion effect and solubility product
- iv. Different groups for basic radicals
- v. Group reagent and precipitating agents
- vi. Interfering anions and its removal
- vii. Separation for basic radicals
- vii. Method of detection of acidic radicals

### **Chapter 7: Analysis of Organic Compounds (Qualitative & Quantitative) [8]**

#### **I. Qualitative**

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

#### **II Quantitative**

B. Analysis–estimation of C, H, (O) by combustion tube, detection of nitrogen, sulfur, halogen and phosphorous by Lassigen's test.

C. Estimation of nitrogen by Dumas's Kjeldahl's method, estimation of halogen, sulphur and phosphate by Carious method.

D. Determination of empirical and molecular formula, numerical problems.

**Aim:** To disseminate knowledge of qualitative & quantitative analysis of organic compounds

**Objectives:** A student should know-

- i. Classification of compounds with different functional groups
- ii. Different tests for detection of elements like C, H, (O), N, S & P.
- iii. Characteristic tests for different functional groups
- iv. Different colour tests and the reactions
- v. Quantitative analysis of C, H by Liebig's method
- vi. Kjeldahl's method with example
- vii. Carius tube method with example
- vii. Empirical and molecular formula
- vii. To solve numericals.

**Name of the reference book:**

1. Analytical Chemistry by G.D. Christian, sixth edition. Pages: 1-10
2. Vogel's textbook of Quantitative Analysis, sixth edition  
J. Mendham, R.C. Denney, J.D. Barnes, MJK Thomas
3. A textbook of macro & semi micro qualitative analysis by  
A.J. Vogel, fifth edition
4. Quantitative Organic Analysis, fourth edition, A.J. Vogel, ELBS

**Paper 2: CH-212**  
**Section – I**  
**Organic Chemistry**

**Chapter 1: Stereoisomerism** **[12]**

Introduction to optical isomerism: Chirality, optical activity and polarimetry, enantiomers, absolute configuration, R/S system nomenclature with wedge and Fischer representation of two chiral centres, erythro, threo, meso-diastereomers with R/S configuration. Stereoisomerism Baeyer's strain theory, heat of combustion, cycloalkanes, factors affecting the stability of conformation, Conformation of cyclohexane - equatorial and axial bonds, Monosubstituted cyclohexane stability with  $-\text{CH}_3$  and  $-\text{C}(\text{CH}_3)_3$  substituents. Structures of geometrical isomers of dimethylcyclohexane only.

Ref. 3

Aims and Objectives

Students should be able to –

- i) Identify chiral center in the given organic compounds.
- ii) Define Erythro, threo, meso, diastereoisomers with suitable examples.
- iii) Able to find R/S configuration in compounds containing two chiral centers.
- iv) Explain Bayer's strain theory, Heat of combustion and relates stability of cycloalkanes.
- v) Explain the stability of cyclohexanes.
- vi) Draw the structure of boat and chair configuration of cyclohexane.
- vii) Draw axial and equatorial bonds in cyclohexane.
- viii) Draw structure of conformations of mono- & disubstituted cyclohexanes
- ix) Explain the stability of axial and equatorial conformation of monosubstituted cyclohexanes.

**Chapter 2: Organic reaction Mechanism** **[12]**

Introduction, types of reagents—electrophile, nucleophile and free radical.

Types of organic reactions: Addition, Elimination ( $\beta$ -elimination and Hofmann elimination), substitution (aliphatic electrophilic and nucleophilic, aromatic electrophilic) and rearrangement.

Mechanism: (i) Aldol condensation (ii) Markovnikov and anti-Markovnikov addition reaction (iii) Saytzeff and Hoffmann elimination (iv)  $\text{S}_\text{N}^1$  and  $\text{S}_\text{N}^2$  reactions (v) Hofmann rearrangement.

Ref. 1 & 4



## Aims and Objectives

Students should be able to –

- i) Define and classify heterocyclic compounds.
- ii) Use Huckel rule to predict aromaticity.
- iii) Suggest synthetic route for preparation of various heterocyclic compounds.
- iv) Write and complete various reactions of heterocyclic compounds.
- v) Predict products.

### Reference Books:

Ref. 1: Organic Chemistry-6h Ed. Morrison and Boyd Prentice Hall of India Pvt Ltd, New Delhi-2001.

Ref. 2: Outline of Biochemistry 5h Ed., Conn, Stumpf Bruening and Roy Doi John Wiley 1987.

Ref. 3: Stereochemistry of carbon compounds - E. L. Eliel

Ref. 4: Reactions, rearrangements and reagents – S N Sanyal

## Section – II Inorganic Chemistry

### Chapter 3: General Principles of Metallurgy: [6]

Introduction, occurrence of metals, ores and minerals, types of ores, operations involved in metallurgy, crushing, connotation, various methods of concentration such as hand picking, gravity separation, magnetic separation. Froth flotation, Calcinations, Roasting etc. Reduction, various methods of reduction such as smelting, Aluminothermic process and electrolytic reduction, Refining of metals, various methods of refining such as poling, liquation, electrolytic and vapour phase refining (Van Arkel Process).

Aims: To study principles and process of metallurgy.

Objectives: A student should be able -

- i) To differentiate between ore and minerals.
- ii) To differentiate between calcination and roasting and smelting.
- iii) To know the different methods for separation of gangue or matrix from metallic compounds.
- iv) To know the terms smelting, flux.

### References:

i) Advanced Inorganic Chemistry, Satyaprakash, Tuli, Basu, pages 262-271.

ii) Text book of Inorganic Chemistry, P.L. Soni, pages 2.3-2.8, 2.13-2.17.

**Chapter 4: Metallurgy of Aluminium (Electrometallurgy):** [4]

Occurrence, Physiochemical principles, Extraction of Aluminium, Purification of bauxite by Baeyer's process, Electrolysis of alumina, application of aluminum and its alloys.

Aims: To study metallurgy of Aluminium.

Objectives: A student should be able -

i) To know physico-chemical principles involved in electrometallurgy.

ii) To understand electrolysis of alumina and its refining.

iii) To explain the uses of Aluminum and its alloys.

iv) To know purification of bauxite ore.

**References:**

i) Advanced Inorganic Chemistry, Satyaprakash, Tuli, Basu pages 458-463.

ii) Text book of Inorganic Chemistry, P.L. Soni pages 2.209 to 2.211

**Chapter 5: Metallurgy of Iron and Steel (Pyrometallurgy)** [8]

Occurrence, concentration, calcination, smelting physio-chemical principles, reactions in the blast furnace, wrought iron, manufacture of steel by Bessemer and L.D. process, its composition and applications.

Aims: To study metallurgy of Iron.

Objectives: A student should be able -

i) To explain the term pyrometallurgy and to explain the physico chemical principles involved in the reduction process by carbon monoxide.

ii) To know different reactions in the blast furnace.

iii) To differentiate between properties of pig iron and wrought iron.

iv) To explain the basic principles of different methods for preparation of steel.

v) To explain the merits and demerits of different methods.

**Reference:**

i) Advanced Inorganic Chemistry, Satyaprakash, Tuli, Basu pages 830-849.

**Chapter 6: Corrosion and Passivity:** [6]

**(a) Corrosion :** Definition of corrosion, Types of corrosion, Atmospheric, Immersed, Mechanism of electrochemical corrosion, Factors affecting corrosion - position of metal in E. C. S., purity effect of moisture, effect of oxygen, pH, physical state of metal, methods of protection of metal from corrosion- alloy formation, making metal cathodic, controlling

external condition. Coating-galvanising, Tinning, electroplating, metal cladding, organic coating.

**(b) Passivity :** Definition, Theories of passivity - (i) Oxide film theory (ii) Gaseous film theory (iii) Physical film theory, Valence theory, Catalytic theory, Allotropic theory, Electrochemical passivity.

A student should know -

- i) Definition of corrosion.
- ii) Types of corrosion.
- iii) Mechanism of corrosion.
- iv) Factors affecting corrosion.
- v) Methods of prevention of metal from corrosion.
- vi) Meaning of passivity.
- vii) Different theories of passivity.
- viii) Galvanising, Tinning, Electroplating from corrosion.

**Reference:**

- i) Introduction to Electrochemistry by S. Glasstone, 2nd Ed. pages 491-503.

## SEMESTER – II

### Paper 3: CH-221

#### Section – I

#### Physical Chemistry

##### Chapter 1: Free Energy and Equilibrium [12]

Introduction, Helmholtz free energy, variation of Helmholtz free energy with volume and temperature, Helmholtz free change energy for chemical reaction, Gibb's free energy, Variation of Gibb's free energy with pressure and temperature, Gibb's free energy change for chemical reaction, Free energy change for physical transitions, Free energy change for an ideal gas; standard free energy change, Gibb's-Helmholtz equation, Properties and significance of Gibb's free change, Van't Hoff reaction isotherm, thermodynamic equilibrium constants, Relation between  $K_p$  and  $K_c$  for gaseous reactions, variation of equilibrium constant with temperature, Criteria for chemical equilibrium, Physical equilibrium, Clapeyron equation, Clausius–Clapeyron equation, Application of Clausius–Clapeyron equation, numericals.

**Aim:** To conceptualize phenomenon of free energy and equilibria.

**Objectives:** The student should able to know

- i. Free energy concepts, types and its variation
- ii. Free energy change for chemical reaction and physical transition
- iii. Free energy change for ideal gases
- iv. Gibb's Helmholtz equations and its properties & significance
- v. van't Hoff reaction isotherm and thermodynamic equilibrium constants,
- vi. Chemical and physical equilibrium
- vii. Clausius –Clapeyron equation and its applications
- viii. To solve numericals.

Ref. 1: Page no. 189 to 200, 206

Ref. 2: Relevant pages.

##### Chapter 2: Solutions of Liquids in Liquids [12]

Types of solutions, Ideal solutions, Raoult's law, ideal and non ideal solutions, Henry's law, Application of Henry's law with example  $CS_2$  in acetone, problems based on Raoult's law and Henry's law, vapor pressure–composition diagram of ideal and non ideal solution, temperature composition diagram of miscible binary solutions, distillation from temperature–composition diagram, Azeotropes, Partially immiscible liquids.

**Aim: To distinguish behavior of liquid phase solutions.**

**Objectives:** The student should to know

- i. Ideal and non ideal solutions and laws governing these solutions
- ii. Interpretation of vapor pressure–composition diagram
- iii. Interpretation of temperature composition diagram.
- iv. Distillation from temperature – composition diagram,
- v. Azeotropes
- vi. Partially immiscible liquids.
- vii. To solve numericals

Ref.2: Pages 229 to 247, 254 to 258

**Reference books:**

1. Principles of Physical Chemistry by S.H. Maron & C. Prutton 4<sup>th</sup> edition.
2. Physical Chemistry by W.J. Moore 5<sup>th</sup> edition.
3. Physical Chemistry by P.W. Atkins 4<sup>th</sup> edition
4. Physical Chemistry by D. Alberty 3<sup>rd</sup> edition.

## **Section – II**

### **Analytical Chemistry**

#### **Chapter 3: Introduction to volumetric analysis**

**[6]**

Introduction, methods of expressing concentrations, primary and secondary standard solutions. Apparatus used and their calibration: burettes, microburettes, volumetric pipettes, graduated pipettes, volumetric flask, methods of calibration, Instrumental & non-instrumental analysis – principles & types.

**Aim: To provide basic knowledge essential for volumetric analysis**

**Objectives:** A student should be able to know

- i. Meaning of equivalent weight, molecular weight, normality, molality, primary and secondary standards.
- ii. Different way to express concentrations of the solution.
- iii. Preparation of standard solution.
- iv. To solve numerical problems.
- v. Calibrate various apparatus such as burette, pipette, volumetric flask, barrel pipette etc.
- vi. Types instrumental and non instrumental analysis

## **Chapter 4: Non Instrumental volumetric analysis** [18]

Indicators—theory of indicators, acid base indicators, mixed and universal indicators [3]

Acid–Base titrations: Strong acid–Strong base, Weak acid–strong base, Weak acid-Weak base titration, Displacement titrations, polybasic acid titrations. (Discuss titration with respect to neutralization and equivalence point determination and limitations) [6]

Redox titrations: Principle of redox titration, detection of equivalence point using suitable indicators. [3]

Complexometric titrations: Principle, EDTA titrations, choice of indicators [6]

Iodometry and Iodimetry: Principle, detection of end point, difference between iodometry and iodimetry, Standardization of sodium thiosulphate solution using potassium dichromate and iodine method, Applications – estimation of Cu, estimation of  $\text{Cl}_2$ .

**Aim: To learn and equip with non instrumental volumetric techniques**

**Objectives:** The student should be able to

- i. Explain role of indicators.
- ii. Know mixed and universal indicators.
- iii. Know neutralization curves for various acid base titration
- iv. Know principle of complexometric precipitation and redox titrations.
- v. Know the definitions and difference between iodometry and iodimetry.
- vi. To know standardization of sodium thiosulphate and EDTA.
- vii. Reactions between  $\text{CuSO}_4$  and Iodine and liberated  $\text{I}_2$  and  $\text{Na}_2\text{S}_2\text{O}_3$
- viii. Choice of suitable indicator.
- ix. Estimate copper from  $\text{CuSO}_4$  and available chlorine in bleaching powder.
- x. Prepare standard silver nitrate solution.
- xi. Mohr's and Fajan's method.
- xii. Determine the amount of halides separately and in presence of each other.

## Paper 4: CH-222

### Section – I

## Organic Chemistry

### Chapter 1: Reagents in Organic Synthesis [8]

Catalytic hydrogenation including liquid phase hydrogenation, Birch reduction,  $\text{NaBH}_4$ ,  $\text{LiAlH}_4$ ,  $\text{Sn/HCl}$

Oxidation reagents:  $\text{KMnO}_4$ ,  $\text{K}_2\text{Cr}_2\text{O}_7$ , Jones reagent, PCC, Per acids,  $\text{OsO}_4$ .

Student should understand:

- i) Concept of different reagents used in the one type of conversion
- ii) Merits & demerits of different reagents
- iii) Reagent based mechanisms
- iv) Use of different hydrogen donors for hydrogenation

Ref. 1 & 4

### Chapter 2: Chemistry of heterocyclic compounds with one hetero atom. [6]

Definition and classification of heterocyclic compounds, nomenclature and aromatic character. Synthesis of Pyrrole, Furan, Thiophene, Pyridine and their reactions: Nitration, Sulphonation, Acylation and Catalytical reduction. Structure and synthesis of quinoline and Isoquinoline.

Student should know:

- i) Define and classify heterocyclic compounds.
- ii) Use Huckel rule to predict aromaticity.
- iii) Suggest synthetic route for preparation of various heterocyclic compounds.
- iv) Write and complete various reactions of heterocyclic compounds.
- v) Predict products.

Ref. 1

### Chapter 3: Introduction of Bio-molecules [10]

Carbohydrates: Definition, classification, reaction of monosaccharide (glucose)- oxidation, reduction, osazone and ester formation, isomerization, Killiani-Fischer synthesis and Ruff

degradation, Configuration of D/L configuration of (+) Glucose, Fischer-Haworth and chair formulae, Brief account of disaccharides: Sucrose, cellobiose, maltose and lactose.

Polysaccharides: Starch, cellulose and glycogen.

Amino acids: Fischer projection, relative configuration, classification, structures and reactions of amino acids, Properties and chemical reactions with amino and carboxylic group.

Proteins: Formation of Peptide linkage,  $\alpha$ -helical conformation,  $\beta$ -plated structure, primary, secondary, tertiary and quaternary structure of proteins.

Ref. 2 & 3

Student should know

- i) Know different biomolecules.
- ii) Appreciate the role of biochemistry in the day to day life.
- iii) Understand the importance of biochemistry.
- iv) Define carbohydrates.
- v) Classify carbohydrates giving suitable examples.
- vi) Write and complete various reactions of glucose.
- vii) Explain optical activity in carbohydrates.
- viii) Write Fischer projection and perspective formula with glyceraldehydes as reference compound.
- ix) Explain the principle in Killani Fischer synthesis.
- x) Explain stereoisomerism in monosaccharide.
- xi) Draw structure of some common aldoses and ketoses.
- xii) Distinguish between diastereomers and epimers.
- xiii) Write cyclic structure of glucose in Fischer, Haworth and chair form.
- xiv) Know the phenomenon of mutarotation.
- xv) Draw the structure and bonding in maltose, lactose, cellobiose and sucrose.
- xvi) Know about polysaccharide, structures of starch and cellulose.
- xvii) Classify the naturally occurring amino acids.
- xviii) Explains the amphoteric nature of amino acids.
- xix) Know the important reactions of  $\alpha$ -amino acids.
- xx) Outline the formation of peptide bond.
- xxi) Explain the hydrogen bonding in  $\alpha$ -helical structure.
- xxii) Relate the stability of  $\alpha$ -helical chain and their R-groups.



xxiii) Define primary, secondary, tertiary and quaternary structure of proteins.

xxiv) Classify proteins.

### **Reference Books:**

Ref. 1: Organic Chemistry-6th Ed. Morrison and Boyd Prentice Hall of India Pvt Ltd, New Delhi-2001.

Ref. 2: Outline of Biochemistry 5th Ed., Conn, Stumpf Bruening and Roy Doi John Wiley 1987.

Ref. 3: Stereochemistry of carbon compounds - E. L. Eliel

Ref. 4: Reactions, rearrangements and reagents – S N Sanyal

## **Section – II**

### **Inorganic Chemistry**

#### **Chapter 4: Chemistry of d-block elements [6]**

Position of d-block in periodic table, electronic configuration, trends in properties of these elements w.r.t.(a) size of atoms & 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.

Student should know:

- i) To know position of d-block elements in periodic table.
- ii) To know the general electronic configuration & electronic configuration of elements.
- iii) 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, colour, magnetic properties, non-stoichiometry, density, melting point, boiling point.

#### **Chapter 5: Organometallic Chemistry [6]**

Definition of Organometallic compounds and Organometallic chemistry, CO as a  $\pi$ -acid donor ligand, binary metal carbonyls, methods of synthesis; (a) Direct reaction (b) Reductive carbonylation (c) Photolysis and thermolysis. Molecular and electronic structures (18 electron rule) of metal carbonyls. Homogenous catalysis-Hydroformylation (Oxo Process) and Wacker Process.

Aim: To study the metal carbonyl complexes and their uses in the homogenous catalysis.

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 electron rule)
- vi) To understand the catalytic properties of binary metal carbonyls.
- vii) To understand the uses of organometallic compounds in the homogenous catalysis.

**References:**

1. Concise Inorganic Chemistry by J. D. Lee-relevant pages.
2. General Chemistry-Raymond Chang- relevant pages.

**Chapter 6: Acids, Bases and Solvents** [6]

Definition of acids and bases, Arrhenius theory, Lowry-Bronsted theory, Lewis concept, Lux-Flood theory, strength of acids and bases, trends in the strength of hydracids and oxyacids, Properties of solvents, M.P-B.P range, dipole moment, dielectric constant, Lewis acid-base character and types of solvents.

Ref: Basic Inorganic Chemistry – F. A. Cotton (Pages- 163-173)

**(6) Acids, Bases, Solvents and reactions in non-aqueous solvents:**

**Aims:** To study different solvents and to know the different theories of acids and bases.

**Objectives:** A student should be able -

- i) To define acids and bases according to Arrhenius theory Lowery- Bronsted concept, Lewis concept.
- ii) To explain the merits and demerits of different theories of acids and bases.
- iii) To define the conjugate acid and base pairs.
- iv) To explain the leveling effect of solvents.
- v) To demonstrate the trends in the strength of hydracids, oxyacids.
- vi) To define hard and soft acids.
- vii) To know the trends in the strength of hydra and oxyacids.
- viii) To know the rules governing the strength of oxyacids.
- ix) To explain the properties of a solvent that determines their utility.
- x) To know some useful solvents.
- xi) To explain the reactions in non-aqueous solvents like HF and NH<sub>3</sub>.

**Chapter 7: Chemical Toxicology** [6]

Toxic chemicals in the environment, Impact of toxic chemistry on enzymes.

Biochemical effect of Arsenic, Cadmium, Lead, 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. Dee. (3<sup>rd</sup> Ed.)

## Practical Course in Chemistry CH – 223

### A) Physical Chemistry practicals (Any Five)

- i. To determine critical solution temperature of phenol water system
- ii. To determine molecular weight of given organic liquid by steam distillation
- iii. Determination of solubility of benzoic acid at different temperature and to determine  $\Delta H$  of dissociation process.
- iv. To study neutralization of acid (HCl) base (NaOH) and  $\text{CH}_3\text{COOH}$  by NaOH and  $\text{H}_2\text{SO}_4$  by NaOH.
- v. To determine the rate constant (or to study kinetics) of acid catalyzed ester hydrolysis.
- vi. To determine the rate constant of base catalyzed ester hydrolysis.
- vii. Partition coefficient of iodine between water and carbon tetrachloride.

Aim: To equip students to correlate theoretical and experimental knowledge

Objectives: After completion of practical course student should be able to

- i. Verify theoretical principles experimentally
- ii. Interpret the experimental data
- iii. Improve analytical skills
- iv. Correlate the theory and experiments and understand their importance

### B) Inorganic Qualitative Analysis (Minimum Five mixtures)

- i. One simple mixture (without phosphate or borate)
- ii. Two Mixtures containing  $\text{PO}_4^{3-}$  (With  $\text{PO}_4^{3-}$  removal)
- iii. Two Mixtures containing  $\text{BO}_3^{3-}$  (With  $\text{BO}_3^{3-}$  removal)

Inorganic Qualitative Analysis of Binary Mixtures (including phosphate and borate removal).

Sodium carbonate extract is to be used wherever necessary for detecting acidic radicals.

### C) Organic Chemistry Practical

- a. Organic qualitative analysis of Binary Mixtures without ether separation  
(**Four only**)

Two: solid-solid, one: solid-liquid, one: liquid-liquid

- b. Organic Preparation: (**Any two including Crystallization, MP, TLC**)

- i) Phthalic anhydride to phthalamide
- ii) Glucose to osazone

- iii) Acetanilide to p-bromoacetanilide
- iv) Benzaldehyde to dibenzylidene acetone

After completion of practical course student should be able to –

- i) Verify theoretical principles experimentally.
- ii) Acquire skill of crystallisation, record correct m. p. / b. p.
- iii) Perform the complete chemical analysis of the given organic compound and should be able to recognize the type of compound.
- iv) Write balanced equation for all the reactions, they carry in the laboratory.
- v) Perform the given organic preparation according to the given procedure.
- vi) Follow the progress of the reaction by using TLC technique.
- vii) Set up the apparatus properly for the given experiments.
- viii) Perform all the activities in the laboratory with neatness and cleanness.

Ref. 1 Organic Qualitative Analysis: A. I. Vogel

#### **D) Analytical Chemistry Practicals (Any Five)**

- i. Estimation of sodium carbonate content of washing soda.  
(Vogel 5<sup>th</sup> Edition: 10.30 page 295).
- ii. Determination of Ca in presence of Mg using EDTA.  
Ref.2: Page 412
- iii. a) Preparation of standard 0.05 N oxalic acid solution and standardization of approx. 0.05N KMnO<sub>4</sub> solution.  
b) Determination of the strength of given H<sub>2</sub>O<sub>2</sub> solution with standard 0.05 N KMnO<sub>4</sub> solution.
- iv. Estimation of Aspirin from a given tablet and find errors in quantitative analysis.
- v. Estimation of Al (III) from the given aluminium salt solution by using Erichrome Black-T indicator (Back titration method)
- vi. Iodometric estimation of copper.
- vii. Report on one day industrial educational visit.

#### **Reference books**

1. Analytical Chemistry by G.D. Christian 6<sup>th</sup> edition.
2. Vogel's Textbook of Quantitative chemical analysis 6<sup>th</sup> edition R.C. Denney, J.D. Barnes, M.J.K. Thomas

Aim: To equip students to correlate theoretical and experimental knowledge

Objectives: After completion of practical course student should be able to

- i. Verify theoretical principles experimentally
- ii. Interpret the experimental data
- iii. Improve analytical skills
- iv. Correlate the theory and experiments and understand their importance

**N.B. - Industrial visit during the academic year is compulsory.**

**Savitribai Phule Pune University, Pune**  
**T.Y.B.Sc. Chemistry Syllabus**

**To be implemented from June 2015**  
**(Academic Year 2015-16)**

**Preamble of the Course**

1. T.Y.B.Sc. Chemistry is consisting of six theory and three practical courses.
  2. Each theory course is of 48 lectures; 4 lectures per course per week should be conducted in every semester.
  3. Out of five optional courses recommended for CH-336 and CH-346, only one option should be taught and the same course should be implemented for the next semester.
  4. Each practical course is of 4 lectures per week per batch. Practical batch for each course should comprise of 12 students only.
  5. Each theory paper will carry 50 Marks out of which 10 Marks will be allotted for Internal assessment and University Examination will be conducted for 40 Marks at the end of each semester.
  6. The practical examination of six hours for each practical course will be conducted at the end of Semester-IV. Each practical course will carry 100 Marks out of which 20 Marks will be allotted for Internal assessment and University Examination will be conducted for 80 Marks.
  - 7. Marks for internal assessment of Practical courses will be allotted as follows.**
    - a. Completed and Certified journal and regularity of the student 10 Marks
    - b. Oral Examination and Internal Test 10 Marks
  8. Internal assessment for theory courses will be done on the basis of the performance of the student in tests. Minimum two tests should be arranged for each course in a Semester.
  9. Visit to a chemical industry may be organized during the academic year.
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**Savitribai Phule Pune University**  
**Board of Studies in Chemistry**  
**T.Y.B.Sc. Chemistry Syllabus**

**Structure to be implemented from June 2015 (i.e. from Academic Year 2015-16)**

Semester	Course Code and Title	Number of Lectures	Marks
Semester III	CH-331: Physical Chemistry	48	50
	CH-332: Inorganic Chemistry	48	50
	CH-333: Organic Chemistry	48	50
	CH-334: Analytical Chemistry	48	50
	CH-335: Industrial Chemistry	48	50
	<b>OPTIONAL COURSE</b> CH-336-A Nuclear Chemistry <b>OR</b> CH-336-B Polymer Chemistry <b>OR</b> CH-336-C Introduction to Biochemistry and Molecular Biology <b>OR</b> CH-336-D Environmental and Green Chemistry <b>OR</b> CH-336-E Agriculture Chemistry	48	50
Semester IV	CH-341: Physical Chemistry	48	50
	CH-342: Inorganic Chemistry	48	50
	CH-343: Organic Chemistry	48	50
	CH-344: Analytical Chemistry	48	50
	CH-345: Industrial Chemistry	48	50
	<b>OPTIONAL COURSE</b> CH-346-A Nuclear Chemistry <b>OR</b> CH-346-B Polymer Chemistry <b>OR</b> CH-346-C Introduction to Biochemistry and Molecular Biology <b>OR</b> CH-346-D Environmental and Green Chemistry <b>OR</b> CH-346-E Dairy Chemistry	48	50
	<b>PRACTICAL COURSES</b>		
	CH-347: Physical Chemistry Practicals		100
	CH-348: Inorganic Chemistry Practicals		100
	CH-349: Organic Chemistry Practicals		100

**NOTE**

1. Each theory paper will carry 50 Marks out of which 10 Marks will be allotted for internal assessment and University Examination will be conducted for 40 Marks at the end of each semester.
2. The practical examination will be conducted at the end of Semester-IV. Each practical course will carry 100 Marks out of which 20 Marks will be allotted for internal assessment and University Examination will be conducted for 80 Marks.



3. Marks for internal assessment of Practical courses will be allotted as follows.

a. Completed and certified journal 10 Marks

b. Overall performance and regularity  
of the student during whole academic year 10 Marks

4. Internal assessment for theory courses will be done on the basis of the performance of the student in tests. Minimum two tests should be arranged for each course in a Semester.

Date: 29/04/2015

**Dr. B. R. Khot**  
**Chairman,**  
**BOS in Chemistry**

# Savitribai Phule Pune University

## Board of Studies in Chemistry

### T.Y.B.Sc. Chemistry Syllabus

To be implemented from June 2015 (i.e. from Academic Year 2015-16)

#### Equivalence of the Courses

Semester	Course Code and Title (Old)	Course Code and Title (New)
Semester III	CH-331: Physical Chemistry	CH-331: Physical Chemistry
	CH-332: Inorganic Chemistry	CH-332: Inorganic Chemistry
	CH-333: Organic Chemistry	CH-333: Organic Chemistry
	CH-334: Analytical Chemistry	CH-334: Analytical Chemistry
	CH-335: Industrial Chemistry	CH-335: Industrial Chemistry
	<b>OPTIONAL COURSE</b> CH-336-A Nuclear Chemistry CH-336-B Polymer Chemistry CH-336-C Introduction to Biochemistry and Molecular Biology CH-336-D Environmental Chemistry	<b>OPTIONAL COURSE</b> CH-336-A Nuclear Chemistry CH-336-B Polymer Chemistry CH-336-C Introduction to Biochemistry and Molecular Biology CH-336-D Environmental and Green Chemistry
	CH-336-E Agriculture Chemistry	CH-336-E Agriculture Chemistry
Semester IV	CH-341: Physical Chemistry	CH-341: Physical Chemistry
	CH-342: Inorganic Chemistry	CH-342: Inorganic Chemistry
	CH-343: Organic Chemistry	CH-343: Organic Chemistry
	CH-344: Analytical Chemistry	CH-344: Analytical Chemistry
	CH-345: Industrial Chemistry	CH-345: Industrial Chemistry
	<b>OPTIONAL COURSE</b> CH-346-A Nuclear Chemistry CH-346-B Polymer Chemistry CH-346-C Introduction to Biochemistry and Molecular Biology CH-346-D Environmental Chemistry	<b>OPTIONAL COURSE</b> CH-346-A Nuclear Chemistry CH-346-B Polymer Chemistry CH-346-C Introduction to Biochemistry and Molecular Biology CH-346-D Environmental and Green Chemistry
	CH-346-E Dairy Chemistry	CH-346-E Dairy Chemistry
<b>PRACTICAL COURSES</b>	<b>PRACTICAL COURSES</b>	<b>PRACTICAL COURSES</b>
	CH-347: Physical Chemistry Practicals	CH-347: Physical Chemistry Practicals
	CH-348: Inorganic Chemistry Practicals	CH-348: Inorganic Chemistry Practicals
	CH-349: Organic Chemistry Practicals	CH-349: Organic Chemistry Practicals

Date: 29/04/2015

Dr. B. R. Khot  
Chairman, BOS in Chemistry

**Semester-III**  
**Course: Physical Chemistry (CH-331)**

<b>Topic</b>	<b>No. of Lectures</b>
1. Chemical Kinetics	10
2. Electrolytic Conductance	14
3. Investigation of Molecular Structure	16
4. Phase Rule	08
<b>Total Lectures</b>	<b>48</b>

**1. Chemical Kinetics :**

**[10 L]**

Recapitulation of Chemical Kinetics, Third order reaction, Derivation of integrated rate law for third order reaction with equal initial concentration, characteristics of third order reaction, examples of third order reaction, Methods to determine order of reaction using Integrated rate equation method, Graphical method, Half-life method, Differential method. Effect of temperature on reaction rate, Arrhenius equation, related numerical.

[ Ref. 1 : Pages 567-574, Ref. 2: Pages 600-612 ]

**2. Electrolytic Conductance:**

**[14 L]**

Recapitulation of Electrolytic conductance, Specific and equivalent conductance, Variation of equivalent conductance with concentration, Kohlrausch's law and its applications to determine

- a. Equivalent conductance at infinite dilution of a weak electrolyte,
- b. The ionic product of water,
- c. Solubility of sparingly soluble salts,

Migration of ions and ionic mobilities, absolute velocity of ions, Transport number determination by Hittorf's method and moving boundary method, Relation between ionic mobility, ionic conductance and transport number, Ionic theory of conductance, Debye-Huckel –Onsager equation and its validity, Activity in solution, fugacity and activity coefficient of strong electrolyte.

[Ref. 1 : Pages 398-437, Ref. 2 : Pages 686-703]

**3. Investigations of Molecular Structure:**

**[16 L]**

Molar refraction, Electrical polarization of molecules, Permanent dipole moment, Determination of dipole moment, Molecular spectra - Rotational, vibrational and Raman spectra Reference

[Ref. 1 : pages 691-710 Ref. 2 : Pages 398-424 ]

**4. Phase Rule:**

**[08 L]**

Definitions, Gibb's phase rule, one component system (moderate pressure only) for sulphur and water system, two component system for silver-lead and zinc-cadmium.

[Ref. 1 : Pages 344-350, 350-354; Ref. 2 Pages 558-575 ]

## AIMS AND OBJECTIVES:

1. **Chemical Kinetics** : After studying this topic students are expected to know-
  - i. Expression for rate constant  $k$  for third order reaction
  - ii. Examples of third order reaction
  - iii. Characteristics of third order rate constant  $k$
  - iv. Derivation for half-life period of third order reaction and to show that half-life is inversely proportional to square of initial concentration of reactants.
  - v. Experimental determination of order of reaction by Integrated rate equation method, Graphical method, Half-life method and Differential method.
  - vi. Explain the term energy of activation with the help of energy diagram
  - vii. Explain the term temperature coefficient.
  - viii. Effect of temperature on rate constant  $k$
  - ix. Derivation of Arrhenius equation
  - x. Graphical evaluation of energy of activation
  - xi. Solve the numerical problems based on this topic.
  
2. **Electrolytic Conductance** : After studying this topic students are expected to know-
  - i. Ohm's law and electrical units such as coulomb, Ampere, Ohm and Volt.
  - ii. Meaning of specific resistance, specific conductance, cell constant and their units.
  - iii. Cell constant, its theoretical and experimental determination.
  - iv. Preparation of conductivity water.
  - v. Experimental determination of conductance.
  - vi. Variation of specific and equivalent conductance of strong and weak electrolyte with dilution
  - vii. Meaning of infinitely dilute solution.
  - viii. Kohlrausch's law of independent migration of ions and its applications such equivalent conductance of weak electrolyte at zero conc., degree of dissociation ( $\alpha$ ), ionic product of water.
  - ix. Transport number of an ion
  - x. Hittorf's rule
  - xi. Experimental determination of transport number by Hittorf's and moving boundary method.
  - xii. Drawbacks of Arrhenius theory, Debye-Huckel-Onsager Interionic Attraction theory
  - xiii. Asymmetry /Relaxation effect
  - xiv. Electrophoretic effect
  - xv. Validity of Onsager equation
  - xvi. Fugacity and activity concept
  - xvii. Activity and activity coefficient of strong electrolyte.
  - xviii. Solve the numerical problems based on this topic.
  - xix.
  
3. **Investigation of molecular structure** : After studying this topic students are expected to know-
  - i. Understand the term additive and constitutive properties
  - ii. Understand the term specific volume, molar volume and molar refraction.
  - iii. Understand the meaning of electrical polarization of molecule.

- iv. Understand the meaning of induced and orientation polarization
- v. Dipole moment and its experimental determination by temperature variation method.
- vi. Application of dipole moment for structure determination.
- vii. Nature of wave and its characteristics such as wavelength, wave number, frequency and velocity.
- viii. Rotational / Microwave spectroscopy
- ix. Derivation for rotational spectra for the transition from J to J+1
- x. Limitations of Rotational Spectra.
- xi. Vibrational Spectra
- xii. Vibrational rotational Spectra
- xiii. Raman Spectroscopy
- xiv. Solve the numerical problems based on this topic.

**4. Phase Rule** : After studying this topic students are expected to know-

- i. Meaning and Types of equilibrium such as true or static, metastable and Unstable equilibrium.
- ii. Meaning of phase, component and degree of freedom.
- iii. Derivation of phase rule.
- iv. Explanation of water system : Description of the curve, Phase rule relationship and typical features.
- v. Explanation of sulphur system : Description of the curve, Phase rule relationship and typical features.
- vi. Explanation of two component system curve : for silver-lead and Zinc-cadmium.

**References:**

1. Principles of Physical Chemistry, Fourth Edition by S.H. Marron and C. F. Pruton
  2. Essentials of Physical Chemistry by B.S. Bahl, G.D.Tuli and ArunBahl Edition 2000 S. Chand and Company Ltd.
  2. Essentials of Physical chemistry by BahlTuli-Revised Multicolor Edition 2009
  3. Essentials of Nuclear Chemistry, H.J.Arnika Second edition
  4. Nuclear and Radiation Chemistry, Third edition
  5. Quantum Chemistry second edition by Manas Chandra
  6. Physical Chemistry a molecular approach by Donald A. McQuarrie , John D. Simon
-

**Semester-IV**  
**Course: Physical Chemistry (CH-341)**

<b>Topic</b>	<b>No. of Lectures</b>
1. Electrochemical Cells	14
2. Nuclear Chemistry	12
3. Crystal Structure	12
4. Quantum Chemistry	10
<b>Total Lectures</b>	<b>48</b>

**1. Electrochemical Cells**

**[14 L]**

Reversible and irreversible cells, EMF and its measurements, Standard cells, cell reaction and EMF, Single electrode potential and its calculation, Calculation of cell EMF, Thermodynamics of cell EMF, Types of electrodes, Classification of electrochemical cells with and without transference, Applications of EMF measurement- i) Solubility product of sparingly soluble salt, ii) Determination of pH, iii) Potentiometric titration

[ Ref. 1 : Pages: 471-486, 492-519 ]

**2. Nuclear Chemistry**

**[12 L]**

The atom, nucleus and outer sphere, classification of nuclides, nuclear stability and binding energy. Discovery of radioactivity, types of radioactivity, general characteristics of radioactive decay and decay kinetics, Measurements radioactivity, gaseous ion collection method, proportional and G.M. counter.

Applications of radioactivity-

Radiochemical principles in the use of tracers,

Typical applications of radioisotopes as a tracer-

i) Chemical investigations- reaction mechanism,

ii) Structure determination- phosphorus pentachloride and thiosulphate ion

iii) Age determination- by Carbon-14 dating and Uranium-Lead/ Thorium-Lead Ratio

iv) Medical applications- Assess the volume of blood in patients body, Goiter

[ Ref. 3 : Pages 1, 4-15, 117-119, 121-125, 371-378, Ref. 4: Pages 243-245, 247-251 ]

**3. Crystal structure**

**[12 L]**

Crystallization and fusion process, Crystallography, Crystal systems, - Properties of crystals, Crystal lattice and unit cell, - Crystal structure analysis by X ray - The Laue method and Bragg's method,  
- X-ray analysis of NaCl crystal system,  
- Calculation of  $d$  and  $\lambda$  for a crystal system.

[Ref. 1 : Pages 67-85 ]

#### 4. Quantum Chemistry

[10 L]

Concept of quantization, atomic spectra (no derivation), wave particle duality, uncertainty principle, wavefunction and its interpretation, well-behaved function, Hamiltonian (energy) operator, formulation of Schrodinger equation, particle in box (1D, 2D and 3D box) (no derivations), sketching of wavefunction and probability densities for 1D box, correspondence principle, degeneracy (lifting of degeneracy), applications to conjugated systems, harmonic oscillator, wavefunction and probability densities (no derivation), zero point energy and quantum tunneling.

[Ref. 5. Quantum Chemistry second edition by Manas Chandra- Relevant pages

Ref. 6. Physical Chemistry a molecular approach by Donald A. McQuarrie, John D. Simon- Relevant pages]

#### AIMS AND OBJECTIVES:

**1. Electrochemical Cell** :After studying this topic students are expected to know-

- i. What is meant by Electrochemical cell with specific example
- ii. Origin of EMF of electrochemical cell.
- iii. Conventions used to represent electrochemical cell.
- iv. Thermodynamic conditions of reversible cell
- v. Explanations of reversible and irreversible electrochemical cell with suitable example.
- vi. What is meant by reference electrode?
- vii. Primary and secondary reference electrode
- viii. Construction, representation, working and limitation of Standard hydrogen Electrode
- ix. Construction, representation and working of Calomel and Silver –Silver Chloride electrode
- x. Types of electrodes
- xi. Conditions of Standard Cell
- xii. Construction, representation and working of Weston Standard Cell.
- xiii. Measurement of EMF of electrochemical cell
- xiv. Nernst Equation for theoretical determination of EMF.
- xv. Thermodynamics and EMF: Relation of EMF with  $\Delta G$ ,  $\Delta G^\circ$ ,  $\Delta H$ ,  $\Delta S$  and equilibrium constant  $K$  of the cell reaction.
- xvi. Explanation of the term liquid junction potential
- xvii. Classification of electrochemical cell
- xviii. Chemical cell with and without transfer
- xix. Electrode and electrolytic concentration cell
- xx. Concentration cell with and without transfer.
- xxi. Application of EMF measurement such as pH determination, Determination of solubility and solubility product.
- xxii. Potentiometric titrations: Weak acid against strong base, Titration of polybasic acids, Precipitation and Redox titrations.
- xxiii. Solve the numerical problems based on this topic.

**2. Nuclear Chemistry:** After studying this topic students are expected to know-

- i. The atom its nucleus and outer sphere.
- ii. Classification of nuclides with suitable examples such as isotope, isobar, isotone and isomers
- iii. Explanation of stability of nucleus through neutron to proton ratio, odd and even nature of proton and neutron, Mean binding energy.
- iv. Conversion of mass into energy
- v. Mass defect, Total and mean binding energy
- vi. Explanation of binding energy curve.
- vii. Types of decay
- viii. Discovery of radioactivity
- ix. Decay kinetics
- x. Relation of half-life with decay constant.
- xi. Unit of Radioactivity : Curie Bq
- xii. Measurement of radioactivity by G.M. and proportional counter
- xiii. Principle, construction and working of G.M. / Proportional counter.
- xiv. Application of radioisotopes as a tracer
- xv. Chemical investigation : Reaction mechanism and structure determination w.r.t  $\text{PCl}_5$  and thiosulphate ion
- xvi. Age determination- by Carbon-14 dating and Uranium-Lead/ Thorium-Lead Ratio
- xvii. Medical applications-Assess the volume of blood in patients body, Goitre
- xviii. Solve the numerical problems based on this topic.

**3. Crystal Structure:**After studying this topic students are expected to know-

- i. Distinguish between crystalline and amorphous solids / anisotropic and isotropic solid
- ii. Explain the term crystallography and laws of crystallography
- iii. Weiss and Millers Indices
- iv. Crystal system and their characteristics
- v. Explain the term polymorphism /allotrophism
- vi. Distance between the planes for 100, 110 and 111 type of simple, body centred and face centred cubic crystals
- vii. Bragg's experiment and Derivation of  $(n\lambda = 2d\sin\theta)$ Bragg's equation
- viii. Explanation: Structure of NaCl can be ascertained with the help of X-ray analysis.
- ix. Laue's and Bragg's method.

**4.Quantum Chemistry:** After studying this topic students are expected to know-

- i. Concept of quantization
- ii. Atomic spectra
- iii. Wave particle duality
- iv. Uncertainty principle and its physical significance
- v. Derivation of time independent Schrodinger wave equation.
- vi. Wave function and its Interpretation
- vii. Well behaved function
- viii. Hamiltonian Operator
- ix. Particle in a box ( 1 and 3 dimensional)
- x. Degeneracy



- xi. Application to conjugated systems
- xii. Harmonic oscillator
- xiii. Solve the numerical problems based on this topic.

**References:**

1. Principles of Physical Chemistry, Fourth Edition by S.H. Marron and C. F. Pruton
  2. Essentials of Physical Chemistry by B.S. Bahl, G.D.Tuli and ArunBahl Edition 2000 S. Chand and Company Ltd.
  2. Essentials of Physical chemistry by BahlTuli-Revised Multicolor Edition 2009
  3. Essentials of Nuclear Chemistry, H.J. Arnikar Second edition
  4. Nuclear and Radiation Chemistry, Third edition
  5. Quantum Chemistry second edition by Manas Chandra
  6. Physical Chemistry a molecular approach by Donald A. McQuarrie , John D. Simon
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## Physical Chemistry Practicals:CH- 347

### Group A:

#### 1. Chemical Kinetics: (Any Five):

- 1.To study the effect of concentration of the reactants on the rate of hydrolysis of an ester.
- 2.To compare the relative strength of HCl and H<sub>2</sub>SO<sub>4</sub> by studying the kinetics of hydrolysis of an ester.
- 3.To compare the relative strength of HCl and H<sub>2</sub>SO<sub>4</sub> by studying the kinetics of Inversion of cane sugar using Polarimeter.
- 4.To study the kinetics of iodination of acetone
- 5.To determine the first order velocity constant of the decomposition of hydrogen peroxide by volume determination of oxygen.
- 6.To determine the energy of activation of the reaction between potassium iodide and potassium persulphate.
- 7.To determine the order of reaction between K<sub>2</sub>S<sub>2</sub>O<sub>8</sub> and KI by half-life method.

#### 2. Viscosity:

To determine the molecular weight of a high polymer by using solutions of different concentrations.

#### 3.Adsorption

To investigate the adsorption of oxalic acid /acetic acid by activated charcoal and test the validity of Freundlich / Langmuir isotherm

#### 4. Phenol-water system

To study the effect of addition of salt on critical solution temperature of phenol water System

#### 5. Transport number

To determine the transport number of cation by moving boundary method.

#### 6. Refractometry (any two)

- i)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.
- ii) To determine the molecular refractivity of the given liquids A, B, C and D.
- iii)To determine the molar refraction of homologues methyl, ethyl and propyl alcohol and show the constancy contribution to the molar refraction by -CH<sub>2</sub> group.

### Group B

#### 1. Colorimetry (any two)

- i)Determination of  $\lambda_{\max}$  and concentration of unknown solution of KMnO<sub>4</sub> in 2 N H<sub>2</sub>SO<sub>4</sub>
- ii)Determination of  $\lambda_{\max}$  and concentration of unknown solution of CuSO<sub>4</sub>.
- iii)To titrate Cu<sup>2+</sup> ions with EDTA photometrically.
- iv)To determine the indicator constant of methyl red indicator

#### 2. Potentiometry(any three)

- i)To prepare standard 0.2 M Na<sub>2</sub>HPO and 0.1 M Citric acid solution, hence prepare four different buffer solutions using them. Determine the pka value of these and unknown solutions.
- ii)To determine the concentrations of strong acid and weak acid present in the mixture by titrating with strong base.
- iii)To determine the formal redox potential of Fe<sup>2+</sup> / Fe<sup>3+</sup> system potentiometrically

iv) To determine the amount of NaCl in the given solution by potentiometric titration against silver nitrate.

### 3. pH metry (any two)

i) To determine the degree of hydrolysis of aniline hydrochloride

ii) To determine pka value of given weak acid by pH-metric titration with strong base.

iii) To determine the dissociation constant of oxalic acid by pH-metric titration with strong base

iv) To determine pH of various mixtures of sodium acetate and acetic acid in aqueous solution and hence to find the dissociation of acetic acid.

### 4. Radioactivity (any one)

i) To determine plateau voltage of the given G M counter.

ii) To determine the resolving time of GM counter

iii) To determine  $E_{\max}$  of beta particle

### 5. Conductrometry (any two)

i) To determine the cell constant of the given cell using 0.01 M KCl solution and hence determine dissociation constant of a given monobasic weak acid.

ii) To estimate the amount of lead present in given solution of lead nitrate by conductometric titration with sodium sulphate.

iii) To investigate the conductometric titration of any one of the following

a) Strong acid against strong base

b) Strong acid against weak base

c) Strong base against weak acid

d) Weak acid against weak base

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### STRUCTURE OF PRACTICAL EXAMINATION

Experiment	Marks
1. One Experiment from Group – A	35
2. One Experiment from Group-B	35
3. Oral	10

### References:

1. Practical Physical Chemistry, 3<sup>rd</sup> Edn. A. M. James and F. E. Prichard, Longman publication.
  2. Experiments in Physical Chemistry, R. C. Das and B. Behra, Tata McGraw Hill.
  3. Advanced Practical Physical Chemistry, J. B. Yadav, Goel Publishing House.
  4. Advanced Experimental Chemistry, Vol-I, J. N. Gurtu and R. Kapoor, S. Chand and Company.
  5. Physical Chemistry Experiments, Raghvan and Vishwanathan.
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## Semester-III

### Course: Inorganic Chemistry (CH-332)

Topic	No. of Lectures
1. Molecular Orbital Theory	15
2. Coordination Chemistry	33
<b>Total Lectures</b>	<b>48</b>

#### 1. Molecular Orbital Theory

15 L

Limitations of Valence Bond theory(VBT), Need of Molecular orbital theory (MOT), Features of MOT, Formation of molecular orbitals(MO's) by LCAO principle, Rules of LCAO combination, Different types of combination of Atomic orbital(AO's): S-S, S-P, P-P and d-d, Non-bonding combination orbitals(formation of NBMO), M.O. Energy level diagram for homonuclear diatomic molecules, Bond order and existence of molecule from bond order, Energy ( $\beta$ ) and magnetic behavior for following molecules or ions:  $H_2$ ,  $H_2^+$ ,  $He_2^+$ ,  $Li_2$ ,  $Be_2$ ,  $B_2$ ,  $C_2$ ,  $N_2$ ,  $O_2$ ,  $O_2^+$ ,  $O_2^-$ ,  $O_2^{2-}$ ,  $F_2$ ,  $Ne_2$ ,

M.O. energy level diagram, for heteronuclear diatomic molecule like CO, NO, HCl, HF.

M.O. energy level diagram, for heteronuclear triatomic molecule like  $CO_2$ ,  $NO_2$

**Ref. 2** Pages 89-112, 106-117

**Ref. 4** Pages 55-72

#### Aims and objective:

A student should:

- i. Know the theories of covalent bond formation
- ii. Know the assumptions and limitations of VBT
- iii. Understand the need of concept of MOT
- iv. Know LCAO principal and its approximation
- v. Understand and show the formation of bonding and antibonding MO's
- vi. Draw the shapes of s, p, d orbital
- vii. Draw combinations of s-s, s-p, p-p and d-d orbital to form  $\sigma$  and  $\pi$  molecular orbitals.
- viii. Give the comparison of
  - a) Atomic orbital and molecular orbital
  - b) BMO and ABMO
  - c) Sigma and pi MO's
  - d) VBT and MOT
  - e) Comparison between BMO, ABMO and NBMO
- ix. Draw the MO energy level diagrams for homonuclear diatomic molecules having interactions between 2s and 2p orbitals and having no interactions between 2s and 2p orbitals :  $H_2$ ,  $H_2^+$ ,  $He_2^+$ ,  $Li_2$ ,  $Be_2$ ,  $B_2$ ,  $C_2$ ,  $N_2$ ,  $O_2$ ,  $O_2^+$ ,  $O_2^-$ ,  $O_2^{2-}$ ,  $F_2$ ,  $Ne_2$ ,
- x. Draw the shapes of molecular orbitals.
- xi. Give the calculations of bond order, energy and explanation on stability of the above molecule and ions
- xii. Draw the MO energy level diagrams for heteronuclear diatomic molecules: CO, NO, HCl, HF and calculations of bond order, energy and explain the stability of the molecules.

- xiii. Understand the formation of BMO, ABMO and NBMO in CO<sub>2</sub> or NO<sub>2</sub> molecule and construct MO energy level diagrams for them.

## 2. Coordination Chemistry

33L

### I. INTRODUCTION TO COORDINATION CHEMISTRY (03 L)

1. General account and meaning of the terms involved in coordination chemistry:

Coordinate bond, central metal atom or ions, ligand, double salt, complex compound, coordination number, charge on the complex ion, oxidation number of Metal ion, first and second coordination sphere.

2. Ligands: Definition, Classification, Chelates and chelating agents.

3. Formation Constant, inert and labile complexes.

4. IUPAC nomenclature of coordination compounds

5. Different geometries of coordination compounds with C.N.= 4 to C.N.=10 and examples of each geometry.

### II. WERNER'S THEORY OF COORDINATION COMPOUNDS (02 L)

Assumptions of Werner's coordination theory, Werner's formulation of Coordination compounds, Physical and chemical test to support his formulation of ionizable and non-ionizable complexes, Stereoisomerism in complexes with C.N.4 and C.N. 6 to identify the correct geometrical arrangement of the complexes.

### III. ISOMERISM IN COORDINATION COMPLEXES (04 L)

Definition of isomerism in complexes-Structural Isomerism and stereoisomerism,

1. Structural isomerism (ionization, hydrate, linkage, ligand, coordination position and polymerization isomers)

2. Stereoisomerism and its types-Geometrical isomerism and optical isomerism.

### IV. SIDGWICK THEORY (02 L)

Concept of Sidgwick's model, Scheme of arrow indication for M-L bond suggested by Sidgwick, Effective Atomic Number rule (EAN), Calculations of EAN value for different complexes and stability of complexes, Advantages and Drawbacks of Sidgwick's theory.

### V. PAULING'S VALENCE BOND THEORY (06 L)

Introduction of Valence Bond Theory (VBT), Need of concept of hybridization, Aspects of VBT, Assumptions, VB representation of tetrahedral, square planer, trigonalbipyramidal and octahedral complexes with examples, Inner and outer orbital complexes, Electro neutrality principle, Multiple bonding(  $d\pi-p\pi$  and  $d\pi-d\pi$ ), Limitations of VBT.

### VI. CRYSTAL FIELD THEORY (10 L)

Introduction and need of Crystal Field Theory(CFT), Assumptions, Shapes and degeneracy of d orbital, Splitting of d-orbitals, Application of CFT to octahedral complexes, pairing energy(P) and distribution of electrons in  $e_g$  and  $t_{2g}$  level, calculation of magnetic moment using spin-only formula, Crystal Field Stabilization Energy (CFSE), calculation of CFSE in weak oh field and strong oh field complexes, Evidence for CFSE, Interpretation of spectra of complexes, calculation of  $10 Dq$  and factors affecting magnitude of  $10Dq$ , d-d transitions and colour of the complexes, Jahn-Teller distortion theorem for octahedral complexes and its illustration, CFT of tetrahedral and square planar

complexes, calculations of CFSE, Spectrochemical series, Nephelauxetic effect and Nephelauxetic series, Limitations of CFT, modified CFT (LFT), Problems related to calculation of  $10 Dq$ , CFSE and spin only magnetic moment for octahedral, tetrahedral & square planar complexes. (i.e. for high spin & low spin complexes)

## VII. MOLECULAR ORBITAL THEORY OF COORDINATION COMPLEX (06 L)

Introduction, 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  $\pi$  bonding, Charge transfer spectra, Comparison of VBT, CFT, and MOT.

**Ref. 2** Pages 194 -236

**Ref. 8** Relevant Pages

**Ref. 9** Relevant Pages

### Aims and objective

A student should:

- i. Know the meaning of various terms involved in coordination chemistry.
- ii. Know the different types of Ligands.
- iii. Understand the chelating agents, chelate and stability of chelates and complexes.
- iv. Calculate the charge on complex ion and the oxidation number.
- v. Be able to give the IUPAC name the co-ordination compound.
- vi. Know the application of co- ordination compounds in biology and chemistry.
- vii. Be able to understand the Werner's formulation of complexes and identify the ionizable ions.
- viii. Be able to distinguish between ionizable and non-ionizable valencies with suitable examples.
- ix. Give the suitable physical and chemical test for identification of number and types of ionizable ions.
- x. Be able to draw the geometrical and optical isomerism of complexes.
- xi. Choose the correct geometry for complexes with C.N. 4 and C.N. 6 with the help of stereoisomerism.
- xii. Be able to define and explain isomerism in complexes.
- xiii. Be able to explain various types of isomerism.
- xiv. Comment on the stereoisomerism in complexes with C.N. 4 and C. N. 6.
- xv. Define EAN rule and calculate EAN value of the complexes.
- xvi. Comment on EAN value and stability of complexes.
- xvii. Know the merits and the demerits of Sidgwick's theory.
- xviii. Be able to explain the need of concept of hybridization.
- xix. Explain the VB representation of tetrahedral, square planar, trigonalbipyramidal and octahedral complexes.
- xx. Be able to identify which d-orbitals are involved in hybridization during formation of complexes with different geometries such as tetrahedral, square planar, trigonalbipyramidal and octahedral.
- xxi. Be able to explain structure and magnetic behaviour of the complexes.
- xxii. Be able to identify the high spin and low spin complexes.
- xxiii. Be able to identify inner orbital and outer orbital complexes.
- xxiv. Explain electroneutrality principle and different types of pi bonding.
- xxv. Know the limitations of VBT.
- xxvi. Know the shapes of d-orbitals and degeneracy of d-orbitals.

- xxvii. Know the assumptions of CFT.
- xxviii. Understand how splitting of d-orbitals occurs when ligand approaches.
- xxix. Be able to draw crystal field splitting diagrams of d orbital of metal ion in octahedral, tetrahedral, square planar or tetragonal ligand field.
- xxx. Interpret the spectra of complexes and calculate the  $10 Dq$ .
- xxxi. Understand the factors affecting magnitude of  $10 Dq$ .
- xxxii. Be able to find high spin and low spin complexes when  $10 Dq$  and pairing energy are given.
- xxxiii. Be able to explain d-d transitions and colour of the complexes.
- xxxiv. Know the conditions under which Jahn-Teller distortion occurs.
- xxxv. Explain, why Jahn-Teller distortion should occur in  $O_h$  complexes?
- xxxvi. Be able to explain Nephelauxetic effect towards covalent bonding.
- xxxvii. Explain MOT of Octahedral complexes with sigma bonding.
- xxxviii. Be able to explain Charge Transfer Spectra.
- xxxix. Be able to compare the different approaches to bonding in Coordination compounds.

**Reference Books:**

**Ref. 1** Introduction to Electrochemistry by Glasstone - 2<sup>nd</sup> edition.

**Ref. 2** Concise Inorganic Chemistry by J.D. Lee - 5<sup>th</sup> edition.

**Ref. 3** Inorganic Chemistry, - D.F. Shriver & P.W. Atkins- C.H. Longford ELBS - 2<sup>nd</sup> edition.

**Ref. 4** Basic Inorganic Chemistry, - F.A. Cotton and G. Wilkinson, Wiley Eastern Ltd 1992.

**Ref. 5** Concept and Model of Inorganic Chemistry by Douglas – Mc Daniels - 3<sup>rd</sup> edition.

**Ref. 6** Chemistry by Raymond Chang - 5<sup>th</sup> edition

**Ref. 7** New Guide to Modern Valence Theory by G.I. Brown - 3<sup>rd</sup> edition

**Ref. 8** Co-ordination Compounds by Baselo and Pearson.

**Ref. 9** Theoretical Inorganic Chemistry by Day and Selbin.

**Ref. 10** Inorganic Chemistry by A. G. Sharpe - 3<sup>rd</sup> Edition.

**Ref. 11** Coordination Chemistry by A. K. De.

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**Semester-IV**  
**Course: Inorganic Chemistry (CH-342)**

<b>Topic</b>	<b>No. of Lectures</b>
1. Chemistry of f-block element	08
2. Metals Semiconductors and Superconductors	10
3. Ionic Solids	10
4. Homogeneous Catalysis	06
5. Heterogeneous Catalysis	08
6. Bioinorganic Chemistry	06
<b>Total Lectures</b>	<b>48</b>

**1. Chemistry of f- block elements (08 L)**

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, Occurrence and separation (Group/ Individual) by modern methods (ion exchange and solvent extraction method), Lanthanide contraction & its effect on chemistry of Lanthanides and post-lanthanide elements, applications of lanthanides

**II. Actinides**

Position in periodic table, Name and electronic Configuration of actinides, Oxidation States, Occurrence, and general methods of preparation of transuranic elements [viz., a) Neutron Bombardment, b) Accelerated projectile bombardment and c) Heavy ion bombardment], Nuclear Fuels-Nuclear Fusion fuels & nuclear fission fuels, IUPAC nomenclature system for super heavy elements with atomic no. (z) greater than 100, Comparison between Lanthanides and Actinides.

**Ref. 2** Pages 859-863, 865-866, 874 – 875, 879-886, 891-893, 898-900

**Aims and objective**

A student should know:

- a. The meaning of term f-block elements, Inner transition elements, lanthanides, actinides.
- b. Electronic configuration of lanthanides and actinides.
- c. Oxidation states of lanthanides and actinides and common oxidation states.
- d. Separation lanthanides by modern methods.
- e. Lanthanide contraction and effects of lanthanide contraction on post-lanthanides.
- f. Use of lanthanide elements in different industries.
- g. Transuranic elements.
- h. Preparation methods of transuranic elements.
- i. Nuclear fuels and their applications.
- j. Why transuranic elements are called as the synthetic elements?
- k. IUPAC nomenclature for super heavy elements with atomic no. 100 onwards.

**2. Metals, semiconductors and Super conductors (10 L)**

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, Super conductivity- Discovery, Property, Models structure and superconductivity, Applications of superconductors,

**Ref. 7** Pages 209-221

**Ref. 6** Related Pages

### **Aims and objective**

A student should know:

- a. The meaning of metal & semiconductor.
- b. The difference between metal, semiconductor and insulator.
- c. Metallic bond on the basis of band theory.
- d. The energy band and energy curve.
- e. Draw  $n(E)$  &  $N(E)$  curves.
- f. Explain the electrical conductivity of metals with respect to valence electrons.
- g. Explain the effect of temperature and impurity on conductivity of metals and semiconductors.
- h. Intrinsic and extrinsic semiconductor.
- i. The term valence band and conduction band.
- j. n and p type of semiconductors.
- k. Non-stoichiometry and semi conductivity.
- l. Insulators on the basis of band theory.
- m. The difference between Na, Mg, and Al in terms of valence electrons and conductivity.
- n. Meaning of super conductors and their structure.
- o. Discovery and applications of superconductors.

### **3. Ionic Solids**

**(06 L)**

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, Pauling's univalent and crystal radii, Conversion of univalent radii to crystal radii, problems based on conversion of radii, Radius ratio effect, Lattice energy, Born-Landé equation, Born Haber cycle and its applications, Schottky and Frenkel defect.

**Ref. 2** Pages 32-61

**Ref. 5** Pages 102-127

**Ref. 7** Pages 55-62

### **Aims and objectives**

A student should:

- i. Know the nature of solids.
- ii. Know the crystal structures of solids.
- iii. Draw the simple cubic, BCC and FCC structures.
- iv. Identify the C.N. of an ion in ionic solid.
- v. Identify the type of void.
- vi. Know the effect of radius ratio in determining the crystal structure.
- vii. Be able to define Pauling's univalent radius and crystal radius.

- viii. Be able to solve simple problems based on Pauling's univalent radii and crystal radii.
- ix. Know how to draw Born-Haber cycle.
- x. Be able to solve simple problems based on Born- Haber cycle.
- xi. Know the defects in Ionic solids.
- xii. Be able to differentiate between the defects.

#### 4. Homogeneous Catalysis

(06 L)

Definition, types of homogeneous catalysts, Essential properties of homogeneous catalysts, Catalytic Reactions such as:

- a. Wilkinson's Catalysis
- b. Zeigler Natta Catalysis
- c. Monsanto acetic acid synthesis

**Ref. 3** Related Pages

**Ref. 6** Related Pages

**Ref. 13** Pages 650-652 and 656-661

#### Aims and objectives

A student should:

- i. Define the homogeneous catalysis.
- ii. Give examples of homogeneous catalysts.
- iii. Understand the essential properties of homogeneous catalysts-Give the catalytic reactions for Wilkinson's Catalysis, Zeigler Natta Catalysis, Monsanto acetic acid synthesis
- iv. Give the brief account of homogeneous catalysis.

#### 5. Heterogeneous Catalysis

(08 L)

Definition, types of heterogeneous catalysts-metals, semiconductors, solid acid catalysts and supported catalysts, Essential properties of heterogeneous catalysts, Catalytic Reactions such as:

- a. Oxidation-
  - i. Synthesis of terephthalic acid from xylene using ZSM-5
  - ii. Synthesis of benzoic acid from toluene using  $\text{KMnO}_4$
- b. Reduction-
  - i. Hydrogenation of alkene to alkane using Raney Ni catalyst.
  - ii. Synthesis of p-aminophenol from nitrobenzene using Pd/C catalyst.
- c. Cyclization- Benzimidazole synthesis using o-phenenediamine and benzaldehyde by acidic support or clay-solid support, amberlist or  $\text{NH}_4\text{Cl}$ .
- d. Biodiesel Synthesis- using heteropolyacid catalyst- Transesterification using phosphomolybdic or phosphotungstic acid.

**Ref. 5** Related Pages

**Ref. 11** Related Pages

**Ref. 13** Related Pages

#### Aims and objectives

A student should:

- i. Define the heterogeneous catalyst and heterogeneous catalysis.
- ii. Give examples of heterogeneous catalysts.
- iii. Understand the essential properties of heterogeneous catalysts.
- iv. Give the catalytic reactions for oxidation, reduction and cyclization processes.
- v. Give the brief account of biodiesel synthesis using heterogeneous catalysis.
- vi. Enlist the catalysts used for benzimidazole synthesis.

- vii. Understand the catalytic reactions used in industries around.

## 6. Bioinorganic Chemistry

(06 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 process- 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, $\text{Fe}_2\text{S}_2$ , $\text{Fe}_3\text{S}_4$ , $\text{Fe}_4\text{S}_4$ ). Transport protein (transferrin) and Storage protein (ferritin)

### III. Bioinorganic Chemistry of Fe: Hemoglobin and myoglobin, its structure and functions.

### IV. Bioinorganic Chemistry of Co: Vitamin- $\text{B}_{12}$ , its structure and function.

**Ref. 3** Pages 782-806

**Ref. 2** Pages 353, 775, 779, 796-797

**Ref. 12** Pages 1-13, 24, 285-290

### Aims and objective

A student should:

- Identify the biological role of inorganic ions & compounds.
- Know the abundance of elements in living system and earth crust.
- Give the classification of metals as enzymatic and non-enzymatic.
- Understand the role of metals in non-enzymatic processes.
- Know the metalloproteins of iron.
- Explain the functions of hemoglobin and myoglobin in  $\text{O}_2$  transport and storage.
- Understand the toxicity of  $\text{CN}^-$  and CO binding to Hb.
- Draw the structure of Vit. $\text{B}_{12}$  and give its metabolism.

### Reference Books:

**Ref. 1** Introduction to Electrochemistry by Glasstone - 2<sup>nd</sup> edition.

**Ref. 2** Concise Inorganic Chemistry by J.D. Lee - 5<sup>th</sup> edition.

**Ref. 3** Inorganic Chemistry, - D.F. Shriver & P.W. Atkins- C.H.Longford ELBS - 2<sup>nd</sup> edition.

**Ref. 4** Basic Inorganic Chemistry, - F.A. Cotton and G. Wilkinson, Wiley Eastern Ltd 1992.

**Ref. 5** Concept and Model of Inorganic Chemistry by Douglas – Mc Daniels - 3<sup>rd</sup> edition.

**Ref. 6** Chemistry by Raymond Chang - 5<sup>th</sup> edition

**Ref. 7** New Guide to Modern Valence Theory by G.I. Brown - 3<sup>rd</sup> edition

**Ref. 8** Co-ordination Compounds by Baselo and Pearson

**Ref. 9** Theoretical Inorganic Chemistry by Day and Selbin

**Ref.10** Inorganic Chemistry by A. G. Sharpe - 3<sup>rd</sup> Edition

**Ref.11** Heterogenous Catalysis by D.K Chakrabarty and B. Vishwanathan, New Age Intl. Publishers, 1<sup>st</sup> Edn.

**Ref. 12** Principles of Bioinorganic Chemistry by S. J. Lippard and J. M. Berg, Panima Publishing Corporation, 1<sup>st</sup> Edn.

**Ref. 13** Inorganic Chemistry by J.E. Huheey, 4<sup>th</sup> Edn, Pearson Education.

## CH-348 - INORGANIC CHEMISTRY PRACTICALS

### A) Gravimetric estimations (Any 3)

1. Fe as  $\text{Fe}_2\text{O}_3$
2. Nickel as Ni – DMG
3. Al as Aluminum oxide
4. Gravimetric estimation of Ba as  $\text{BaSO}_4$  using homogeneous precipitation method.

### B) Volumetric Estimations (Any 4)

1. Mn by Volhard's method
2. Estimation of  $\text{NO}_2^-$  by using  $\text{KMnO}_4$ .
3. Estimation of % purity of given sample of Sodium Chloride
4. Analysis of Brass-Estimation of copper by Iodometry
5. Fertilizer analysis ( $\text{PO}_4^{3-}$ )

### C) Inorganic preparations (Any 4)

1. Preparation of Hexamminenickel(II),  $[\text{Ni}(\text{NH}_3)_6]^{2+}$ .
2. Preparation of Potassium Trioxalatoferrate (III),  $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$ .
3. Preparation of Tetraamminecopper (II) sulphate,  $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$ .
4. Preparation of Manganese (III) acetylacetonate  $[\text{Mn}(\text{acac})_3]$ .
5. Preparation of Tris(Thiourea)Copper (I) Chloride  $[\text{Cu}(\text{Thiourea})_3]\text{Cl}$ .

### D) Colorimetric Estimations (Any 2)

1. Iron by thiocyanate method.
2. Cobalt by using R-nitroso salt method.
3. Titanium by  $\text{H}_2\text{O}_2$ .

### E) Separation of binary mixture of cations by Column Chromatography (3 mixtures)

(One mixture should be colorless, Zn + Al, Zn + Mg)

OR

### E) Flame Photometry (Any 3)

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.

### F) Qualitative Analysis (4 mixtures including Borates and Phosphates)

### G) Visit to a chemical industry and report writing is compulsory.

**Reference Books:** Ref. 1 General Chemistry Experiment – Anil J Elias (University press).

Ref. 2 Vogel Textbook of Quantitative Chemical Analysis G.H. Jeffery, J. Basset.

Ref. 3 Quantitative Chemical Analysis S. Sahay (S. Chand & Co.).

Ref. 4 Quantitative Analysis R.A. Day, Underwood (Prentice Hall).

Ref. 5 Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).

Ref. 6 Vogel's Textbook of Quantitative Chemical Analysis.

Ref. 7 Monograph on Green Chemistry Laboratory Experiments by Green Chemistry Task Force Committee, DST.

Ref. 8 "Experimental Methods in Inorganic Chemistry." Tanaka, J. and Suib, S.L., Prentice Hall, New Jersey, 1999.

### STRUCTURE OF PRACTICAL EXAMINATION

<b>Experiment</b>	<b>Marks</b>
<b>Q.1.</b> Qualitative analysis OR Gravimetric Experiment*	<b>35</b>
<b>Q.2.</b> Volumetric Experiment (25 Marks) Preparation (10 marks) OR Flame Photometry (20 marks) Preparation (10 marks)  OR Column Chromatography (20 marks) Preparation (10 marks)  OR Colorimetric Estimation (25 Marks) Preparation (10 marks)	<b>35</b>
<b>Q.3.</b> Oral	<b>10</b>

\*Minimum 50 % students of each batch should be allotted Gravimetric Estimation.

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**Semester III**  
**Course: Organic Chemistry (CH-333)**

<b>Topic</b>	<b>No. of Lectures</b>
1. Strength of organic acids and bases	03
2. Stereochemistry of disubstituted cyclohexane	06
3. Nucleophilic substitution at aliphatic Carbon	08
4. Reactions of unsaturated hydrocarbons and carbon oxygen double bond	15
5. Elimination Reactions	06
6. Aromatic Electrophilic and Nucleophilic Substitution Reactions	10
<b>Total Lectures</b>	<b>48</b>

**1. Strength of organic acids and bases** (03) Introduction,  $pK_a$ , origin of acidity, influence of solvent, simple aliphatic saturated and unsaturated acids, substituted aliphatic acid, phenols, aromatic carboxylic acids,  $pK_a$  and temperature,  $pK_b$ , aliphatic and aromatic bases, heterocyclic bases, acid base catalysis.

*Aims and objectives:* Students should know –

1. Definition and types of organic acid and base
2. The  $pK_a$  and  $pK_b$  concepts
3. Effect of temperature on  $pK_a/pK_b$
4. Comparison between strengths of acids/bases
5. What is acid-base catalysis

**Ref.8 (53-75), Ref. 7 Relevant pages.**

**2. Stereochemistry of disubstituted cyclohexane** (06)  
Introduction, 1,1-alkyl disubstituted cyclohexane; Dimethyl cyclohexane 1,2; 1,3 and 1,4. Geometrical isomerism, Optical isomerism, stability of conformation, energy calculations.

*Aims and objectives:* Students should learn –

1. To draw different types of disubstituted cyclohexane in Chair form
2. To distinguish between geometrical and optical isomerism
3. Stability, energy calculations with potential energy diagram and optical activity of these conformers.

**Ref. 1 Relevant pages, Ref. 3 (204-214),**

**3. Nucleophilic substitution at aliphatic Carbon** (08)  
Introduction, Nucleophile and leaving groups, Mechanism of nucleophilic substitution. The  $S_N1$  reaction: Kinetics, mechanism and stereochemistry (Racemization), stability of carbocation. The  $S_N2$  reaction: Kinetics, mechanism & stereochemistry (inversion). How to know whether a given reaction will follow  $S_N1$  or  $S_N2$  mechanism. Comparison of  $S_N1$  &  $S_N2$  reactions.  $S_Ni$  reaction and mechanism.

*Aims and objectives:* Students should understand –

1. Definition and type of nucleophiles and leaving groups
2. Different types of nucleophilic substitution reactions
3. Definition of inversion and racemization
4. The kinetics, mechanism & stereochemistry of these reactions
5. Whether a given reaction follows  $S_N1$  or  $S_N2$  mechanism?
6. The comparison between  $S_N1$  &  $S_N2$  reactions
7. An  $S_Ni$  mechanism in presence and absence of pyridine
8. To predict product/s or supply the reagent/s for these reactions

**Ref.1. Pages 172-203 and 208 to 210 Ref.8.Relevant pages**

#### **4. Reactions of unsaturated hydrocarbons and carbon oxygen double bond (15)**

**a) Reaction of Carbon-Carbon double bond:** Introduction, Mechanism of electrophilic addition to C=C bond. Orientation & reactivity, Rearrangements, (Support for formation of carbocation). Addition of hydrohalogen, Anti Markownikoff's addition (peroxide effect) with mechanism, Addition of halogens (dl pairs and meso isomers), hypohalous acids (HOX), Hydroxylation (Mechanism of cis and trans 1,2-diols). Hydroboration- Oxidation (Formation of alcohol), Hydrogenation (Formation of alkane), Ozonolysis (formation of aldehydes & ketones)

**Ref.1. (Pages 317-323,327-343,346-355,357,360)**

**b) Reactions of Carbon –Carbon triple bond:** Addition of hydrogen, halogens, halogen acids, water and formation of metal acetylides and its application.

**Ref.1 (Pages 431-433)**

#### **c) Reactions of Carbon –Oxygen double bond:**

Introduction, Structure of carbonyl group, reactivity of carbonyl group, addition of Hydrogen cyanide, alcohols, thiols, water, ammonia derivatives, Cannizzaro and Reformatski reactions with mechanism.

*Aims and objectives:* Students should know –

1. Different types of carbon-carbon unsaturated compounds
2. Orientation / rules in addition reactions
3. The structure of carbonyl group
4. Reactivity concept
5. Correct mechanism of addition reactions using different reagents
6. Types of some known addition reactions
7. To predict product/s or supply the reagent/s for such reactions.

**Ref.1.Relevant pages**

#### **5. Elimination Reactions (06)**

Introduction; 1,1; 1,2 elimination, E1, E2 and E1cB mechanism with evidences, Hoffmann and Saytzeff's elimination, reactivity effect of structure, attacking and leaving groups.

*Aims and objectives:* Students should learn –

1. Definition and types of elimination reactions
2. Different types of bases and leaving groups

3. Statement of Hoffmann and Saytzeff rule
4. The evidences, mechanism & stereochemical aspects of these reactions
5. Whether a given reaction follows E1, E2 or E1cB mechanism?
6. Comparison between E1 & E2 reactions
7. The effect of structure, attacking and leaving group on reactivity of such reactions
8. To predict product/s or supply the reagent/s for these reactions

**Ref. 1. (Pages 290-310)**

**Ref. 2. Relevant Pages.**

## **6. Aromatic Electrophilic and Nucleophilic substitution reactions (10)**

Introduction, arenium ion mechanism, Effect of substituent group (Orientation, o/p directing and meta directing groups). Classification of substituent groups (activating and deactivating groups) Mechanism of – Nitration, Sulfonation, Halogenation, Friedel-Crafts reactions, Diazo Coupling reactions, Ipso-substitution. Addition-elimination ( $S_NAr$ ),  $S_N1$ , Elimination-addition (Benzyne)  $S_NR1$  reactions, reactivity.

*Aims and objectives:* Students should understand –

1. Definition and types of aromatic substitution reactions
2. Classification of directing groups
3. What is an arenium ion and Ipso substitution?
4. The evidences, reactivity and mechanism of these reactions
5. Whether a given reaction follows addition-Elimination or Elimination-addition mechanism?
6. To predict product/s or supply the reagent/s for these reactions

**Ref 1-(Pages 517-544, 666-67), Ref 7 and 8- Relevant Pages.**

### **Reference Books:**

- 1) Organic Chemistry by Morrison and Boyd 6<sup>th</sup> Edn
  - 2) Organic Chemistry by Cram and Hammond.
  - 3) Stereochemistry of Organic compounds by Eliel Tata McGraw Hill 1989.
  - 4) Organic Chemistry by John McMurry V<sup>th</sup> Edn. 1999
  - 5) Organic Chemistry by Graham Solomans
  - 6) Organic Chemistry by I.L. Finar Vol. IIV<sup>th</sup> Edn.
  - 7) Organic Chemistry by Clayden, Greeves, Warren and Wothers (Oxford Press)
  - 8) A guide book to reaction Mechanism by Peter Sykes VI<sup>th</sup> Edn.
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**Semester IV**  
**Course: Organic Chemistry (CH-343)**

<b>Topic</b>	<b>No. of Lectures</b>
1. Carbanions and their reactions	06
2. Retrosynthetic analysis and applications	05
3. Rearrangement reactions	06
4. Spectroscopic methods in structure determination of Organic compounds	24
5. Natural Products	07
<b>Total Lectures</b>	<b>48</b>

**1. Carbanions and their reactions (06)**

Introduction, Formation and stability of Carbanion. Reactions involving carbanions and their mechanisms: Aldol, Claisen, Dieckmann and Perkin condensations. Synthesis and Synthetic applications of Malonic ester, Acetoacetic ester and Wittig reagent.

*Aims and objectives:* Students should know –

1. Definition and formation of carbanions
2. Possible mechanism of some known name reactions involving carbanions
3. Synthetic applications some reagents
4. To predict product/s or supply the reagent/s for these reactions

**Ref. 2 (270-299).**

**2. Retrosynthetic analysis and applications (05)**

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.

*Aims and objectives:* Students should learn –

1. Meaning of terms Disconnection, Synthons, Synthetic equivalence, Functional Group Interconversion, Target Molecule
2. What is retrosynthesis?
3. Various steps involved in the synthesis of some molecules (detailed mechanism is not expected)

**Ref.3 Relevant pages**

**Ref.4. Relevant pages**

**3. Rearrangement reactions (06)**

Introduction, Mechanism of rearrangement reaction involving carbocation, nitrene and oxonium ion intermediate. Beckmann, Bayer-Villiger, Pinacol-pinacolone, Curtius, Favorski, Claisen rearrangement.

*Aims and objectives:* Students should understand –

1. What is rearrangement reaction?
2. Different types of intermediate in rearrangement reactions?
3. To write mechanism of some named rearrangement reactions

**Ref. 8. (Pages 86-90,105,112,122,158)**

**Ref. 6.Relevant Pages.**

#### **4. Spectroscopic methods in structure determination of Organic compounds (24)**

Introduction, meaning of spectroscopy, nature of electromagnetic radiation, wave length, frequency, energy, amplitude, wave number, and their relationship, different units of measurement of wavelength frequency, different regions of electromagnetic radiations. Interaction of radiation with matter. Excitation of molecules with different energy levels, such as rotational, vibrational and electronic level. Types of spectroscopy and advantages of spectroscopic methods.

*Aims and objectives:* Students should know –

1. What is Spectroscopy?
2. Different regions of electromagnetic radiations
3. Various terms used in spectroscopy
4. What is the interaction of radiation with matter
5. Types of energy levels with diagram
6. Brief idea about the advantages of spectroscopic methods

**Ref-5.(Pages 1-3, 7-11), Ref. 9 and 10 Relevant pages.**

#### **A) Ultra Violet Spectroscopy**

Introduction, nature of UV, Beer's law, absorption of UV radiation by organic molecule leading to different excitation. Terms used in UV Spectroscopy- Chromophore, Auxochrome, Bathochromic shift(Red shift), hypsochromic shift(Blue shift), hyperchromic and hypochromic effect. Effect of conjugation on position of UV band. Calculation of  $\lambda_{max}$  by Woodward and Fisher rules for dienes and enone systems, Colour and visible spectrum, Applications of UV Spectroscopy- Determination of structure, Determination of stereo chemistry (Cis and trans)

*Aims and objectives:* Students should learn –

1. What is UV Spectroscopy and Beer's law?
2. Different types of electronic excitations
3. Various terms used in UV spectroscopy
4. What is the effect of conjugation on UV band
5. To calculation of  $\lambda_{max}$  for dienes and enone systems
6. Define colour?
7. What is the range of vision region ?
8. Applications of UV Spectroscopy

**Ref-5. (Pages 13-15, 18-38)**

#### **B) Infra red Spectroscopy**

Introduction, Principle of IR Spectroscopy, Fundamental modes of vibrations (3N-6, 3N-5) Types of vibrations (Stretching and bending), Hooke's law, Condition for absorption of IR radiations, vibration of diatomic molecules. Regions of IR Spectrum: fundamental group region, finger print region aromatic

region, Characteristic of IR absorption of functional groups: Alkanes, alkenes, alkynes, alcohol, ethers, alkyl-halides, carbonyl compounds (-CHO, C=O,-COOR-COOH), amines, amides and Aromatic Compounds and their substitution Patterns. Factors affecting on IR absorption: Inductive effect, resonance effect, hydrogen bonding. Application of IR Spectroscopy in determination of structure, chemical reaction and hydrogen bonding.

*Aims and objectives:* Students should understand–

1. What is IR Spectroscopy?
2. To calculate fundamental modes of vibrations for a given molecule
3. Which factors affect IR band position?
4. To distinguish compounds by this spectroscopic method
5. To determine structure and follow the course of reaction by IR spectrum

**Ref-5.( Pages 46-51, 53, 54,72-81, 86)**

### **C) PMR Spectroscopy**

Introduction, Principles of PMR Spectroscopy, Magnetic and nonmagnetic nuclei, Precessional motion of nuclei without mathematical details, Nuclear resonance, chemical shift, shielding, & deshielding effect. Measurement of chemical shift, delta and Tau-scales. TMS as reference and its advantages, peak area, integration, spin-spin coupling, coupling constants, *J*-value (Only first order coupling be discussed)

*Aims and objectives:* Students should know–

1. What is the principle of PMR?
2. Various terms used in PMR spectroscopy.
3. Why TMS is used as a reference compound?
4. To distinguish compounds by PMR

**Ref-5. (Pages 95-98, 106-108)**

### **D) Problems based on U.V., I.R. and PMR.**

**Ref-1, 9 and 10.**

### **5) Natural Products**

**(07)**

**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 Ephedrin by Nagi.

*Aims and objectives:* Students should learn–

1. What are terpenoids and alkaloids?
2. Various methods of isolation/extraction of these natural products.
3. Synthesis of Citral and Ephedrin by Barbier- Bouveault and Nagi methods, respectively.
4. To determine the structure of above compounds by chemical methods.

**Ref-6 (1437-1440) Ref.7.Relevant Pages.**

**Reference Books :**

1. Organic Chemistry by Morrison and Boyd. VI<sup>th</sup>Edn.
  2. A guide book to reaction mechanism by Peter Sykes VI<sup>th</sup>Edn.
  3. Designing organic Synthesis by Stuart Warren 1983
  4. Organic Chemistry by Cram and Hammond
  5. Absorption Spectroscopy of Organic Molecules by V. M. Parikh 1974
  6. Organic Chemistry by Clayden, Greeves, Warren and Wothers
  7. Organic Chemistry by I. L. Finar Vol. II V<sup>th</sup>Edn.
  8. Reactions, Rearrangements and reagents by S. N. Sanyal
  9. Introduction Spectroscopy by Pavia
  10. Spectroscopic identification of organic molecules by Silverstein
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## Organic Chemistry Practical (CH-349)

### A) Separation of Binary Mixtures and Qualitative Analysis (8 Mixtures)

Solid-Solid (4 Mixtures), Solid-Liquid (2 Mixtures), Liquid-Liquid (2 Mixtures).

At least one mixture from each of the following should be given-Acid-Base, Acid-Phenol, Acid-Neutral, Phenol-Base, Phenol-Neutral, Base-Neutral and Neutral- Neutral.

*Name and structure of the separated components of the binary mixture is not necessary. Students are expected to record the- Type, Separation of mixture, Preliminary tests, Physical constants, Elements and Functional groups only. The purified samples of the separated components should be submitted. Separation and qualitative analysis of the binary Mixtures should be carried out on micro scale using micro scale kits.*

### B) Organic Estimations (Four)

- i. Estimation of acetamide.
- ii. Estimation of Glucose.
- iii. Estimation of Ethyl benzoate.
- iv. Determination of Molecular weight of Monobasic acids by Volumetric Methods.
- v. Determination of Molecular weight of Dibasic acids by Volumetric Methods.

### C) Organic Preparations (Eight)

**Preparation of:** Adipic acid from cyclohexanone (Oxidation by Con.  $\text{HNO}_3$ )

Benzoquinone from Hydroquinone (Oxidation by  $\text{KBrO}_3/\text{K}_2\text{CrO}_3$ )

P-nitroacetanilide from Acetanilide (Nitration)

B-Naphthyl ether from B-naphthol (Methylation by DMS, NaOH)

Hippuric acid from Glycine (Benzoylation)

P-Iodonitrobenzene from P-Nitroaniline (Sandmeyer Reaction)

Benzoic acid from Ethyl benzoate (Ester hydrolysis)

P-Bromacetanilide from Acetanilide (Bromination)

Paraacetamol from P-Hydroxyaniline (Acetylation)

Ethylbenzene from Acetophenone (Wolff Kishner reduction)

*The preparation should be carried out on small scale. The starting compound should not be given more than one gm. Double burette method should be used for titration. Monitoring of the reaction and purification should be carried out by recrystallization and purity of the product in preparation should be checked by physical constant(M.P/B.P.) determination and thin layer Chromatography (TLC) with proper selection of the solvent system.*

#### **Reference Books**

- 1) Practical Organic Chemistry by – A.I. Vogel.
- 2) Practical Organic Chemistry by – O.P. Agarwal.

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#### **STRUCTURE OF ANNUAL PRACTICAL EXAMINATION**

1. Binary Mixture separation and qualitative Analysis	40 Marks
2. Organic Estimation/ Preparation	30 Marks
3. Oral	10 Marks

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## Semester-III

### Course: Analytical Chemistry (CH-334)

Sr. No.	Topic	No. of Lectures
1	Gravimetric Analysis	12
2	Thermal methods of analysis	06
3	Spectrophotometry	10
4	Polarography	08
5	Atomic Absorption Spectroscopy	06
6	Flame Emission Spectroscopy	06
<b>Total Lectures</b>		<b>48</b>

#### 1. Gravimetric Analysis

(12 L)

Common ion effect and solubility product principles, Conditions for good precipitation, Factors affecting precipitation like acid, temperature, nature of solvent, Super saturation and precipitation formation, Precipitation from homogeneous solution and examples, Co-precipitation, post-precipitation and remedies for their minimization, Washing of precipitate and ignition of precipitate, Brief idea about method of filtration and drying of precipitate, Introduction to electrogravimetry: principle, applications, electrolytic separations of Cu and Ni, Numerical problems only on gravimetric analysis.

Ref. 1. Pg. 22-28, 30-33, 95, 107-114, 169-171, 403-404, 407-415

Ref. 3. Pg. 527-532

#### Aims and Objectives

Student should know,

1. Principles of common ion effect and solubility product
2. Formation of complex ion
3. Factors affecting on solubility of precipitation
4. Phenomenon of super saturation and precipitation formation
5. Meaning of co-precipitation and post precipitation
6. Choice of liquid for washing the precipitate
7. Precautions during filtration, drying and ignition of precipitate
8. Conceptual understanding of electrogravimetric principle
9. Numerical Problems

#### 2. Thermal methods of analysis

(06L)

Principle of thermal analysis, classification of thermal techniques, Principle, instrumentation and applications of TGA and DTA, factors affecting the thermal analysis, numerical problem.

#### Aims and Objectives

Student should know,

1. Methods of thermo gravimetric analysis

2. Principles of TGA and DTA
3. Types of TGA
4. Relation between TGA and DTA
5. Thermal equation of TGA
6. Different factors affecting TGA curve
7. Determination of calcium oxalate precursor
8. Applications of TGA, DTA and DSC

**Ref. 1.** Pg. 515-527,531-537

**Ref. 6** Pg. 732-737

### **3. Spectrophotometry**

**(10 L)**

Introduction, Electromagnetic spectrum, Interaction of electromagnetic radiations with the matter, Mathematical Statement and derivation of Lambert's Law and Beer's Law, Terminology involved in spectrophotometric analysis, Instrumentation of single beam colorimeter, Instrumentation of single and double beam spectrophotometer, Principle of additivity of absorbance and simultaneous determination, Spectrophotometric Titrations, Experimental Applications-Structure of organic compounds, Structure of complexes, Numerical Problems

**Ref. 1** Pg. 693-705

**Ref. 3** Pg. 144-153, 157-160, 170-174

#### **Aims and Objectives**

Student should know,

1. Principles of Spectrophotometric analysis and properties of electromagnetic radiations
2. Different Terms like absorbance, transmittance, and molar absorptivity
3. Mathematical Statement and derivation of Lambert's Law and Beer's Law
4. Different wavelength selectors and their importance
5. Instrumentation and working of single and double beam spectrophotometer
6. Additivity Principle
7. Different methods of color comparators
8. Applications
9. Numerical Problems

### **4. Polarography**

**(08 L)**

Introduction to voltammetric methods of analysis, Principles of polarographic analysis, Dropping Mercury Electrode, Instrument and working of polarographic apparatus, Ilkovic equation and quantitative analysis, Polarogram and chemical analysis, Analysis of mixture of cations, Factors affecting polarographic wave, Quantitative Applications, Numerical Problems

**Ref.6.** 691-734

#### **Aims and Objectives**

Student should know,

1. Voltammetry and polarography as an analytical tool
2. Construction, working, advantages and disadvantages of DME



3. Different terms involved in Ilkovic equation
4. Determination of Zn and Cd from the mixture
5. Significance of the different terms involved.
6. Need of removal of dissolved oxygen from analyte solution
4. Applications and numerical problems

### 5. Atomic Absorption Spectroscopy

(06 L)

Introduction and theory of atomic absorption spectroscopy, Instrumentation of single beam atomic absorption Spectrophotometer, Measurement of absorbance of atomic species by AAS, Spectral and Chemical Interferences, Qualitative and Quantitative Applications of AAS. Numerical Problems.

Ref. 3.Pg. 321-342

#### Aims and Objectives

Student should know,

1. Atomic absorption spectroscopy as an analytical tool
2. Measurement of absorbance of atoms by AAS.
3. Interferences in atomic absorption spectroscopy
4. Applications and numerical problems

### 6. Flame Emission Spectroscopy

(06 L)

Introduction and theory of atomic emission spectroscopy, Instrumentation of single beam flame emission spectrophotometer, Measurement of emission of atomic species, Interferences in emission spectroscopy, Methods of analysis- calibration curve method, Standard addition method, and internal, standard method, Qualitative and Quantitative Applications of FES, Numerical Problems.

Ref. 3.Pg. 321-322, 336-341, 364-370, 372-376

#### Aims and Objectives

Student should know,

1. Emission spectroscopy as an analytical tool
2. Measurement of emission of atomic species
3. Different methods of analysis
4. Application and numerical problems.

#### References

Ref.1 Textbook of Quantitative Chemical Analysis- 3<sup>rd</sup> Edition, A. I. Vogel

Ref.2 Principles of Physical Chemistry 4<sup>th</sup> edition – Prutton and Marron

Ref.3 Instrumental Methods of Chemical Analysis- Chatwal and Anand

Ref.4 Basic Concept of Analytical Chemistry-2<sup>nd</sup> edition S.M. Khopkar

Ref.5 Vogel's textbook of Quantitative Inorganic Analysis-4<sup>th</sup> edition

Besset Denney, Jaffrey, Mendham

Ref.6 Instrumental Methods of Chemical Analysis- 6<sup>th</sup> edition

Willard, Merritt, Dean and Settle

Ref.7 Analytical Chemistry by Skoog

Ref.8 Introduction to Instrumental Analysis- R.D. Braun

Ref.9 Instrumental methods of Chemical Analysis-Willard, Dean & Merrit-6th Edition

## Semester-IV

### Course: Analytical Chemistry (CH-344)

Sr. No.	Topic	No. of Lectures
1	Solvent Extraction	08
2	Chromatography	10
3	Gas Chromatography	09
4	High Performance Liquid Chromatography	09
5	Electrophoresis	06
6	Nephelometry and Turbidimetry	06
<b>Total Lectures</b>		<b>48</b>

#### 1. Solvent Extraction

(08L)

Introduction, Principle of solvent extraction, Distribution coefficient, distribution ratio, relation between Distribution coefficient and distribution ratio, factors affecting solvent extraction, percentage extracted, solvent extraction method, separation factor, batch extraction, counter current extraction, application of solvent extraction, numerical problems.

**References: 3,4,7,9** relevant pages.

##### Aims and Objectives

A student should know,

- i) Principles of solvent extraction.
- ii) Difference between KD and D
- iii) Various types of techniques of solvent extraction such as-  
(a) extraction (b) continuous extraction (c) counter current extraction.
- iv) Difference between batch and multiple extraction.
- v) Advantages and applications of solvent extraction.
- vi) To solve the numerical problems.

#### 2. Chromatography

(10L)

Introduction and classification of chromatographic methods, Principle of chromatographic analysis with match box model, Theoretical plates and column efficiency, Theory, Principle, technique and applications of- Column Chromatography, Ion exchange Chromatography, Thin layer Chromatography, Paper Chromatography, Numerical Problems

**Ref. 1-8** Relevant pages

##### Aims and Objectives

Student should know:

1. Principle of chromatographic methods
2. Relation between theoretical plates and column efficiency
3. Technique and applications of- Column Chromatography,
4. Technique and applications of- Thin layer Chromatography
5. Technique and applications of- Paper Chromatography

6. Technique and applications of- Ion exchange Chromatography
7. Numerical Problem

### **3. Gas Chromatography**

**(09 L)**

Introduction, Theory, Principle, GSC and GLC, Separation mechanism involved in GSC and GLC, Instrumentation of Gas chromatography, Working of gas chromatography, Gas chromatogram and qualitative-quantitative analysis, Applications of gas chromatography

**Ref. 1.** Pg. 167-174

**Ref. 4.** Pg. 454-464

**Ref. 5** Pg. 624-640

#### **Aims and Objectives**

Student should know,

- 1 Principle of GSC and GLC analysis
2. Separation mechanism involved in GSC and GLC
3. Instrumentation- stationary phases, column types, detectors
4. Working of gas chromatographic apparatus.
4. Chromatogram and use in qualitative-quantitative analysis
5. Applications of gas chromatography

### **4. High Performance Liquid Chromatography**

**(09 L)**

Introduction, Need of liquid chromatography, Separation mechanism involved in adsorption and partition HPLC, Instrumentation and working of HPLC, Applications of HPLC, Introduction to supercritical fluid chromatography

**Ref. 6.** Pg. 529-545

**Ref. 4.** Pg. 178-183

#### **Aims and Objectives**

Student should know,

- 1 Need of liquid chromatography
2. Separation mechanism involved in adsorption and partition HPLC
3. Instrumentation and working of HPLC
4. Applications of HPLC
5. Advantages of supercritical fluid chromatography

### **5. Electrophoresis**

**(06L)**

Introduction, Principle and theory of electrophoresis, Different types of electrophoresis techniques, Moving Boundary Electrophoresis, Zone electrophoresis- Paper, Cellulose acetate and Gel electrophoresis, Applications of electrophoresis

**Ref. 3 and Ref. 4 relevant pages**

#### **Aims and Objectives**

Student should know,

- 1 Comparison between electrophoresis and chromatography

2. Principle and theory of electrophoresis
  3. Different types of electrophoresis techniques
- Applications of electrophoresis

## **6. Nephelometry and Turbidimetry**

**(06L)**

Introduction, Principles and instrumentation of Nephelometric and Turbidimetric analysis, Difference between Nephelometric and Turbidimetric measurements, Choice between Nephelometry and Turbidimetry, Factors affecting Nephelometric and Turbidimetric measurements, Quantitative Applications, Numerical Problems

**Ref.1.** Pg.781-785

**Ref.3.** Pg.380-390

### **Aims and Objectives**

Student should know,

1. Nephelometry and Turbidimetry as an analytical tool
2. Measurement of turbidance
3. Difference between Nephelometry and Turbidimetry
4. Application and numerical problems

### **List of References**

**Ref.1** Textbook of Quantitative Chemical Analysis- 3<sup>rd</sup> Edition, A. I. Vogel

**Ref.2** Principles of Physical Chemistry 4<sup>th</sup> edition – Prutton and Marron

**Ref.3** Instrumental Methods of Chemical Analysis- Chatwal and Anand

**Ref.4** Basic Concept of Analytical Chemistry-2<sup>nd</sup> edition S.M. Khopkar

**Ref.5** Vogel's textbook of Quantitative Inorganic Analysis-4<sup>th</sup> edition  
Besset Denney, Jaffrey, Mendham

**Ref.6** Instrumental Methods of Chemical Analysis- 6<sup>th</sup> edition  
Willard, Merritt, Dean and Settle

**Ref.7** Analytical Chemistry by Skoog

**Ref.8** Introduction to Instrumental Analysis- R.D. Braun

**Ref.9** Instrumental methods of Chemical Analysis-Willard, Dean & Merrit-6th Edition

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## Semester- III

### Course: Industrial Chemistry (CH-335)

Topics	No. of lectures
1. Modern Approach to Chemical Industry	08
2. Agrochemicals	08
3. Manufacture of Basic Chemicals	08
4. Petrochemicals and eco-friendly fuels	08
5. Food and Starch Industry	08
6. Cement and Glass industry	08
<b>Total Lectures</b>	<b>48</b>

#### 1. Modern Approach to Chemical Industry (08)

Introduction, basic requirements of chemical industries, chemical production, raw materials, unit process and unit operations, Quality control, quality assurance, process control, research and development, pollution control, human resource, safety measures, classification of chemical reactions, batch and continuous process, Conversion, selectivity and yield, copy right act, patent act, trade marks

**Ref. 1: Chapter 2 (relevant pages)**

2. [www.wikipedia.org/wiki/copyright\\_act\\_of1976](http://www.wikipedia.org/wiki/copyright_act_of1976)

3. [www.wikipedia.org/wiki/patentact](http://www.wikipedia.org/wiki/patentact)

4. [www.wikipedia.org/wiki/trademark](http://www.wikipedia.org/wiki/trademark)

#### 2. Agrochemicals (08)

General introduction and scope of agrochemicals, meaning and examples of: Insecticides, Herbicides, Fungicides, Rodenticides, Pesticides, Plant growth regulators. Pesticide formulation, slow release pesticide formulations, storage stability test, and Industrial entomology. Advantages and disadvantages of agrochemicals. Structure,: DDT, BHC, Warfarin, Aldrin, Endosulphan, synthesis and application: DDT, BHC and Endosulphan. Biopesticides like Neem oil and Karanj oil.

**Ref. No. 5-7**

#### 3. Manufacture of Basic Chemicals (08)

a) Ammonia: Physicochemical principles involved, Manufacture of ammonia by modified Haber-Bosch process, its uses.

b) Sulphuric acid: Physicochemical principles involved, Manufacture of sulphuric acid by contact process, its uses.

c) Nitric acid: Physicochemical principles involved, Manufacture of nitric acid by Ostwald's process, its uses.

**Ref.No.1: P.No. 571 to 588, 618 to 664**

#### 4. Petrochemicals and eco-friendly fuels (08)

a) Introduction, occurrence, composition of petroleum, resources, processing of petroleum, calorific value of fuel, cracking, octane rating (octane number), cetane number, flash

point, and petroleum refineries, applications of petrochemicals, synthetic petroleum, lubricating oils & additives

b) *Fuels and eco-friendly fuels*: liquid, gaseous fuel (LPG, CNG), fossil fuels, diesel, bio diesel, gasoline, aviation fuels. Use of solar energy for power generation.

**Ref. 15, 16, 17**

## **5. Food and Starch Industry**

**(08)**

### **Food Industry:**

(a) Definition and scope, nutritive aspects of food constituents, , food deterioration factors and their control; (b) Preservation and processing: Heat and cold preservation and processing, cold storage, food dehydration and concentration, various foods, their processing and preservation methods, fruits, beverages, cereals, grains, legumes and oil seeds; (c) Food additives: Enhancers, sugar substitutes, sweeteners, food colors,

**Ref.12**

### **Starch industries:**

Chemistry of starch, manufacturing of industrial starch and its applications, characteristics of some food starches, non-starch polysaccharides-cellulose-occurrence.

**Ref. 11**

## **6. Cement and Glass industry**

**(08)**

### **Cement industry:**

Introduction, Importance, composition of portland cement, raw materials, proportioning of raw materials, setting and Hardening of cement, reinforced concrete.

**Ref.1: P.No. 313-333 Ref. 8: P.No173-176, Ref. 10: P.No.188-192**

### **Glass industry**

Introduction, importance, physical and chemical properties of glass, chemical reaction, annealing of glass Special glasses: colored, safety, hard, borosilicate, optical, photosensitive, conducting, glass laminates.

**Ref.1: P. No.160-171;Ref. 8: P. No. 247-265; Ref.9: P. No. 197-212**

## **Aims and objectives**

### **1. Modern Approach to Chemical Industry**

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. Agrochemicals**

Students should know the

- i. Various insecticides,

- ii. Pesticides,
- iii. Fungicides,
- iv. Rodenticides & biopesticides used in agriculture field with their synthesis and applications.

### **3. Manufacture of Basic Chemicals**

Students should know the

- i. Concept of basic chemicals,
- ii. their uses and manufacturing process.
- iii. They should also know the physical chemical principles involved in manufacturing process

### **4. Petrochemicals and eco-friendly fuels**

Introduction, occurrence, composition of petroleum, resources, processing of petroleum, other properties

Fuels and eco-friendly fuels, use of solar energy etc.

### **5. Food and Starch Industry**

#### **Food Industry:**

Students should know

- i. Scope,
- ii. Nutritive aspects of food constituents,
- iii. Quality factors and their measurements,
- iv. Food deterioration factors and their control;
- v. Food preservation and Food additives

#### **Starch Industry:**

Students should know about the

- i. Chemistry of starch,
- ii. Manufacturing of industrial starch and its applications,
- iii. Characteristics of some food starches,
- iv. Non-starch polysaccharides-cellulose-occurrence

### **6. Cement and Glass industry**

#### **Cement industry**

The students are expected to

- i. Learn importance of these industries,
- ii. Manufacture of cement by modern methods
- iii. Definition of setting and hardening
- iv. Reinforced concrete

#### **Glass industry**

The students are expected

- i. To learn about making of glass by different methods,
- ii. Various operations involved in the manufacture and compositions,
- iii. Properties and uses of special glasses.

## References

1. Industrial Chemistry-B.K. Sharma, Goyal publishing house, Mirut, Chapter 2 (relevant pages)
  2. [www.wikipedia.org/wiki/copyright\\_act\\_of1976](http://www.wikipedia.org/wiki/copyright_act_of1976)
  3. [www.wikipedia.org/wiki/patentact](http://www.wikipedia.org/wiki/patentact)
  4. [www.wikipedia.org/wiki/trademark](http://www.wikipedia.org/wiki/trademark)
  5. Insects and Pesticides, Saxena A B, Anmol Publications
  6. Emergency Medicine: Chapter 146 Insecticides, Herbicides & Rodenticides, by James Adams
  7. Growth Regulators in Agriculture and Horticulture, by Amarjit Basra, CRC Press, 2000
  8. Shreeve's chemical process industries 5th Edition, G.T. Oustin, McGraw Hill
  9. Riegel's hand book of Industrial chemistry, 9th Edition, Jems A. Kent
  10. Industrial chemistry –R.K. Das, 2nd Edition, 1976.
  11. Chemistry and industry of starch, New York, N.Y., Academic Press, incby Kerr, Ralph Waldo Emerson
  12. The Complete Manual Of Small-Scale Food Processing, by Peter Fellows, Practical Action Pub
  13. Polymeric Materials, C. C. Winding and G. D. Hiatt McGraw Hill Book Co. Polymer Science by Gowarikar
  14. Polymer science, Bill Meyer, F. W. Jr. John Wiley& sons
  15. The Petroleum chemicals industry by R. F. Goldstine, e &Fn London
  16. Fundamentals of petroleum chemical technology by P Below.
  17. Petro Chemicals Volume 1 and 2 ; A Chauvel and Lefevrev ; Gulf Publishing company
  18. Perfumes Soaps Detergents & Cosmetics (Soaps & Detergents) (Volume 1) 1<sup>st</sup> Edition, CBS Publisher
  19. Dyes & Paints: A Hands-On Guide to Coloring Fabric, by Elin Noble
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**Semester- IV**  
**Course: Industrial Chemistry (CH-345)**

Topics	No. of lectures
1. Polymer chemistry	10
2. Sugar and Fermentation Industry	08
3. Soap, detergents and Cosmetics	08
4. Dyes and paints	08
5. Chemistry of pharmaceutical industries	08
6. Pollution prevention and waste management	06
<b>Total Lectures</b>	<b>48</b>

**1. Polymer chemistry** **(10)**

Classification of Polymers: Organic and Inorganic polymers

(a) Basic concepts, nomenclature, degree of polymerization, classification of polymerization reactions, thermodynamic and transport properties of polymer

b) *Commercial polymers and their importance:* (a) Nylon, polyesters (terylene and dacron), rubber, vulcanization of rubber, synthetic rubber, Bun 2-N rubber, copolymers of butadiene, PVC, acrylic, teflon, polyethylene and acrylonitrile; (b) Silicone polymers: silicone oils, rubber, grease and resin; (c) Resins: Phenol-formaldehyde resins, urea-formaldehyde resins, epoxy resins, melamine-formaldehyde resins;

**Ref. 13, 14**

**2. Sugar and Fermentation Industry** **(08)**

Sugar: Occurrence, Manufacturing of refine cane sugar from sugar cane, general idea of carbonation and sulphitation processes and their comparison, by-product and their use.

**Ref.8-10**

**Fermentation Industry:**

Introduction, importance, Basic requirement of fermentation process, Manufacture of industrial alcohol from molasses, fruits, food grains, & ethylene, Manufacturing of wine, beer, whisky, rum ; importance Power alcohol

**Ref. 1, 8-10**

**3. Soap, detergents and Cosmetics** **(08)**

- A. Chemistry of soap, raw material, chemical reaction, types of soap.
- B. Meaning of the terms detergent and surfactants, emulsion and emulsifying agents, wetting and non-wetting, hydrophobic and hydrophilic nature, amphipathic structures, types of surfactants, raw materials for detergents, washing action of soaps and detergents, detergent builders, additives.

- C. Raw materials: emulsifiers (natural, synthetic and finely dispersed solids), lipid components (oils, waxes, fats), humectants, colours (dyes and pigments), preservatives and antioxidants. (b) Cosmetics for skin: Types and problems of skin, key ingredients of skin cleansing, toners, moisturizers, nourishing, protective sunscreen, talcum powder and bleaching products. (c) Hair care: classification, ingredients, special additives for conditioning and scalp health, hair colourants (temporary, semi-permanent and gradual colourants), the plant materials (herbs) used in hair cosmetics.

**Ref. 18.**

#### **4. Dyes and paints**

(a) *Dyes*: Introduction, classification of dyes: Structures and applications, nitro, nitroso, azo, heterocyclic, phthalenes, xanthenes, rhodamines, thiazine, cyanine, anthraquinone, indigoids, thioindigoids, phthalocyanines, wet dyes.

(b) *Paints*: Introduction of paints, ingredients and classification, new technologies; properties of coatings; solvents, plasticizers, dyes and bioactive additives;

(c) *Pigments*: Introduction, classification and general physical properties.

**Ref.1: P. No.777-814; Ref.9: P. No.863-915 ;Ref.10 Relevant page**

**Ref. 19.**

#### **5. Chemistry of pharmaceutical industries**

**(08)**

- General aspects of drug action*: Introduction, classification, nomenclature, structure-activity relationship, action of drugs, factors affecting drug action, metabolism of drugs, chemical structures, methods of production and pharmacological activity.
- Meaning of the terms: Prescriptions, doses, analgesic, antipyretic, diuretic, anesthetics, antibiotics, anti-inflammatory, anti-viral, tranquilizer, antiulcer, antialergic and bronchodilators, cardiovascular, cold preparations, anti-hypertensive, cough preparation, anti-neoplastic, sedative and hypnotics, steroidal, contraceptive, histamine and antihistamine.
- Synthesis and uses: Paracetamol, Aspirin, Sulphanilamide.

**Ref.1: P. No.762-775; Ref.8: P. No.803-804, 818-822 ; Ref.9: P. No.987-1011**

#### **6. Pollution prevention and waste management**

**(06)**

Introduction, importance of waste management, concept of atom economy, Terms involved in waste minimization: source reduction, recycling, product changes, source control, use and reuse, reclamation, assessment procedures, types of wastes, treatment and disposal of industrial waste. Treatment of wastes or effluents with organic impurities. Treatment of wastes or effluents with inorganic impurities. The nature, effect and treatment of some important chemical wastes-(Pulp and paper industries, soap and detergent industries and food processing industries).

**Ref. 1: P.No. 8-92; Ref.6: P.No. 15-30;**

**Ref. [www.wikipedia.org/atom\\_economy](http://www.wikipedia.org/atom_economy)**

## **Aims and Objectives:**

### **1. Polymer chemistry**

Students should know

- i. Basics of polymer,
- ii. Nomenclature,
- iii. Degree of polymerization,
- iv. Classification of polymerization reactions,
- v. Thermodynamic and transport properties of polymer,
- vi. Commercial polymers and their importance,
- vii. Biomedical polymers: implants,
- viii. Contact lens and dental polymers.

### **2. Sugar and Fermentation Industry**

The students are expected to learn

- i. Importance of sugar industry,
- ii. Manufacture of direct
- iii. Consumption (plantation white) sugar with flow diagram.
- iv. Cane juice extraction by various methods,
- v. Clarification by processes like carbonation,
- vi. Sulphitation,
- vii. Phosphatation, etc.
- viii. Concentration of juice by using multiple effect evaporator system,
- ix. Crystallization of sucrose by using vacuum pan.

### **Fermentation Industry**

- i. Importance,
- ii. Basic requirement of fermentation process,
- iii. Manufacturing of ethyl alcohol by using molasses,
- iv. Food grains, fruits & ethylene.
- v. Manufacturing of wine, beer, whisky, rum etc.

### **3. Soap, detergents and Cosmetics**

Students should know about

- i. Different types of soap products,
- ii. Chemistry of soap.
- iii. Students should know about various cosmetics,
- iv. Raw materials,
- v. Properties and various types of cosmetics used.
  - i. Meaning of the terms detergent,
  - ii. Surfactants, emulsion and emulsifying agents,
  - iii. Wetting and non-wetting,
  - iv. Hydrophobic and hydrophilic nature,
  - v. Amphipathic structures,
  - vi. Types of surfactants,
  - vii. Raw materials for detergents,

- viii. Washing action and detergents,
- ix. Detergent builders, additives.

#### 4. Dyes and paints

Students should know about

- i. *Dyes*: introduction,
- ii. Dye intermediates,
- iii. Preparation of dye intermediates,
- iv. Structural features of a dye;
- v. Classification of dyes,
- vi. Structures and applications,
- vii. Nitro, nitroso,
- viii. Azo, heterocyclic,
- ix. Phthalenes,
- x. Xanthenes,
- xi. Rhodamines,
- xii. Thiazine,
- xiii. Cyanine,
- xiv. Anthraquinone,
- xv. Indigoids,
- xvi. Thioindigoids,
- xvii. Phthalocyanines, wet dyes.

(b) *Paints*:

- i. Introduction of paints,
- ii. Ingredients and classification,
- iii. New technologies;
- iv. Properties of coatings;
- v. Solvents, plasticizers, dyes and bioactive additives.

(b) *Pigments*:

- i. Introduction,
- ii. Classification and general physical properties.

#### 5. Chemistry of pharmaceutical industries

Students should know about

- i. *General aspects of drug action*:
- ii. Introduction, classification,
- iii. Nomenclature,
- iv. Structure-activity relationship,
- v. Action of drugs,
- vi. Assay of drugs and factors affecting drug action,
- vii. Metabolism of drugs,
- viii. Chemical structures,
- ix. Methods of production and pharmacological activity.
- x. Meaning of the terms of the various drugs.
- xi. Synthesis and uses of few drug molecules.

## 6. Pollution prevention and waste management

The students are expected to learn all the problems of pollution and disposal of waste of various industries.

### References

1. Industrial Chemistry-B.K. Sharma, Goyal publishing house, Mirut, Chapter 2 (relevant pages)
  2. [www.wikipedia.org/wiki/copyright\\_act\\_of1976](http://www.wikipedia.org/wiki/copyright_act_of1976)
  3. [www.wikipedia.org/wiki/patentact](http://www.wikipedia.org/wiki/patentact)
  4. [www.wikipedia.org/wiki/trademark](http://www.wikipedia.org/wiki/trademark)
  5. Insects and Pesticides, Saxena A B, Anmol Publications
  6. Emergency Medicine: Chapter 146 Insecticides, Herbicides & Rodenticides, by James Adams
  7. Growth Regulators in Agriculture and Horticulture, by Amarjit Basra, CRC Press, 2000
  8. Shreeve's chemical process industries 5th Edition, G.T. Oustin, McGraw Hill
  9. Riegel's hand book of Industrial chemistry, 9th Edition, James A. Kent
  10. Industrial chemistry –R.K. Das, 2nd Edition, 1976.
  11. Chemistry and industry of starch, New York, N.Y., Academic Press, inc by Kerr, Ralph Waldo Emerson
  12. The Complete Manual Of Small-Scale Food Processing, by Peter Fellows, Practical Action Pub
  13. Polymeric Materials, C. C. Winding and G. D. Hiatt McGraw Hill Book Co. Polymer Science by Gowariker
  14. Polymer science, Bill Meyer, F. W. Jr. John Wiley & sons
  15. The Petroleum chemicals industry by R. F. Goldstine, e & fn London
  16. Fundamentals of petroleum chemical technology by P Below.
  17. Petro Chemicals Volume 1 and 2 ; A Chauvel and Lefevrev ; Gulf Publishing company
  18. Perfumes Soaps Detergents & Cosmetics (Soaps & Detergents) (Volume 1) 1st Edition, CBS Publisher
  19. Dyes & Paints: A Hands-On Guide to Coloring Fabric, by Elin Noble
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## Optional Course

### Semester-III

#### Course: Nuclear Chemistry (CH-336A)

Topic	No. of Lectures
1. The Atomic Nucleus, Properties of Nucleons and Nuclei	08
2. Nuclear Models	12
3. Radioactivity	16
4. Nuclear Reactions	12
<b>Total Lectures</b>	<b>48</b>

#### 1. The Atomic Nucleus, Properties of Nucleons and Nuclei

(08 L)

The atom, Elementary particles, Sub-nucleons, quarks, The nucleus and outer sphere, Classification of nuclides, Nuclear stability, Even-odd nature, N/Z ratio, The Nuclear potential, Binding energy, Binding energy calculations.

The nucleus, its size, shape and radius, Mechanical effects due to orbiting and spinning of nucleons, Magnetic quantum numbers, principal and radial quantum number.

Ref.1: pages 1 to 13 and 19 to 25.

#### 2. Nuclear Models

(12 L)

Historical, The shell model, Periodicity in nuclear properties: the magic numbers, The salient features of shell model, The sequence of filling the orbit, Rectangular well potential model, Harmonic oscillator potential model, Spin-orbit coupling model, Nuclear configuration of lighter nuclides ( $Z < 20$ ), Merits of the shell model, The liquid drop model, The semi-empirical mass equation, Merits of the liquid drop model, Limitations of liquid drop model.

Ref.1 pages 64 to 69, 72 to 84 and 91 to 92.

Ref.2 pages 464 to 469

#### 3. Radioactivity

(16 L)

Discovery, Types of radioactive decay, Decay schemes, General characteristics of radioactive decays, decay kinetics, units of radioactivity, problem solving on decay kinetics.

**Alpha decay:** Alpha active nuclides, The alpha energy spectrum, Geiger-Nuttals law, The theory of alpha decay. **Beta decay:** Types of beta decay, absorption and range through matter, Fermi theory of beta decay. (Mathematical details are not expected) **Gamma decay:** Nuclear isomerism and isomeric transitions, internal conversion, Auger effect.

Ref.1 pages 100 to 106, 120 to 135, 138 to 142, and 150 to 154.

#### 4. Nuclear Reactions

(12 L)

Bethe's notation, Types of nuclear reactions, Conservation of nuclear reactions (Conservation of protons and neutrons, Conservation of momentum and energy), Reaction cross-section, The compound nucleus theory, Calculations of excitation energy of compound nucleus, Photonuclear reactions, Thermonuclear reactions.

**Ref.1 pages 160 to 174 and 192 to 196.**

#### Aims and objectives:

##### 1. The Atomic Nucleus, Properties of Nucleons and Nuclei:

The students are expected to know the following from this topic.

- The atom, elementary particles, sub-nucleons and the quarks.
- Classification of nuclides, isotopes, isobars, isotones and isomers.
- Nuclear stability on the basis of even-odd nature of Z and N, N/Z ratio.
- The binding energy
- The nucleus, its size and shape, mechanical effects due to orbiting and spinning of nucleons, Magnetic quantum numbers, principal and radial quantum number.

##### 2. Nuclear Models:

By studying this topic students are expected to understand

- The Shell model
- Magic number
- Salient features of shell model
- Nuclear configuration
- The liquid drop model
- Semi-empirical mass equation

##### 3. Radioactivity:

By studying this topic students are expected to understand

- Types of radioactive decay, decay kinetics and their general characteristics.
- Alpha decay, Beta decay and gamma decay
- Nuclear isomerism, isomeric transitions, internal conversion, Auger effect.

##### 4. Nuclear Reactions:

The students are expected to understand,

- Bethe's notation
- Different types of Nuclear reactions.
- Conservation in nuclear reaction
- Excitation energy of compound nucleus

#### References:

- Essentials of Nuclear Chemistry by H. J. Arnikar, 4<sup>th</sup> Revised Edition, New Age International Publishers.
  - Source book of Atomic energy by Samuel Glasstone, 3<sup>rd</sup> edition, East -West press.
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## Semester-IV

### Course: Nuclear Chemistry (CH-346A)

Topic	No. of Lectures
1. Nuclear Fission	10
2. Nuclear Reactors	08
3. Nuclear Accelerators	08
4. Detection and measurement of nuclear radiations	08
5. Applications of Radioactivity	10
6. Radiation Safety precautions	04
<b>Total Lectures</b>	<b>48</b>

#### 1. Nuclear Fission

(10 L)

Introduction, Discovery of nuclear fission, The process of nuclear fission, Fission fragments and their mass distribution, Fission energy, Fission cross-section and thresholds, Fission neutrons, Theory of nuclear fission.

Ref.1: pages 209 to 225

#### 2. Nuclear Reactors

(08 L)

The fission energy, The natural uranium reactor, The four factor formula, The classification of reactors. Reactor power, Critical size of a thermal reactor, Breeder reactor, The fast breeder test reactor at Kalpakkam, India's nuclear energy programme.

Ref.1: pages 232 to 249

#### 3. Nuclear Accelerators

(08 L)

Electrostatic Accelerators, The Cockcroft-Walton Accelerator, The Van de Graaff Accelerator, Cyclic Accelerator, Linear Accelerator.

Ref: 2 Pages 290 to 305, 325 to 330

#### 4. Detection and measurement of nuclear radiations

(08 L)

Scintillation Counters, Semiconductor detectors, Neutron detectors.

Ref.2 Pages 211 to 222.

#### 5. Applications of Radioactivity

(10 L)

Probing by isotopes, Typical reactions involved in the preparation of radioisotopes, Szilard-Chalmer reaction, Cow and milk system, Use of charged plates in the collection of radioisotopes, Radiochemical principles in the use of tracers, Analytical applications: Isotope dilution analysis, Neutron activation analysis, Radiometric titrations, Numericals, medical applications a) thyroiditis (goitre), b) radioimmunoassay.



**Ref.1 Pages 309 to 328, 338 to 345**

**6. Radiation Safety precautions**

**(04 L)**

Safety standards, safe working methods, biological effects of radiations, nuclear waste and its management.

**Ref.3 Pages 322 to 328**

**Aims and objectives:**

**1. Nuclear Fission:**

By studying this topic students are expected to understand

- a) Discovery of nuclear fission
- b) The process of nuclear fission
- c) The charge distribution
- d) Fission energy
- e) Theory of nuclear fission

**2. Nuclear Reactors**

The students are expected to know the following from this topic

- a) the natural Uranium reactor, The breeder reactor
- b) the four factor formula
- c) Classification of reactors. d) India's Nuclear Energy programme

**3. Nuclear Accelerators:**

The student should understand

- a) Principle and working of various accelerators
- b) What are the electrostatic accelerators?

**4. Detection and measurement of nuclear radiations**

The aims and objectives are as follows

- a) Gaseous ionization and its applications
- b) Principle and working of Scintillation Counters , Semiconductor detectors, Neutron detectors

**5. Applications of Radioactivity**

The students are expected to know the following from this topic

- a) The Probing by isotopes.
- b) Typical reactions involved in the preparation of radioisotopes
- c) Szilard-Chalmer reaction
- d) Analytical applications – Isotope Dilution Analysis, Neutron Activation Analysis, Radiometric Titrations
- e) Medical applications such as thyrodisis and radioimmunoassay.

**6. Radiation Safety precautions**

By studying this topic students are expected to understand

- a) Biological effects of radiations, safety standards, safe working methods
- b) Reprocessing of the nuclear waste and its management.

**References :**

1. Essentials of Nuclear Chemistry by H. J. Arnikar, 4<sup>th</sup> Revised Edition, New Age International Publishers
2. Source book of Atomic energy by Samuel Glasstone, 3rd edition, East -West press.
3. Nuclear Physics by Irving Kaplan, 2nd edition.
4. Introduction to Nuclear physics and chemistry by B.G. Harvey.
5. Fundamentals of Radiochemistry by D. D. Sud, A.V. R. Reddy and N. Ramamoorthy.

## Semester- III

### Course: Polymer Chemistry (CH-336B)

Topic	No. of lectures
1. Introduction to Polymer Chemistry	04
2. Mechanism and Nomenclature of Polymers	04
3. Chemistry of Polymerization	10
4. Polymerization Techniques	08
5. Polymer Additives	06
6. Molecular Weights of Polymers	05
7. Silicone and Cellulose Polymers	04
8. Polymer Reactions	07
<b>Total Lectures</b>	<b>48</b>

#### 1. Introduction to Polymer Chemistry

(04 L)

Brief History, Polymer definition, Preparation, Classification, Structures, Chemical bonding & Molecular forces in Polymers.

Ref. 1: Pages 1-14

Ref. 2: Pages 1-16

Ref. 3: Pages 1-12

Ref. 4: Pages 1-17

Ref. 7: Relevant Pages

Ref. 9: Pages 1-8

#### 2. Mechanism and Nomenclature of Polymers

(04 L)

a) Polymerization Mechanism, b) Nomenclature of Polymers-i) Common/Trivial names ii) Source-Based names, iii) Structure-Based names (Non IUPAC), iv) IUPAC Structure-based and Linkage-based nomenclature system and v) Trade names / Brand names & Abbreviations

Ref. 4: Pages 11-25

Ref. 12: Pages 6-17

#### 3. Chemistry of Polymerization

(10 L)

a) Introduction, b) Chain Polymerization: Free radical Polymerization, Ionic polymerization, Coordination polymerization- Ziegler-Natta catalyst c) Step Polymerization: Polycondensation, Polyaddition polymerization, and Ring Opening polymerization.

Ref. 1: Pages 15-64

Ref. 2: Pages 25-32, 49-56, 82-86, 88-89, 91-94

**Ref. 3: Relevant Pages**

**Ref. 4: Relevant Pages**

**Ref. 6: Relevant Pages**

**Ref. 9: Pages 22-63**

#### **4. Polymerisation Techniques (08 L)**

Bulk polymerisation, Solution polymerization, Suspension polymerization, Emulsion polymerization, Melt polycondensation, Solution Polycondensation, Interfacial condensation, electrochemical polymerisation, Salient features of different polymerization techniques

**Ref. 1: Pages 71-79, 82-84**

**Ref. 2: Pages 126-132**

**Ref. 4: Pages 309-324**

**Ref. 12: Pages 335-341, 173-175**

#### **5. Polymer Additives (06 L)**

Fillers & Reinforcement, Plasticizers, Antioxidants & Thermal Stabilizers (Heat Stabilizers), Ultraviolet stabilizers, Fire retardants, Colourants, Antistatic agents & Curing agents.

**Ref. 3: Pages 170-176**

**Ref. 4: Pages 502-512, 528-538**

**Ref. 10: Relevant Pages**

#### **6. Molecular Weights of Polymers (05 L)**

a) 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**

**Ref. 2&4: Relevant Pages**

#### **7. Silicone and Cellulose Polymers (04 L)**

a) Introduction, Synthesis, Reactions, Uses of Silicone polymers, b) Cellulose & Derivatives of cellulose: Rayon, Cellophane, Cellulose nitrate, Cellulose acetate and their uses.

**Ref. 1: Pages 255-261**

**Ref. 5: Pages 143-155**

## 8. Polymer Reactions

(07 L)

Introduction, Hydrolysis, Hydrogenation, Addition and Substitution reactions, Cross-linking reactions, Cure reactions, Reactions of various aliphatic and aromatic pendent groups in polymers.

**Ref. 1: Pages 291-297, 306-308, 311-321, Ref. 3: Relevant Pages, Ref. 4: 545-555**

### Aims and Objectives:

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 methods 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) Importance of silicone polymers.
- 10) Derivatives of cellulose polymers & their applications.
- 11) Ingredients added to polymers.
- 12) What are fillers.
- 13) Polymer reactions and applications.
- 14) Polymer reactions and their effect on physical and chemical properties.
- 15) Advantages of polymer reactions to change their properties.

### Reference Books:

1. Polymer Science by V.R. Gowariker, N.V. Vishvanathan, Jaydev Shreedhar New Age International Ltd. Publisher 1996. (Reprint 2012)
  2. Textbook of Polymer Science by Fred Billmeyer, 3<sup>rd</sup> 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.), 6<sup>th</sup> Edn, (First Indian Print 2005), New York-Basel.
  5. Inorganic Polymers by G.R. Chatwal Himalaya Publishing House 1<sup>st</sup> Edn. 1996
  6. Polymer Science – A Text Book by V.K. Ahluwalia, Anuradha Mishra.
  7. Principle of Polymer Science by P. Bahadur, N.V. Sastry, 2<sup>nd</sup> Edn, Narosa Publishing House.
  8. Polymer Chemistry by Ayodhya Singh, 2008, Published by Campus Book International, New Delhi.
  9. Organic Polymer Chemistry by Jagdamba Singh, R.C. Dubey, 4<sup>th</sup> Edn, 2012.
  10. Advanced Polymer Chemistry by V.K. Selvaraj, 1<sup>st</sup> Edn, 2008, Published by Campus International, New Delhi.
  11. Organic Polymer Chemistry by V. Jain, IVY Publishing House, New Delhi.
  12. Principles of Polymerisation by George Odian 3<sup>rd</sup> Edn. John Wiley & Sons New York.
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## Semester- IV

### Course: Polymer Chemistry (CH-346B)

Topic	No. of lectures
1. Polymer Degradation	03
2. Chemical and Geometrical structures of Polymer Molecules	04
3. Glass Transition Temperature and Heat Distortion Temperature (Softening Point)	05
4. Crystallinity in polymers	04
5. Some Important Polymers	08
6. Analysis and testing of polymers	06
7. Some Special Polymers	06
8. Polymer Processing	12
<b>Total Lectures</b>	<b>48</b>

#### 1. Polymer Degradation

(03 L)

Introduction, Types of Degradation, Thermal degradation, Mechanical degradation, Photo degradation.

Ref. 1: Pages 262 – 277

Ref. 3: Pages 151-160

Ref. 4: Relevant Pages

Ref. 11: Pages 60-65

#### 2. Chemical and Geometrical structures of Polymer Molecules

(04 L)

a) Microstructures based on chemical structures-Organic & Inorganic polymers, Homochain&Heterochain polymers, Homopolymers& Copolymers, b) Microstructures based on geometrical structures-Interpenetrating coils, Folded chain, Helical chain, Linear, Branched, Random, Alternating, Graft and Block polymers and c) Stereo-regular polymers-Optical and Geometric Isomerism.

Ref 1: Pages 136-149

Ref 4: Relevant Pages

#### 3. Glass Transition Temperature (GTT) and Heat Distortion Temperature(Softening Point)(05 L)

Definition, Factors influencing the Glass transition temperature, Glass transition temperature and molecular weight, Glass transition temperature and plasticizers, Glass Transition Temperature and Crystalline melting point (T<sub>m</sub>), Importance of Glass transition temperature.

Ref 1: Pages 150, 163-169, 171-172, 219

Ref 4: Relevant pages

Ref 9: Page 113-116

Ref 10: Pages 47-58

#### 4. Crystallinity in polymers

(04 L)

Introduction, Degree of Crystallinity, Crystallisability, crystallites, Factors affecting crystallisability, Effect of crystallinity on the properties of polymers.

Ref. 1: Pages 173-177, 180-183, 189-191,

Ref. 5: Pages 69-74, Ref. 9: Pages 103-112

#### 5. Some Important Polymers

(08 L)

Polystyrene, Polymethylmethacrylate, Polyester, Polycarbonates, Polyamides, Polyvinyl alcohol (PVA), Polyvinyl chloride (PVC), Polytetrafluoroethylene (Teflon) & polyvinyl fluoride, Isoprene, Polyimide, Phenol formaldehyde resin (Novolac), Urea formaldehyde resin, Epoxy polymers.

**Ref. 1: Pages 213-254,**

**Ref. 3: Relevant Pages**

**Ref. 4: Relevant Pages,**

**Ref. 8: Relevant Pages**

## **6. Analysis and testing of polymers**

**(06 L)**

a) Spectroscopic Methods: IR, NMR, b) Thermal analysis: Differential Scanning Calorimeter (DSC), & Thermo Gravimetric Analysis (TGA), c) Physical testing: Mechanical properties, Thermal properties, Optical properties, Electrical properties, Chemical properties.

**Ref 2: Pages 229-237, 242-252,**

**Ref 4: Pages 121-139**

## **7. Some Special Polymers**

**(06 L)**

Polymer blends, Bio-medical polymers, Biodegradable polymers, Liquid Crystalline polymers (LC's), Conducting polymers, thermally stable polymers, Optical fibers,

**Ref. 4: Relevant Pages,**

**Ref. 6: Pages 179,185,197**

**Ref.7: Pages 262-299,**

**Ref. 9: Pages 130-162**

## **8. Polymer Processing**

**(12 L)**

### **a) Plastic Technology**

**(04)**

1) Molding 2) Extrusion 3) Other processing methods: Calendaring, Film Casting, Coating, Foaming, Forming, Laminating & Low pressure molding, Compounding.

**Ref. 2: Pages 457-469, 474-475.,**

**Ref. 1, 4, 6, 7, 9: Relevant pages**

### **b) Fiber Technology**

**(04)**

1) Introduction, Textile & Fabric properties, 2) Fiber Spinning: i) Melt spinning ii) Dry spinning iii) Wet spinning and 3) Fiber after treatments: Scouring, Lubrications, Sizing, Dyeing, Finishing, Texture yarns, Nonwoven fabrics.

**Ref 2: Pages 486-501,**

**Ref. 1, 4, 6, 7, 9: Relevant pages**

### **c) Elastomer Technology**

**(04)**

1) Introduction, Vulcanization (Sulphur & non sulphur vulcanization), 2) Reinforcement, Elastomer Compounding.

**Ref. 2: Pages 506-518 ,**

**Ref. 1, 4, 6, 7, 9: Relevant pages**

## **Aims and Objectives**

The students are expected to learn the following aspects of Polymer Chemistry

1) What is polymer degradation?

2) Chemical and geometric structures of polymers.

3) Important polymers like PVC, polystyrene, polyvinyl alcohol, Teflon, Resins, nylon, epoxy polymers, etc.

- 4) Uses & properties of polymers.
- 5) Role of polymer industry in the economy.
- 6) Advantages of polymers.
- 7) Some industrially important polymers
- 8) What is polymer processing?
- 9) Different polymer processing techniques.
- 10) Polymer testing and analysis.
- 11) Properties of polymers & testing.
- 12) Various fiber spinning techniques.
- 13) Reinforcement & compounding of polymers.

**Reference Books:**

1. Polymer Science by V.R. Gowarikar, N.V.Vishvanathan, JaydevShreedhar New Age International Ltd. Publisher 1996.(Reprint 2012)
  2. Textbook of Polymer Science by Fred Billmeyer, 3<sup>rd</sup>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.), 6<sup>th</sup>Edn, (First Indian Print 2005), New York-Basel.
  5. Inorganic Polymers by G.R.Chatwal Himalaya Publishing House 1<sup>st</sup> Edn.1996
  6. Polymer Science – A Text Book by V.K. Ahluwalia, Anuradha Mishra.
  7. Principle of Polymer Science by P. Bahadur, N.V. Sastry, 2<sup>nd</sup>Edn, Narosa Publishing House.
  8. Polymer Chemistry by Ayodhya Singh, 2008, Published by Campus Book International, New Delhi.
  9. Organic Polymer Chemistry by Jagdamba Singh, R.C. Dubey, 4<sup>th</sup>Edn, 2012.
  10. Advanced Polymer Chemistry by V.K. Selvaraj, 1<sup>st</sup>Edn, 2008, Published by Campus International, New Delhi.
  11. Organic Polymer Chemistry by V. Jain, IVY Publishing House, New Delhi.
  12. Principles of Polymerisation by George Odian 3<sup>rd</sup>Edn. John Wiley & Sons New YorkYork.
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## Semester- III

### Course: Introduction To Biochemistry And Molecular Biology (CH-336C)

Name of the Topic	Number of lectures
1. Amino acids and Proteins	11
2. Carbohydrates	06
3. Lipids	06
4. Hormones	03
5. Enzymes	07
6. Vitamins and Coenzymes	04
7. Cell Biochemistry	05
8. Biochemical techniques	06
<b>Total lectures</b>	<b>48</b>

#### 1. Amino acids and proteins: (11 L)

Introduction, biological functions, classification-based on structure, function and composition. Structural organization of proteins- primary, secondary, tertiary and quaternary structures (general overview). Factors that stabilize protein structure. Denaturation of Proteins.

**Reference: 3**, Chapter 4, Amino acids and Proteins, pg 45-71.

- 1) Foldings and misfoldings of proteins by stepwise process
- 2) Diseases caused by misfoldings of proteins for ex.. Alzheimer, Prions

**Reference: 1**, Page no 116 to 153

#### 2. Carbohydrates: (06 L)

Introduction of carbohydrates, Introduction and biological significance of proteoglycans, Glycoproteins, Glycolipids, Lectin Carbohydrates- Interaction( Sugar code). Analysis of carbohydrates.

**Reference.1:** page no. 255 to 268

**Reference.2:** Page no : 648 to 653 .

#### 3. Lipids: (06 L)

Introduction, Biological significance, Classification-Simple , compound, steroids and derived lipids. Structure of saturated and unsaturated fatty acids, structure of phospholipids (Phosphatidic acid, Lecithin, Cephalin, Lipositol), structure of Sphingomyelin and Cholesterol. Amphipathic lipids and their behavior in water. Saponification number, Acid number, Iodine number and their significance. Rancidity of lipids. Types of Lipoproteins and their significance, Structural Lipids in membrane glycerophospholipids, Sulphalipids, Galactolipids, glycosphingolipids

**Reference.1:** page no. 343 to 360

**Reference: 3**, Chapter 3, Lipids, pg 29-42.

#### 4. Hormones: (03 L)



Definition, classification based on biochemical nature, location and mechanism of action. Concept of second messengers-c.AMP and Calcium inositide system.

**Reference:** 2, Chapter 42 and 43, pg 434, 462 and 464.

**5. Enzymes: (07 L)**

Classification- Six major classes of enzymes, Conjugated enzymes- Apoenzyme, Holo enzyme, prosthetic group (coenzymes and cofactors). Features of active site.enzyme specificity, Factors affecting enzyme activity- substrate concentration, pH, temperature, and enzyme concentration, product concentration. MM equation, LB equation (derivation not required) and significance of Km. Enzyme inhibition-competitive, non competitive and uncompetitive with suitable examples.Allosteric enzymes and clinical significance of Isoenzymes.

**Reference:** 3, Chapter 6, Enzymes, pg 85 – 112.

**6. Vitamins and Coenzymes: (04 L)**

Classification- Fat soluble and water soluble vitamins (source, biological functions and deficiency disorders), coenzyme forms of vitamin B complex.( Structure not required).

**Reference:** 2, Chapter 45: pg 481-496

**7. Cell Biochemistry: (05 L)**

Introduction to Cell, Unicellular and Multicellular organisms, Distinguishing features of Prokaryotic and Eukaryotic cell. Structure and function of Cell membrane, Mitochondria, Endoplasmic reticulum, Golgi complex, Lysosomes, Peroxisomes, Plant cell wall and Chloroplast. Concepts of Biomolecules and types of bonds in biomolecules.

**Reference:** 5, Chapter 3, Unicellular and multicellular cell, cell membrane, pg 32- 68, Chapter 10, Mitochondria, pg 191- 219, Chapter 6, Endoplasmic Reticulum, pg 154- 165, Chapter 7, Golgi Complex, pg 166- 174, Chapter 8, Lysosomes, pg 175- 183, Chapter 9, Peroxisomes, pg 184-189, Chapter 1, Chloroplast, pg 220- 240.

**8. Biochemical techniques. (06 L)**

Principle, working and applications of dialysis, Paper chromatography, Thin layer chromatography, Column chromatography- Gel filtration, Ion exchange, Affinity Chromatography. Electrophoresis- Paper and Gel ( Agarose, Native and SDS- PAGE).

**Reference:** 6, Chapter 11, pg 524- 546. Chapter 10, pg 449- 473.2, Chapter 3, pg 89. 7, pg 344-421,

**Aim and Objectives :**

I **Cell Biochemistry:** The student needs to understand of Cell types, Difference between a bacterial cell., Plant cell and animal cell. Biological composition and organisation of cell membrane as per Singer and Nicholson model, structure and function of various cell organelles of plant and animal cell. Concepts of biomolecules,Bonds that link monomeric units to form macromolecules.

**II. Carbohydrates,:** The student needs to know 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.

**III. Lipids:** The student needs to know the types of lipids with examples, structure of lipids, properties of lipids.

**IV. Aminoacids and proteins:** The student needs to know the structure and types of amino acids. Reactions of amino acids. Properties of aminoacids. Peptide bond formation. Types of proteins. Structural hierarchy in proteins. Features of denaturation of proteins.

**V. Enzymes:** The student needs to 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.

**VI. Biochemical techniques:** The student needs to know the principle, working procedure and applications of various techniques used in biochemical studies.

**VII. Vitamins and Coenzymes:** The student needs to know the types of vitamins, their source, biochemical significance and deficiency disorders. Coenzyme forms of Vitamin B complex and their metabolic significance.

**VIII. Hormones:** Basic concepts of Endocrinology. Types of Endocrine glands and their hormones. Biochemical nature of hormones. Role of Second messengers in hormone action.

## Reference Books

1. Lehninger's, Principles of Biochemistry, by Nelson and Cox Macmillan Publisher 4<sup>th</sup> Edn..
  2. Harper's Illustrated Biochemistry, 26<sup>th</sup> Edition.
  3. Biochemistry by U. Satyanarayana
  4. Biotechnology, B.D.Singh, 3<sup>rd</sup> edition.
  5. Cell biology, Genetics, Molecular Biology, Evolution and Ecology, by Verma and Agarwal, 14<sup>th</sup> edition.
  6. Principle techniques of Biochemistry and Molecular Biology by Keith Wilson and John Walker, 6<sup>th</sup> edition.
  7. Biophysical techniques by Upadhyay and Nath, 3<sup>rd</sup> revised edition.
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## Semester- III

### Course: Introduction To Biochemistry And Molecular Biology (CH-346C)

Name of the Topic	Number of lectures
1. Introduction to Metabolism	02
2. Carbohydrate metabolism	06
3. Lipid metabolism	04
4. Amino acid metabolism	04
5. Electron Transport Chain and Oxidative Phosphorylation	06
6. Nucleic acids	07
7. DNA replication	06
8. Transcription	05
9. Translation	04
10. Introduction to Genetic engineering	04
<b>Total lectures</b>	<b>48</b>

#### **1. Introduction to Metabolism: (02 L)**

Definition of catabolism and anabolism, Types of metabolic reactions, High energy compounds, Significance of ATP.

**Reference: 3**, Chapter 12, Introduction to metabolism , pg 247- 249 and Chapter 11 Biological oxidation pg. 227-230.

#### **2. Carbohydrate metabolism and TCA cycle (06 L)**

Aerobic and anaerobic glycolysis- structures of intermediates, various enzymes involved and energetics. Fate of Pyruvate, Pyruvate dehydrogenase complex. TCA cycle- enzymatic reactions and energetics.

**Reference: 2**, Chapter 17: Glycolysis pp 136-144 and Chapter 16: The Citric Acid Cycle pp. 130-135

#### **3. Lipid metabolism (04 L)**

Transportation of fatty acids with the help of carnitine,  $\beta$ -oxidation of palmitic acid in mitochondria and its energetics. Triacylglycerol synthesis, ketogenesis.

**Reference: 2**, Chapter 22, Oxidation of fatty acids: Ketogenesis, pp 180-189.

#### **4. Amino acid metabolism: (04 L)**

Significance of transamination, deamination, decarboxylation reactions of amino acids. Urea cycle.

**Reference: 2**, Chapter 29: Catabolism of Proteins and of amino acid nitrogen. pp 242 - 248

#### **5. Electron Transport Chain and Oxidative Phosphorylation: (06 L)**

Location of Electron carriers, Electron transport chain, Proton gradient, Oxidative phosphorylation- Chemiosmotic hypothesis, Inhibitors and Uncouplers of Electron transport chain and Oxidative phosphorylation .

**Reference: 3**, Chapter 11 Biological oxidation, pg 230-239.

**6. Nucleic acids:****(07 L)**

Structures of Purines and Pyrimidines, Nucleosides, Nucleotides, Polynucleotides. Difference between DNA and RNA. Watson and Crick model of DNA. DNA as genetic material (Macleod and McCarty, Hershey and Chase experiments). RNA and its types. Central dogma of molecular biology.

**Reference:** 3, Chapter 5, Nucleic acids, pg 73-83.

**7. DNA replication:****(06 L)**

Semiconservative model of replication (Messelson and Stahl experiment). Brief account of initiation (features of OriC), elongation and termination of DNA replication in prokaryotes. Okazaki fragments, Leading and Lagging strands, Distinguishing features of DNA polymerase I, II and III. Klenow fragment of DNA polymerase I.

**Reference:** 1, Chapter 25, DNA metabolism, pg 950 - 984

**8. Transcription:****(04 L)**

Brief account of initiation- Promoter sequences, elongation and termination of transcription in prokaryotes. RNA polymerase. Examples of inhibitors of transcription. Chapter 26: 996- 1027

**Reference:** 1, Chapter 26, RNA metabolism, pg 948 – 1033.

**9. Translation:****(05 L)**

Genetic code and its features. Brief account of initiation, elongation and termination of translation in prokaryotes. Examples of inhibitors of translation. Regulation of gene expression- Lac operon.

**Reference:** 1, Chapter 27, Protein metabolism, pg 1034- 1075.

**10. Introduction to genetic engineering:****(04 L)**

Basic concepts of genetic engineering - Restriction Enzymes- Types and features, Vectors (Plasmids, Phages and Cosmids) , Recombinant or Chimeric vector. Principle and Steps involved in gene cloning with insulin as example. Applications of genetic engineering in various fields.

**Reference:** 1, Chapter 9, pg 307- 310, pg 311-313(vectors), 4, Chapter 2, pg 15.

**Aim and Objectives**

**a. Metabolism, Carbohydrate, Lipid and Amino acid metabolism:** The student needs to know the significance of metabolism and energetics. Role of ATP and types of other high energy compounds. Individual reactions of the metabolic pathways, various enzymes and coenzymes, energetic and features of the pathway.

**b. Electron Transport Chain and Oxidative Phosphorylation:** The student needs to know the concepts of biological oxidation. Types of electron carriers and their location in mitochondria. Formation of proton gradient, Proton motive force and Oxidative phosphorylation, formation of ATP in the oxysomes. Inhibitors and Uncouplers of Mitochondrial ETC.

- c. **Nucleic acids:** Understanding the structures of purines, pyrimidines, nucleosides and nucleotides , structural features of nucleic acid types and their role. Central dogma of molecular biology. Experimental procedures that prove DNA as genetic material and its interpretations.
- d. **Replication:** The student needs to know the experiment that showed the salient features of semi conservative DNA replication, stepwise events involved in replication of DNA.
- e. **Transcription:** The student needs to know stepwise events of transcription of RNA and list of inhibitors of transcription.
- f. **Translation:** The student needs to know the stepwise events of translation of proteins and its significance. List of inhibitors of translation.Features of regulation of gene expression with lac operon studies.
- e. **Introduction to genetic engineering:** The student needs to know the overview of the steps involved in insulin gene cloning, and applications of genetic engineering in various fields like agriculture, industries and medicine.

### Reference Books

1. Lehninger's, Principles of Biochemistry, by Nelson and Cox Macmillan Publisher 4<sup>th</sup>Edn..
  2. Harper's Illustrated Biochemistry, 26<sup>th</sup> Edition.
  3. Biochemistry by U. Satyanarayana
  4. Biotechnology, B.D.Singh, 3<sup>rd</sup> edition.
  5. Cell biology, Genetics, Molecular Biology, Evolution and Ecology, by Verma and Agarwal, 14<sup>th</sup> edition.
  6. Principle techniques of Biochemistry and Molecular Biology by Keith Wilson and John Walker, 6<sup>th</sup> edition.
  7. Biophysical techniques by Upadhyay and Nath, 3<sup>rd</sup> revised edition.
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## Semester-III

### Course: Environmental and Green Chemistry (CH-336D)

Name of the Topic	Number of lectures
1. Concepts and scope of Environmental Chemistry	02
2. Atmosphere and Air Pollution	14
3. Hydrosphere and water pollution	08
4. Introduction to Green Chemistry	10
5. Green Chemistry and Technology for sustainable development	10
6. Green Chemistry and Hazardous Organic Solvents	04
<b>Total lectures</b>	<b>48</b>

#### Chapter 1: Concepts and scope of Environmental Chemistry

(02)

- 1.1 Introduction
- 1.2 Terminologies
- 1.3 Units of concentration
- 1.4 Segments of Environment

Ref. 1, Ref. 3

#### Aims and Objectives-

Students should know-

- i. Importance and conservation of environment.

#### Chapter 2: Atmosphere and Air Pollution

(14)

- 2.1 Composition and structure of atmosphere
- 2.2 Chemical and photochemical reactions in atmosphere
- 2.3 Chemistry of O<sub>3</sub>, SO<sub>x</sub>, NO<sub>x</sub> and chlorides in atmosphere
- 2.4 Primary air pollutants
- 2.5 Sampling of air
- 2.6 Particulate matter: inorganic and organic
- 2.7 Smog: reducing and photochemical
- 2.8 Mechanism of ozone depletion
- 2.9 Stability and reactions of CFCs
- 2.10 Harmful effects of CFCs
- 2.11 CFCs substitutes
- 2.12 Bhopal gas tragedy

Ref. 1, Ref. 3, Ref. 5

#### Aims and Objectives-

Students should know-

- i. Segments of atmosphere

- ii. Hazards of flue gases
- iii. Ozone depletion
- iv. Ecological changes due to hazardous gases
- v. Understand the social issues

**Chapter 3: Hydrosphere and water pollution (08)**

- 3.1 Water resources
- 3.2 Physical chemistry of sea water: composition, equilibria, pH, pE
- 3.3 Microbially mediated aquatic reactions, nitrogen cycle, iron and manganese bacteria
- 3.4 Classification of water pollutants
- 3.5 Organic and Inorganic pollutants: Pesticides, Detergents, Eutrophication, Marine, Oil, Acid mine drainage, remedial measures and sediments
- 3.6 Thermal pollution
- 3.7 Sampling and monitoring water quality parameters: pH, D.O. (Winkler Method), COD, TOC, Total hardness, free chlorine.

**Ref. 1, 2, 3, and 5**

**Aims and Objectives-**

Students should know-

- i. Water resources
- ii. Quality of potable water
- iii. WHO limits for toxic materials in water stream
- iv. Quality measures

**Chapter4. Introduction to Green Chemistry [10]**

- 4.1 Chemistry is good
- 4.2 The environment and the five environmental spheres
- 4.3 What is environmental Chemistry?
- 4.4 Environmental Pollution
- 4.5 What is green Chemistry?
- 4.6 Green Chemistry and synthetic chemistry
- 4.7 Reduction of risk: Hazard and exposure
- 4.8 The risk and no risks
- 4.9 Waste prevention
- 4.10 Basic principles of green chemistry
- 4.11 Examples based on green technology

**[ Ref: Green Chemistry By Stanley E Manahan, Chemchar Research Inc. (2006) -2<sup>nd</sup>Edn. chapter 1, P1-17 and Ref.6 Relevant pages.]**

**Chapter 5. Green Chemistry and Technology for sustainable development [10]**

- 5.1 Green Chemistry from theory to practice
- 5.2 The twelve principles of green chemistry
- 5.3 Green Chemistry and sustainable Development
- 5.4 Designing Products under the holistic approach “ Cardle-to Cardle”
- 5.5 Scientific areas for practical applications of green chemistry
- 5.6 Use of alternative basic chemicals as feedstocs in chemical industry and research

- 5.7 Green Chemistry and Reduction of solvent Toxicity ( Alternative Solvents or replacement)  
5.8 Applications of New Methodologies in the synthesis of chemical compounds- catalysis and green chemistry.

**[Ref : Green Chemistry–Green engineering by AthanasiosValavanidis and ThomaisVlachogianni ( March 2012) ; Chapter 2 p17-37 and Ref.6 Relevant pages ]**

**Chapter 6. Green Chemistry and Hazardous Organic Solvents ( Green solvents, replacement and Alternative techniques ) [04]**

- 6.1 Introduction to Green Chemistry and Toxic organic solvents  
6.2 Green solvents and Alternative methods  
6.3 Green Chemistry, Green solvents – Alternative techniques in organic synthesis

**[ Ref : Green Chemistry –Green engineering , Chapter 5, p81-91, Ref.6 Relevant pages ]**

**Aims and Objectives-(for Chapters 4, 5 and 6)**

Students should know-

- i. Need of green chemistry technology
- ii. Principles of green chemistry
- iii. Advantages of green chemistry
- iv. Simple examples to clarify the principles
- v. Catalytic routes for sustainable developments

**Reference Books:**

- 1: Environmental Chemistry – A. K. De, 5th Edition (New age international publishers)
  - 2: Environmental Chemistry – J. W. Moore and E. A. Moore (Academic Press, New York)
  - 3: Environmental Chemistry – A. K. Bhagi and C. R. Chatwal (Himalaya Publishing House)
  - 4: Analytical Chemistry – G. D. Christian 4th Edition (John Wiley and Sons)
  - 5: Environmental Chemistry – H. Kaur 2nd Edition 2007, PragatiPrakashan, Meerut, India
  6. Environmental Chemistry with Green Chemistry A. K Das , Books and Allied (P) Ltd, and
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**Semester-III**  
**Course: Environmental and Green Chemistry (CH-346D)**

Name of the Topic	Number of lectures
1. Water treatment and effluent management	08
2. Soil and solid waste management	04
3. Instrumental methods in environmental analysis	08
4. Green House Effect and Global Warming	04
5. Water the ultimate Green solvent	12
6. Energy Relations	12
<b>Total lectures</b>	<b>48</b>

**Chapter 1: Water treatment and effluent management** **[08]**

- 1.1 Domestic sewage, waste water treatment: primary, secondary and tertiary treatments, aerobic, anaerobic and upflow anaerobic sludge bed treatment processes
- 1.2 Industrial waste water treatment i) filtration method ii) ion-exchange method iii) membrane techniques: ultrafiltration, reverse osmosis and electrodialysis
- 1.3 Treatment of drinking water

**Aims and Objectives-**

Students should know-

- i. Methods of water purification
- ii. Waste water treatment process
- iii. Waste water treatment plants

**Chapter 2: Soil and solid waste management** **[04]**

- 2.1 Composition of soil and types of soil.
- 2.2 Organic and inorganic components of soil
- 2.3 Acid base and ion exchange reactions in soil and pH of soil
- 2.4 Chemistry of disposal of solid waste i) sanitary landfills ii) incinerators iii) pyrolysis

**Ref.1, Ref. 2, Ref. 3**

**Aims and Objectives-**

Students should know-

- i. Types of soil
- ii. Components of soil
- iii. Types of solid waste and their disposal

**Chapter 3: Instrumental methods in environmental analysis** **[08]**

- 3.1 Atomic absorption spectroscopy: determination of Hg, As, Zn, Ag, Pb, Mn, Fe, Cu, Cr, Cd
- 3.2 Gas chromatography: detection and determination of CO, HC and pesticides
- 3.3 HPLC: determination of pesticides, PAH as metabolites
- 3.4 Spectrophotometry: determination of NO<sub>x</sub>, SO<sub>2</sub>, NH<sub>3</sub>, CN, PO<sub>4</sub>, Cd, Pb, Hg
- 3.5 Chemiluminescence: determination of NO<sub>x</sub> and O<sub>3</sub>.

3.6 Non Dispersive IR spectrometry of determination of CO  
3.7 Ion selective electrodes: determination of NO<sub>3</sub> and dissolved oxygen (D. O.)

[Ref. 1, Ref. 2]

**Aims and Objectives-**

Students should know-

- i. Techniques used to monitor hazardous materials present in environment

**Chapter 4: Green House Effect and Global Warming**

[04]

4.1 Introduction

4.2 Greenhouse gases

4.3 Radiative forcing

4.4 Sources and sinks of CO<sub>2</sub>

4.5 Causes of fluctuations in global temperature

4.6 Global warming and climate changes

4.7 Implications of climate changes

[Ref. 5]

**Aims and Objectives-**

Students should know-

- i. Green house gases and their effects
- ii. Global warming
- iii. Climate change

**Chapter 5. Water the ultimate Green solvent**

[12]

5.1 H<sub>2</sub>O : Simple formula and complex molecule

5.2 Important properties of water

5.3 The hydrologic cycle

5.4 Bodies of water and life in water

5.5 Chemical process in water

5.6 Fizzy water from underground

5.7 Oxygen in water

5.8 Weak acid from sky

5.9 Why natural water contains alkalinity and calcium

5.10 Metals in water

5.11 Water interactions with other phases

[ Ref: Green Chemistry By Stanley E Manahan, Chemchar Research Inc. (2006)-2<sup>nd</sup>Edn Chapter 7 : P 161-173 ]

**Aims and Objectives-**

Students should know-

- i. What do you mean by green solvent
- ii. Resources of green solvents like alcohol and water
- iii. Importance of water as a green solvent

**Chapter6 .Energy Relations :**

[12 ]

6.1 Energy

- 6.2 Radiant Energy from the sun
- 6.3 Storage and release of energy by chemicals
- 6.4 Energy sources
- 6.5 Conversions between forms of energy
- 6.6 Green engineering and energy conversion efficiency
- 6.7 Conversion of chemical energy
- 6.8 Renewable energy sources

[ Ref: Green Chemistry By Stanley E Manahan, Chemchar Research Inc. (2006) -2<sup>nd</sup>Edn Chapter 6 : P 135-157 ]

**Aims and Objectives-**

Students should know-

- i. Natural resources of energy
- ii. Conventional and nonconventional energy resources
- iii. Conservation of energy
- iv. Utilization of solar and wind energies.

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**Reference Books:**

- 1: Environmental Chemistry – A. K. De, 5th Edition (New age international publishers)
  - 2: Environmental Chemistry – J. W. Moore and E. A. Moore (Academic Press, New York)
  - 3: Environmental Chemistry – A. K. Bhagi and C. R. Chatwal (Himalaya Publishing House)
  - 4: Analytical Chemistry – G. D. Christian 4th Edition (John Wiley and Sons)
  - 5: Environmental Chemistry – H. Kaur 2nd Edition 2007, PragatiPrakashan, Meerut, India
  - 6. Environmental Chemistry with Green Chemistry A. K Das , Books and Allied (P) Ltd.
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## Semester-III

### Course: Agriculture Chemistry (CH-336E)

Name of the Topic	Number of lectures
1. Soil Chemistry	10
2. Problematic Soil and Soil testing	10
3. Quality of Irrigation Water	08
4. Plant Nutrients	08
5. Fertilizers and Manures	06
6. Protection of Plants	06
<b>Total lectures</b>	<b>48</b>

#### Chapter I –Soil Chemistry

(10 L)

- 1.1 Role of agriculture chemistry
- 1.2 Scope and importance of agricultural chemistry
- 1.3 Agricultural chemistry and other science
- 1.4 Definition of soil, Soil components-mineral component, organic matter or humus, soil atmosphere, soil water, soil microorganism
- 1.5 Physical properties of soil- soil texture, soil structure, soil color, soil temp, soil density, porosity of soil.
- 1.6 Surface soil and sub-soil
- 1.7 Chemical properties of soil, soil reactions and solutions
- 1.8 Factor controlling soil reaction, buffering capacity, importance of buffer action in agriculture, ion exchange

**Ref 1- Pagers 8-12, 92-94, 98-113, 116-146**

**Ref 3- Pages 28-50**

#### Chapter II – Problematic Soil and Soil testing

(10 L)

- 2.1 Acid soil- formation of acid soil, effect of soil acidity of soil, reclamation of acidic soil
- 2.2 Alkali Soil- formation of alkali soil, reclamation of alkali soil
- 2.3 Classification of alkali soil- saline soil, saline alkali soil, non-saline alkali soil
- 2.4 Calcareous soils
- 2.5 Introduction to soil testing
- 2.6 Objectives of soil testing
- 2.7 Phases of soil testing- collection of soil sample, analysis in the laboratory and fertilizer applications

**Ref 1- 345-370, Ref 3- 301-312, Ref 4- 135-147 and 150-159**

#### Chapter III- Quality of Irrigation Water

(08 L)

- 3.1 Sources of Water- Atmospheric water, Surface Water, Stored Water, Ground Water
- 3.2 Impurities in Water, Water quality, related problems in public health, environment and agriculture

3.3 Analysis of irrigation Water (ppm, meq/lit.epm)

3.4 Dissolved constituents and their functions

Major constituents- Ca, Mg, Na, K, Carbonate, bicarbonate, sulfate, Chloride and nitrate

Minor constituents- B, Si, nitrite, Sulfide and fluoride

3.5 Water quality standard- total soluble salt (TSS), sodium adsorption ratio (SAR), Exchangeable sodium percentage (ESP), Residual sodium carbonate, salinity classes for irrigation water

**Ref 8- Pages 293-309**

#### **Chapter IV- Plant Nutrients**

**(08 L)**

4.1 Need of plant nutrients, forms of nutrients updates, nutrient absorption by plants

4.2 Classification of essential nutrients

4.2.1 Primary nutrients (N, P, K), its role and deficiency symptoms in plants

4.2.2 Secondary nutrients, (Ca, Mg, S), its role and deficiency symptoms in plants

4.2.3 Micronutrients, General functions of micronutrients (Zn, Fe, Mn, Cu, B, Mo, Cl)

4.3 Effect of environmental condition, nutrient uptake

**Ref 3- Pages 207-241, Ref 4- Pages 176-195, Ref 7- pages 287-300**

#### **Chapter V- Fertilizers and Manures**

**(06 L)**

##### **Fertilizers**

5.1 Introduction, Classification & application of fertilizers

5.2 Time and methods of fertilizers

5.3 Factors affecting efficiency of fertilizers

5.4 Vermicompost preparation, effect of vermicompost on soil fertility

5.5 Synthetic fertilizers definition, comparison of synthetic fertilizers with organic fertilizers , environmental effect of synthetic fertilizers

##### **Manures**

5.6 Introduction, Definition and classification of manures

5.7 Effect of bulky organic manures on soil, farm yard manures (FYM), Factors affecting on FYM, method of preparation, losses during handling and storage

5.8 Biogas plant. Human waste, sewage and sludge, types of sludge, carbon nitrogen ratio, sewage irrigation and uses

5.9 Green manuring, types of green manuring, characteristics, advantages and disadvantages of green manuring

6.0 Biofertilizers: definition, classification, role & advantages

**Ref 2- Pages 205-213, Ref 3- 90-112, 137-149**

#### **Chapter VII- Protection of Plants**

**(06 L)**

Pesticide Classification and mode of action

7.1 Insecticide- Definition, Classification, chemical properties, elemental composition, mode of action of synthetic and plant originated compounds organophosphates, malathion, parathion, carbamates

7.2 Fungicides- Definition, Classification, Chemical properties, mode of action of S

& Cu fungicides

7.3 Herbicides- Definition,, Classification, composition, mode of action of Selective and non-selective herbicides.

### Ref 6- Relevant Pages

#### Learning Objectives of Agriculture Chemistry

After studying this course, student is expected to

1. Know the role of agriculture chemistry and its potential
2. Understand basic concept of soil, properties of soil & its classification on the basis of pH
3. Know the different plant nutrients, Their functions and deficiency symptoms
4. Understand importance of manures as compared to chemical fertilizers'
5. Understand the importance of green manuring
6. Have the knowledge of the use of proper the plants
7. Know various techniques to protect the plants
8. Have the knowledge of various pesticides, insecticides, fungicides and herbicides
9. Identify the problematic soil and recommend method for their reclamation
10. Have the knowledge of quality irrigation water, water quality standard and analysis of irrigation water

#### Reference Books

1. A text book of soil science (Recise Ed) J.A. Daji, Revised by J.R. Adam, N.D. Patil, Media promoters and publishers, Mumabi, 1996
  2. Text book of soil science, T.D. Biswas, S.K. Mukharjee, Tata McGraw Hill Publishing company, New Delhi
  3. Introduction to Agronomy and soil, water management, V.G. Vaidya, K.R. Sahashtra Buddhe (Continental Prakashan)
  4. Principals of soil science, M.M. Rai, Millian complex of India, Bombay, 1977
  5. Manures and fertilizers (sixth ed), K.S. Yawalkar, J.P. Agarwal and Bokde, Agrihorticulture publishing house, Nagpur, India
  6. Chemistry of insecticides and fungicides, U.S. Sreeramula (2nd Ed), oxford and IBH Publishing company, New Delhi
  7. Fundamentals of soil sciences, C.E. Millar and L.M. Turk, Bio-Tech- New Delhi (1st Ed 2001)
  8. Soil, Plant, Water and fertilizer analysis, P.K. Gupta, Published by Agro Botanica
  9. **Biofertilizers** and biopesticides , Author: Deshmukh, A. M. (ArvindMadhavrao),
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## Semester-IV

### Course: Dairy Chemistry (CH-336E)

Name of the Topic	Number of lectures
1. Market Milk	08
2. Common Dairy Processes	06
3. Special Milks	08
4. Milk proteins, Carbohydrates and Vitamins	08
5. Preservatives & Adulterants in Milk	06
6. Milk Products	08
7. Dried Milk Products	04
<b>Total lectures</b>	<b>48</b>

#### Chapter I – Market Milk

(08 L)

Introduction, Definition, constituents of milk of different species such as cow, buffalo, goat, etc., Chemical composition of milk of Indian breed and foreign breeds of cow, factor affecting composition of milk, characteristics of milk of different mammals, physicochemical properties of milk, acidity, pH, density, specific gravity, color and flavor of milk, food and nutritive value of milk. Microbiology of milk, growth of microorganism, stages of growth, product of microbial growth, destruction of microorganisms growth.

Ref 1 chap I relevant pages, Ref 2 pages 9-26, Ref 6 – relevant pages.

#### Chapter II – Common Dairy Processes

(06 L)

(Manufacture, storage and packaging)

Cream separation- Basic principles, gravity creaming water dilution and centrifugal creaming method, construction of centrifugal separator, factors affecting percentage of fat, speed of machine, temp. of milk, rate of inflow amount of flushing water formation of separator slime Pasteurization of milk, flow sheet diagram, process receiving milk, preheating filtration, clarification, cooling and storage raw milk, standardization, pasteurization, homogenization, packing and storage, uses of milk.

Ref 1.- Relevant pages.

#### Chapter- III Special Milks

(08 L)

1. Sterilized milk- Definition, method of manufacture in detail, Advantages and disadvantages. 2. Homogenized milk,- Definition, merits and demerits factor influencing homogenization, Process of manufacture. 3. Soft curd milk- Definition, characteristics, method of preparation of soft curd milk. 4. Flavored milk- Definition, types, method of manufacture flow sheet diagram. 5. Vitaminised / irradiated milk- - Definition, method of manufacture. 6. Fermented milk-Definition, method of manufacture. 7. Standardized milk- Definition, method of manufacture.

Ref 1 Chap II relevant pages.

#### Chapter IV- Milk proteins, Carbohydrates and Vitamins

(08 L)

1. Milk proteins- importance of proteins found in the milk-casein, albumin and globulin, composition, nomenclature, properties and uses. 2. Carbohydrates- importance of lactose, classification, properties, nutritive value of lactose use of lactose. 3. Vitamins- importance, definition,

properties nutritive value of vitamins, Vit-A, Vit-B, B2, B6, B12, Vit-C (Ascorbic acid) & Vitamin-D. 4. Food and nutritive value of milk, milk & public health.

**Ref-2 Pages 11,12,33 to 38, 42 to 49, 51 to 53**

**Chapter V- Preservatives & Adulterants in Milk**

**(06 L)**

1. Preservation of milk- Introduction, Common preservatives are used. 2. Adulterants- Introduction, Modes of Adulteration and their detection such as skimming, addition of separated milk, skim milk, Water, Starch and cane sugar.

**Ref -2 Pages 78-81**

**Chapter VI- Milk Products**

**(08 L)**

**Cream, Butter, Cheese and Ice-Cream.**

1. Cream- Definition, Classification, Composition, Food & Nutritive value, Physicochemical properties, Manufacture and uses of cream. Ref-1 117, 118, 121 & 142

2. Butter- Definition, Classification, Composition, Food & nutritive value, Physicochemical properties, Manufacture and uses of Butter selection of milk/cream. Preheating of milk, Separating of milk, neutralization of cream, Pasteurization of cream, Cooking & ageing, repending of cream, salting of butter, washing of butter, packaging & Storage, use of butter.

**Ref -1 Pages 143, 144, 145 to 158 & 173**

3. Cheese- Definition, Classification, Food & nutritive value, properties, Manufacture and uses of cheese.

**Ref -1 Pages 224, 227, 229 to 242 & 267**

4. Ice-cream- Definition, Classification, Composition, Food & Nutritive value, Manufacture, packing, hardening & Storage, uses of Ice-cream.

**Ref -1 Pages 182, 183, 184, 193,223**

**Chapter VII- Dried Milk Products**

**(04 L)**

Introduction, butter milk powder, whey powder, cream powder, infact milk powder, Shrikand powder, Ice-cream mix powder, cheese powder.

**Ref-1 Pages 357 to377**

**Learning Objectives-**

The students are expected to study "Dairy Chemistry" in view of-

1. Knowing importance of the subject from the point of rural economy.
2. Knowing the composition of milk, its food & nutritive value
3. Understanding the Microbiology of the milk
4. Understanding various preservation and adulterants, various milk proteins and their role for the human body.
5. Knowing various milk products, their composition, manufacture and uses.

**References-**

Ref- 1: Outline of Dairy Technology- Oxford University press By- Sukumar De. (Edition-1983)



Ref- 2: Dairy Chemistry and Animal Nutrition- M.M. Rai, Kalyani, Publishers, New Delhi 3rd Edition, 1980

Ref- 3: Fundamentals of Dairy Chemistry- B.H. Webb, A.H. Hohsson, J.A. Alford, CBB Publishers and Distributors.

Ref- 4: Milk and Milk Products- C.H. Eckles, H. Macy, Tata McGraw Hikk Publishing Company Ltd.

Ref- 5: Chemistry and Testing of Dairy Products- H.V. Athertion, J.A. New Lander, CBS, Publishers and Distributors.

Ref-6: Dairy Microbiology, Dr. K.C. MahantaOmsons Publication New Delhi.

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**University of Pune**

**Two Year M. Sc. Degree Course in Chemistry**

**M. Sc. Chemistry**

**(Credit and Semester based Syllabus to be implemented from Academic Year 2013-14)**

**1) Title of the Course:** M.Sc. Chemistry

**2) Preamble of the Syllabus:**

Master of Science (M.Sc.) in Chemistry is a post graduation course of University of Pune. The credit system to be implemented through this curriculum, would allow students to develop a strong footing in the fundamentals and specialize in the disciplines of his/her liking and abilities.

The students pursuing this course would have to develop in depth understanding of various aspects of the subject. The conceptual understanding, development of experimental skills, designing and implementation of novel synthetic methods, developing the aptitude for academic and professional skills, acquiring basic concepts for structural elucidation with hyphenated techniques, understanding the fundamental biological processes and rationale towards computer assisted drug designing are among such important aspects.

**3) Introduction:**

**Salient Features of the Credit System:**

1. Master's degree course in Chemistry would be of 100 credits, where one credit course of theory will be of one clock hour per week running for 15 weeks and one credit for practical course will consist of 15 of laboratory exercise including the revision and setting up the practical. Thus, each credit will be equivalent to 15 hours.
2. Student will have to take admission in Chemistry Department and complete 75 credits incorporated in the syllabus structure of Chemistry. The remaining 25 credits shall be chosen from courses offered by the Chemistry Department or other Departments of the University/College with credit system structure.
3. Except practical credits wherever applicable, students may be allowed to complete less courses per semester on the condition they complete the degree in maximum of four years. This facility will be available subject to the availability of concerned courses in a given semester and with a maximum variation of 25 credits (in case of fresh credits) per semester.
4. Every student shall complete 100 credits in a minimum of four semesters. All Semesters will have average 25 credits each.
5. The student will be declared as failed if s/he does not pass in all credits within a total period of four years. After that such students will have to seek fresh admission as per admission rules prevailing at that time.
6. Academic calendar showing dates of commencement and end of teaching, internal assessment tests and term end examination will be prepared and duly notified before commencement of each semester every year.
7. Project course should not be greater than 5% of the total credits of the degree course. Project course is equivalent to 4 credits.

## **Instructions for the Students**

The students seeking admission to M.Sc. Chemistry course is hereby informed that they are supposed to adhere to the following rules:

1. A minimum of 75 % attendance for lectures / practical is the pre-requisite for grant of term.
2. There shall be tutorial / practical / surprise test / home assignment / referencing of research papers / seminar / industrial visits / training course as a part of internal assessment in each semester. The students are supposed to attend all the tests. The students should note that re-test will not be given to the student absent for the test/s.
3. The students opting for dissertation course shall follow the rules framed for the same.
4. Industrial / Institute - Visit and or Industrial Workshops / Laboratory Workshops / Training Programme is a compulsory component of the syllabus. The students are supposed to attend all the Industrial Workshops / Laboratory Workshops / Training Programme organized by the department. The students shall attend these programs at their own cost.

### **4) Eligibility:**

The candidate should have a B.Sc. degree with Chemistry as principal subject **OR** B.Sc. (General) degree with Chemistry (Electronics) as one of the subsidiary subjects.

Admission: 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.

### **5) Examination**

#### **[A] Pattern of Examination**

Evaluation of Students:

- 1) The In-semester and End-Semester examinations will be of 50 marks each.
- 2) Student has to obtain 40% marks in the combined examination of In-Semester and End-Semester assessment with minimum passing of 30% passing in both assessments separately.
- 3) A student cannot register for third semester if s/he fails to complete the 50% credits of the total expected within two semesters.
- 4) Internal marks will not change. Student cannot repeat internal assessment. If student misses internal assessment examination, s/he will have second chance with the permission of the concerned teacher. But it will not be right of the student. It will be the discretion of the concerned teacher and internal departmental assessment committee. In case s/he wants to repeat Internal, s/he can do so only by registering for the said courses during 5<sup>th</sup>/6<sup>th</sup> semester whichever is applicable.
- 5) There shall be revaluation of answer script of end semester examination, but not of internal assessment papers.
- 6) Internal assessment answer scripts may be shown to the concerned student but not end semester answer script.

**i. In-semester Examination:** Internal assessment for each course would be continuous and dates for each tutorials/practical tests will be pre-notified in the time table for teaching or placed separately as a part of time table. Department / College Internal Assessment Committee will coordinate this activity

**a) Theory Courses:** Conducting written tests should not be encouraged. More focus should be on non-written tests. Students should be encouraged to conduct various academic activities. A teacher must select a variety of the procedures for internal assessment suggested as follows.

- a) Mid-term test
- b) On-line test
- c) Computer based examination
- d) Open book test (concerned teacher will decide the allowed books)
- e) Tutorial
- f) Surprise test
- g) Oral
- h) Assignments
- i) Review of research paper
- j) Seminar presentation
- k) Journal/Lecture/Library notes

Student has to preserve the documentation of the internal assessment except midterm test answer script. It is the responsibility of the student to preserve the documents.

**b) Practical Courses:** It is a continuous evaluation process. Practical courses will be evaluated on the basis of the following

1. Performance assessment of each experiment on the basis of attendance, punctuality, journal completion, practical skills, results, oral and analysis.
2. Test on practical may be conducted before the end-semester examination.
3. Assessment of each experiment shall be done for each practical weekly.
4. Assessment of the Activity will be based on any one of the following per practical course.
  - i. Experimental and analytical skills
  - ii. Synthesis of compounds
  - iii. Evaluation of physical constants, purity of compounds
  - iv. Fundamental understanding of instrumental techniques
  - v. Recording and analysis of spectral data
  - vi. Economic utilization of chemicals
  - vii. Basic understanding of the experiment

The student strength of practical batch should be eight. Note that one practical session of 4 hour duration of one practical batch.

**Project Course:** Project will be evaluated by In-Charge of project batch in concern with project guide. Assessment will be done weekly in the respective batch. Evaluation will be on the basis of weekly progress of project work, progress report, referencing, oral, results and documentation.

- ii. **End-Semester Examination:** End-Semester examination for 50 marks per course would be held about two weeks after completion of teaching for the semester. Paper setting and assessment for a particular course would be the responsibility of the course In-charge, and these activities would be coordinated by the Department Examination Committee. The Department Examination committee would undertake preparation of the result-sheets for the student

### **[B] Standard of Passing**

Student has to obtain 40% marks in the combined examination of In-Semester and End-Semester assessment with minimum passing of 30% passing in both assessments separately.

### **[C] ATKT Rules**

A student cannot register for third semester if s/he fails to complete the 50% credits of the total credits expected to be ordinarily completed within two semesters.

### **[D] Award of Class**

Grades will be awarded from grade point average (GPA) of the credits.

### **GPA Rules:**

1. The formula for GPA will be based on Weighted Average. The final GPA will not be printed unless a student passes courses equivalent to minimum 100 credit hours (Science). Total credits hours means the sum of credit hours of the courses which a student has passed.
2. A seven point grade system [guided by the Government of Maharashtra Resolution No. NGO – 1298 / [4619] / UNI 4 dt. December 11, 1999 and University regulations] will be followed. The corresponding grade table is attached herewith.
3. If the GPA is higher than the indicated upper limit in the third decimal digit then the student be awarded higher final grade (e.g. a student getting GPA of 4.492 may be awarded 'A')
4. For Semester I, II, III examinations, only the grade points will be awarded for each subject. Final GPA along with final grade will be awarded only at the end of IV semester. There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. The revaluation result will be adopted if there is a change of at least 10% marks and in the grade of the course.
5. After the declaration of result, for the improvement of Grade, the student can reappear for the examination of 30 credits worth theory courses.
6. Grade improvement programme will be implemented at the end of the academic year. A student can opt for grade improvement programme only after the declaration of final semester examination i.e. at the end of next academic year after passing M.Sc. (Chemistry) examination and within two years of completion of M.Sc. (Chemistry). A student can appear for grade improvement programme only once.

Grade and Grade Point Average		
Marks	Obtained Grade	Grade Points
100 – 75	‘O’ Outstanding	06
74 – 65	‘A’ Very Good	05
64 – 55	‘B’ Good	04
54 – 50	‘C’ Average	03
49 – 45	‘D’ Satisfactory	02
44 – 40	‘E’ Pass	01
39 and less	‘F’ Fail	00

Final Grade Points	
Grade Points	Final Grade
5.00 – 6.00	<b>O</b>
4.50 – 4.99	<b>A</b>
3.50 – 4.49	<b>B</b>
2.50 – 3.49	<b>C</b>
1.50 – 2.49	<b>D</b>
0.50 – 1.49	<b>E</b>
0.00 – 0.49	<b>F</b>

Common Formula for Grade Point Average (GPA):

$$\text{GPA} = \frac{\text{Total of Grade Points earned} \times \text{Credit hours for each course}}{\text{Total Credit hours}}$$

B Grade is equivalent to at least 55% of the marks

[E] **External Students:** There shall be no external students.

[F] **Setting of Question Paper / Pattern of Question Paper**

For core (compulsory) theory courses, end semester question papers set by the University of Pune and 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.

Theory examination will be of 2 hours duration for each theory course of 5 credits. There will be **two sections** for each paper. Each section will be of **25 marks** and the pattern of question paper shall be:

Question 1 (10 Marks)	5 compulsory sub-questions, each of 2 marks; answerable in 2-3 lines
Question 2 (10 Marks)	2 out of 4 – short answer type questions of 5 marks each; answerable in 8 – 10 lines
Question 3 (5 Marks)	1 out of 2 – numerical problem type question; note, spectral analysis, functioning of instrumental technique with components

### [G] Verification / Revaluation

There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. The revaluation result will be adopted if there is a change of at least 10% marks and in the grade of the course. There shall be revaluation of answer script of end semester examination, but not of internal assessment papers.

### 6) Structure of 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 Pune University.

#### a) Compulsory Papers

Theory: CHP-110, CHP-210, CHI-130, CHI-230, CHO-150, CHO-250,  
CHA-290

Practical: CHP-107, CHI-147, CHO-247

#### M. Sc. Chemistry - Course structure & Credits Distribution

Semester	Course Code	Course Title	No. of Units	No. of credits
Sem-I	CHP-110	Fundamentals of Physical Chemistry-I	04	04
	CHI-130	Molecular Symmetry & Chemistry of p-block elements	04	04
	CHO-150	Basic organic chemistry	04	04
	CHA-190	Safety in Chemical Laboratory and Good Laboratory Practices	04	04
	CHP-107	Practical Course (Physical Chemistry)	24 Practical Sessions	06
	CHI-147	Practical Course (Inorganic Chemistry)	24 Practical Sessions	06
Sem-II	CHP-210	Fundamentals of Physical Chemistry-II	04	04
	CHI-230	Coordination and Bioinorganic Chemistry	04	04
	CHO-250	Synthetic organic chemistry and spectroscopy	04	04
	CHA-290	General Chemistry	04	04
	CHO-247	Practical Course (Organic Chemistry)	24 Practical Sessions	06



**b) Question Papers and papers etc.:**

Theory

In-Semester Examination: 50 Marks  
End-Semester Examination: 50 Marks

Practical

In-Semester Examination: 50 Marks  
End-Semester Examination: 50 Marks

**c) Medium of Instructions:** English.**7) Equivalence of Previous Syllabus:**

<b>New Course ( 5 credit pattern; 20013-14 Pattern)</b>	<b>New Course ( 4 Credit pattern; 2014 - 15 Pattern)</b>
CH-110	CHP-110
CH-130	CHI-130
CH-150	CHO-150
-	CHA-190
CH-107	CHP-107
CH-127	CHI-127
CH-210	CHP-210
CH-230	CHI-230
CH-250	CHO-250
CH-290	CHA-290
CH-247	CHO-247

**8) University Terms:**

Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only for duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

**9) Qualification of Teacher:**

- i. M.Sc. (Chemistry) degree with NET/SET qualification.
- ii. Recognition of Pune University as a post graduate teacher, by papers.

iii. Other criteria as per the guidelines of UGC and University of Pune.

## **M. Sc. Chemistry Part-I**

### **Physical Chemistry**

#### **Semester - I**

#### **CHP-110: Fundamentals of Physical Chemistry-I**

**(4 Credits)**

#### **SECTION-I**

**(2 Credits, 24 L, 6 T)**

#### **Thermodynamics**

1. Recapitulation:- Heat, work & Conservation of energy – The basic concepts, the first law, infinitesimal changes, mechanical work, work of compression & expansion, free expansion, expansion against constant pressure, reversible expansion. Heat:- heat capacity, enthalpy. State functions & differentials – State functions, exact & inexact differential, changes in internal energy, temperature dependence of the internal energy, temperature dependence of the enthalpy. Work of adiabatic expansion – Irreversible adiabatic expansion, reversible adiabatic expansion. (02 L)
2. The second law of Thermodynamics: Measuring the dispersal the entropy. The second law, the definition of entropy, the entropy changes in the system, natural events. Entropy changes in the universe – The enthalpy change when a system is heated. Entropy changes in surroundings. The entropy of phase transition. The entropy of irreversible changes. Concentrating on the system – The Helmholtz & Gibbs function, some remarks on the Helmholtz function. Maximum work, some remarks on Gibbs function. Evaluating the entropy & Gibbs function. The third law of Thermodynamics, Third law entropies standard molar Gibbs function. (05 L)
3. Combining First & Second law – One way of developing the fundamental equations properties of Gibbs function. The temperature dependence of the Gibbs functions. The pressure dependence of the Gibbs functions. The chemical potential of a perfect gas. The open system & changes of composition. (03 L)

4. Changes of State: Physical Transformation of pure materials. The stabilities of phases, Phase equilibrium & phase diagrams. The solid – liquid boundary. The liquid - vapor boundary. The solid-liquid-vapor boundary. (03 L)

5 Changes of State: Physical transformation of simple mixtures, partial molar quantities – Partial molar volume, Partial molar Gibbs function. The thermodynamics of mixing – the Gibbs function of mixing after thermodynamics mixing functions. The chemical potential of liquid-liquid mixture. Colligative properties – The common features, the elevation of boiling point. The depression of freezing point, solubility, osmosis. Mixtures of volatile liquid-vapor pressure diagram. (04 L)

6. Quantum Chemistry (07 L)

Historical development of quantum theory, failure of classical mechanics, black body radiation, photo electric effect, specific heats of solids, Atomic spectra, wave particle duality, uncertainty principles, Schrodinger equation, free particle, particle in one dimensional box, hydrogen like atoms (No derivation), atomic orbital's.

## SECTION-II

(2 Credits, 24 L, 6 T)

### Chemical kinetics and reaction dynamics

1. Recapitulation: The rates of reaction, reaction rate, rate laws & rate constants, the determination of the rate law, first order, second order reactions, half lives, fractional order reactions. (02 L)

2. Accounting for rate laws, simple reactions, the temperature dependence of reaction rates, reactions approaching equilibrium, consecutive reactions, the steady state approximations, pre equilibria, unimolecular reactions. (05 L)

3. The kinetics of complex reactions: chain reaction- explosion, photochemical reactions- quantum efficiency, fast reactions-flash photolysis, flow techniques, relaxation methods.

(02 L)

4. Molecular reaction dynamics- collision theory-the basic calculations, the steric requirements, Diffusion control reactions- classes of reactions, diffusion and reactions, the details of diffusion, Activated complex theory- the reaction coordinate and the transition state, the formation and decay of the activated complex, how to use the Eyring equation, thermodynamics aspects, reactions between ions. (05 L)
5. Enzyme catalysts: Michaelis-Menten mechanism, limiting rate, Lineweaver Burk and Eadie plots enzyme inhibition, competitive and non-competitive inhibition. (04 L)
6. Molecular Thermodynamics: Molecular energy levels, Boltzmann distribution law, partition functions and ensembles, translational, rotational and vibrational partition functions of diatomic molecules, Obtaining energy, heat capacity, entropy free energy, equilibrium constants from partition functions, equipartition of energy, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics. (06 L)

## References

1. Physical Chemistry- P.W.Atkin and De Paule 8th edition (2010)
2. Physical Chemistry-T. Engel and P. Reid, Pearson Education (2006)
3. Physical Chemistry and molecular approach- D. Mcquarie and J. Simon (University Science) (2000)
4. Physical Chemistry for Biological Sciences by Raymond Change (Universal books ) (2000)
5. Physical Chemistry – Marron and Prouton
6. Physical Chemistry- G.M. Barrow, Tata McGraw Hill 1988
7. Quantum Chemistry- I. Levine 5<sup>th</sup> edition, Prentice Hall, 1999.

# Inorganic Chemistry

## Semester - I

**CHI-130: Molecular Symmetry & Chemistry of p-block elements (4 credits)**

### **SECTION-I: Molecular Symmetry and its Applications**

**(2 Credits, 24 L, 6 T)**

**(a) Definitions and Theorems of Group Theory:** Defining properties of a group, group multiplication table, some examples of group, subgroups, classes

**(b) Molecular Symmetry and Symmetry Groups:** 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 symmetry elements and symmetry operations, symmetry elements and optical isomerism, symmetry point groups, classes of symmetry operations, classification of molecular point groups.

**(c) Representations of Groups:** Matrix representation and matrix notation for geometric transformation, The Great Orthogonality Theorem and its consequence, character tables (No mathematical part)

**(d) Group theory and quantum mechanics:** Wave function as basis for irreducible representations

**(e) Symmetry Adapted Linear Combinations:** Projection operators and their use of construct SALC (Construction of SALC for sigma bonding for molecules belonging point groups:  $D_{2h}$ ,  $D_{3h}$ ,  $D_{4h}$ ,  $C_{4v}$ , Td, Oh, normalization of SALC.

**(f) Molecular Orbital Theory:** Transformation properties of atomic orbital, MO's for Sigma bonding  $AB_n$  molecules, tetrahedral  $AB_4$  and Oh  $AB_6$  cases.

#### **References:**

1) Chemical Applications of Group Theory, 3<sup>rd</sup> Ed<sup>n</sup>., Author - F. A. Cotton (Wiley, New York)

- 2) Symmetry and spectroscopy of molecules, 2<sup>nd</sup> Ed. 2009; K. Veera Reddy, (New Age International Publication)
- 3) Group Theory and its Chemical Applications, P.K. Bhattarchrya

## **Section-II: Chemistry of Main group elements**

**(2 Credits, 24 L, 6 T)**

1. Hydrogen and its compounds: Hydrides: Classification, electron deficient, electron precise and electron rich hydrides.  $\text{PH}_3$ ,  $\text{SbH}_3$ ,  $\text{AsH}_3$ , Selenides, Tellurides **(2 L)**
2. Alkali and alkaline earth metals: Solutions in non-aqueous Media, Application of crown ethers in extraction of alkali and alkaline earth metals **(2 L)**
3. Organometallic Compounds of Li, Mg, Be,: Classification, Synthesis, Properties, Uses and Structure **(3 L)**
4. Boron Group: Boron Hydrides, preparation, structure and Bonding with reference to LUMO, HOMO, interconversion of lower and higher boranes, Metalloboranes, Carboranes, Reactions of Organoboranes **(4 L)**
5. Carbon Group: Allotropes of Carbon,  $\text{C}_{60}$  and compounds (fullerenes), Intercalation compounds of Graphite, Carbon nanotubes, synthesis, properties, structure-single walled, multi walled, applications **(2 L)**
6. Organometallic compounds of Si, Sn, Pb, Ga, As, Sb, Bi. Structures, synthesis, **(3 L)** Reactions
7. Nitrogen Group: Nitrogen activation, Boron nitride, Oxidation states of nitrogen and their interconversion, PN and SN Compounds,  $\text{NO}_x$  and their redox chemistry **(3 L)**
8. Oxygen Group: Metal Selenides and Tellurides, oxyacids, and oxoanions of sulphur & nitrogen. Ring, Cage and Cluster compounds of p-block elements. Silicates, including Zeolites **(3 L)**
9. Halogen Group: Interhalogens, pseudo-halogen, Synthesis, Properties and Applications, Structure, Oxyacids and Oxoanions of Halogens, Bonding **(2 L)**

References:

- 1) Inorganic Chemistry : Shriver & Atkins (4<sup>th</sup> edition 2003, Oxford)
- 2) Concise Inorganic Chemistry, J. D. Lee, Fourth Edn.(Chapman and Hall)

- 3) Inorganic chemistry: principle of structures and reactivity, Huheey, Keiter, Keiter, Medhi, Pearson Education, 4<sup>th</sup> Edn. (2007).
- 4) Inorganic Chemistry: Catherine Housecroft
- 5) Inorganic Chemistry: Messler & Tarr, Pearson Publishers 3rd Edition
- 6) Organometallic Chemistry-A Unified Approach: R. C. Mehrotra & A. Singh



# Organic Chemistry

## Semester - I

**CHO-150: Basic organic chemistry**

**(4 Credits)**

### Section-I

**(2 credits, 24 L, 6 T)**

**1. Structure and reactivity:**

**(10 L)**

- a) Chemical bonding and basis of reactivity- Chemical bond, delocalization, conjugation, resonance, hyperconjugation, tautomerism, inductive effects.
- b) Acidity and basicity: various structural effects, hard and soft acid and base concept.
- c) Aromaticity: Benzenoid and non-benzenoid compounds, Huckels rule, antiaromaticity, Application to carbocyclic and heterocyclic systems, annulenes, azulenes, current concepts of aromaticity.
- d) Structure and stability of reactive intermediates, carbenes, nitrenes, carbocations, carbanions and free radicals.

**2. Stereochemistry:**

**(14 L)**

- a) 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.
- b) Conformational analysis of cyclic and acyclic compounds.

### Section-II

**1. Organic reactions:**

**(2 credits, 24 L, 6 T)**

**a) Substitution reaction:**

**(10 L)**

Aliphatic nucleophilic substitution- $S_N1$ ,  $S_N2$  mechanism, NGP by pi and sigma bonds, classical and non-classical carbocations, phenonium ions, norbornyl system, carbocation rearrangement in NGP,  $S_Ni$  mechanism, nucleophilic substitution in allylic, trigonal and vinylic carbon.

Effect of structure, nucleophile, leaving group and solvent on rate of  $S_N1$  and  $S_N2$  reactions, ambident nucleophile and regioselectivity.

**b) Aromatic Electrophilic substitution (4 L)**

Arenium ion mechanism, orientation and reactivity, energy profile diagram, ortho, para, ipso attack, orientation in other ring systems, six and five membered heterocycles with one hetero atom.

Important reactions like Friedel crafts alkylation and acylation, Nitration, halogenation, formylation, chloromethylation, sulphonation, diazonium coupling.

**Aromatic nucleophilic substitution (2 L)**

$S_NAr$ ,  $S_N1$ , Benzyne and  $S_NR1$  reactions, reactivity: effect of substrate structure, leaving group and attacking nucleophile.

**c) Addition reactions (4 L)**

Addition to C-C multiple bonds - mechanism and stereochemical aspects of addition reaction involving electrophile, nucleophile and free radicals, Regio and chemo selectivity, orientation and reactivity, conjugate addition.

**d) Elimination reactions (4 L)**

E1, E2, E1cb mechanisms, orientation and stereochemistry in elimination reaction, reactivity effect of structure, attacking and leaving group, competition between elimination and substitution, syn eliminations.

**References:**

1. Organic Chemistry—by J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford)
2. Advanced Organic Chemistry —by J. March 6<sup>th</sup> Edition
3. Advanced Organic Chemistry (part A) —by A. Carey and R.J. Sundberg
4. Stereochemistry of carbon compound-by E.L. Eliel
5. Stereochemistry of organic compound-by Nasipuri
6. Guide book to Reaction Mechanism —Peter Sykes

# General Chemistry

## Semester – I

**CHA-190**

**(4 Credits, 48 L, 12 T)**

### **Safety in Chemical Laboratory and Good Laboratory Practices**

- 1 History and importance of safety and health in Laboratory (1 L)
  - Moral, legal and financial reasons.
- 2 Different types of Hazards at workplace handling chemicals (3 L)
  - Physical, chemical, biological, allergens
  - Effect of hazards on health
  - Where to find Hazard information-Reading Labels,  
Ref. 1; Page 1 – 8.
- 3 Personal Protective and other safety equipments and their uses (6 L)

Various safety goggles, types of gloves, apron, masks, different filters for masks, face shield, full body suit, safety shoes, helmet, breathing apparatus suit, safety belt, earmuffs along with inspection methods. Emergency exit, its location and approach path, fire extinguishers, and their periodic inspection, first aid kit, its contents and need for monitoring. Eye wash fountains and safety showers, fire drill, and chemical accident drills, accident free days and incentives to follow safety rules, accident recording and investigation for future controls  
Ref. 2; relevant pages  
Dos and Don't: Safe clothing, hair, dangling jewellery responsible attitude, good House Keeping, use proper PPE, No food in Labs. (2 L)
- 6 First Aid (1 L)

For contact of different chemicals on skin, eyes, and inhalation and ingestion
- 7 Types of fire extinguishers, method of use. (1 L)
- 8 Material Safety Data Sheets, Globally Harmonised System (GHS) Signs (<http://www.calstatela.edu/univ/ehs/msds.php>) (3 L)

Importance and use of current 16 point format, Labels and pictograms and some of their discrepancies, Globally Harmonized System for SDS, label changes (2014)
9. Inventory Management, Storage and Disposal (10 L)

Inventory Management, Storage, Waste Classification, Hazardous Waste, Non-Hazardous Waste, mixed waste, Waste Disposal

10. What to do when things go wrong (2 L)

Spills, mercury spills, Injuries, Fires, building Evacuations, Emergencies

11. OSHA laboratory Standards (2 L)

Case studies: Reason for fire or accident, affixing responsibility and proposing action for prevention or minimizing possibility or severity (6 L)

Losses in an accident, Financial and non-financial, Importance of system based solutions over manual action, Economical solutions, Compromise between accident costs and prevention costs.

12. Good Laboratory Practices (GLP) (12 L)

Introduction and principles of GLP, performance of Lab studies and calibration using Standard Operating Procedures (SOPs), Instrument validation, reagent certification, Lab notebook maintenance to contemporary standards, maintenance of lab records based on instrument and reagent certification. Introduction to ISO and NABL accreditation.

Books:

1. Chemical Laboratory Safety and Security: A Guide to Prudent Chemical Management, Lisa Moran and Tina Masciangioli, Editors, THE NATIONAL ACADEMIES PRESS Washington, DC [www.nap.edu](http://www.nap.edu)
2. Safety in Academic Chemical Laboratory, Vol. II, ACS Publication, 7<sup>th</sup> Edition (2003).
3. OECD Series on Principles of Good Laboratory Practices and Compliance Monitoring, 1997.
4. Handbook of Good Laboratory Practices, TDR, WHO, UNICEF, UNDP (2009).
5. A Primer for Good Laboratory Practices and Good Manufacturing Practices, L. Huber, Agilent Technologies, 2002.
6. What went wrong By Trevor Kletz, Gulf professional Publisher

# Physical Chemistry

## Semester – II

### CHP-210: Fundamentals of Physical Chemistry-II

(4 Credits)

#### SECTION-I

(2 Credits, 24 L, 6 T)

#### Molecular Spectroscopy

- 1) Recapitulation:-Width and intensity of spectral transitions, Fourier transform, microwave spectroscopy, rotation spectra of di and poly atomic molecules, Stark effect (04 L)
- 2) Infra red spectroscopy : Harmonic and an harmonic oscillator, vibrational spectra of di – and poly- atomic molecules, coarse and fine structure, Nuclear spin effect, application, (05 L)
- 3) Raman Spectroscopy: Introduction, Rotational Raman- spectra, Vibrational Raman , Spectra, polarization of light and Raman effect, structure elucidation from combined Raman and IR spectroscopy, applications in structure elucidation. (05 L)
- 4) Electronic spectroscopy of molecules: Born – Oppenheimer approximation, electronic spectra of diatomic molecules, vibration, al coarse structure, rotational fine structure dissociation energy and dissociation products, electronic structure of diatomic molecules, molecular photoelectron spectroscopy, and application. (06 L)
- 5) ESR and Mossbauer spectroscopy applications. (02 L)
- 6) Principles of NMR – Chemical applications of PMR in structure elucidation. (02 L)

#### Reference:

Fundamentals of molecular spectroscopy: C.N. Banewell and E.Mc. Cash ( Fourth edition).

#### SECTION-II

(2 Credits, 24 L, 6 T)

#### Nuclear and Radiation Chemistry

- 1) Radio Chemistry : recapitulation – type of radioactive decay, Decay Kinetics, Detection & measurement of radiation ( G.M. & Scintillation counter) (03 L)

- 2) Elements of radiation chemistry – Radiation chemistry, interaction of radiation with matter, passage of nucleolus through matter, interaction of radiation with matter, Units for measuring radiation absorption, Radiation dosimetry, Radiolysis of water, free radiation in water Radiolysis, Radiolysis of some aqueous solution. (06 L)
- 3) Nuclear Reactor: - The fission energy, The Natural uranium reactor, the four factor formula- The reproduction factor K, the classification of reactor. Reactor power, Critical size of thermal reactor, excess reactivity & control, the Breeder reactor, The Indians nuclear energy programme, Reprocessing of spent fuel, Recovery of Uranium & Plutonium, Nuclear waste management, Natural nuclear reactor. (06 L)
- 4) Isotopes for nuclear reactors. Isotope separation, separation of selected isotopes, Plutonium. (03 L)
- 5) Applications of radioactivity: Typical reaction involved in preparation of radio isotopes:  $^3\text{H}$ ,  $^{14}\text{C}$ ,  $^{22}\text{Na}$   $^{32}\text{P}$   $^{35}\text{S}$ , and  $\text{I}^{127}$  General principles of using radioisotopes. Physical constants – Diffusion coefficients, surface area, solubility. Analytical applications- neutron activation analysis, dilution analysis, radiometric titration. Industrial applications – radiation gauging, friction and wear out, gamma radiography. (06 L)

### Reference Books

1. Elements of Nuclear chemistry – H.J. Arnikar, fourth edition wiley Estern Ltd.
2. Source book of atomic energy – S. Glasstanc, D. Van Norton Company
3. Chemical applications of radioisotopes – H.J. M. Brown Buffer & Jammer Ltd.

# Inorganic Chemistry

## Semester – II

### CHI-230: Coordination and Bioinorganic Chemistry (4 Credits)

#### SECTION-I: Coordination Chemistry (2 Credits, 24 lectures, 6 T)

1. Concept & Scope of Ligand Fields, Free ion Configuration, Terms and States, Energy levels of transition metal ions, free ion terms, term wave functions, spin-orbits coupling. (4 L)
2. Ligand Field Theory of Coordination Complexes (7 L)  
Effect of ligand field on energy levels of transition metal ions, weak cubic ligand field effect on Russell- Saunders terms, strong field effect, correlation diagrams, Tanabe- Sugano Diagrams, Spin-Pairing energies.
3. Electronic spectra of Transition Metal Complexes (7 L)  
Introduction, Band intensities, band energies, band width & shapes, spectra of 1<sup>st</sup>, 2<sup>nd</sup> & 3<sup>rd</sup> row ions and rare earth ion complexes, spectrochemical & nephelauxetic series, charge transfer & luminescence, spectra, calculations of  $Dq$ ,  $B$ ,  $\beta$  parameters.
4. Magnetic Properties of Coordination Complexes (6 L)  
Origin magnetism, types of magnetism, Curie law, Curie-Weiss Law, Magnetic properties of complexes-paramagnetism 1<sup>st</sup> & 2<sup>nd</sup> Ordered Zeeman effect, quenching of orbital angular momentum by Ligand fields, Magnetic properties of A, E & T ground terms in complexes, spin free spin paired equilibria.

#### References:

1. Ligand field theory & its applications: B.N. Figgis & M.A. Hitchman (2000) Wiley VCH Publ.
2. Symmetry and spectroscopy of molecules, Second Ed<sup>n</sup>, by K. Veera Reddy, New Age International Publication, 2009.
3. Elements of magnetochemistry, R. L. Datta and Syamal, Second Ed<sup>n</sup>, Afiliated East West Press Pvt. Ltd. 2007.

## **Section-II: Bioinorganic Chemistry**

**(2 Credits, 24 Lectures, 6 T)**

1. Overviews of Bioinorganic Chemistry (1 L)
2. Principles of Coordination Chemistry related to Bioinorganic Research and Protein, Nucleic acids and other metal binding biomolecules. (7 L)
3. Biochemistry of Na, K and Ca w.r.t. Na/K pumps, Calmodulin and blood coagulation. (8 L)
4. Biochemistry of following elements:
  - (a) Iron: Ferritin, Transferrin, Fe-S clusters, Porphyrin based systems (6 L)
  - (b) Manganese: Photosynthesis (2 L)

### Reference Books:

1. Principle of Bioinorganic Chemistry: S.J. Lippard and J.M. Berg
2. Bioinorganic Chemistry: Inorganic Elements in Chemistry of Life: W.Kaim and B. Schwederski
3. Bioinorganic Chemistry: Bertini, Gray, Lippard and Valentine
4. Bioinorganic Chemistry: R.J.P. Williams
5. Bioinorganic Chemistry: Robert Hay
6. Bioinorganic Chemistry: M.N. Hughes



# Organic Chemistry

## Semester – II

**CHO-250: Synthetic organic chemistry and spectroscopy (4 Credits)**

**SECTION – I: Synthetic Organic Chemistry (2 Credits, 24 L, 6 T)**

1. **Oxidation reactions:** (6 L)

CrO<sub>3</sub>, PDC, PCC, KMnO<sub>4</sub>, MnO<sub>2</sub>, Swern, SeO<sub>2</sub>, Pb(OAc)<sub>4</sub>, Pd-C, OsO<sub>4</sub>, m-CPBA, O<sub>3</sub>, NaIO<sub>4</sub>, HIO<sub>4</sub>

2. **Reduction reactions:** (4 L)

Boranes and hydroboration reactions, MPV reduction and reduction with H<sub>2</sub>/Pd-C, Willkinsons catalyst, DIBAL and Wolff Kishner reduction.

3. **Rearrangements:** (6 L)

Beckmann, Hofmann,, Curtius, Smith, Wolff, Lossen, Bayer-villiger, Sommelet, Favorskii, Pinacol-pinacolone, Benzil-benzilic acid, Fries.

4. **Ylides:** (4 L)

Phosphorus, Nitrogen and Sulphur ylides

5. **Addition to carbonyl group:** (4 L)

Grignard, organo zinc, organo copper, organo lithium, reagents to carbonyl and unsaturated carbonyl compounds.

**SECTION-II: Spectroscopy (2 Credits 24 Lectures, 6T)**

a) UV: Factors affecting UV absorption and interpretation of UV spectra (2 L)

b) IR: Basic ideas about IR frequencies, interpretation of IR spectra (4 L)

c) PMR: Fundamentals of PMR, factors affecting chemical shift, integration coupling (1<sup>st</sup> order analysis) (8 L)

d) Introduction to CMR and mass spectrometry (4 L)

e) Problems on UV, IR and PMR (6 L)

**References:**

1. Organic Chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford)
2. Modern Synthetic reactions- H.O. House
3. Organic Synthesis – M.B. Smith
4. Advanced Organic Chemistry (part A & B)– A. Carey and R.J. Sundberg
5. Stereochemistry conformations and mechanism by P.S. Kalsi
6. Organic chemistry –by Cram, Hammond, Pine and Handrickson
7. Introduction to spectroscopy – D.I. Pavia, G.M. Lampman, G.S. Kriz, 3<sup>rd</sup> Edition
8. Spectroscopic methods in organic molecules – D.H. Williams & I Fleming Mc Graw Hill
9. Mechanism and Structure in Organic Chemistry - E.S. Gould

# General Chemistry

## Semester – II

### CHA-290: General Chemistry – II

(Any two parts except B) (4 Credits)

**PART-A: Modern Separation Methods and Hyphenated Techniques (2 Credits, 24 L, 6 T)**

#### **1. Mass Spectrometry (8 L)**

Principle, Instrumentation, Ionization methods- Electron bombardment ionization, Arc and spark ionization, Photo-ionization, Thermal ionization, Chemical ionization, Mass analyzers- Magnetic, Double focusing, Time of flight, Quadrupolar, Ion cyclotron resonance analyzer, Correlation of mass spectra with molecular structure and molecular weight, Isotopic Abundances, Fragmentation patterns, Quantitative analysis, Applications and Problems. Fourier transform mass spectrometry, Tandem mass spectrometry, inductively coupled Plasma-mass spectrometry,

**Ref. 1, Pages 647-696; Ref. 2, Pages 465-506**

#### **2. Gas Chromatography (8 L)**

Theory and Instrumentation of GC, Sample injection- Split and splitless injection, Column types, Solid/Liquid Stationary phases, Column switching techniques, Basic and specialized detectors, elemental detection, chiral separations, , Gas chromatographs and chemical analysis, Interfacing of gas chromatography with mass spectrometry, Applications of GLC, Use of GC-MS ,High Speed gas chromatography, Gas- solid chromatography and problems,

**Ref. 2, Pages 540-569; Ref. 3, Pages 125-143; Ref. 4, Pages 947-970.**

#### **3. High Performance Liquid Chromatography (HPLC) (8 L)**

Theory and instrumentation of HPLC, Optimization of column performance, Gradient elution and related procedures, Derivatization, Mobile phase delivery system, sample injection, separation column, detectors, Interfacing HPLC with mass spectrometry, Structure types of

column packing, adsorption chromatography, Bonded phase chromatography, reverse phase chromatography, ion-pair chromatography, ion exchange chromatography, size exclusion chromatography, GC-MS and LC-MS, Applications and Problems.

**Ref. 2: Pages 580-650, Ref. 4: Pages 974-992.**

### **References:**

1. Introduction to Instrumental Analysis, R. D. Braun, Mc Graw-Hill. Inc.1987.
2. Instrumental Methods of Chemical analysis, H. H. Willard, L. L. Merritt Jr., J. A. Dean & F. A. Settle Jr., 6th Edition, Wadsworth Publishing Company, USA,1986
3. Handbook of Instrumental Techniques for Analytical Chemistry, F. A. Settle editor, Prentice Hall Inc. A Simon and Schuster Company, New Jersey, 1997.
4. Fundamentals of Analytical Chemistry, D. A. Skoog, D. M. West, F. J. Holler, S. R. Crouch, 7th Edition, Thomson Asia Pte. Ltd, Singapore,2004

### **PART-B: (Compulsory for Drug Chemistry Students and Students from other disciplines also can opt for it)**

#### **Basic Biochemistry**

**(4 Credits, 48 L, 12 T)**

1. Introduction to Biochemistry: Scope of the subject in pharmaceutical sciences, Biochemical reactions, Highlights of prokaryotic and Eukaryotic cell metabolism.
2. Biochemical Morphology: Prokaryotes and Eukaryotes, Cell structure, sub-cellular components: Nucleus, plasma membranes, endoplasmic reticulum, Lysosome, Peroxisomes, Golgi apparatus, and Mitochondria.
3. Biomembrane: Structure, functions and composition, Model proposed , Function and properties of membrane, Transport hypothesis, Active and passive facilitated transport, Na<sup>+</sup>, K<sup>+</sup>, H<sup>+</sup>, pumps, glucose transport, Excitable membrane, drug transport.
4. Biomolecules:  
Proteins: Introduction, functional, classification of amino acids, classification, physicochemical properties, Optical activity, Reaction with ninhydrin, Formaldehyde,Aminoacids, Essential and non essential amino acids, efficacy, structure, peptide bond, end group analysis, Helix, B-sheet structure, tertiary, quaternary structure, globular protein, fibrous protein, amino acid therapy, Protein engineering

Carbohydrates: complex carbohydrate, structure of Chitin, Starch, Glycogen + Metabolism

Lipids: definition, classification, functions, types of fatty acids, and its biological role and metabolism.

5. Enzymes: Introduction, classification according to the reaction catalysis and source) structure of enzyme, co factors, active sites, Binding sites,  $K_m$ ,  $V_{max}$ , Enzyme kinetics, Double reciprocal plot, effect of substrate, pH ionic strength, Concentration, Temperature on the rate of enzyme reactions, Enzyme inhibition(competitive, uncompetitive, non competitive and irreversible), Enzyme biotechnology. Manufacturing of medicinal compounds by enzymatic reactions, Penicillin acylase for the production 6-APA, Therapeutical uses of enzymes.

### **References:**

1. Principals of biochemistry, Albert Lehninger (CBS Publisher and Distributers Pvt. Delhi.
2. Biochemistry Lubert Stryer, W. H. (Freeman and company New York)
3. Harper's Biochemistry by R.K. Murray, D. I. Granner, P. A. Mayes, (Prentice Hall International Inc.)
4. Practical Clinical Biochemistry, Harold Varley, (CBS Publisher and Distributers Pvt. Delhi.
5. Molecular Biology, J.D. Watson (The Benjamin/ Cumming Company, Inc.)

## **PART- C: Concept of Analytical Chemistry**

**(2 Credits, 24 L, 6 T)**

### **1. Data Handing and Spreadsheets in Analytical Chemistry**

**(6 L)**

Accuracy and Precision, classification of errors, Significant figures, rounding off, ways of expressing accuracy, Mean Deviation, Average Deviation, RMD, Standard Deviation Propagation of errors, Confidence limits, Tests of Significance, Rejection of results and Problems.

**Ref. 2: Pages 65-99.**

### **2. Sampling, Standardization and Calibration**

**(8 L)**

Analytical Samples and Methods of Sampling, Sample Handling, Gross sample, Preparation of Laboratory samples, Automated Sample Handling, Comparisons with standard and Numerical Problems.

**Ref. 1: Pages 175-200.**

**3. Introduction to analytical separations (8 L)**

Separation by precipitation, separation of species by distillation, separation by extraction, separation by ion exchange chromatography and problems.

**Ref. 1: Pages 906-946**

References:

1. Fundamentals of Analytical Chemistry, D. A. Skoog, D. M. West, F. J. Holler, S. R. Crouch, 5th Edition, Thomson Asia Pte. Ltd, Singapore, 2004.
2. Analytical Chemistry, G.D. Christian, 6 th Edition.

**PART- D: Industrial Methods of Analysis (2 Credits, 24 L, 6 T)**

**1. Chemometrics: (10 L)**

Concentration of solution based on volume and mass unit, calculations of ppm , ppb and dilution of the solutions , Concept of mmole, Stoichiometry of chemical reactions, Concept of gmole, Limiting reactants, theoretical and practical yield, solubility and solubility equilibria. Concept of formation constant, Stability and instability constants, stepwise formation constants and Numerical problems.

**2. Quality in Analytical Chemistry (6 L)**

Quality systems in chemical laboratories, cost and benefits of quality system, types of quality standards for laboratories, total quality management, quality audits, and quality reviews , responsibility of laboratory staff for quality and problems.

**3. Process Instruments and Automated Analysis (8 L)**

Introduction, industrial process analyzer, methods based on bulk properties, continuous online process control, automatic chemical analyzers, automatic elemental analyzers, Numerical problems.

**Ref 3: Pages: 786-828.**

**References:**

1. Vogel's Text book of Quantitative Analysis.
2. Analytical Chemistry, G.D. Christian, 6 th Edition.
3. Instrumental Methods of Chemical analysis, H. H. Willard, L. L. Merritt Jr., J. A. Dean & F. A. Settle Jr., 6th Edition, Wadsworth Publishing Company, USA,1986

**PART- E: Organometallic and Inorganic Reaction Mechanism (2 Credits, 24 L, 6 T)**

**(Recommended for M. Sc. other than Inorganic specialization)**

**1) Organometallic Chemistry (8 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 (8 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 (8L)**

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 Book:**

Inorganic Chemistry: Gary Miessler and Donald A. Tarr, Third Ed., Pearson (Chapter-12, 13 and 14 pages: 422 to 561)

**Part F: Mathematics for Chemists****(2 Credit; 24 L, 6 T)****(Recommended for M. Sc. other than Physical Chemistry specialization)**

1. Functions: Differential and integral calculus, limits, derivatives, physical significance, basic rules of differentiation, maxima and minima, application in chemistry, exact and inexact differentiation, Taylor & McLaurin Theorem, curve sketching, partial differentiation, rules of integration, separation of variable, substitution, partial fraction method to solve to indefinite integrals in chemistry. **(14 L)**
2. Differential Equations: Separation of variables, homogeneous, exact, linear equations of second order, series solution method. **(6 L)**
3. Vectors Matrices, and Determinants: **(4 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)

**Part G: Pericyclic reactions, Photochemistry and Free radicals****(2 Credit; 24 L, 6 T)****(Recommended for M. Sc. other than Organic Chemistry specialization)**

1. **Pericyclic reactions** **(10 L)**  
Electrocyclisation, cycloaddition, sigmatropic and Alder-ene reactions. Analysis of pericyclic reactions by construction of correlation diagrams and by FMO approach.
2. **Free radicals** **(6 L)**  
Generation, stability and general reactions like displacement, addition and rearrangements.



### 3. Photochemistry

(8 L)

Basic concepts in Photochemistry, Jablonski diagram, quenching, triplet excitation, photosensitization, quantum yield, photochemistry of carbonyl compounds (photoreduction, photoenolization, Norrish type I and II) and benzene derivatives.

#### References:

1. Conservation of orbital symmetry – Woodward and Hoffmann
2. Organic Chemistry – Morrison and Boyd
3. Organic Chemistry – Warren, Clayden, Greeves and Wothers
4. Advanced Organic Chemistry – Carey, Sandburg Vol. A.
5. Organic reactions and Orbital Symmetry - T. L. Gilchrist and R. C. Storr
6. Excited states in Organic Chemistry – J. D. Coyle and J. A. Barltrop
7. Orbital Symmetry – A problem solving approach. R. F. Lehr and A. P. Marchand
8. Principles of Organic Synthesis – Norman, Coxon

# M.Sc.-I: Practical

## CHP-107: Physical Chemistry Practicals

(6 Credits)

### A) Conductometry: (Any four)

1. Study the Hydrolysis of  $\text{NH}_4\text{Cl}$  or  $\text{CH}_3\text{COONa}$  or aniline hydrochloride.
2. Determination of equivalent conductance at infinite dilution and dissociation constant of acetic acid.
3. Study the second order velocity constant of the hydrolysis of ethyl acetate by sodium hydroxide.
4. Determination of  $\Delta G$ ,  $\Delta H$ , and  $\Delta S$  of silver benzoate by conductometry.
5. Determination of critical micellar concentration (CMC) and  $\Delta G$  of micellization of sodium dodecyl sulphate (SDS).
6. Determination of concentrations of strong acid and weak acid present in the mixture by titration with strong base.

### B) Potentiometry: (Any four)

1. Determination of stability Constant of a complex ion.
2. Determination of Solubility and solubility product of a sparingly soluble salt.
3. Estimation of amount of halides present in the mixture.
4. Determination of concentrations of strong acid and weak acid present in the mixture by titrating with strong base.
5. Determination of concentrations of reductant or oxidant by redox titration.

### C) pH metry: (Any two)

1. Determination of the acid and base dissociation constant of an amino acid and hence the isoelectric point of the acid.
2. Determination of dissociation constants of tribasic acid (phosphoric acid)
3. Determination of Hammett constant of o-, m-, p- amino/nitro benzoic acid.

### D) Polarography:

1. Determination of half wave potential ( $E_{1/2}$ ) and unknown concentration of an ion.
2. Amperometric titration of  $\text{Pb}(\text{NO}_3)_2$  with  $\text{K}_2\text{Cr}_2\text{O}_7$ .

### E) Colorimetry/Spectrophotometry: (Any two)

1. Simultaneous determination of cations from the mixture.

2. Determination of amount of copper by photometric titration with EDTA.
3. Study the kinetics of iodination of acetone spectrophotometrically.

**F) Radioactivity: (Any two)**

1. Estimation of Manganese in tea leaves by Neutron Activation Analysis.
2. Determination of half-life of a radioactive nuclide and counting errors.
3. Determination of  $E_{\max}$  of  $\beta$  radiation and absorption coefficients in Al.

**G) Chemical Kinetics: (Any three)**

1. Study of Kinetic decomposition of diacetone alcohol by dilatometry.
2. Determination of individual orders of iodide and persulphate ions and overall order of oxidation reaction of iodide ion by persulphate ion.
3. Investigation of influence of ionic strength on rate constant (Brönsted primary salt effect).
4. Determination of temperature coefficient and energy of activation of acid catalyzed ester hydrolysis reaction.

**H) Non-Instrumental: (Any five)**

- 1) Determination of surface excess of amyl alcohol or TX-100 surfactant by Capillary rise method.
- 2) Statistical treatment of experimental data.
- 3) Determination of molecular weight by steam distillation.
- 4) Determination of glycerol radius by viscosity.
- 5) Determination of partial Molar Volume (Polynometry) and the densities of a series of solutions and to calculate the molar volumes of the components.
- 6) Analysis of crystal structure from single crystal X-ray pattern.

**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, 7<sup>th</sup> Edition, 2003.
5. Physical chemistry by Wien (2001)
6. Practical physical chemistry, B. Vishwanathan and P.S. Raghavan, 2<sup>nd</sup> edition, (2012)

7. Experimental Physical chemistry, V.D. Athawale, Parul Mathur, New age International publishers.

## **CHI-107: Inorganic Chemistry Practical**

**(6 Credits)**

### **Part-I: Ore analysis (Any Two) (Ref. -1)**

- a. Analysis of Pyrolusite ore.  
Determination of (i) Silica and (ii) Manganese
- b. Analysis of Chalcopyrite ore.  
Determination of (i) Copper and (ii) Iron
- c. Analysis of hematite ore.  
Determination of (i) Silica and (ii) Iron

### **Part-II: Alloy Analysis (Any Two) (Ref. -1)**

- a. Determination of tin and lead from solder.
- b. Determination of iron and chromium from mild steel.
- c. Determination of copper and nickel from cupronickel.

### **Part-III: Inorganic Synthesis and Purity (Any five)**

**(Ref. – 2)**

#### **Part A: Five preparations**

#### **Part B; Purity determination of above preparations**

- a.  $\text{Mn}(\text{acac})_3$
- b. Chloro penta-ammine cobalt (III) chloride
- c. Nitro penta-amminecobalt (III) chloride
- d. Nitrito penta-amine cobalt (III) Chloride.
- e. Potassium tri-oxalato aluminate
- f. Tris(ethylene di ammine) Ni(II) thiosulphate.
- e. Bis[TrisCu(I)thiourea]

### **Part-IV: Ion – exchange chromatography (Any one experiment)**

**(Ref. -1 and 3)**

- a) Separation of mixture of Zn(II) and Cd(II) using Amberlite IRA 400 anion exchanger and quantitative estimation of separated ions Zn(II) and Cd(II)
- b) 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-V: Spectrophotometry (all two experiments)**

- a. Estimation of phosphate from waste water by calibration curve method (Ref. -4)
- b. Determination of equilibrium constant of M – L systems Fe (III) – Salicylic acid or Fe(III)–Sulphosalicylic acid or Fe(III)–β–resorcilic acid by Job’s continuous variation method. (Ref.-3)
- c. 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)

or

- c) Determination of Cu(II) by solvent extraction as Dithiocarbamate/8-Hydroxyquinoline complex (Ref-1,3)

**Part-VI: Inorganic characterization techniques** (any one of the following)

- a. 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 analyse it. Arrange three ligands according to their increasing strength depending on your observations. (Ref. -5)
- b. Determination of magnetic susceptibility ( $\chi_g$  and  $\chi_m$ ) of mercury tetracyanato cobalt or  $\text{Fe}(\text{acac})_3$  or Ferrous ammonium sulfate by Faraday or Gouy method. (Ref. -3)

**Part-VII: Synthesis of Nanomaterials** (any one of the following)

- a) Synthesis of nano size ZnO, its characterization by UV-Visible spectroscopy and removal of dye by ZnO-photocatalysis (Ref-2)
- b) Synthesis of nano size  $\alpha\text{-Fe}_2\text{O}_3$  and study of adsorption of phosphate on it (Ref-2)

**Part-VIII: Conductometry** (any one of the following).

- a) Verification of Debye Huckle theory of ionic conductance for strong electrolytes  $\text{KCl}$ ,  $\text{BaCl}_2$ ,  $\text{K}_2\text{SO}_4$ ,  $\text{K}_3[\text{Fe}(\text{CN})_6]$  (Ref. -3)
- b) Structural determination of metal complexes by conductometric measurement. (Ref-3)
- c) To study complex formation between Fe(III) with sulfosalicylic acid by conductometry (Ref-3).

**Part-IX:** (any one of the following)

- a) 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)
- b) Kinetics of substitution reaction of  $[\text{Fe}(\text{Phen})_3]^{2+}$  (Ref-3)

**Part-X: Table work**

a) Data analysis, error analysis, least squares method.

**(Ref-3)**

**Reference Books:**

- 1) Text book of Quantitative Analysis, A.I. Vogel 4<sup>th</sup> 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) Ligand Field Theory, B. N. Figgis.

## **CHO-247: Organic Chemistry Practical**

**(6 Credits)**

**Use of chemistry software like MOPAC, ISIS draw, Chem office (Minimum 3 experiments)**

### **Purification techniques**

**(any 5)**

Purification of solvents and reagents using techniques like crystallization, distillation, steam distillation, vacuum distillation, drying and storage of solvents, sublimation etc.

- a) Chromatography: TLC, Column.
- b) Solvent extraction using soxhlet extractor

### **1. Three component mixture separation and analysis using ether.**

(8 mixtures minimum including amino acid)

### **2. Single stage preparations (minimum 8 preparations)**

- a) 2-Methoxy naphthalene to 1-formyl-2- methoxy naphthalene
- b) Toluene to 4-methyl acetophenone
- c) Anthranilic acid to 2-iodo /2-choro benzoic acid
- d) Cyclohexanol to cyclohexanone
- e) Benzophenone to diphenyl methane
- f) Benzyl cyanide to phenyl acetic acid
- g) Benzaldehyde to chalcone
- h) Gycine to Benzoylglycine
- i) Nitrobenzene to m-di-nitrobenzene
- j) m-di-nitrobenzene to m-nitroaniline
- k) Benzoic acid to ethylbenzoate
- l) Diel's Alder reaction of anthracene and maleic anhydride
- m) Chlorobenzene to 2,4-dintro chlorobenzene

Reference books

- n) 1. Textbook of practical organic chemistry – A.I. Vogel



# M.Sc. Drug Chemistry

## Practical

### CHD-128: INORGANIC AND ANALYTICAL CHEMISTRY PRACTICALS

(6 Credits)

1. Inorganic synthesis and characterization by physical or chemical methods:
  - a) Cis-trans potassium diaquo dioxalate chromate (III)
  - b) Chloropentammino cobalt (III) chloride.
2. Colorimetry;  
Keg of M-L systems such as:
  - i) Fe (III) Salicylic acid
  - ii) Fe (III) Sulphosalicylic acid
  - iii) Fe (III) resorcilic acid by Job's method and Mole ratio method
3. Photometric titration of systems such as:
  - a)  $\text{Cu}^{2+}$  - EDTA
  - b)  $\text{Fe}^{2+}$  - Sulphosalicylic acid
  - c)  $\text{Co}^{2+}$  - R-nitroso salt.
4. Potentiometry:
  - a) Complexometric determination using disodium EDTA of
    - i)  $\text{Co}^{2+}$
    - jj)  $\text{Al}^{3+}$
    - iii)  $\text{Cu}^{2+}$
5. Solvent extraction of Al / Mo usmg 8-hydroxy quinoline complex and determination by spectrophotometry
6. Solvent extraction of ferric thiocyanate complex and determination by colorimetry.
7. Separation and estimation of Fe and Al on a cation exchanger.
8. Separation and estimation of copper and cobalt on cellulose column.
9. Analysis of Vitamin C in juices and squashes.
10. Analysis of Vitamin A in food products.
11. Simultaneous determination by titanium and vanadium Pt and Pd using hydrogen peroxide by spectrophotometry.

12. Estimation of Na, K and Ca in binary mixture by flame photometry using Li as Internal standard and using standard addition method.
13. Determination of the strength of the following by fluorimetry, beryllium, aluminium, vitamin B1, vitamin B2.
14. Determination of the strength of commercial phosphoric acid/vinegar by conductometric titration.
15. Analysis of malathion by colorimetry or polarography.
16. Estimation of nitrile, fluoride, dissolved chlorine, chloride, iron, chromium, manganese colorimetrically.
17. Estimation of Hg, Pb, Cd spectrophotometrically/complexometrically.
18. Estimation of sulphadiazine.
19. Estimation of mixtures of benzoic acid and salicylic acid in pharmaceutical preparations
20. Determination of iron, calcium and phosphorous in milk powder.
21. Partition coefficient.

References:

- 1) A textbook of Qualitative Inorganic Analysis 3<sup>rd</sup> Edn., A. I Vogel, ELBS.
- 2) A Textbook of Practical Organic Chemistry, 4<sup>th</sup> Edn., A. I. Vogel, ELBS.
- 3) Standard Methods of Chemical Analysis, 6<sup>th</sup> Edn.; A series of volumes edited by F. J. Weicher, Robert E. Krieger Publishing co.
- 4) Pharmacopoeia of India.

**CHD-108: Practical Course in Separation, Purification & Analytical techniques in Drug**

**Chemistry**

**(5 Credits)**

1. Purification of solvents and reagents
2. Mixture separation Two and Three components.
3. Isolation of Natural products from Clove, Cinnamon by steam distillation. Also use Soxhlet apparatus for one natural product.
4. Chromatographic techniques as TLC, Column chromatography
5. Biomolecule separation and identification using Gel Electrophoresis, Paper chromatography Immunoelectrophoresis.

6. Separation and Identification of active drug ingredients from commercial pharmaceutical preparations.
7. Try to use spectral data whenever possible.
8. Any current techniques as per need and demand.

### **CHD-248: ORGANIC CHEMISTRY PRACTICALS**

**(5 Credits)**

1. Techniques: Crystallization, fractional crystallisation, fractional distillation, vacuum distillation, sublimation, steam distillation.
2. Single stage preparation involving different type of reactions (minimum 8 preparations).
3. Two-stage preparations (minimum 2 preparation).
4. Three-stage preparations (minimum 2 preparations).
5. Derivatives of functional groups such as acetyl, benzoyl, 2, 4-DNP, oxime, anilide, amide and aryloxy acetic acid (minimum one of each type)

Typical preparations from which the single and two stage preparations can be chosen are:

1. Toluene — p-nitrotoluene — p-nitrobenzoic acid — p-amino benzoic acid
2. Benzene — Acetophenone — Acetophenone oxime — Acetanilide
3. Benzaldehyde — Benzoin — Benzil — Benzillic acid
4. Nitrobenzene — m-dinitrobenzene — m-nitroaniline — m-nitrophenol
5. Phthalic acid — phthalic anhydride — phthalimide — Anthranilic acid
6. Anthranilic acid — phenylglycine — orthocarboxylic acid — indigo
7. Acetophenone — Benzalacetophenone — epoxide
8. Cyclohexanone —Cyclohexanone oxime—caprolactam
9. Phthalic anhydride—o-benzoylbenzoic acid—anthraquinone.
10. O-Chlorobenzoic acid —N-phenylanthranilic acid —acridone.
11. Chlorobenzene—2,4-dinitrochlorobenzene —2,4-dinitrophenol
12. Bromobenzene—triphenylcarbinol-tritylchloride
13. Resorcinol—resacetophenone — 4-ethyl resorcinol
14. Phenol—allylphenyl ether—o-allylphenol
15. Phenol —salicylaldehyde—coumarin

## Revised Syllabus to be implemented during 2015-16

### M.Sc. II: Organic Chemistry

#### Semester III

<b>CHO-350</b>	<b>Organic Reaction Mechanism</b>	<b>48 Lectures, 4 Credits</b>
<b>CHO-351</b>	<b>Spectroscopic Methods in Structure Determination</b>	<b>48 Lectures, 4 Credits</b>
<b>CHO-352</b>	<b>Organic Stereochemistry</b>	<b>48 Lectures, 4 Credits</b>
<b>CHO-353</b>	<b>Pericyclic Reactions, Photochemistry and Heterocyclic Chemistry</b>	<b>48 Lectures, 4 Credits</b>

#### Semester IV

<b>CHO-450</b>	<b>Natural Products</b>	<b>48 Lectures, 4 Credits</b>
<b>CHO-451</b>	<b>Advanced Synthetic Organic Chemistry</b>	<b>48 Lectures, 4 Credits</b>
<b>CHO-452</b>	<b>Carbohydrate and Chiron approach/ Chiral Drugs and Medicinal Chemistry</b>	<b>48 Lectures, 4 Credits</b>
<b>CHO-453</b>	<b>Designing Organic Synthesis and Asymmetric Synthesis</b>	<b>48 Lectures, 4 Credits</b>

#### M.Sc. II: Organic Chemistry Practical

<b>CHO-347</b>	<b>Single Stage Preparations</b>	<b>6 Credits</b>
<b>CHO-447</b>	<b>Two Stage Preparations</b>	<b>6 Credits</b>
<b>CHO-448</b>	<b>Project/Industrial training/ Green Chemistry and Chemical Biology Experiments</b>	<b>6 Credits</b>

Each practical course should be of 6 h/week/batch. Practical batch for each course should comprise of 8 students only.

### Equivalence of previous Syllabus

	<b>New Syllabus 2014 Pattern</b>		<b>Old Syllabus 2008 Pattern</b>
<b>CHO-350</b>	<b>Organic Reaction Mechanism</b>	<b>CH-350</b>	<b>Organic Reaction Mechanism</b>
<b>CHO-351</b>	<b>Spectroscopic Methods in Structure Determination</b>	<b>CH-351</b>	<b>Spectroscopic Methods in Structure Determination</b>
<b>CHO-352</b>	<b>Organic Stereochemistry</b>	<b>CH-352</b>	<b>Organic Stereochemistry</b>
<b>CHO-353</b>	<b>Pericyclic Reactions, Photochemistry and Heterocyclic Chemistry</b>	<b>CH-353</b>	<b>Free Radicals, Photochemistry, Pericyclic Reactions and their Applications</b>
<b>CHO-450</b>	<b>Chemistry of Natural Products</b>	<b>CH-450</b>	<b>Chemistry of Natural Products</b>
<b>CHO-451</b>	<b>Advanced Synthetic Organic Chemistry</b>	<b>CH-451</b>	<b>Synthetic Methods in Organic Chemistry</b>
<b>CHO-452</b>	<b>Carbohydrate and Chiron Approach/ Chiral Drugs and Medicinal Chemistry</b>	<b>CH-452</b>	<b>Heterocyclic Chemistry, Chiron Approach and Medicinal Chemistry</b>
<b>CHO-453</b>	<b>Designing Organic Synthesis and Asymmetric Synthesis</b>		
<b>CHO-347</b>	<b>Single Stage Preparations</b>	<b>CH-347</b>	<b>Ternary Mixture Separation</b>
<b>CHO-447</b>	<b>Double Stage Preparation</b>	<b>CH-447</b>	<b>Single Stage and Two Stage Preparation</b>
<b>CHO-448</b>	<b>Project/Industrial Training/ Green Chemistry and Chemical Biology Experiments</b>	<b>CH-448</b>	<b>Project and Practicals</b>

## M.Sc. Organic Chemistry PART-II

### REVISED SYLLABUS-2014

#### **CHO-350: Organic Reaction Mechanism [4 credits, 48 Lectures]**

1. Carbanions-Formation, stability and related name reactions [14L]  
Ref. 1, 2, 3 Vol.A and 7
2. Enamines –formation and applications, Ref. 3 [4L]
3. NGP :Neighbouring group participation , Ref. 1 [6L]
4. Reactions of carbenes and nitrenes Ref.3 Vol B [4L]
5. Free radicals: [14L]  
Generation of radiacls, Stable free radicals, Nucleophilic and electrophilic radicals, Characteristics reactions, -Free radical substitution, addition to multiple bonds, Radicals in synthesis: Inter and intra molecular C-C bond formation via mercuric hydride, tin hydride, thiol dionors, cleavage of C-X, C-Sn, C-Co, C-S, O-O bonds. Oxidative coupling. C-C bond formation in aromatics, SNAr reactions  
Ref. 1, 3 Vol A, 6
6. Mechanisms in Biological Chemistry (Ref. 5) [6L]

#### **References:**

1. Mechanism and structure in Organic Chemistry – E. S. Gould (Holt, Rinehart and Winston)
2. Advanced organic chemistry by J. March, 6th Ed.
3. Advanced organic chemistry. F. A. Carey and R. J. Sundberg, 5th Ed. Springer (2007)
4. A guidebook to mechanism in organic chemistry – Peter Sykes 6th Ed. Orient Longman
5. Organic Chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers. Oxford University Press (2001)
6. Radicals in Organic Synthesis B. Giese, Pergamon press (1986)

#### **CHO-351: Spectroscopic Methods in Structure Determination**

[4 credits, 48 Lectures]

##### **<sup>1</sup>H NMR Spectroscopy**

(14 L)

Chemical shift, factors influencing chemical shift, deshielding, chemical shift values and correlation for protons bonded to carbons (aliphatic, olefinic, aldehydic, aromatic) and other nuclei (alcohols, phenols, enols, acids, amides and mercaptans), chemical exchange, effect of deuteration, spin-spin coupling, (n+1) rule, complex spin-spin interaction between two, three, four and five nuclei (first order spectra), factors effecting coupling constant “J”, classification of spin system like AB, AX, AX<sub>2</sub>, ABX, AMX, ABC, A<sub>2</sub>B<sub>2</sub>. Spin decoupling,

Factors affecting coupling constant, simplification of complex spectra, nuclear magnetic double resonance, spin decoupling, contact shift reagents, solvent effects, nuclear overhauser effect (NOE), resonance of other nuclei like  $^{31}\text{P}$ ,  $^{19}\text{F}$

**$^{13}\text{C}$  NMR spectroscopy (8 L)**

FT NMR, Types of  $^{13}\text{C}$  NMR Spectra: un-decoupled, Proton decoupled, Off resonance, APT, INEPT, DEPT, chemical shift, calculations of chemical shifts of aliphatic, olefinic, alkyne, aromatic, hetero aromatic and carbonyl carbons, factors affecting chemical shifts, Homo nuclear ( $^{13}\text{C}$ - $^{13}\text{C}$ ) and Hetero nuclear ( $^{13}\text{C}$ - $^1\text{H}$ ) coupling constants.

**2D NMR Techniques (6 L)**

General idea about two dimensional NMR spectroscopy, Correlation spectroscopy (COSY)- Homo COSY ( $^1\text{H}$ - $^1\text{H}$ ), TOCSY, Hetero COSY (HMQC, HMBC), Homo and Hetero nuclear 2D resolved spectroscopy, NOESY and 2D-INADEQUATE experiments and their applications.

**Mass Spectrometry (10 L)**

Instrumentation, various methods of ionization (field ionization, field desorption, SIMS, FAB, MALDI, Californium plasma), different detectors (magnetic analyzer, ion cyclotron analyzer, Quadrupole mass filter, time of flight (TOF)). Rules of fragmentation of different functional groups, factors controlling fragmentation

**Problems based on joint application of UV, IR, PMR, CMR, and Mass. (10 L)**

(Including reaction sequences)

**References:**

1. Introduction to Spectroscopy – D. L. Pavia, G.M. Lampman, G. S. Kriz, 3rd Ed. (Harcourt college publishers).
2. Spectrometric identification of organic compounds R. M. Silverstein, F. X. Webster, 6th 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 C Morrill, John Wiley
11. Introduction to NMR spectroscopy-R J Abraham, 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 Delpenck, 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

### **CHO-352: Organic Stereochemistry**

**[4 credits, 48 Lectures]**

- |  |                 |       |
|--|-----------------|-------|
| 1. Stereochemistry of six membered rings.                        | Ref. 1, 4, 5, 6 | (12L) |
| 2. Stereochemistry of rings other than six membered              | Ref. 1, 4, 5, 6 | (8L)  |
| 3. Fused Bridged and caged rings                                 | Ref. 1, 2, 4, 5 | (6L)  |
| 4. Resolution of racemic modification                            | Ref. 1, 4       | (7L)  |
| 5. Geometrical Isomerism and Stereochemistry of olefins          | Ref.1, 2        | (11L) |
| 6. Determination of stereochemistry organic compounds using NMR. |                 | (4L)  |
| Ref. 3 Chapters 32 (1 <sup>st</sup> Edition)                     |                 |       |

#### **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-Kalsi
6. Organic stereochemistry – Jagdamba Singh



**CHO-353: Photochemistry, Pericyclic Reactions and Heterocyclic  
Chemistry [4 credits, 48 Lectures]**

- 1. Photochemistry** [12L]  
General basic principles, photochemistry of carbonyl compounds, alkenes, dienes, polyenes and aromatic compounds, photorearrangements, Barton reaction  
Ref. 1,2,3,4  
Application of photochemical reactions in synthesis– Isocomene  
Ref. 8, 9
- 2. Pericyclic reactions** [12L]  
Electrocyclic, cycloaddition, sigmatropic and ene reactions. 1,3-dipolar additions, Analysis by correlation diagrams, FMO approach and ATS concept. Application of pericyclic reactions.  
Ref. 1, 3, 5, 6, 7, 13
- 3. Heterocyclic Chemistry** (24 L)
  - Five and six membered heterocycles with one and two hetero atoms:  
Synthesis, reactivity, aromatic character and importance of following heterocyclic rings: Furan, Pyrrole, Thiophene, Pyrazole, Imidazole, Pyridine
  - Condensed five and six membered heterocycles:  
Benzofuran, Indole, Quinoline
  - Condensed five membered heterocycles:  
Benzoxazole, Benzthiazole, Benzimidazole
  - Five and six membered heterocycles with more than two hetero atoms:  
Synthesis, reactivity, aromatic character and importance of following heterocycles:  
1,2,3-triazole, 1,2,4-oxadiazole, 1,2,5-oxadiazole, tetrazole,  
Ref. 14-20

**References:**

- Advanced Organic Chemistry, Part A – F. A. Carey and R. J. Sundberg, 5<sup>th</sup> Ed. Springer (2007)
- Excited states in Organic Chemistry- J.A. Barltrop and J.D.Coyle, John Wiley & sons
- Photochemistry and Pericyclic reactions-Jagdamba Singh, Jaya Singh 3<sup>rd</sup> Ed.
- Organic photochemistry: A visual approach-Jan Kopecky, VCH publishers (1992).
- Conservation of orbital symmetry – R. B. Woodward and R. Hoffmann; Verlag Chemie, Academic press (1971).
- Orbital Symmetry : A problem solving approach- R. E. Lehr and A. P. Marchand; Academic (1972)
- Organic reactions and orbital symmetry, 2<sup>nd</sup> Ed. T. L. Gilchrist and R. C. Storr; Cambridge, University Press.
- Classics in total synthesis- K. C. Nicolaou and E. J. Sorensen; VHC (1996)
- P. A. Wender and J. J. Howbert **J. Am. Chem. Soc.** **103**, 688-690 (1981)
- Pericyclic reactions: A text book –S. Sankararaman
- Pericyclic reactions- Gill and Willis
- Frontier orbitals and organic chemical reactions-Ian Fleming, John Wiley & sons

13. Organic Chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers
14. Heterocyclic Chemistry -T. Gilchrist
15. An introduction to the chemistry of heterocyclic compounds-R M Acheso
16. Heterocyclic Chemistry- J A Joule and K Mills
17. Principles of modern heterocyclic chemistry- A Paquette
18. Heterocyclic Chemistry- J A Joule and Smith
19. Handbook of Heterocyclic Chemistry- A R Katritzky, A F Pozharskii
20. Heterocyclic Chemistry-II- R R Gupta, M Kumar, V Gupta, Springer (India) pvt

### **CHO–450 Chemistry of Natural Products [4 credits, 48 Lectures]**

1. Structure and stereochemistry of Hardwickiic acid, Camptothecin (8L)  
and podophyllotoxin  
Ref. 1 to 4 and 11
2. Synthesis of (16L)
  - i) Taxol Ref. 6
  - ii) Estrone and Mifepristone Ref. 6, 7
  - iii) Juvabione (K.Mori and Matsui, Pawson and Cheung Synthesis) Ref.12
  - iv) Fredericamycin A Ref. 5
3. Biogenesis – The building blocks and construction mechanism of (24L)
  1. Terpenoids – Mono, Sesqui, Di and Triterpenoids and cholesterol
  2. Alkaloids derived from ornithine, lysine, nicotinic acid, tyrosine and tryptophan.
  3. The shikimate pathway – cinnamic acids, lignans and lignin, coumarins, flavonoids and stilbens, isoflavanoids and terpenoid quinones.  
Ref. 8, 9, 10

#### **References:**

1. **J. Am Chem. Soc.** **88**, 3888 (1966).
2. M. C. Wani and M. E. Wall **J. Org. Chem.** **34**, 1364 (1969).
3. (i) **Tetrahedron Letters**, 3751 (1964),  
(ii) **Tetrahedron Letters**, 2861 and 2865 (1968).
4. Chemistry of Natural products- Kalsi
5. Principles of organic synthesis by R. O. C. Norman and J.M.Coxon; Chapman and Hall
6. Classics in organic synthesis – K. C. Nicolaou & E. J. Sorensen
7. **J.Indian Inst.Sci.** 81,287 (2001)
8. Medicinal Natural Products - A Biosynthetic approach by Paul M. Dewick 2<sup>nd</sup> Ed.(Wiley)
9. Secondary metabolism - J. Mann, 2nd edition.
10. Chemical aspects of Biosynthesis – J. Mann (1994).
11. i) **J.C.S. Perkin Transactions II**, 288-292, (1973). ii) **J.Am.Chem.Soc.** Vol.77.432-437, (1955).
12. Advanced Organic Chemistry- Carey and Sundberg Part B 5<sup>th</sup> Ed.

## **CHO-451: Advanced Synthetic Organic Chemistry [4 credits, 48 Lectures]**

1. Transition metal complexes in organic synthesis ; only Pd, Ni, Co, Fe (Metal mediated C-C and C-X bond formation reactions: Suzuki, Heck, Sonogashira, Stille, Fukuyama, Kumada, Hiyama, Negishi, Buchwald-Hartwig, Noyori, Reppe, Oxo process [16L]
2. C=C formation reactions: Wittig, Horner-Wordworth-Emmons, Shapiro, Bamford-Stevens, McMurry, Julia-Lythgoe and Peterson olefination reactions, Titanium-carbene mediated olefination: Tebbe, Petasis and Nysted reagent [8L]
3. Multi-component reactions: Ugi, Passerini, Biginelli and Mannich reactions [4L]
4. Ring formation reactions: Pausan-Khand, Bergman and Nazarov cyclization [3L]
5. Click chemistry: criterion for click reaction, Sharpless azides cycloadditions [2L]
6. Metathesis: Grubbs 1<sup>st</sup> and 2<sup>nd</sup> generation catalyst, Olefin cross coupling (OCM), ring closing (RCM) and ring opening (ROM) metathesis, applications [4L]
7. Use of Boron and Silicon in organic synthesis [8L]
8. Other important reactions: Baylis Hilman, Eschenmoser-Tanabe fragmentation, Mitsunobu reaction [3L]

### **References:**

1. Organic synthesis using transition metals-Roderick Bates (Wiley)
2. Organic chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford Press)
3. Designing of organic synthesis – S. Warren (Wiley)
4. Some modern methods of organic synthesis – W. Carruthers (Cambridge)
5. Organic synthesis – Michael B. Smith
6. Organometallics in organic synthesis – J. M. Swan and D. C. Black (Chapman and Hall)
7. Advanced organic chemistry, Part B – F. A Carey and R. J. Sundberg, 5th edition (2007)
8. Guidebook to organic synthesis-R K Meckie, D M Smith and R A Atken
9. Organic synthesis- Robert E Ireland
10. Strategic Applications of named reactions in organic synthesis-Laszlo Kurti and Barbara Czako

## **CHO-452: Carbohydrate and Chiron approach, Chiral Drugs and Medicinal Chemistry [4 credits, 48 Lectures]**

### **1. Carbohydrates [4L]**

Introduction of sugars, structures of triose, tetrose, pentose, hexose, stereochemistry and reactions of Glucose, conformation and anomeric effects in hexoses Ref. 1, 2

### **2. Chiron approach [8L]**

a) Introduction

b) The concept of chiral templates and chirons wherein the carbon skeleton is the chiral precursor.

c) Utilisation of the basic concepts for retrosynthetic strategy and synthesis of the following – (S) Propanediol, (R) and (S) – Epichlorohydrin, L (+)-Alanine,

(-) Multistratin, (-) Pentenomycin, (-) Shikimic acid, Ref. 1,2,3

**3. Chiral Drugs [12L]**

- a) Introduction of chiral drugs, Eutomer, Distomer and eudesmic ratio,
  - b) Distomers-a) with no side effects b) with undesirable side effects Synthesis of S-Ibuprofen, S-Metoprolol, Ininvir sulfate, Dextropropoxyphen, (+) Ephedrine, Griseofulvin, R-Indacrinone, hydrochloride, S-S-captopril
- Ref. 4, 5

References:

1. Organic Chemistry – R. P. Morrison and R. N. Boyd
2. Organic Chemistry – I. L. Finar, volume II
3. Chiron Approach in organic synthesis – S. Hanessianh
4. Pharmaceutical Chemistry and drug synthesis –Rot and Kleeman
5. Drug Design –E.J. Arienes

**4. Medicinal Chemistry**

1. Introduction to drugs, their action and discovery Ref. 1,2,3 [4L]
  2. Relation of Drug structure and its chemical and biological properties [4L]  
Ref. 1,2,3
  3. Structure, activity and quantitative relationship Ref. 1,2,3 [3L]
  4. Drug targetslike proteins, enzymes, receptors, nucleic acids, lipids and [4L]  
carbohydrates Ref. 2 and 3
  5. Antimicrobial drugs: [9L]  
Antibacteraials: Discovery and development of Penicillins, Cephalosporins, Sulphones and  
sulphonamides, Tetracyclins, Macrolides, Polypeptides, Chloromycetin  
Antifungals: Fungal Diseases and Anti-fungal agents  
Antivirals: Viral diseases and Anti-viral drugs  
Anti-protozoals: Anti-malarials, Anti-amoebic
- Ref. 4,5,6

References:

1. Medicinal Chemistry an Introduction-Gareth Thomas 2<sup>nd</sup> Ed. Wiley
2. An introduction to medicinal chemistry-Graham L. Patrick 5<sup>th</sup> Ed. Oxford
3. Introduction to Medicinal Chemistry-Alex Gringauz (Wiley)
4. Foye's Medicinal Chemistry
5. Medicinal Chemistry-A. Burger
6. Medicinal Chemistry-Ashutosh Karr

## CHO-453: Designing Organic Synthesis and Asymmetric Synthesis

[4 credits, 48 Lectures]

1. Designing of organic synthesis: Protection and de-protection of hydroxyl, amino, carboxyl, ketone and aldehyde functions as illustrated in the synthesis of polypeptide and polynucleotide, enamines, Umpolung in organic synthesis, Retrosynthesis. (24L)
2. Principles and applications of asymmetric synthesis: (24L)  
stereoselectivity in cyclic compounds, enantio-selectivity, diastereo-selectivity, enantiomeric 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. Ref. 3 chapters 33, 34, 35

1. Designing of organic synthesis – S. Warren (Wiley)
2. Some modern methods of organic synthesis – W. Carruthers (Cambridge)
3. Organic chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford Press)
4. Organic synthesis – Michael B. Smith
5. Advanced organic chemistry, Part B – F. A Carey and R. J. Sundberg, 5th edition (2007)
6. Guidebook to organic synthesis-R K Meckie, D M Smith and R A Atken
7. Organic synthesis- Robert E Ireland
8. Strategic Applications of named reactions in organic synthesis-Laszlo Kurti and Barbara Czako

## M.Sc. II: Organic Chemistry Practical

### CHO-347: (A) Single stage preparations

[6 Credits]

At least fourteen single stage and three Isolation of Natural products should carried out. The preparation should be carried out on micro scale.

1. 2-Phenyl indole (Fischer indole synthesis),
2. 7-Hydroxy -3-methyl flavone (Baker-Venkatraman reaction),
3. Benzyl alcohol and benzoic acid from benzaldehyde (Cannizzaro reaction)
4. 4-Chlorotoluene from p-toluidine (Sandmeyer reaction)
5. Benzilic acid from benzoin (Benzilic acid rearrangement)
6. Benzopinacol (Photochemical reaction),
7. 7-Hydroxy-4-methyl coumarin (Pechmann Reaction)
8. 4-Methyl benzophenone (Friedal Craft reaction)
9. Benzanilide (Beckmann rearrangement)
10. Vanillyl alcohol from vanillin ( $\text{NaBH}_4$  reduction)
11. 2- and 4-nitrophenols (nitration and separation by steam distillation)
12. Stilbene from benzyl chloride (Wittig reaction)
13. Ethyl cinnamate from benzaldehyde (Wittig reaction)
14. Triphenyl or diphenyl methyl carbinol (Grignard reaction)
15. Benzotriazole
16. 1-Phenyl-3-methyl pyrazol-5-one
17. Glucose pentaacetate
18. 2,4-diethoxycarbonyl-3,4-dimethyl pyrrole from ethyl acetoacetate
19. Quinoline from aniline Skraup synthesis)
20. Benzimidazole from benzyl
21. Cyclohexanol from cyclohexanone (LAH reduction)

### B) Isolation of Natural products (Any three)

1. Caffeine from tea leaves (Soxhlet extraction)
2. Piperine from pepper (Soxhlet extraction)
3. Eucalyptus oil from leaves (Steam distillation)
4. Lycopene from tomatoes
5. Trimyristin from nutmeg
6. Cinnamaldehyde from cinnamom
7. Eugenol from clove

References:

1. Practical organic chemistry by Mann & 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

**CHO-447: Two stage preparations (any Ten)**

[6 Credits]

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 hydrazone → 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. Hippuric acid → Azalactone → 4-Benzylidene 2-phenyl oxazol-5-one
9. p-Cresol → p-Cresyl benzoate → 2-Hydroxy-5-methyl benzophenone
10. Phthalimide → N-Benzylphthalimide → Benzylamine
11. o-Nitroaniline → o-Phenylene diamine → Benzimidazole
12. Phthalic acid → Phthalimide → Anthranilic acid
13. Benzyl cyanide → p-Nitrobenzyl cyanide → p-Nitro phenyl acetic acid
14. Hydroquinone → Hydroquinone diacetate → 2,5-Dihydroxy acetopheneone
15. Cyclohexanone → Enamine → 2-Acetyl cyclohexanone
16.  $\alpha$ -Pinene → Disiamyl borane → Pinanol

**CHO-448: Project/Industrial training/Green Chemistry and Chemical biology experiments (any Twelve)**

[6 Credits]

1. Preparation of acetanilide from aniline and acetic acid using Zn dust
2. Base catalyzed aldol condensation using LiOH.H<sub>2</sub>O as a Catalyst.
3. Bromination of *trans*-stilbene using sodium bromide and sodium bromate
4. [4+2] cycloaddition reaction in aqueous medium at room temperature
5. Benzil Benzilic acid rearrangement under solvent free condition
6. Thiamine hydrochloride catalyzed synthesis of benzoin from benzaldehyde
7. Clay catalyzed solid state synthesis of 7-hydroxy-4-methylcoumarin
8. Ecofriendly nitration of phenols and its derivatives using Calcium nitrate
9. Bromination of acetanilide using ceric ammonium nitrate in aqueous medium
10. Green approach for preparation of benzopinacolone from bezopinacol using iodine catalyst
11. Preparation of 1, 1-bis-2-naphthol under grinding at room temperature.

12. Solvent free aldol condensation between 3,4-dimethoxybenzaldehyde and 1-indanone
13. Solvent free quantitative solid phase synthesis of azomethines from substituted anilines and substituted benzaldehydes.
14. Sucrose to ethyl alcohol (Baker's yeast)
15. Asymmetric reduction of EAA by using Baker's yeast

Note: i) Project/Industrial training students have to perform 6 practical from the above experiments.

ii) 20% students should be given project or industrial training.

**Reference:**

1. Comprehensive Practical Organic Chemistry by V.K. Ahluwalia and Renu Aggarwal
2. Monograph on Green Chemistry Laboratory Experiments by Green Chemistry Task Force Committee, DST





**University of Pune**

**Three Year Degree Course in  
B. Sc. Computer Science**

## 1) Title of the Course : B. Sc. Computer Science

### F.Y.B.Sc. Computer Science Syllabus (To be implemented from Academic Year 2013-14)

#### 2) Preamble:

B. Sc. Computer Science is a systematically designed three year course that prepares the student for a career in Software Industry. The syllabus of computer Science subject along with that of the three allied subjects (Mathematics, Electronics and Statistics) forms the required basics for pursuing higher studies in Computer Science. The Syllabus also develops requisite professional skills and problem solving abilities for pursuing a career in Software Industry.

#### 3) Introduction:

At **first year of under-graduation** basic foundation of two important skills required for software development is laid. A course in programming and a course in database fundamentals forms the preliminary skill set for solving computational problems. Simultaneously two practical courses are designed to supplement the theoretical training. The second practical course also includes a preliminary preparation for website designing in the form of HTML programming.

Alongwith Computer Science two theory and one practical course each in Statistics, Mathematics and Electronics help in building a strong foundation.

At **second year under-graduation**: The programming skills are further strengthened by a course in Data structures and Object oriented programming. The advanced topics in Databases and preliminary software engineering form the second course. Two practical courses alongside help in hands-on training. Students also undertake a mini project using software engineering principles to solve a real world problem. Simultaneously two theory and one practical course each in Mathematics and Electronics help in strengthening problem solving abilities.

At **third year under-graduation**: Six theory papers in each semester and practical courses cover the entire spectrum of topics necessary to build knowledge base and requisite skill set. Third practical course also includes project work which gives students hands on experience in solving a real world problem.

#### 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 imbibe quality software development practices. To create awareness about process and product standards
- 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

#### 4) Eligibility:

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

**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.

**5 A) Examination Pattern:****First Year B. Sc. Computer Science****Subject : Computer Science**

Pattern of Examination: Annual

Theory courses (CS-101): Annual

(CS-102): Annual

Practical Course (CS-103): Annual

(CS-104): Annual

Paper/ Course No.	Title	Total Number of lectures/practicals per Term	Standard of passing		
			Internal marks out of <b>20</b>	External marks out of <b>80</b>	Total marks out of <b>100</b>
Computer Science Paper I (CS-101)	Problem Solving Using Computers and 'C' Programmin g	Three lectures/Week (Total 80 lectures )	08	32	40 *
Computer Science Paper II CS-102)	File Organizatio n and Fundament al of Databases	Three lectures/Week (Total 80 lectures )	08	32	40 *
Computer Science Practical Paper I (CS-103)	Computer Science Practical Paper I	25 Practical slots of 4 lectures each	08	32	40 *
Computer Science Practical Paper II (CS-104)	Computer Science Practical Paper II	25 Practical slots of 4 lectures each	08	32	40 *

\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory (100 + 100 ) = 200 marks
2. Total marks per year 200 (Theory) + 100 marks (practical)+ Grade(practical) = 300 marks +Grade
3. Internal marks for theory papers given on the basis of internal assessment tests and for practicals on continuous assessment of lab work.
4. In case of Computer Science Practical Paper II, marks out of 100 will be converted to grades

Marks	Grade
75 and above	O

65 and above	A
55 and above	B
50 and above	C
45 and above	D
40 and above	E
Below 40 ( indicates Failure)	F

**Theory examination** will be of three hours duration for each theory course. There shall be 5 questions each carrying equal marks. The pattern of question papers shall be:

Question 1	8 sub-questions, each of 2 marks; answerable in 2 -3 lines and based on entire syllabus
Question 2, 3 ,4 and 5	4 out of 5/6– short answer type questions; answerable in 8 – 10 lines ; mix of theory and problems

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each term. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain). There shall be 20 questions.

Practical: Continuous assessment of Lab work and mini project.

**Practical Examination:** Practical examination shall be conducted by the respective college at the end of the academic year. Practical examination will be of 3 hours duration for each practical course. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination.

### Second Year B. Sc. Computer Science

No	Paper	Title: Semester I	Title: Semester II
1	Computer Science Paper I	CS-211:Data Structures using 'C'	CS-221:Object Oriented Concepts using C++
2	Computer Science Paper II	CS-212: Relational Database Management System	CS-222:Software Engineering
3	Computer Science Paper III	CS-223:Data structures Practicals and C++ Practicals	
4	Computer Science Paper IV	CS-224:Database Practicals & Mini Project using Software Engineering techniques	

5	Mathematics Paper I	MT-211:Mathematics Paper I-Sem I	MT-221:Mathematics Paper I-Sem II
6	Mathematics Paper II	MT-212:Mathematics Paper II-Sem I	MT-222:Mathematics Paper II-Sem II
7	Mathematics Paper III	MT-223:Practical Course in Mathematics	
8	Electronics Paper I	EL-211:Electronics Paper I-Sem I	EL-221:Electronics Paper I-Sem II
9	Electronics Paper II	EL-212:Electronics Paper II-Sem I	EL-222:Electronics Paper II-Sem II
10	Electronics Paper III	EL-223:Practical Course in Electronics	
11	English	EN-211:Technical English-Sem I	EN-221:Technical English – Sem II

Pattern of examination: Semester

Theory courses (Sem I: CS-211 and CS212): Semester  
 (Sem II: CS-221 and CS-222): Semester  
 Practical Course (CS-223 and CS-224): Annual

Paper/ Course No.	Title	Total Number of lectures/practicals Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
Theory Paper I (CS- 211)	Data Structures using 'C'	Four lectures/Week (Total 48 per Semester )	04	16	20 *
Theory Paper II (CS 212)	Relational Database Management System	Four lectures/Week (Total 48 per Semester )	04	16	20 *
Theory Paper I (CS 221)	Object Oriented Concepts using C++	Four lectures/Week (Total 48 per Semester )	04	16	20 *
Theory Paper II (CS 222)	Software Engineering	Four lectures/Week (Total 48 per Semester )	04	16	20 *

		Semester )			
Practical paper I (CS 223) (First & Second Semester)	Data structures Practicals and C++ Practicals	Practicals of 4 lectures each 25 practicals / year)	08	32	40 **
Practical paper II (CS 223) (First & Second Semester)	Database Practicals & Mini Project using Software Engineeri ng technique s	Practicals of 4 lectures each 25 practicals / year)	08	32	40 **

\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester (50 + 50 ) = 100 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals)+Grade(practical) = 300 marks+Grade
3. Internal marks for theory papers given on the basis of Continuous internal assessment

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

Question 1	10 questions, each of 1 marks	10 marks
Question 2 3	Sub-questions carrying 5 marks (2 out of 3)	10 marks each
Question 4	Sub-questions carrying marks depending on their complexity with options	10 marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain) There shall be 20 questions.

Practicals: Continuous assessment of practical performance

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of 3 hours duration. Certified journal is compulsory to appear for practical examination. There shall be one expert and two examiners per batch for the practical examination. One of the examiners will be external.

### Third Year B. Sc. Electronic Science

No	Paper	Title: Semester I	Title: Semester II
1	Computer Science Paper I	CS-331: System Programming	CS-341: Operating System
2	Computer Science Paper II	CS-332: Theoretical Computer Science	CS-342: Compiler Construction
3	Computer Science Paper III	CS-333: Computer Networks-I	CS-343: Computer Networks-II
4	Computer Science Paper IV	CS-334: Internet Programming- I	CS-344: Internet Programming- II
5	Computer Science Paper V	CS-335: Programming in Java-I	CS-345: Programming in Java-II
6	Computer Science Paper VI	CS-336: Object Oriented Software Engineering	CS-346: Computer Graphics
7	Computer Science Paper VII	CS-347: Practicals Based on CS-331 and CS341 – Sem I & Sem II	
8	Computer Science Paper VIII	CS-348: Practicals Based on CS-335 and CS-344 – Sem I & Sem II and Computer Graphics using Java	
9	Computer Science Paper IX	CS-349: Practicals Based on CS-334 and CS-344 – Sem I & Sem II and Project	

### Subject : Computer Science

Pattern of examination: Semester

Theory courses:

(Sem III: CS-331-CS-336): Semester (Sem IV: CS-341-CS-346): Semester

Practical Course:

(CS-347-CS-349): Annual

Theory Papers					
Paper/Course No.	Title	Total Number of lectures Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
<b>SEM III</b>					
CS-331	System Programming	48	4	16	20*



CS-332	Theoretical Computer Science	48	4	16	20*
CS-333	Computer Networks-I	48	4	16	20*
CS-334	Internet Programming- I	48	4	16	20*
CS-335	Programming in Java-I	48	4	16	20*
CS-336	Object Oriented Software Engineering	48	4	16	20*
<b>SEM IV</b>					
CS-341	Operating System	48	4	16	20*
CS-342	Compiler Construction	48	4	16	20*
CS-343	Computer Networks-II	48	4	16	20*
CS-344	Internet Programming- I	48	4	16	20*
CS-345	Programming in Java-I	48	4	16	20*
CS-346	Computer Graphics	48	4	16	20*
<b>Practical Papers</b>					
CS 347 (Semester III & IV)	Practicals Based on CS-331 and CS-341 – Sem I & Sem II	25 practicals/ year	08	32	40 **
CS 348 (Semester III & IV)	CS-348:Practicals Based on CS-335 and Cs-344 – Sem I & Sem II and Computer Graphics using Java	25 practicals/ year	08	32	40 **

CS 349 (Semester III & IV)	CS-349:Practicals Based on CS-334 and CS-344 – Sem I & Sem II and Project	25 practicals/ year	08	32	40 **
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\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester ( $50 \times 6$ ) = 300 marks
2. Total marks per year 600 (Theory) + 300 marks (practicals) = 900 marks
3. Internal marks for theory papers given on the basis of continuous internal assessment

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

Question 1	10 questions, each of 1 marks	10 marks
Question 2 and 3	Sub-questions carrying 5 marks (2 out of 3)	10 marks each
Question 4	Sub-questions carrying marks depending on their complexity with options	10 marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain) There shall be 20 questions.

Practicals: one internal assessment test + practical journals + attendance + activity.

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of 3 hours duration. Certified journal is compulsory to appear for practical examination. There shall be one expert and two examiners per batch for the practical examination. One of the examiners will be external.

### 5 B) Standard of Passing:

- i. In order to pass in the first year theory 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 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 16 marks out of 40 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.)

### 5 C) ATKT Rules:

While going from F.Y.B.Sc. to S.Y.B.Sc. at least 8 courses (out of total 13) should be passed; however all F.Y.B.Sc. courses should be passed 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 22) should be passed (Practical Course at S.Y.B.Sc. will be equivalent to 2 courses).

### 5 D) 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

**5 E) External Students:** There shall be no external students.

### 5 F) Setting question papers:

**F.Y.B.Sc.:** For theory papers I and II annual question papers shall be set by the University of Pune and assessment done at the respective colleges. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Papers, the Question paper slips will be provided by the University of Pune and assessment done at the respective colleges.

**S.Y.B.Sc. and T.Y.B.Sc.:** For theory papers I and II for each semester and also for the annual practical examination question papers set by the University of 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. For Practical Papers: Papers shall be set by the University of Pune and assessment done by the internal examiner and external examiner appointed by University of Pune.

**5G) Verification and Revaluation Rules:**

As per university Statues and rules for verification and revaluation of marks in stipulated time after declaration of the semester examination result.

**6) Course Structure:**

**Duration:** The duration of B.Sc. Computer Science Degree Program shall be three years.

**a) All are Compulsory Papers:**

F.Y.B.Sc. : 2 Theory + 2 Practical (Annual)

S .Y.B.Sc.: 2 Theory per semester + 2 Practical (Annual)

T.Y.B.Sc.: 6 Theory per semester + 3 Practical (Annual)

**b) Question Papers :****F.Y.B.Sc.Theory paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

**S.Y / T.Y. - B.Sc.Theory paper:**

University Examination – 40 marks (at the end of each term)

Internal Examination – 10 marks

**F.Y. / S.Y / T.Y. - B.Sc.Practical Paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

**c) Medium of Instruction:** The medium of instruction for the course shall be **English.**

**7) Equivalence of Previous Syllabus:**

<b>Old Course (2008 Pattern)</b>	<b>New Course (2013 Pattern)</b>
Paper I: Introduction to Computers and 'C' Programming	CS-101:Problem Solving Using Computers and 'C' Programming
Paper II: File Organization and Fundamental of Databases	CS 102:File Organization and Fundamental of Databases
Paper III: Computer Science Practical paper I	CS-103: Computer Science Practical paper I
Paper IV: Computer Science Practical paper II	CS-104: Computer Science Practical paper II

**8) University Terms:** Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

**9) Qualification of Teachers:**M.Sc. Computer Science/M.C.A. or equivalent master degree in science with class/grades and NET/SET as per prevailing University/Government /UGC rules.

**10) Detail Syllabus with Recommended Books:**

**Title :** Problem Solving Using Computers and 'C' Programming

**Objective :-**

- i) To develop Problem Solving abilities using computers
- ii) To teach basic principles of programming
- iii) To develop skills for writing programs using 'C'

**Syllabus****Chapter 1 Problem Solving using Computers****[8]**

- 1.1 Problem-Solving
- 1.2 Writing Simple Algorithms
- 1.3 Algorithms
- 1.4 Flowcharts

**Chapter 2 Programming Languages as Tools****[3]**

- 2.1 Machine language R6(1.5,1.6)
- 2.2 Assembly language
- 2.3 High level languages
- 2.4 Compilers and Interpreters

**Chapter 3 Introduction to C****[2]**

- 3.1 History R3(2-1), R6(1.1)
- 3.2 Structure of a C program R3(2-2), R6(1.8)
- 3.3 Functions as building blocks R3(4-1,4-2)
- 3.4 Application Areas
- 3.5 C Program development life cycle R6(1.10)
- 3.6 Sample programs

**Chapter 4 C Tokens****[12]**

- 4.1 Keywords R6 (Ch 2, 3)
- 4.2 Identifiers
- 4.3 Variables
- 4.4 Constants – character, integer, float, string, escape sequences
- 4.5 Data types – built-in and user defined
- 4.6 Operators and Expressions Operator types (arithmetic, relational, logical, assignment, bitwise, conditional , other operators) , precedence and associativity rules.
- 4.7 Simple programs using printf and scanf

**Chapter 5 Input and Output****[3]**

- 5.1 Character input and output R6(4.2 - 4.5)
- 5.2 String input and output
- 5.3 Formatted input and output

**Chapter 6 Control Structures****[10]**

- 6.1 Decision making structures If, if-else, switch R3(5-2, 5-3), R6(5.2 - 5.8)
- 6.2 Loop Control structures While, do-while, for R6 (Ch 8)
- 6.3 Nested structures
- 6.4 break and continue

<b>Chapter 7 Functions in C</b>		<b>[8]</b>
7.1 What is a function	R3(4-2, 4-4)	
7.2 Advantages of Functions		
7.3 Standard library functions	R3(5-4)	
7.4 User defined functions :Declaration, definition, function call, parameter passing (by value), return keyword,	R6 (Ch 9)	
7.5 Scope of variables, storage classes		
7.6 Recursion	R3 (6-9)	
<b>Chapter 8 Arrays</b>		<b>[8]</b>
8.1 Array declaration, initialization	R6(Ch 7)	
8.2 Types – one, two and multidimensional	“	
8.3 Passing arrays to functions	R3(8-3), R6(9.17)	
<b>Chapter 9 Pointers</b>		<b>[6]</b>
9.1 Pointer declaration, initialization	R6(11.1 - 11.14)	
9.2 Dereferencing pointers		
9.3 Pointer arithmetic		
9.4 Pointer to pointer		
9.5 Arrays and pointers		
9.6 Functions and pointers – passing pointers to functions, function returning pointers		
9.7 Dynamic memory allocation	R6(13.1-13.6)	
<b>Chapter 10 Strings</b>		<b>[6]</b>
10.1 Declaration and initialization, format specifiers	R6(Ch 8)	
10.2 Standard library functions		
10.3 Strings and pointers		
10.4 Array of strings		
10.5 Command Line Arguments	R3(Appendix I1-I2)	
<b>Chapter 11 Structures and Unions</b>		<b>[6]</b>
11.1 Creating structures	R6(Ch 10)	
11.2 Accessing structure members (dot Operator)		
11.3 Structure initialization		
11.4 Array of structures		
11.5 Passing structures to functions		
11.6 Nested structures		
11.7 Pointers and structures		
11.8 Unions		
11.9 Difference between structures and unions		
<b>Chapter 12 File Handling</b>		<b>[6]</b>
12.1 Streams	R3(7-1, 7-2)	
12.2 Types of Files		
12.3 Operations on files	R6(12.1- 12.4), 12.6, 12.7	
12.4 Random access to files		
<b>Chapter 13 C Preprocessor</b>		<b>[2]</b>

- 13.1 Format of Preprocessor directive R6(14.1 - 14.3)  
 13.2 File Inclusion directive  
 13.3 Macro substitution, nested macro, argumented macro

### References

1. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, ISBN:9788120305960, PHI Learning
2. How to Solve it by Computer, R.G. Dromey, ISBN:9788131705629, Pearson Education
3. A Structured Programming Approach Using C, Behrouz A. Forouzan, Richard F. Gilberg ISBN:9788131500941, Cengage Learning India
4. Using The GNU Compiler Collection, Richard M. Stallman;The GCC Developer Community Pothi.com
5. Using the Gnu Compiler Collection, Richard M. Stallman, Gcc Developer community ISBN:9781441412768,Createspace
6. Programming in ANSI C, E. Balaguruswamy,ISBN:9781259004612,Tata Mc-Graw Hill Publishing Co.Ltd.-New Delhi

**Computer Science: Paper – II : File Organization and Fundamental of Databases**

**Title :** File Organization and Fundamental of Databases

### Objective :-

- i) To understand data processing using computers
- ii) To teach basic organization of data using files
- iii) To understand creations, manipulation and querying of data in databases

### Syllabus

**Chapter 1 File Organization R3**  
**[6]**

- 1.1 Introduction
- 1.2 Physical / logical files
- 1.3 Types of file organization ( heap,sorted, indexed,hashed)
- 1.4 Choosing a file organization

**Chapter 2 Introduction of DBMS R1(Ch 1) [6]**

- 2.1 Overview
- 2.2 File system Vs DBMS
- 2.3 Describing & storing data (Data models (relational,hierarchical, network))
- 2.4 Levels of abstraction
- 2.5 Data independence
- 2.6 Structure of DBMS
- 2.7 Users of DBMS
- 2.8 Advantages of DBMS

**Chapter 3 Conceptual Design (E-R model) R1(Ch 2), R3, R4**  
**[15]**

- 3.1 Overview of DB design
- 3.2 ER data model (entities , attributes, entity sets, relations, relationship sets)
- 3.3 Additional constraints (Key constraints, Mapping constraints, Strong & Weak entities, aggregation / generalization)
- 3.4 Conceptual design using ER modelling ( entities VS attributes, Entity Vs relationship, binary Vs ternary, constraints beyond ER)
- 3.5 Case studies

**Chapter 4 Relational data model R1(Ch 3)**  
**[6]**

- 4.1 Structure of Relational Databases (concepts of a table, a row, a relation, a Tuple and a key in a relational database)
- 4.2 Conversion of ER to Relational model
- 4.3 Integrity constraints ( primary key, referential integrity, unique constraint, Null constraint, Check constraint)

**Chapter 5 Relational algebra R1(Ch 3)**  
**[7]**

- 5.1 Preliminaries
- 5.2 Relational algebra ( selection, projection, set operations, renaming joins, division)

**Chapter 6 SQL R1(Ch 4)**  
**[20]**

- 6.1 Introduction
- 6.2 Basic structure
- 6.3 Set operations
- 6.4 Aggregate functions
- 6.5 Null values
- 6.6 Nested Subqueries
- 6.7 Modifications to Database
- 6.8 DDL commands with examples
- 6.9 SQL mechanisms for joining relations (inner joins, outer joins and their types)
- 6.10 Examples on SQL (case studies )

**7 Relational Database Design R1(ch 7)**  
**[20]**

- 7.1 Pitfalls in Relational-Database Design ( undesirable properties of a RDB design like repetition, inability to represent certain information),
- 7.2 Functional dependencies ( Basic concepts, F+, Closure of an Attribute set, Concept of a Super Key and a primary key)



- (Algorithm to derive a Primary Key for a relation)
- 7.3 Concept of Decomposition
  - 7.4 Desirable Properties of Decomposition ( Lossless join & Dependency preservation)
  - 7.5 Concept of Normalization
  - 7.6 Normal forms (only definitions) 1NF, 2NF, 3NF, BCNF
  - 7.7 Examples on Normalization

### References

1. Database System Concepts, Henry F. Korth, Abraham Silberschatz, S. Sudarshan,  
ISBN:9780071289597, Tata McGraw-Hill Education
2. Database Management Systems ,Raghu Ramakrishnan,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, Ramez Elmasri,  
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),John Worsley, Joshua Drake,  
ISBN:9788173663925  
Shroff/O'reilly
8. Practical Postgresql , By Joshua D. Drake, John C Worsley (**O'Reilly publications**)
9. "An introduction to Database systems", Bipin C Desai, Galgotia Publications

**Important to Note:** It is absolutely necessary and essential that all the practicals for Paper III and Paper IV be conducted on Open Source Operating System like Linux. All the practicals related to C needs to be conducted using GCC compiler.

<b>Paper III – Computer Science Practical Paper I</b>
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**Title :** Basic 'C' Programming and Database Handling practicals

**Objective :-**

- i) Design and implement a 'C' programs for simple problems
- ii) Understand appropriate use of data types and array structures
- iii) Understand use of appropriate control structures

**Syllabus**

1. Initial 3 practical slots (12 lectures) should be used for teaching basic operating systems commands and use of editors

2. Last 2 slots (8 lectures) are to be used for revision
3. Remaining 80 lectures are to be utilised for the following 20 Assignments

<b>Computer Science : Paper III : Basic 'C' Programming and Database Handling practicals#</b>		
No	Topic	Lectures
1	Assignment to demonstrate use of data types, simple operators (expressions)	4
2	Assignment to demonstrate decision making statements (if and if-else, nested structures)	4
3	Assignment to demonstrate decision making statements (switch case)	4
4	Assignment to demonstrate use of simple loops	4
5	Assignment to demonstrate use of nested loops	4
6	Assignment to demonstrate menu driven programs.	4
7	Assignment to demonstrate writing C programs in modular way ( use of user defined functions)	4
8	Assignment to demonstrate recursive functions.	4
9	Assignment to demonstrate use of arrays (1-d arrays ) and functions	4
10	Assignment to demonstrate use of multidimensional array(2-d arrays ) and functions	4
11	Assignment to create simple tables , with only the primary key constraint ( as a table level constraint & as a field level constraint) (include all data types)	4
12	Assignment to create more than one table, with referential integrity constraint, PK constraint.	4
13	Assignment 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	4
14	Assignment to drop a table from the database, to alter the schema of a table in the Database.	4
15	Assignment to insert / update / delete records using tables created in previous Assignments. ( use simple forms of insert / update / delete statements)	4

16	Assignment 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 <>]	4
17	Assignment to query table, using set operations (union, intersect)	4
18	Assignments to query tables using nested queries	4
19	Assignment to query tables , using nested queries ( use of 'Except', exists, not exists clauses	4
20	Assignment related to small case studies ( Each case study will involve creating tables with specified constraints, inserting records to it & writing queries for extracting records from these tables)	4

#### Paper IV – Computer Science Practical Paper II<sup>#</sup>

**Title :** HTML5 programming and Advanced 'C' Programming practicals

**Objective :-**

- i) Understanding basic HTML designing
- ii) Writing C programs using complex data structures such as pointers, structures etc.

**Syllabus**

1. Initial 3 practical slots (8 lectures) should be used for teaching basic internet usage including use of browsers
2. Last 2 slots (8 lectures) are to be used for revision
- 3. Remaining 80 lectures are to be utilised for the following 20 Assignments**

<b>Computer Science : Paper IV : HTML 5 programming and Advanced 'C' Programming practicals</b>		
No	Topic	Lectures
1	Creating simple HTML pages (use of different tags for changing fonts, foreground and background colors etc.) )	4
2	HTML programming (use of lists, tables )	4
3	HTML programming using frames	4
4	HTML programming using hyperlinks	4
5	HTML programming ( Creation of forms)	4

6	HTML programming – Case Study 1	4
7	HTML programming – Case Study 1	4
8	HTML programming – Case Study 1	4
9	Assignment to demonstrate use of pointers	4
10	Assignment to demonstrate concept of strings ( string & pointers)	4
11	Assignment to demonstrate array of strings.	4
12	Assignment to demonstrate use of bitwise operators.	4
13	Assignment to demonstrate structures (using array and functions )	4
14	Assignment to demonstrate structures and unions	4
15	Assignment to demonstrate command line arguments and preprocessor directives	4
16	Assignment to demonstrate file handling (text files)	4
17	Assignment to demonstrate file handling (binary files and random access to files)	4
18	C Programming – Case study 1	4
19	C Programming – Case study 2	4
20	C programming – Case Study 3	4

#The Lab Hand Book will define in detail the contents and provide guidelines for each practical Assignment.

# **Syllabus for S.Y.B.Sc.(Computer Science) to be implemented from 2014-15**

**Important to Note about Laboratory courses:** It is absolutely necessary and essential that all the practical's for Paper III and Paper IV be conducted on Free and Open Source Operating System like Linux.

- All the practical's related to C and C++ needs to be conducted using GCC compiler.
- For laboratory work/assignments of Database Systems, PostgreSQL to be used.

## 1) Title of the Course : B. Sc. Computer Science

### S.Y.B.Sc. Computer Science Syllabus (To be implemented from Academic Year 2014-15)

#### 2) Preamble:

B. Sc. Computer Science is a systematically designed three year course that prepares the student for a career in Software Industry. The syllabus of computer Science subject along with that of the three allied subjects (Mathematics, Electronics and Statistics) forms the required basics for pursuing higher studies in Computer Science. The Syllabus also develops requisite professional skills and problem solving abilities for pursuing a career in Software Industry.

#### 3) Introduction:

At **first year of under-graduation** basic foundation of two important skills required for software development is laid. A course in programming and a course in database fundamentals forms the preliminary skill set for solving computational problems. Simultaneously two practical courses are designed to supplement the theoretical training. The second practical course also includes a preliminary preparation for website designing in the form of HTML programming.

Alongwith Computer Science two theory and one practical course each in Statistics, Mathematics and Electronics help in building a strong foundation.

At **second year under-graduation**: The programming skills are further strengthened by a course in Data structures and Object oriented programming. The advanced topics in Databases and preliminary software engineering form the second course. Two practical courses alongside help in hands-on training. Students also undertake a mini project using software engineering principles to solve a real world problem.

Simultaneously two theory and one practical course each in Mathematics and Electronics help in strengthening problem solving abilities.

At **third year under-graduation**: Six theory papers in each semester and practical courses cover the entire spectrum of topics necessary to build knowledge base and requisite skill set. Third practical course also includes project work which gives students hands on experience in solving a real world problem.

#### 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 imbibe quality software development practices. To create awareness about process and product standards
- 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

**4) Eligibility:**

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

**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.

**5 A) Examination Pattern:**

**First Year B. Sc. Computer Science**

**Subject: Computer Science**

Pattern of Examination: Annual

Theory courses (CS-101): Annual

(CS-102): Annual

Practical Course (CS-103): Annual

(CS-104): Annual

Paper/ Course No.	Title	Total Number of lectures/practical' s per Term	Standard of passing		
			Internal marks out of <b>20</b>	External marks out of <b>80</b>	Total marks out of <b>100</b>
Computer Science Paper I (CS-101)	Problem Solving Using Computers and 'C' Programmi ng	Three lectures/Week (Total 80 lectures )	08	32	40 *
Computer Science Paper II CS-102)	File Organizatio n and Fundament al of Databases	Three lectures/Week (Total 80 lectures )	08	32	40 *
Computer Science Practical Paper I (CS-103)	Computer Science Practical Paper I	25 Practical slots of 4 lectures each	08	32	40 *

Computer Science Practical Paper II (CS-104)	Computer Science Practical Paper II	25 Practical slots of 4 lectures each	08	32	40 *
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\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory (100 + 100 ) = 200 marks
2. Total marks per year 200 (Theory) + 100 marks (practical)+ Grade(practical) = 300 marks +Grade
3. Internal marks for theory papers given on the basis of internal assessment tests and for practicals on continuous assessment of lab work.
4. In case of Computer Science Practical Paper II, marks out of 100 will be converted to grades

Marks	Grade
75 and above	O
65 and above	A
55 and above	B
50 and above	C
45 and above	D
40 and above	E
Below 40 ( indicates Failure)	F

**Theory examination** will be of three hours duration for each theory course. There shall be 5 questions each carrying equal marks. The pattern of question papers shall be:

Question 1	8 sub-questions, each of 2 marks; answerable in 2 -3 lines and based on entire syllabus
Question 2, 3 ,4 and 5	4 out of 5/6– short answer type questions; answerable in 8 – 10 lines ; mix of theory and problems



**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each term. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain). There shall be 20 questions.

Practical: Continuous assessment of Lab work and mini project.

**Practical Examination:** Practical examination shall be conducted by the respective college at the end of the academic year. Practical examination will be of 3 hours duration for each practical course. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination.

### Second Year B. Sc. Computer Science

No	Paper	Title: Semester I	Title: Semester II
1	Computer Science Paper I	CS-211:Data Structures using 'C'	CS-221:Object Oriented Concepts using C++
2	Computer Science Paper II	CS-212: Relational Database Management System	CS-222:Software Engineering
3	Computer Science Paper III	CS-223:Data structures Practicals and C++ Practicals	
4	Computer Science Paper IV	CS-224:Database Practicals & Mini Project using Software Engineering techniques	
5	Mathematics Paper I	MT-211:Mathematics Paper I-Sem I	MT-221:Mathematics Paper I-Sem II
6	Mathematics Paper II	MT-212:Mathematics Paper II-Sem I	MT-222:Mathematics Paper II-Sem II
7	Mathematics Paper III	MT-223:Practical Course in Mathematics	
8	Electronics Paper I	EL-211:Electronics Paper I-Sem I	EL-221:Electronics Paper I-Sem II
9	Electronics Paper II	EL-212:Electronics Paper II-Sem I	EL-222:Electronics Paper II-Sem II
10	Electronics Paper III	EL-223:Practical Course in Electronics	
11	English	EN-211:Technical English-Sem I	EN-221:Technical English – Sem II

Pattern of examination: Semester

Theory courses (Sem I: CS-211 and CS212): Semester  
 (Sem II: CS-221 and CS-222): Semester

Practical Course (CS-223 and CS-224): Annual

Paper/ Course No.	Title	Total Number of lectures/practicals Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
Theory Paper I (CS- 211)	Data Structures using 'C'	Four lectures/Week (Total 48 per Semester )	04	16	20 *
Theory Paper II (CS 212)	Relational Database Management System	Four lectures/Week (Total 48 per Semester )	04	16	20 *
Theory Paper I (CS 221)	Object Oriented Concepts using C++	Four lectures/Week (Total 48 per Semester )	04	16	20 *
Theory Paper II (CS 222)	Software Engineering	Four lectures/Week (Total 48 per Semester )	04	16	20 *
Practical paper I (CS 223) (First & Second Sem)	Data structures Practicals and C++ Practicals	Practicals of 4 lectures each 25 practicals/Yr.)	08	32	40 **
Practical paper II (CS 223) (First & Second Semester)	Database Practicals & Mini Project using Software Engineering techniques	Practicals of 4 lectures each 25 practicals/ Yr.)	08	32	40 **

\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester (50 + 50 ) = 100 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals)+Grade(practical) = 300 marks+Grade
3. Internal marks for theory papers given on the basis of Continuous internal assessment

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

Question 1	10 questions, each of 1 marks	10 marks
Question 2 3	Sub-questions carrying 5 marks (2 out of 3)	10 marks each
Question 4	Sub-questions carrying marks depending on their complexity with options	10 marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain) There shall be 20 questions.

**Practicals:** Continuous assessment of practical performance

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of 3 hours duration. Certified journal is compulsory to appear for practical examination. There shall be one expert and two examiners per batch for the practical examination. One of the examiners will be external.

### Third Year B. Sc. Computer Science

No	Paper	Title: Semester I	Title: Semester II
1	Computer Science Paper I	CS-331: System Programming	CS-341: Operating System
2	Computer Science Paper II	CS-332: Theoretical Computer Science	CS-342: Compiler Construction
3	Computer Science Paper III	CS-333: Computer Networks-I	CS-343: Computer Networks-II
4	Computer Science Paper IV	CS-334: Internet Programming- I	CS-344: Internet Programming- II
5	Computer Science Paper V	CS-335: Programming in Java-I	CS-345: Programming in Java-II

6	Computer Science Paper VI	CS-336:Object Oriented Software Engineering	CS-346:Computer Graphics
7	Computer Science Paper VII	CS-347:Practicals Based on CS-331 and CS341 – Sem I &Sem II	
8	Computer Science Paper VIII	CS-348:Practicals Based on CS-335 and CS-344 – Sem I &Sem II and Computer Graphics using Java	
9	Computer Science Paper IX	CS-349:Practicals Based on CS-334 and CS-344 – Sem I &Sem II andProject	

### Subject: Computer Science

Pattern of examination: Semester

Theory courses:

(Sem III: CS-331-CS-336): Semester (Sem IV: CS-341-CS-346): Semester

Practical Course:

(CS-347-CS-349): Annual

Theory Papers					
Paper/Course No.	Title	Total Number of lectures Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
<b>SEM III</b>					
CS-331	System Programming	48	4	16	20*
CS-332	Theoretical Computer Science	48	4	16	20*
CS-333	Computer Networks-I	48	4	16	20*
CS-334	Internet Programming- I	48	4	16	20*
CS-335	Programming in Java-I	48	4	16	20*
CS-336	Object Oriented Software Engineering	48	4	16	20*
<b>SEM IV</b>					

CS-341	Operating System	48	4	16	20*
CS-342	Compiler Construction	48	4	16	20*
CS-343	Computer Networks-II	48	4	16	20*
CS-344	Internet Programming- I	48	4	16	20*
CS-345	Programming in Java-I	48	4	16	20*
CS-346	Computer Graphics	48	4	16	20*
<b>Practical Papers</b>					
CS 347 (Semester III & IV)	Practicals Based on CS-331 and CS-341 – Sem I & Sem II	25 practicals/ year	08	32	40 **
CS 348 (Semester III & IV)	CS-348:Practicals Based on CS-335 and Cs-344 – Sem I & Sem II and Computer Graphics using Java	25 practicals/ year	08	32	40 **
CS 349 (Semester III & IV)	CS-349:Practicals Based on CS-334 and CS-344 – Sem I & Sem II and Project	25 practicals/ year	08	32	40 **

\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester ( $50 \times 6$ ) = 300 marks
2. Total marks per year 600 (Theory) + 300 marks (practicals) = 900 marks
3. Internal marks for theory papers given on the basis of continuous internal assessment

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

Question 1	10 questions, each of 1 marks	10 marks
Question 2 and 3	Sub-questions carrying 5 marks (2 out of 3)	10 marks each
Question 4	Sub-questions carrying marks depending on their complexity with options	10 marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain) There shall be 20 questions.

Practicals: one internal assessment test + practical journals + attendance + activity.

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of 3 hours duration. Certified journal is compulsory to appear for practical examination. There shall be one expert and two examiners per batch for the practical examination. One of the examiners will be external.

### **5 B) Standard of Passing:**

- i. In order to pass in the first year theory 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 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 16 marks out of 40 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.)

**5 C) ATKT Rules:**

While going from F.Y.B.Sc. to S.Y.B.Sc. at least 8 courses (out of total 13) should be passed; however all F.Y.B.Sc. courses should be passed 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 22) should be passed (Practical Course at S.Y.B.Sc. will be equivalent to 2 courses).

**5 D) 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

**5 E) External Students:** There shall be no external students.

**5 F) Setting question papers:**

**F.Y.B.Sc.:** For theory papers I and II annual question papers shall be set by the University of Pune and assessment done at the respective colleges. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Papers, the Question paper slips will be provided by the University of Pune and assessment done at the respective colleges.

**S.Y.B.Sc. and T.Y.B.Sc.:** For theory papers I and II for each semester and also for the annual practical examination question papers set by the University of 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. For Practical Papers: Papers shall be set by the University of Pune and assessment done by the internal examiner and external examiner appointed by University of Pune.

### 5G) Verification and Revaluation Rules:

As per university Statues and rules for verification and revaluation of marks in stipulated time after declaration of the semester examination result.

### 6) Course Structure:

**Duration:** The duration of B.Sc. Computer Science Degree Program shall be three years.

**a) All are Compulsory Papers:**

F.Y.B.Sc. : 2 Theory + 2 Practical (Annual)

S .Y.B.Sc.: 2 Theory per semester + 2 Practical (Annual)

T.Y.B.Sc.: 6 Theory per semester + 3 Practical (Annual)

**b) Question Papers :**

**F.Y.B.Sc.Theory paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

**S.Y / T.Y. - B.Sc.Theory paper:**

University Examination – 40 marks (at the end of each term)

Internal Examination – 10 marks

**F.Y. / S.Y / T.Y. - B.Sc.Practical Paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

**c) Medium of Instruction:** The medium of instruction for the course shall be English.

### 7) Equivalence of Previous Syllabus:

Semester & Paper	Title of Paper (Old Pattern)(Implemented from theacademic year 2009-10)	Title of Paper (New Pattern)(to be implemented from the academic year 2014-15)
Semester-I, Paper-I	CS-211, Data Structures Using C	CS-211 Data Structures using 'C'
Semester-I, Paper-II	CS- 212, Relational Database Management System	CS-212 Relational Database Management System
Semester-II, Paper-I	CS-221, Object Oriented Concepts and Programming in C++	CS-221 Object Oriented Conceptsusing C++
Semester-II, Paper-II	CS-222, Software Engineering	CS-222Software Engineering
Practical paper II (CS 223) (First & Second	CS-224: Database Assignments and Mini Project using Software Engineering	CS-224: Database Practicals & Mini Project using Software



Semester)	Techniques	Engineering techniques
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**8) University Terms:** Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

**9) Qualification of Teachers:** M.Sc. Computer Science/M.C.A. or equivalent master degree in science with class/grades and NET/SET as per prevailing University/Government /UGC rules.

**10) Detail Syllabus with Recommended Books:**

**S.Y.B.Sc. Computer Science Paper I**

CS-211: Data Structures using 'C'  
 CS-221: Object Oriented Concepts using C++

**S.Y.B.Sc. Computer Science Paper II**

CS-212: Relational Database Management System  
 CS-222: Software Engineering

**S.Y.B.Sc. Computer Science Paper III**

CS-223: Data structures Practicals and C++ Practicals

**S.Y.B.Sc. Computer Science Paper IV**

CS-224: Database Practicals & Mini Project using Software Engineering techniques

**S.Y.B.Sc. Computer Science Theory Paper I**  
**Semester – 1**  
**CS 211- DATA STRUCTURES USING ‘C’**  
**(Compulsory Course)**

**Total Lectures: 48**

**Objective:**

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

**Prerequisites:** Knowledge of C Programming Language

**1. Introduction to data structures [3]**

- 1.1 Concept
- 1.2 Data type, Data object, ADT
  - 1.2.1 Data Type
- 1.2.2 Data Object
  - 1.2.3 ADT -Definition, Operation, examples on rational number
- 1.3 Need of Data Structure
- 1.4 Types of Data Structure

**2. Algorithm analysis [2]**

- 2.1 Algorithm – definition, characteristics
- 2.2 Space complexity, time complexity
- 2.3 Asymptotic notation (Big O, Omega  $\Omega$ )

**3. Linear data structures [6]**

- 3.1 Introduction to Arrays - array representation
- 3.2 Sorting algorithms with efficiency
  - Bubble sort, Insertion sort, Merge sort, Quick Sort
- 3.3 Searching techniques –Linear Search, Binary search

**4. Linked List [8]**

- 4.1 Introduction to Linked List
- 4.2 Implementation of Linked List – Static & Dynamic representation,
- 4.3 Types of Linked List
- 4.4 Operations on Linked List
  - create, display, insert, delete, reverse, search, sort, concatenate &merge
- 4.5 Applications of Linked List – polynomial manipulation
- 4.6 Generalized linked list – Concept and Representation

## 5. Stacks [6]

- 5.1 Introduction
- 5.2 Representation- Static & Dynamic
- 5.3 Operations
- 5.4 Application - infix to postfix, infix to prefix, postfix evaluation,
- 5.5 Simulating recursion using stack

## 6. Queues [4]

- 6.1 Introduction
- 6.2 Representation - Static & Dynamic
- 6.3 Operations
- 6.4 Circular queue, priority queue (with implementation)
- 6.5 Concept of doubly ended queue

## 7. Trees [12]

- 7.1 Concept & Terminologies
- 7.2 Binary tree, binary search tree
- 7.3 Representation – Static and Dynamic
- 7.4 Operations on BST – create, Insert, delete, traversals (preorder, inorder, postorder), counting leaf, non-leaf & total nodes , non recursive inorder traversal
- 7.5 Application - Heap sort
- 7.6 Height balanced tree- AVL trees- Rotations, AVL tree examples.

## 8. Graph [7]

- 8.1 Concept & terminologies
- 8.2 Graph Representation – Adjacency matrix, adjacency list, inverse Adjacency list, adjacency multilist, orthogonal list
- 8.3 Traversals – BFS and DFS
- 8.4 Applications – AOV network – topological sort, AOE network – critical path

## References:

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.Sc. Computer Science Theory paper-II**  
**Semester – I**

**CS-212-Relational Database Management System**  
**(Compulsory Course)**

**Total Lectures: 48**

**Objective:-**

- To teach fundamental concepts of RDBMS (PL/PgSQL)
- To teach principles of databases
- To teach database management operations
- To teach data security and its importance
- To teach client server architecture

**Prerequisites:** Knowledge of DBMS

**1. Relational Database Design [14]**

1.1 Preliminaries

Functional Dependencies

Basic concepts : Closure of a set of functional dependencies, Closure of attribute set, Canonical cover, Decomposition.

1.2 PL/PgSQL: Datatypes, Language structure

1.3 Controlling the program flow, conditional statements, loops

1.4 Views

1.5 Stored Functions, Stored Procedures

1.6 Handling errors and exceptions

1.7 Cursors

1.8 Triggers

**2 Transaction Concepts and concurrency control [14]**

2.1 Describe a transaction, properties of transaction, state of the transaction.

2.2 Executing transactions concurrently associated problem in concurrent execution.

2.3 Schedules, types of schedules, concept of Serializability, precedencegraph for Serializability.

2.4 Ensuring Serializability by locks, different lock modes, 2PL and its variations.

2.5 Basic timestamp method for concurrency, Thomas Write Rule.

2.6 Locks with multiple granularity, dynamic database concurrency (Phantom Problem).

2.7 Timestamps versus locking.

2.8 Deadlock handling methods

2.8.1 Detection and Recovery (Wait for graph).

2.8.2 Prevention algorithms (Wound-wait, Wait-die)

### **3 Database Integrity and Security Concepts [8]**

3.1 Domain constraints

3.2 Referential Integrity

3.3 Introduction to database security concepts

3.4 Methods for database security

3.4.1 Discretionary access control method

3.4.2 Mandatory access control and role base access control for multilevel security.

3.5 Use of views in security enforcement.

3.6 Overview of encryption technique for security.

3.7 Statistical database security.

### **4 Crash Recovery [8]**

4.1 Failure classification

4.2 Recovery concepts

4.3 Log base recovery techniques (Deferred and Immediate update)

4.4 Checkpoints

4.5 Recovery with concurrent transactions (Rollback, checkpoints, commit)

4.6 Database backup and recovery from catastrophic failure.

### **5. Client-Server Technology [4]**

5.1 Describe client-server computing.

5.2 Evolution of Client - Server information systems.

5.3 Client – Server Architecture benefits.

5.4 Client Server Architecture

- Components, Principles, Client Components
- Communication middleware components
- Database middleware components
- Client Server Databases

**References:-**

1. Fundamentals of Database Systems (4th Ed) By: Elmasri and Navathe
2. Database System Concepts (4th Ed) By: Korth, Sudarshan, Silberschatz
3. Practical PostgreSQL O'REILLY
4. Beginning Databases with PostgreSQL, From Novice to Professional, 2nd Edition By Richard Stones , Neil Matthew, Apress

## CS-223 : Data structures Practicals and C++ Practicals

(semester 1)

### Objective:-

1. Design and implement Data structures and related algorithms
2. Understand several ways of solving the same problem.

### S.Y.B.Sc.(Computer Science) : Paper III : Data Structures using C Assignments

No	Topic	Lectures
1	Sorting Algorithms – Bubble sort, Insertion	4
2	Recursive Sorting Algorithms – Quick sort , Merge Sort	4
3	Searching Method-Linear search, Binary search	4
4	Static/Dynamic stack implementation, infix to postfix, infix to prefix and evaluation of Postfix.	8
5	Static and Dynamic Queue Implementation – Linear Queue, Circular queue	8
6	Dynamic implementation of Singly Linked List, Doubly Linked List and Circular Linked List.	8
7	Polynomial addition (Using Linked list).	4
8	Binary Search Tree Traversal: Create, add, delete, and display nodes.	8
9	Adjacency matrix to adjacency list conversion, in degree, out degree	4
10	Graph: DFS, BFS.	4

**CS-224:Database Practicals & Mini Project using Software  
Engineering techniques  
(Semester 1)**

**Title:** Database Assignments and Mini Project using Software Engineering techniques

**Objective:-**

- Understanding the use of cursors, triggers, views and stored procedures
- Understanding the steps of system analysis and design
- Understanding Data requirements for a specific problem domain
- Designing Data base as per the Data requirements
- Designing queries as per the functional requirements

No	Topic	Lectures
1	Simple Queries	4
2	Nested Queries, using aggregate functions	4
3	Queries using Views	8
4	Queries using loops and conditional statements	8
5	Stored Function	12
6	Exception Handling	4
7	Cursors and Triggers	12



**S.Y.B.Sc. Computer Science Theory Paper I**  
**Semester II**  
**CS 221 -Object Oriented Concepts using C++**

**Total Lectures: 48**

**Objective:-**

1. Acquire an understanding of basic object oriented concepts and the issues involved in effective class design
2. Write C++ programs that use object oriented concepts such as information hiding, constructors, destructors, inheritance etc.

**Prerequisites:** Knowledge of C Programming Language

**1. Object oriented concepts [2]**

- 1.1 Object oriented concepts
- 1.2 Features, advantages and Applications of OOPS

**2. Introduction to C++ [6]**

- 2.1 Data types, new operators and keywords, using namespace concept
- 2.2 Simple C++ Program
- 2.3 Introduction to Reference variables
- 2.4 Usage of 'this' pointer
- 2.5 Classes and Objects
- 2.6 Access specifiers
- 2.7 Defining Data members and Member functions
- 2.8 Array of objects

**3. Function in C++ [8]**

- 3.1 Call by reference, Return by reference
- 3.2 Function overloading and default arguments
- 3.3 Inline function
- 3.4 Static class members
- 3.5 Friend Concept – Function, Class

**4. Constructors and destructor [4]**

- 4.1 Types of constructors
- 4.2 Memory allocation (new and delete)
- 4.3 Destructor

## **5. Operator overloading [4]**

- 5.1 Overloading Unary and Binary operators
- 5.2 Overloading using friend function
- 5.3 Type casting and Type conversion

## **6. Inheritance [8]**

- 6.1 Types of inheritance with examples
- 6.2 Constructors and destructor in derived classes
- 6.3 Virtual base classes, Virtual functions and Pure virtual function
- 6.4 Abstract base classes

## **7. Managing Input and Output using C++ [4]**

- 7.1 Managing console I/O
- 7.2 C++ stream classes
- 7.3 Formatted and unformatted console I/O
- 7.4 Usage of manipulators

## **8. Working with files [6]**

- 8.1 File operations – Text files, Binary files
- 8.2 File stream class and methods
- 8.3 File updation with random access
- 8.4 Overloading insertion and extraction operator

## **9. Templates [4]**

- 9.1 Introduction to templates
- 9.2 Class templates, function templates and overloading of function templates
- 9.3 Templates with multiple parameters

## **10. Exception Handling in C++ [2]**

- 10.1 try, catch and throw primitives

### **Reference Books: -**

- 1. Object Oriented Programming with C++ by Robert Lafore
- 2. Object Oriented Programming with C++ by E. Balagurusamy
- 3. Object Oriented Modeling and Design by James Rumbough
- 4. The Complete Reference C++ by Herbert Schildt
- 5. Let us C++ by – YashwantKanitkar
- 6. Mastering C++ by Venugopal, T Ravishankar, RajkumarTHM Pub.
- 7. Trouble free C++ by HarimohanPande, ANE publication

**S.Y.B.Sc.Computer Science Theory paper-II**

**Semester – II**

**CS - 222: Software Engineering**

**Total Lectures : 48**

**Objectives:-**

- To teach basics of System Analysis and Design.
- To teach principles of Software Engineering
- To teach various process models used in practice
- To know about the system engineering and requirement engineering
- To build analysis model

**Prerequisites:** Basic knowledge of DBMS

**1. System Concepts [5] ( R1 : Chapter 1 & R3 : Chapter 1 )**

1.1 System Definition

1.2 Characteristics of a System : Organization, Subsystem, Interaction, Interdependence, Integration, Central objective, Standards, Black-box

1.3 Elements of a system : Outputs, Inputs, Processor(s), Control, Feedback, Environment, Boundaries, Interface.

1.4 Types of Systems : Physical & Abstract Systems, Open & Closed Systems, Computer-based Systems (MIS : Management Information System & DSS : Decision Support System)

**2. Software and Software Engineering [5] ( R2 : Chapter 1 )**

2.1 The Nature of Software

2.1.1 Defining Software

2.1.2 Software Application Domains

2.1.3 Legacy Software

2.2 Software Engineering

2.3 The Software Process

- 2.4 Software Engineering Practice**
  - 2.4.1 The Essence of Practice**
  - 2.4.2 General Principles**
- 2.5 Software Myths**
- 3. System Development Life Cycle (SDLC) [8] ( R3 : Chapter 1 )**
  - 3.1 Introduction**
  - 3.2 Activities of SDLC**
    - 3.2.1 Preliminary Investigation (Request Clarification, Feasibility Study, Request Approval)**
    - 3.2.2 Determination of System Requirements**
    - 3.2.3 Design of System**
    - 3.2.4 Development of Software**
    - 3.2.5 System Testing ( Unit Testing, Integration testing, System Testing)**
    - 3.2.6 System Implementation & Evaluation**
    - 3.2.7 System Maintenance**
- 4. Process Models [6] ( R2 : Chapter 2 )**
  - 4.1 A Generic Process Model**
  - 4.2 Prescriptive Process Models**
    - 4.2.1 The Waterfall Model**
    - 4.2.2 Incremental Process Models**
    - 4.2.3 Evolutionary Process Models**
      - 4.2.3.1 Prototyping**
      - 4.2.3.2 Spiral Model**
    - 4.2.4 Concurrent Models**
- 5. Requirements Engineering [8] ( R2 : Chapter 5 )**
  - 5.1 Introduction**
  - 5.2 Requirements Engineering Tasks**

- 5.2.1 Inception
- 5.2.2 Elicitation
- 5.2.3 Elaboration
- 5.2.4 Negotiation
- 5.2.5 Specification
- 5.2.6 Validation
- 5.2.7 Requirements Management
- 5.3 Initiating the Requirements Engineering Process
  - 5.3.1 Identifying the Stakeholders
  - 5.3.2 Recognizing Multiple Viewpoints
  - 5.3.3 Working toward Collaboration
- 5.4 Fact Finding Techniques ( **R3 : Chapter 3** )
  - 5.4.1 Interview
  - 5.4.2 Questionnaire
  - 5.4.3 Record Review
  - 5.4.4 Observation
- 6. Structured Analysis Development Strategy [10] ( R3 : Chapter 4 )**
  - 6.1 Structured Analysis
    - 6.1.1 What is Structured Analysis?
    - 6.1.2 Components of Structured Analysis
    - 6.1.3 What is Data Flow Analysis?
  - 6.2 Features & Tools of Data Flow Analysis
    - 6.2.1 Logical Data Flow Diagram ( Logical DFD )
      - 6.2.1.1 Notations
      - 6.2.1.2 Drawing a Context Diagram
      - 6.2.1.3 Exploding A Context diagram into Greater detail (1<sup>st</sup> level, 2<sup>nd</sup> Level DFD etc...)

#### **6.2.1.4 Evaluating Data Flow Diagram for Correctness**

### **6.2.2 A Data Dictionary**

#### **6.2.2.1 What is a Data Dictionary?**

#### **6.2.2.2 Why is a Data Dictionary Important?**

#### **6.2.2.3 What does a Data Dictionary Record?**

## **7. An Agile View of Process [6] ( R2 : Chapter 3)**

### **7.1 What is an Agility?**

### **7.2 What is an Agile Process?**

#### **7.2.1 The Politics of Agile Development**

#### **7.2.2 Human Factors**

### **7.3 Agile Process Models**

#### **7.3.1 Extreme Programming (XP)**

#### **7.3.2 Adaptive Software Development (ASD)**

#### **7.3.3 Dynamic Systems Development Method (DSDM)**

## **Reference Books :**

R1 : System Analysis and Design (Second Edition) by Elias M. Awad, Galgotia Publications Pvt. Ltd.

R2 : Software Engineering : A Practitioner's Approach (Seventh Edition) by Roger S. Pressman, McGraw Hill International Edition.

R3 : Analysis and Design of Information Systems (Second Edition) by James A. Senn, McGraw Hill International Editions.

## CS-223 : Data structures Practicals and C++ Practicals

(semester 2)

### C++ Lab Assignments

1	Class , Object and methods implementation	4
2	Constructor: Copy Constructor, Default Constructor, Parameterized Constructor	4
3	Memory Allocation: new and delete operators , dynamic constructor	4
4	Inline function, friend function, default argument,	4
5	Function Overloading.	4
6	Operator overloading.	8
7	Inheritance: Single, multiple, multilevel, hierarchy, Constructor and destructor in derived class	12
8	File Handling: Updation of files using random access	4

**CS-224: Database Practicals & Mini Project using Software  
Engineering techniques  
(Semester 2)**

No	Topic	Lectures
1	Problem definition , scope	8
2	Feasibility study	4
3	Gathering Data Requirements and Functional Requirement	12
4	ERD	4
5	Designing the normalized Database	8
6	Designing queries related to Functional requirements	12



**University of Pune**  
**S.Y.B.Sc.(Computer Science) Practical Examination**  
**Lab Course I**  
**(Data Structures Using C & Object Oriented Programming Concepts Using C++)**

**Duration: 3 hours**

**Max. Marks: 80**

**Q 1. Data Structures using C**

1. Simple program based on searching / sorting / ADT of Stack, Queue, operations on linked list [15]
2. Program based on applications of stack/queue/linked list, trees / graph [25]

OR

3. Program based on case study involving multiple data structures [40]

**Q 2. Object Oriented Concepts and Programming in C++**

1. Program based on different concepts in C++ [30]

OR

2. Program based on different concepts in C++ [30]
3. Viva [10]

**Savitribai Phule Pune University**

**Three Year Degree Course in  
B. Sc. Computer Science**

## 1) Title of the Course : B. Sc. Computer Science

### T. Y. B. Sc. Computer Science Syllabus in the Subject Computer Science (To be implemented from Academic Year 2015-16)

#### 2) Preamble:

B. Sc. Computer Science is a systematically designed three year course that prepares the student for a career in Software Industry. The syllabus of Computer Science subject along with that of the three allied subjects (Mathematics, Electronics and Statistics) forms the required basics for pursuing higher studies in Computer Science. The Syllabus also develops requisite professional skills and problem solving abilities for pursuing a career in Software Industry.

#### 3) Introduction:

At **first year of under-graduation** basic foundation of two important skills required for software development is laid. A course in programming and a course in database fundamentals forms the preliminary skill set for solving computational problems. Simultaneously two practical courses are designed to supplement the theoretical training. The second practical course also includes a preliminary preparation for website designing in the form of HTML programming.

Along with Computer Science two theories and one practical course each in Statistics, Mathematics and Electronics help in building a strong foundation.

At **second year under-graduation**: The programming skills are further strengthened by a course in Data structures and Object oriented programming. The advanced topics in Databases and preliminary software engineering form the second course. Two practical courses alongside help in hands-on training. Students also undertake a mini project using software engineering principles to solve a real world problem. Simultaneously two theories and one practical course each in Mathematics and Electronics help in strengthening problem solving abilities.

At **third year under-graduation**: Six theory papers in each semester and practical courses cover the entire spectrum of topics necessary to build knowledge base and requisite skill set. Third practical course also includes project work which gives students hands on experience in solving a real world problem.

#### 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 imbibe quality software development practices.
- To create awareness about process and product standards
- 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

#### 4) Eligibility:

Higher Secondary School Certificate (10+2) Science with Mathematics or its equivalent Examination as per Savitribai Phule Pune University eligibility norms.

**Note:** Admissions will be given as per the selection procedure / policies adopted by the respective college, in accordance with conditions laid down by Savitribai Phule Pune University. Reservation and relaxation will be as per the Government rules.

**5 A) Examination Pattern:****First Year B. Sc. Computer Science****Subject : Computer Science**

Pattern of Examination: Annual for both Theory and Practical Courses

Paper/ Course No.	Title	Total Number of lectures/practicals per Term	Standard of passing		
			Internal marks out of 20	External marks out of 80	Total marks out of 100
Computer Science Paper I (CS-101)	Problem Solving Using Computers and 'C' Programmin g	Three lectures/Week (Total 80 lectures )	08	32	40 *
Computer Science Paper II CS-102)	File Organizatio n and Fundament al of Databases	Three lectures/Week (Total 80 lectures )	08	32	40 *
Computer Science Practical Paper I (CS-103)	Computer Science Practical Paper I	25 Practical slots of 4 lectures each	08	32	40 *
Computer Science Practical Paper II (CS-104)	Computer Science Practical Paper II	25 Practical slots of 4 lectures each	08	32	40 *

\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory (100 + 100 ) = 200 marks
2. Total marks per year 200 (Theory) + 100 marks (practical)+ Grade(practical) = 300 marks +Grade
3. Internal marks for theory papers given on the basis of internal assessment tests and for practicals on continuous assessment of lab work.
4. In case of Computer Science Practical Paper II, marks out of 100 will be converted to grades

Marks	Grade
75 And Above	O
65 And Above	A
55 and above	B
50 And above	C

45 And Above	D
40 And Above	E
Below 40 ( indicates Failure)	F

**Theory examination** will be of three hours duration for each theory course. There shall be 5 questions each carrying equal marks. The pattern of question papers shall be:

Question 1	8 sub-questions, each of 2 marks; answerable in 2 -3 lines and based on entire syllabus
Question 2, 3 ,4 and 5	4 out of 5/6– short answer type questions; answerable in 8 – 10 lines mix of theory and problems

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each term. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain). There shall be 20 questions. Practical: Continuous assessment of Lab work and mini project.

**Practical Examination:** Practical examination shall be conducted by the respective college at the end of the academic year. Practical examination will be of 3 hours duration for each practical course. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination.

**Second Year B. Sc. (Computer Science)**  
**Subject : Computer Science**

No	Paper	Title: Semester I	Title: Semester II
1	Computer Science Paper I	CS-211:Data Structures using 'C'	CS-221:Object Oriented Concepts using C++
2	Computer Science Paper II	CS-212: Relational Database Management System	CS-222:Software Engineering
3	Computer Science Paper III	CS-223:Data structures Practicals and C++ Practicals	
4	Computer Science Paper IV	CS-224:Database Practicals & Mini Project using Software Engineering techniques	

**Pattern of examination: Semester**

Theory courses (Sem I: CS-211 and CS212): Semester  
(Sem II: CS-221 and CS-222): Semester  
Practical Course (CS-223 and CS-224): Annual

Paper/Course No.	Title	Total Number of Lectures/Practicals Per Week	Standard Of Passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100

					(practicals)
Theory Paper I (CS-211)	Data Structures using 'C'	Four Lectures/per Week (Total 48 per Semester)	04	16	20*
Theory Paper II (CS-212)	Relational Database Management System	Four Lectures/per Week (Total 48 per Semester)	04	16	20*
Theory Paper I (CS-221)	Object Oriented Concepts using C++	Four Lectures/per Week (Total 48 per Semester)	04	16	20*
Theory Paper II (CS-222)	Software Engineering	Four Lectures/per Week (Total 48 per Semester)	04	16	20*
Practical paper I (CS 223) (First & Second Semester)	Data structures Practicals and C++ Practicals	Practicals of 4 lectures each 25 practicals / year)	08	32	40*
Practical paper II (CS 224) (First & Second Semester)	Database Practicals & Mini Project using Software Engineering techniques	Practicals of 4 lectures each 25 practicals / year)	08	32	40**

\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester (50 + 50 ) = 100 marks

2. Total marks per year 200 (Theory) + 100 marks (practicals)+Grade(practical) = 300 marks+Grade

3. Internal marks for theory papers given on the basis of Continuous internal Assessment

**Theory examination** will be of two hours duration for each theory course. There

shall be 4 questions carrying equal marks. The pattern of question papers shall be:

Question 1	10 sub-questions, each of 1 mark; answerable in 2 -3 lines and based on entire syllabus	10 Marks
Question 2, 3	Sub-questions carrying 5 marks (2 out of 3)	10 Marks
Question 4	Sub-questions carrying marks depending on their complexity with options	10 Marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain) There shall be 20 questions.

Practicals: Continuous assessment of practical performance

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of 3 hours duration. Continuous assessment of practical performance should be using a Lab Book specifically designed for the purpose. Certified Lab book is compulsory to appear for practical examination. There is no need of attaching program printouts to the Lab Book. There shall be two experts and two examiners per batch for the practical examination. One of the examiners will be external.

### Third Year B. Sc. (Computer Science)

No	Paper	Title: Semester I	Title: Semester II
1	Computer Science Paper I	CS-331: System Programming	CS-341: Operating System
2	Computer Science Paper II	CS-332: Theoretical Computer Science	CS-342: Compiler Construction
3	Computer Science Paper III	CS-333: Computer Networks-I	CS-343: Computer Networks-II
4	Computer Science Paper IV	CS-334: Internet Programming- I	CS-344: Internet Programming- II
5	Computer Science Paper V	CS-335: Programming in Java-I	CS-345: Programming in Java-II
6	Computer Science Paper VI	CS-336: Object Oriented Software Engineering	CS-346: Computer Graphics
7	Computer Science Paper VII	CS-347: Practicals Based on CS-331 and CS341 – Sem I & Sem II	
8	Computer Science Paper VIII	CS-348: Practicals Based on CS-335 and CS-344 – Sem I & Sem II and Computer Graphics using Java	
9	Computer Science Paper IX	CS-349: Practicals Based on CS-334 and CS-344 – Sem I & Sem II and Project	

Pattern of examination: Semester

Theory courses:

(Sem III: CS-331-CS-336): Semester (Sem IV: CS-341-CS-346): Semester

Practical Course:

(CS-347-CS-349): Annual

Theory Papers					
Paper/Course No.	Title	Total Number of Lectures/Practicals Per Week	Standard Of Passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
<b>SEM III</b>					
Theory Paper I (CS-331)	System Programming	48	04	16	20*
Theory Paper II (CS-332)	Theoretical Computer Science	48	04	16	20*
Theory Paper III (CS-333)	Computer Networks-I	48	04	16	20*
Theory Paper IV (CS-334)	Internet Programming I	48	04	16	20*
Theory Paper V (CS-335)	Programming in Java-I	48	04	16	20*
Theory Paper V (CS-336)	Object Oriented Software Engineering	48	04	16	20*
<b>SEM IV</b>					
Theory Paper I (CS-341)	Operating System	48	04	16	20*
Theory Paper II (CS-342)	Compiler Construction	48	04	16	20*
Theory Paper III (CS-343)	Computer Networks-II	48	04	16	20*
Theory Paper IV (CS-344)	Internet Programming II	48	04	16	20*
Theory Paper V	Programmin				



(CS-345)	g in Java-II	48	04	16	20*
Theory Paper V (CS-346)	Computer Graphics	48	04	16	20*
<b>Practical Papers</b>					
Practical paper I CS 347 (Semester III & IV)	Practicals Based on CS-331 and CS-341 – Sem I & Sem II	Practicals of 4 lectures each 25 practicals / year)	08	32	40**
Practical paper II CS 348 (Semester III & IV)	CS-348:Practicals Based on CS-335 and CS-345 – Sem I & Sem II and Computer Graphics using OpenGL	Practicals of 4 lectures each 25 practicals / year)	08	32	40**
Practical paper I CS 349 (Semester III & IV)	CS-349:Practicals Based on CS-334 and CS-344 – Sem I & Sem II and Project	Practicals of 4 lectures each 25 practicals / year)	08	32	40**

\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester (50 x 6 ) = 300 marks
2. Total marks per year 600 (Theory) + 300 marks (practicals) = 900 marks
3. Internal marks for theory papers given on the basis of continuous internal assessment

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

**Theory examination** will be of two hours duration for each theory course. There

shall be 4 questions carrying equal marks. The pattern of question papers shall be:

Question 1	10 sub-questions, each of 1 mark; answerable in 2 -3 lines and based on entire syllabus	10 Marks
Question 2, 3	Sub-questions carrying 5 marks (2 out of 3)	10 Marks
Question 4	Sub-questions carrying marks depending on their complexity with options	10 Marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain) There shall be 20 questions.

Practicals: Continuous assessment of practical performance

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of 3 hours duration. Continuous assessment of practical performance should be using a Lab Book specifically designed for the purpose. Certified Lab book is compulsory to appear for practical examination. There shall be one expert and two examiners per batch for the practical examination. One of the examiners will be external.

**5 B) Standard of Passing:**

i. In order to pass in the first year theory 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 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.

**5 C) ATKT Rules:**

While going from F.Y.B.Sc. to S.Y.B.Sc. at least 8 courses (out of total 13) should be passed; however all F.Y.B.Sc. courses should be passed 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 22) should be passed (Practical Course at S.Y.B.Sc. will be equivalent to 2 courses).

**5 D) 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

**5 E) External Students:** There shall be no external students.

**5 F) Setting question papers:**

**F.Y.B.Sc.:** For theory papers I and II annual question papers shall be set by the University of Pune and assessment done at the respective colleges. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Papers, the Question paper slips will be provided by the University of Pune and assessment done at the respective colleges.

**S.Y.B.Sc. and T.Y.B.Sc.:** For theory papers I and II for each semester and also for the annual practical examination question papers set by the University of 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. For Practical Papers: Papers shall be set by the University of Pune and assessment done by the internal examiner and external examiner appointed by University of Pune.

**5G) Verification and Revaluation Rules:**

As per university Statues and rules for verification and revaluation of marks in stipulated time after declaration of the semester examination result.

**6) Course Structure:**

**Duration:** The duration of B.Sc. Computer Science Degree Program shall be three years.

**a) All are Compulsory Papers:**

F.Y.B.Sc. : 2 Theory + 2 Practical (Annual)

S .Y.B.Sc.: 2 Theory per semester + 2 Practical (Annual)

T.Y.B.Sc.: 6 Theory per semester + 3 Practical (Annual)

**b) Question Papers :**

**F.Y.B.Sc. Theory paper:**

University Examination – 80 marks (at the end of 2nd term)

Internal Examination – 20 marks

**S.Y / T.Y. - B.Sc.Theory paper:**

University Examination – 40 marks (at the end of each term)

Internal Examination – 10 marks

**F.Y. / S.Y / T.Y. - B.Sc. Practical Paper:**

University Examination – 80 marks (at the end of 2nd term)

Internal Examination – 20 marks

**c) Medium of Instruction:** The medium of instruction for the course shall be **English.**

**7) Equivalence of Previous Syllabus:**

<b>Old Course (2008 Pattern)</b>	<b>New Course (2013 Pattern)</b>
CS 331: System Programming & Operating System I	CS 331 : System Programming
CS 341: System Programming & Operating System II	CS 341 : Operating System
CS 332 : Theoretical Computer Science & Compiler Construction I	CS 332 : Theoretical Computer Science
CS 342 : Theoretical Computer Science & Compiler Construction II	CS 342 : Compiler Construction
CS 333 :Computer Networks I	CS 333 :Computer Networks I
CS 343 :Computer Networks II	CS 343 :Computer Networks II
CS 334 :Web development and PHP programming I	CS 334 :Internet Programming I
CS 344 : Web development and PHP programming II	CS 344 :Internet Programming II
CS 335 :Programming in Java I	CS 335 :Programming in Java I
CS 345 :Programming in Java II	CS 345 :Programming in Java II
CS 336 :Object Oriented Software Engineering	CS 336 :Object Oriented Software Engineering

CS 346 :Business Applications	CS 346 :Computer Graphics
CS 347: Lab Course I	CS 347: Lab Course I
CS 348:Lab Course II	CS 348:Lab Course II
CS 349: Lab Course III	CS 349: Lab Course III

**8) University Terms:** Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

**9) Qualification of Teachers:** M.Sc. Computer Science/M.C.A. or equivalent master degree in science with class/grades and NET/SET as per prevailing University/Government /UGC rules.

**10) Detail Syllabus with Recommended Books:**

**SAVITRIBAI PHULE PUNE UNIVERSITY**  
**T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS**  
**TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16**  
**TITLE OF PAPER : Systems Programming**  
**Code No. : CS-331**

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**Semester III**

**Total Lectures : 48**

**Aim :** To understand the design and implementation issues of System programs that play an important role in program development.

**Objectives :**

- To understand the design structure of a simple editor.
- To understand the design structure of Assembler and macro processor for an hypothetical simulated computer.
- To understand the working of linkers and loaders and other development utilities.
- To understand Complexity of Operating system as a software.

**1. Introduction**

**[4]**

- 1.1. Types of program – System program and Application program.
- 1.2. Difference between system programming and application programming.
- 1.3. Elements of Programming environment - Editor, Preprocessor, Assembler, Compiler, Interpreter, Linker and Loader, Debugger, Device drivers, Operating System.
- 1.4. Simulation of simple computer smac0 (hypothetical computer) -Memory, Registers, Condition Codes, Instruction format, Instruction Set, smac0 programs.

**2. Editors**

**[2]**

- 2.1 Definition, need/purpose of editor.
- 2.2 Types of editor- Examples ed, sed, VIM & emacs
- 2.3 Structure of editor

**3. Assembler**

**[10]**

- 3.1 Definition.
- 3.2 Features of assembly language, advantages
- 3.3 Statement format, types of statements – Imperative, Declarative, Assembler Directive.
- 3.4 Constants and Literals.
- 3.5 Advanced assembler directives (LTORG, ORIGIN, EQU),
- 3.6 Design of assembler – Analysis Phase and Synthesis Phase.
- 3.7 Overview of assembling process
- 3.8 Pass Structure of Assembler – One pass, Two pass assembler.
- 3.9 Problems of 1-pass assembler - forward reference, efficiency, Table of Incomplete Instructions.
- 3.10 Design of 2-pass Assembler – Pass-I and Pass-II
- 3.11 Data structure of 2-pass assembler.
- 3.12. Intermediate Code – Need, Forms-variant I and Variant II

**4. Macros and Macro Processors**

**[10]**

- 4.1 Definition
- 4.2 Macro definition and call
- 4.3 Macro expansion – positional and keyword parameters
- 4.4 Design of Data structures to be used for Macro definition and use
- 4.5 Nested macro calls
- 4.6 Advanced macro facilities – alteration of flow of control during expansion, expansion time variable, conditional expansion, expansion time loops. (with examples)
- 4.7 Design of macro preprocessor – Design overview, data structure, processing of macro definition and macro expansion (Except algorithms)

4.8 Macro assembler – Comparison of macro preprocessor and macro assembler. Pass structure of macro assembler.

## **5. Compiler Design options**

[2]

5.1 Interpreter - Use of interpreter, definition, Comparison with compiler, Overview of interpretation, Pure and impure interpreter.

5.2 P-code compiler

## **6. Linker and Loader**

[6]

6.1 Introduction

6.2 Concept of bindings, static and dynamic binding, translated, linked and load time addresses.

6.3 Relocation and linking concept – program relocation, performing relocation, public and external references, linking, binary program, object module.

6.4 Relocatability - nonrelocatable, relocatable, and self relocating programs (no algorithms), Linking for Overlays.

6.5 Object file formats: a.out, ELF, COFF, EXE, PE and COM

## **7. Debuggers & Development utilities**

[6]

7.1 Debugging functions and capabilities

7.2 Types of debuggers: visual & console -Case study of ddd(visual ) and gdb(console)

7.3 Development utilities on UNIX/Linux strip, make, nm, objdump, intermediate files in compilation process etc.

## **8. Operating System as System Software**

[6]

8.1 What Operating Systems Do – User View, System View, Defining OS

8.2 Computer System Architecture – Single processor system, Multiprocessor systems, Clustered Systems

8.3 Operating System Operations – Dual mode operation, Timer

8.4 Process Management

8.5 Memory Management

8.6 Storage Management – File system management, Mass storage management, Caching, I/O systems

8.7 Protection and Security

8.8 Distributed Systems

8.9 Special Purpose System – Real time embedded systems, Multimedia systems, Handheld systems,

8.10 Computer Environment – Traditional computing, Client server computing, Peer to peer Computing

## **9. System Structure**

[2]

9.1 Operating System Services

9.2 User Operating-System Interface – Command interpreter, GUI

9.3 System Calls

9.4 Types of System Calls – Process control, File management, Device management, Information maintenance, Communication, Protection

## **Reference Books:**

1. Systems Programming and Operating Systems by D.M.Dhamdhare (Second Revised Edition). [Chapters: 2, 3, 4, 5, 7]

2. System Software - An introduction to Systems Programming - Leland L. Beck (Pearson Education) [ Chapter: 1]

3. Linkers and Loaders – John R. Levine, Elsevier Morgan Kaufmann[chapter 6]

4. Operating System Concepts - Siberchatz, Galvin, Gagne (8th Edition).[chapter 8, 9]

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**T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS**  
**TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16**  
**TITLE OF PAPER : Operating Systems**  
**Code No. : CS-341**

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**Semester IV**

**Total Lectures : 48**

**Aim :** To understand the design and implementation issues of Operating System.

Objectives :

- To understand design issues related to process management and various related algorithms
- To understand design issues related to memory management and various related algorithms
- To understand design issues related to File management and various related algorithms

**1. Introduction** **[2]**

- 1.1 Operating System Structure – Simple structure, Layered approach, Micro kernels, Modules
- 1.2 Virtual Machines – Introduction, Benefits
- 1.3 System Boot

**2. Process Management** **[4]**

- 2.1 Process Concept – The process, Process states, Process control block.
- 2.2 Process Scheduling – Scheduling queues, Schedulers, context switch
- 2.3 Operations on Process – Process creation with program using fork(), Process termination
- 2.4 Interprocess Communication – Shared memory system, Message passing systems.

**3. Multithreaded Programming** **[2]**

- 3.1 Overview
- 3.2 Multithreading Models

**4. Process Scheduling** **[8]**

- 4.1 Basic Concept – CPU-I/O burst cycle, CPU scheduler, Preemptive scheduling, Dispatcher
- 4.2 Scheduling Criteria
- 4.3 Scheduling Algorithms – FCFS, SJF, Priority scheduling, Round-robin scheduling, Multiple queue scheduling, Multilevel feedback queue scheduling
- 4.4 Thread Scheduling

**5. Process Synchronization** **[6]**

- 5.1 Background
- 5.2 Critical Section Problem
- 5.3 Semaphores: Usage, Implementation
- 5.4 Classic Problems of Synchronization – The bounded buffer problem, The reader writer problem, The dining philosopher problem

**6. Deadlocks** **[8]**

- 6.1 System model
- 6.2 Deadlock Characterization – Necessary conditions, Resource allocation graph
- 6.3 Deadlock Prevention
- 6.4 Deadlock Avoidance - Safe state, Resource allocation graph algorithm, Banker's Algorithm
- 6.5 Deadlock Detection
- 6.6 Recovery from Deadlock – Process termination, Resource preemption

**7. Memory Management** **[11]**

- 7.1. Background – Basic hardware, Address binding, Logical versus physical address space, Dynamic loading, Dynamic linking and shared libraries

7.2 Swapping

7.3 Contiguous Memory Allocation – Memory mapping and protection, Memory allocation, Fragmentation

7.4 Paging – Basic Method, Hardware support, Protection, Shared Pages

7.5 Segmentation – Basic concept, Hardware

7.6 Virtual Memory Management – Background, Demand paging, Performance of demand paging, Page replacement – FIFO, OPT, LRU, Second chance page replacement

## **8. File System**

[7]

8.1 File concept

8.2 Access Methods – Sequential, Direct, Other access methods

8.3 Directory and Disk Structure – Storage structure, Directory overview, Single level directory, Two level directory, Tree structure directory, Acyclic graph directory, General graph directory

8.4 Allocation Methods – Contiguous allocation, Linked allocation, Indexed allocation

8.5 Free Space Management – Bit vector, Linked list, Grouping, Counting, Space maps

### **Reference Books:**

1. Operating System Concepts - Silberchatz, Galvin, Gagne (8th Edition).

2. Operating Systems : Principles and Design – Pabitra Pal Choudhary (PHI Learning Private Limited)

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**SAVITRIBAI PHULE PUNE UNIVERSITY**  
**T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS**  
**TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16**  
**TITLE OF PAPER : Theoretical Computer Science**  
**Code No. : CS-332**

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**Semester III**

**Total Lectures : 48**

**Aim:**

To have a introductory knowledge of automata, formal language theory and computability.

**Objectives:**

- To have an understanding of finite state and pushdown automata.
- To have a knowledge of regular languages and context free languages.
- To know the relation between regular language, context free language and corresponding recognizers.
- To study the Turing machine and classes of problems.

**Prerequisite:**

- Sets, Operations on sets, Finite & infinite sets Formal Language
- Relation, Equivalence Relation,(reflexive, transitive and symmetric closures)

**1. Introduction**

**[3]**

1.1 Symbol, Alphabet, String, Prefix & Suffix of Strings, Formal Language, Operations on Languages.

1.2 Regular Expressions (RE) : Definition & Example

1.3 Regular Expressions Identities.

**2. Finite Automata**

**[12]**

2.1 Deterministic finite Automaton – Definition, DFA as language recognizer, DFA as a pattern recognizer.

2.2 Nondeterministic finite automaton – Definition and Examples.

2.3 NFA TO DFA : Method (From Book 4)

2.4 NFA with  $\epsilon$ - transitions Definition and Examples.

2.5 NFA with  $\epsilon$ -Transitions to DFA & Examples

2.6 Finite automaton with output – Mealy and Moore machine, Definition and Examples.

2.7 Minimization of DFA, Algorithm & Problem using Table Method.

**3. Regular Languages**

**[5]**

3.1 Regular language-Definition and Examples.

3.2 Conversion of RE To FA-Examples.

3.3 Pumping lemma for regular languages and applications.

3.4 Closure properties of regular Languages

(Union, Concatenation, Complement, Intersection and Kleene closure)

**4. Context Free Grammar and Languages**

**[12]**

4.1 Grammar - Definition and Examples.

4.2 Derivation-Reduction - Definition and Examples.

4.3 Chomsky Hierarchy.

4.4 CFG : Definition & Examples. LMD, RMD, Parse Tree

4.5 Ambiguous Grammar : Concept & Examples.

4.6 Simplification of CFG :

4.6.1 Removing Useless Symbols,

4.6.2 Removing unit productions

4.6.3 Removing  $\epsilon$  productions & Nullable symbols

4.7 Normal Forms :

4.7.1 Chomsky Normal Form (CNF) Method & Problem

- 4.7.2 Greibach Normal form (GNF) Method & Problem
- 4.8 Regular Grammar : Definition.
  - 4.8.1 Left linear and Right Linear Grammar-Definition and Example.
  - 4.8.2 Equivalence of FA & Regular Grammar
    - 4.8.2.1 Construction of regular grammar equivalent to a given DFA
    - 4.8.2.2 Construction of a FA from the given right linear grammar
- 4.9 Closure Properties of CFL's(Union, concatenation and Kleen closure) Method and examples

## **5. Push Down Automaton**

[6]

- 5.1 Definition of PDA and examples
- 5.2 Construction of PDA using empty stack and final State method : Examples using stack method
- 5.3 Definition DPDA & NPDA, their correlation and Examples of NPDA
- 5.4 CFG (in GNF) to PDA : Method and examples

## **6. Turing Machine**

[10]

- 6.1 The Turing Machine Model and Definition of TM
- 6.2 Design of Turing Machines
- 6.3 Problems on language recognizers.
- 6.4 Language accepted by TM
- 6.5 Types of Turing Machines(Multitrack TM,Two way TM, Multitape TM,Non-deterministic TM)
- 6.6 Introduction to LBA (Basic Model) &CSG.( Without Problems)
- 6.7 Computing TM, Enumerating TM, Universal TM
- 6.8 Recursive Languages
  - 6.5.1. Recursive and Recursively enumerable Languages.
  - 6.5.2. Difference between recursive and recursively enumerable language.
- 6.9 Turing Machine Limitations
- 6.10 Decision Problem, Undecidable Problem, Halting Problem of TM

## **References :-**

- 1 Introduction to Automata theory, Languages and computation By John E. Hopcroft and Jeffrey Ullman – Narosa Publishing House.
2. Introduction to Automata theory, Languages and computation By John Hopcroft, Rajeev Motwani and Jeffrey Ullman –Third edition Pearson Education
3. Introduction to Computer Theory Daniel I. A. Cohen – 2<sup>nd</sup> edition – John Wiley & Sons
4. Theory of Computer Science (Automata, Language & Computation) K. L. P. Mishra & N. Chandrasekaran, PHI Second Edition
5. Introduction to Languages and The Theory of Computation John C. Martin TMH, Second Edition

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**T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS**  
**TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16**  
**TITLE OF PAPER : Compiler Construction**  
**Code No. : CS-342**

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**Semester IV**

**Total Lectures : 48**

**Aim :**

To understand the various phases of a compiler and to develop skills in designing a compiler

**Objective :**

- 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 issues related to memory allocation
- To understand and design code generation schemes

**1. Introduction**

**[5]**

- 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.

**2. Lexical Analysis(Scanner)**

**[5]**

- 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)

**3. Syntax Analysis(Parser)**

**[20]**

- 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
  - 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
  - 3.8.1 Model
  - 3.8.2 Types [SLR(1), Canonical LR, LALR] Method & examples.
- 3.9 YACC (from Book 3) –program sections, simple YACC program for expression evaluation

#### **4. Syntax Directed Definition [8]**

- 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

#### **5. Memory Allocation [2]**

- 5.1 Memory allocation – static and dynamic memory allocation,
- 5.2 Memory allocation in block structure languages, Array allocation and access.

#### **6. Code Generation and Optimization [8]**

- 6.1 Compilation of expression –
  - 6.1.1 Concepts of operand descriptors and register descriptors with example.
  - 6.1.2 Intermediate code for expressions – postfix notations,
  - 6.1.3 triples and quadruples, expression trees.
- 6.2 Code Optimization – Optimizing transformations – compile time evaluation, elimination of common sub expressions, dead code elimination, frequency reduction, strength reduction
- 6.3 Three address code
  - 6.3.1 DAG for Three address code
  - 6.3.2 The Value-number method for constructing DAG's.
- 6.4 Definition of basic block, Basic blocks And flow graphs
- 6.5 Directed acyclic graph (DAG) representation of basic block
- 6.6 Issues in design of code generator

#### **References :-**

1. Compilers: Principles, Techniques, and Tools ,Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman
2. Principles of Compiler Design By : Alfred V. Aho, Jeffrey D. Ullman (Narosa Publication House)
3. LEX & YACC (O'reilly Publication)

**SAVITRIBAI PHULE PUNE UNIVERSITY**  
**T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS**  
**TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16**  
**TITLE OF PAPER : Computer Networks -I**  
**Code No. : CS-333**

**Semester III**

**Total Lectures : 48**

Pre-requisites: Basics of computer, Knowledge of ‘C’ for assignment.

Objectives: This course will prepare students in Basic networking concepts.

1. Understand different types of networks, various topologies and application of networks.
2. Understand types of addresses, data communication.
3. Understand the concept of networking models, protocols, functionality of each layer.
4. Learn basic networking hardware and tools.

Ch.No.	Name of Chapter	Reference Book
<b>1</b>	<b>Chapter 1 Introduction to Computer Networks</b>	<b>[Lectures 8]</b>
1.1	Computer Networks- Goals and applications – Business Application , Home Application, Mobile User, Social Issues	Book 1 CH1 (Pg. No.3 -14)
1.2	Network Hardware - Broadcast and point-to-point	Book 1 CH1 (Pg. No.14-16)
1.3	topologies – star, bus, mesh, ring etc.	Book 2 CH1 (Pg. No. 9-13)
1.4	Network Types-LAN, MAN, WAN, Wireless Networks, Home Networks, Internetwork	Book 1 CH1 (Pg. No.16-26)
1.5	Data Communication-Definition, components, data representation, Data Flow	Book 2 CH1 (Pg. No. 3-7)
1.6	Protocols & Standards De facto and De jure standard,	Book 2 CH1 (Pg. No. 19-20)
1.7	Network Software - Protocol Hierarchies -layers, protocols, peers, interfaces Network architecture, protocol stack, Design issues of the layers –addressing, error control, flow control, multiplexing and demultiplexing, routing Connection-oriented and connectionless service, Service Primitives – listen, connect, receive, send, disconnect and Berkley Socket ,the relationships of services to protocols.	Book 1 CH1 (Pg. No.26-37)
2.	Network Models	[Lectures 5]
2.1	OSI Reference Model - Functionality of each layer	Book 2 CH2 (Pg. No 29-42)

2.2	TCP/IP Reference Model, Comparison of OSI and TCP/IP model	Book 1 CH1 (Pg. No. 41-46)
2.3	TCP/IP Protocol Suite	Book 2 CH2 (Pg. No. 42-45)
2.4	Addressing - Physical, Logical and Port addresses (No examples)	Book 2 CH2 (Pg. No.45-50)
3.	Transmission Media	[Lectures 5]
3.1	Twisted pair cable – UTP Vs STP, categories connectors & applications , Coaxial cable – standards, connectors & applications Fiber Optic cable – propagation modes, connectors & applications(No diagrams will be asked in examination)	Book 2 CH7 (Pg. No.192,193, 195-202)
3.2	Unguided Media – Wireless- Radio Waves,- Microwaves, Infrared	Book 2 CH7 (Pg. No. 203-208)
3.3	Light wave transmission	Book 1 CH2 (Pg. No. 107-108)
3.4	Types of cabling and Networking Tool - CAT5 and CAT6 Cable Color Code, Crossover Cabling and Straight Through Cable, Crimping and Line testing tool	Book 3
4.	The Physical Layer	[Lectures 14]
4.1	Analog and Digital data, Analog and Digital signals, Periodic & Non-periodic signals Digital Signals- Bit rate, bit length, baseband Transmission (no cases)	Book 2 CH3 (Pg. No. 57-58) Book 2 CH3 (Pg. No. 71-75)
4.2	Transmission Impairments –attenuation, distortion and noise, Data Rate Limits – Noiseless channel: Nyquist’s bit rate,noisy channel : Shannon’s law (Enough problems should be covered on every topic.)	Book 2 CH3 (Pg. No. 80-88)
4.3	Performance of the Network Bandwidth, Throughput, Latency(Delay), Bandwidth –Delay Product, Jitter	Book 2 CH3 (Pg. No. 89-94)
4.4	Line Coding Characteristics, Line Coding Schemes – Unipolar - NRZ, Polar-NRZ-I, NRZ-L, RZ, Manchester and Differential Manchester (Enough problems should be covered on every topic.)	Book 2 CH4 (Pg. No. 101-109)
4.5	Transmission Modes, Parallel Transmission and Serial Transmission –Asynchronous and Synchronous and Isochronous	Book 2 CH4 (Pg. No. 131-135)
4.6	Trunks & Multiplexing FDM and TDM	Book 1 CH2 (Pg. No. 137,138 140-143)

4.7	Switching - Circuit Switching, Message Switching and Packet Switching, comparison of circuit & packet switching	Book 1 CH2 (Pg. No. 146-151)
4.8	Physical Layer Devices Repeaters, Hubs- active hub Passive hub	Book 2 CH15 (pg. No. 445-447)
5.	The Data Link Layer	[Lectures 9]
5.1	Design Issues – Services provided to the Network Layer , Framing – Concept, Methods - Character Count, Flag bytes with Byte Stuffing, Starting & ending Flags with Bit Stuffing and Physical Layer Coding Violations, Error Control, Flow Control	Book 1 CH3 (pg. No. 184-192)
5.2	Error detection code CRC (Enough problems should be covered on every topic.)	Book 1 CH3 (pg. No. 196-199)
5.3	Data Link Layer Protocols –Noiseless channel -A Simplex, Stop-And-Wait protocol, noisy channel –stop & wait, ARR, Pipelining, Go –back –N ARR & ARQ, selective repeat ARR(No examples & no algorithms)	Book 1 CH3 (pg. No. 312-338)
5.4	Sliding Window Protocols Piggybacking-Need, Advantages/Disadvantages, 1-bit sliding window protocols,	Book 1 CH3 (pg. No. 211-216)
5.5	Data Link Layer Protocols-HDLC – frame format, all frame types PPP – Use, Frame Format, Use of PPP in the Internet	Book 1 CH3 (pg. No. 234-242)
5.6	Data Link Layer Devices - Bridges – Filtering, Transparent Bridges, spanning tree and Source Routing Bridges, Bridges Connecting Different LANs	Book 2 CH15 (pg. No. 447-454)
5.7	Remote bridges	Book 1 CH4 (pg. No. 325-326)
6.	The Medium Access Sublayer	[Lectures 7]
6.1	Random Access Protocols ALOHA – pure and slotted	Book 2 CH12 (pg. No. 364-390)
6.2	CSMA – 1-persistent, p-persistent and non-persistent CSMA/CD,CSMA/CA	
6.3	Controlled Access Reservation, Polling and Token Passing	
6.4	Channelization FDMA, TDMA and CDMA-Analogy, Idea, Chips, Data Representation, Encoding and Decoding, Signal Level, Sequence Generation(Enough problems should be covered on every topic.)	

**Reference Books:**

- 1) Computer Networks by Andrew Tanenbaum, Pearson Education.[4<sup>th</sup> Edition]
- 2) Data Communication and Networking by Behrouz Forouzan, TATA McGraw Hill. .[4<sup>th</sup> Edition]
- 3) Networking All In One Dummies Wiley Publication.[5<sup>th</sup> Edition]

**Guidelines For Examination:**

- 1) Frame and Packet formats should be asked.

- 2) Problems should be asked at least for 8 marks.
- 3) Page no listed above may vary according to year of publication of 4<sup>th</sup> edition but topics remain same.
- 4) All sub topics listed pages of respective reference books should be covered.



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**TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16**  
**TITLE OF PAPER : Computer Networks -II**  
**Code No. : CS-343**

**Semester IV**

**Total Lectures: 48**

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Pre-requisites: Basics of computer networks covered last semester, Knowledge of 'C'.

Objectives: This course will prepare students in

1. Basic networking concepts.
2. Understand wired and wireless networks, its types, functionality of layer.
3. Understand importance of network security and cryptography.

<b>Ch. No.</b>	<b>Name of Chapter</b>	<b>Reference Book</b>
1.	Wired LANs	[Lectures 9]
1.1	IEEE Standards Data Link Layer, Physical Layer	Book 2 CH13 (Pg. No 395-397)
1.2	Standard Ethernet MAC Sublayer – Frame Format, Frame Length, Addressing, Access Method	Book 2 CH13 (Pg. No 397-402)
1.3	Physical Layer – Encoding and Decoding, 10Base5, 10Base2, 10Base-T, 10Base-F,	Book 2 CH13 (Pg. No 402-405)
1.4	Changes In The Standard – Bridged Ethernet, Switched Ethernet, Full Duplex Ethernet	Book 2 CH13 (Pg. No 406-409)
1.5	Fast Ethernet – Goals, MAC Sublayer, Topology, Implementation	Book 2 CH13 (Pg. No.409-410)
1.6	Gigabit Ethernet – goals, MAC Sublayer, Topology, Implementation	Book 2 CH13 (Pg. No 412-414)
1.7	Ten-Gigabit Ethernet – goals, MAC Sublayer, Physical Layer	Book 2 CH13 (Pg. No 416)
1.8	Backbone Networks Bus Backbone, Star Backbone, Connecting Remote LANs	Book 2 CH15 (Pg. No 456-458)
1.9	Virtual LANs Membership, Configuration, Communication between Switches, IEEE standards Advantages	Book 1 CH1 (Pg. No 458-463)
2.	Wireless LAN	[Lectures 2]
2.1	IEEE 802.11 Architecture – Basic Service Set, Extended Service Set, Station Types	Book 2 CH14 (Pg. No421-422)

2.2	Bluetooth Architecture – Piconet, scatternet	Book 2 CH14 (Pg. No 434-436)
3.	The Network Layer	[Lectures 10]
3.1	Design Issues Store-and-forward packet switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection Oriented Service, Comparison of Virtual Circuit and Datagram subnets	Book 1 CH5 (Pg. No 343-349)
3.2	Logical Addressing IPV4 Addresses – Address Space, Notations, Classful Addressing, Subnetting, Supernetting, Classless Addressing, Network Address Translation(NAT), (Enough problems should be covered on Addressing),	Book 2 CH19 (Pg. No 549-566)
3.3	IPV4 Protocol Datagram Format, Fragmentation, Checksum, Options	Book 2 CH20 (Pg. No 582-596)
3.4	Routing Properties of routing algorithm, Comparison of Adaptive and Non- Adaptive Routing Algorithms	Book 1 CH5 (Pg. No 350-352)
3.5	Congestion Control – Definition, Factors of Congestion, Difference between congestion control and flow control, General Principles of Congestion Control, Congestion Prevention Policies	Book 1 CH5 (Pg. No 384-389)
3.6	Network Layer Devices –Routers	Book 2 CH15 (Pg. No. 455)
4.	Address Mapping	[Lectures 4]
4.1	Protocol(ARP)-Cache Memory, Packet Format, Encapsulation, Operation, Four Different Cases, Proxy ARP, RARP , BOOTP, DHCP – Static Address Allocation, Dynamic Address Allocation, Manual and automatic Configuration	Book 2 CH21 (Pg. No 611-620)
5.	The Transport Layer	[Lectures 6]
5.1	Process-to-Process Delivery Client Server Paradigm, Multiplexing and De-multiplexing, Connectionless Vs Connection-Oriented Service, Reliable Vs Unreliable	Book 2 CH23 (Pg. No 703-708)
5.2	User Datagram Protocol(UDP) Datagram Format, Checksum, UDP operations, Use of UDP	Book 2 CH23 (Pg. No709-715)
5.3	Transmission Control Protocol (TCP) TCP Services – Process to-Process Communication, Stream Delivery Service, sending and Receiving Buffers, Segments, Full –Duplex Communication, Connection oriented service, Reliable service	Book 2 CH23 (Pg. No 715-719)
5.4	TCP Features –Numbering System, Byte Number, Sequence Number, Acknowledgement Number, Flow Control, Error Control, Congestion Control	Book 2 CH23 (Pg. No 719-720)
5.5	TCP Segment – Format	Book 2 CH23

		(Pg. No 721-723)
6.	The Application Layer	[Lectures 7]
6.1	Domain Name System (DNS) Name Space, Domain, Name Space, Distribution of Name Space, DNS in the Internet, Resolution	Book 2 CH25 (Pg. No 797-809)
6.2	E-MAIL Architecture, User Agent, Message Transfer Agent-SMTP, Message Access Agent-POP3, IMAP4, Web Based Mail	Book 2 CH26 (Pg. No 824-840)
6.3	File Transfer Protocol (FTP) Communication over control connection, Communication over Data Connection, Anonymous FTP	Book 2 CH26 (Pg. No 840-844)
6.4	WWW Architecture, WEB Documents	Book 2 CH27 (Pg. No 851-861)
6.5	HTTP - HTTP Transaction, Persistent and Non persistent Connection, Proxy Server	Book 2 CH27 (Pg. No 861-868)
6.6	Devices- Gateways –Transport & Application Gateways	Book 1 CH4 (Pg. No 328)
7.	Network Security	[Lectures 10]
7.1	Introduction – Security Services- Message-Confidentiality, Integrity, Authentication, Non repudiation. Entity (User)- Authentication.	Book 2 CH31 (Pg. No 961-962)
7.2	Message confidentiality –Confidentiality with Asymmetric-Key Cryptography, Confidentiality with Symmetric-Key Cryptography	Book 2 CH31 (Pg. No 962-964)
7.3	Cryptography Encryption Model, Substitution Cipher and Transposition Cipher (Problems should be covered.)	Book 1 CH8 (Pg. No 724-730)
7.4	Two Fundamental Cryptographic Principles	Book 1 CH8 (Pg. No 735-736)
7.5	Communication Security Firewalls	Book 1 CH8 (Pg. No 776-779)
7.6	Web Security Threats, Secure Naming, DNS Spoofing, Secure DNS, Self Certifying names	Book 1 CH8 (Pg. No 805-813)
7.7	Mobile Code Security Java Applet Security, ActiveX, JavaScript, Viruses	Book 1 CH8 (Pg. No 816-819)
7.8	Social Issues Privacy, Anonymous Remailers, Freedom of Speech, Steganography, Copyright	Book 1 CH8 (Pg. No 819-828)

**Reference Books:**

1. Computer Networks by Andrew Tanenbaum, Pearson Education.[4<sup>th</sup> Edition]
2. Data Communication and Networking by Behrouz Forouzan, TATA McGraw Hill. .[4<sup>th</sup> Edition]

**Guidelines For Examination:**

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**T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS**  
**TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16**  
**TITLE OF PAPER : Internet Programming I**  
**Code No. : CS-334**

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**Semester III**

**Total Lectures: 48**

**Aim:** To Design dynamic and interactive Web pages.

**Objective:**

- Learn Core-PHP, Server Side Scripting Language
- Learn PHP-Database handling.

**Prerequisite:** HTML.

- |   |             |
|---|-------------|
| <b>1. Introduction to web techniques</b>                    | <b>[8]</b>  |
| 1.1 HTTP basics, Introduction to Web server and Web browser |             |
| 1.2 Introduction to PHP                                     |             |
| 1.3 What does PHP do?                                       |             |
| 1.4 Lexical structure                                       |             |
| 1.5 Language basics   |             |
| Book 1 chapter 2  |             |
| <br>  |             |
| <b>2. Function and String</b>                               | <b>[10]</b> |
| 2.1 Defining and calling a function                         |             |
| 2.2 Default parameters                                      |             |
| 2.3 Variable parameters, Missing parameters                 |             |
| 2.4 Variable function, Anonymous function                   |             |
| 2.5 Types of strings in PHP                                 |             |
| 2.6 Printing functions                                      |             |
| 2.7 Encoding and escaping                                   |             |
| 2.8 Comparing strings                                       |             |
| 2.9 Manipulating and searching strings                      |             |
| 2.10 Regular expressions                                    |             |
| Book 1 chapter 3 and 4                                      |             |
| <br>  |             |
| <b>3. Arrays</b>  | <b>[6]</b>  |
| 3.1 Indexed Vs Associative arrays                           |             |
| 3.2 Identifying elements of an array                        |             |
| 3.3 Storing data in arrays                                  |             |
| 3.4 Multidimensional arrays                                 |             |
| 3.4 Extracting multiple values                              |             |
| 3.5 Converting between arrays and variables                 |             |
| 3.6 Traversing arrays                                       |             |
| 3.7 Sorting   |             |
| 3.8 Action on entire arrays                                 |             |
| 3.9 Using arrays  |             |
| Book 1 chapter 5  |             |

**4. Introduction to Object Oriented Programming** [8]  
4.1 Classes  
4.2 Objects  
4.3 Introspection  
4.4 Serialization  
4.5 Inheritance  
4.6 Interfaces  
4.7 Encapsulation  
Book 1 , 2 chapter 12

**5. Files and directories** [6]  
5.1 Working with files and directories  
5.2 Opening and Closing, Getting information about file, Read/write to file,  
Splitting name and path from file, Rename and delete files  
5.3 Reading and writing characters in file  
5.4 Reading entire file  
5.5 Random access to file data  
5.6 Getting information on file  
5.7 Ownership and permissions  
Book 2 chapter 7

**6. Databases (PHP-PostgreSQL)** [10]  
6.1 Using PHP to access a database  
6.2 Relational databases and SQL  
6.3 PEAR DB basics  
6.4 Advanced database techniques  
6.5 Sample application (Mini project)  
Book 1 chapter 9

## References

1. Programming PHP By Rasmus Lerdorf 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. PHP for Beginners, SPD publication
8. Programming the World Wide Web , Robert W Sebesta(3<sup>rd</sup> Edition)
9. Check out Joomla!press  
**Pearson** (*Addison-Wesley Professional*).
10. [www.php.net.in](http://www.php.net.in)
11. [www.W3schools.com](http://www.W3schools.com)
12. [www.wrox.com](http://www.wrox.com)
13. <https://api.drupal.org>

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**TITLE OF PAPER : Internet Programming II**  
**Code No. : CS-344**

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**Semester IV**

**Total Lectures: 48**

**Aim:** To Design dynamic and interactive Web pages.

**Objective:**

- Learn different technologies used at client Side Scripting Language
- Learn XML,CSS and XML parsers.
- One PHP framework for effective design of web application.
- Learn JavaScript to program the behavior of web pages.
- Learn AJAX to make our application more dynamic.

**1. Web Techniques** **[10]**

- 1.1 Variables
  - 1.2 Server information
  - 1.3 Processing forms
  - 1.4 Setting response headers
  - 1.5 Maintaining state
  - 1.6 SSL
- Book 1 chapter 7

**2. Handling email with php** **[8]**

- 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 attachments.
  - 2.6 Email id validation and verification
  - 2.7 PHP error handling.
- Book 2 chapter 15

**3. PHP framework** **[4]**

- 3.1 Introduction to PHP framework.
  - 3.2 Features, Applications.
  - 3.3 One example like JOOMLA,DRUPAL.
- Book 11, <https://api.drupal.org>

**4. XML** **[8]**

- 4.1 What is XML?
  - 4.2 XML document Structure
  - 4.3 PHP and XML
  - 4.4 XML parser
  - 4.5 The document object model
  - 4.6 The simple XML extension
  - 4.7 Changing a value with simple XML
- Book 2 chapter 8

**5. WEB DESIGNING TECHNOLOGIES(JavaScript-DHTML)** **[10]**

- 5.1 Overview of JavaScript, DHTML
- 5.2 Object Orientation and JavaScript

- 5.3 Basic Syntax(JS datatypes, JS variables )
- 5.4 Primitives, Operations and Expressions
- 5.5 Screen Output and keyboard input(Verification and Validation)
- 5.6 JS Control statements
- 5.7 JS Functions
- 5.8 JavaScript HTML DOM Events(onmouseup, onmousedown, onclick, onload,onmouseover,onmouseout).
- 5.9 JS Strings.
- 5.10 JS String methods
- 5.11 JS popup boxes(alert, confirm, prompt).
- 5.12 Changing property value of different tags using DHTML  
(ex. adding innerhtml for DIV tag, changing source of image etc.).

Book 10, [www.w3schools.com](http://www.w3schools.com).

## 6. AJAX

[8]

- 6.1 Introduction of AJAX
  - 6.2 AJAX web application model
  - 6.3 AJAX –PHP framework
  - 6.4 Performing AJAX validation
  - 6.5 Handling XML data using php and AJAX
  - 6.6 Connecting database using php and AJAX
- Book 4 chapter 1,2 and 9

## References

1. Programming PHP By Rasmus Lerdorf 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. Learning PHP and MYSQL, O'Reilly publication
8. PHP and MYSQL, O'Reilly publication
9. PHP for Beginners, SPD publication
10. Programming the World Wide Web , Robert W Sebesta(3<sup>rd</sup> Edition)
11. Check out Joomla!presss **Pearson** (*Addison-Wesley Professional*).
12. [www.php.net.in](http://www.php.net.in)
13. [www.W3schools.com](http://www.W3schools.com)
14. [www.wrox.com](http://www.wrox.com)
15. <https://api.drupal.org>

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**TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16**  
**TITLE OF PAPER : Programming in Java-I**  
**Code No. : CS-335**

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**Semester IV**

**Total Lectures: 48**

**Prerequisite:**

- Knowledge of C Programming language

**Objective:**

- To learn Object Oriented Programming language
- To handle abnormal termination of a program using exception handling
- To create flat files
- To design User Interface using Swing and AWT

**1. An Introduction to Java** **[4]**

- 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)

**2. An Overview of Java** **[4]**

- 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)

**3. Objects and Classes** **[8]**

- 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
- 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

**4. Inheritance and Interface** **[7]**

- 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
- 4.7 Object Cloning

**5. Exception Handling [4]**

- 5.1 Dealing Errors
- 5.2 Exception class, Checked and Unchecked exception
- 5.3 Catching exception and exception handling
- 5.4 Creating user defined exception
- 5.5 Assertions

**6. Strings, Streams and Files [7]**

- 6.1 String class and StringBuffer Class
- 6.2 Formatting string data using format() method
- 6.2 Using the File class
- 6.3 Stream classes
  - Byte Stream classes
  - Character Stream Classes
- 6.4 Creation of files
- 6.5 Reading/Writing characters and bytes
- 6.6 Handling primitive data types
- 6.7 Random Access files

**7. User Interface Components with AWT and Swing [10]**

- 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

**8. Applet [4]**

- 8.1 Applet Life Cycle
- 8.2 appletviewer tool
- 8.3 Applet HTML Tags
- 8.4 Passing parameters to Applet
- 8.5 repaint() and update() method

**References:**

- 1) Complete reference Java by Herbert Schildt(5th edition)
- 2) Java 2 programming black books, Steven Horlzner
- 3) Programming with Java , A primer ,Forth edition , By E. Balagurusamy
- 4) Core Java Volume-I-Fundamentals, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Press

**SAVITRIBAI PHULE PUNE UNIVERSITY**  
**T.Y. B.Sc. COMPUTER SYLLABUS**  
**TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16**  
**TITLE OF PAPER : Programming in Java-II**  
**Code No. : CS-345**

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**Semester IV**

**Total Lectures : 48**

**Prerequisite:**

- Knowledge of Core Java (CS – 345)

**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

**1. Collection**

**[6]**

- 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

**2. Database Programming**

**[10]**

- 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)

**3. Servlet**

**[12]**

- 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

**4. JSP**

**[10]**

- 4.1 Simple first JSP program
- 4.2 Life cycle of JSP
- 4.2 Implicit Objects
- 4.3 Scripting elements – Declarations, Expressions, Scriptlets, Comments
- 4.4 JSP Directives – Page Directive, include directive
- 4.5 Mixing Scriptlets and HTML
- 4.6 Example of forwarding contents from database to servlet, servlet to JSP and displaying it using JSP scriptlet tag

## **5. Multithreading**

[6]

- 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

## **6. Networking**

[4]

- 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

### **References:**

- 1) Complete reference Java by Herbert Schildt(5th edition)
- 2) Java 2 programming black books, Steven Horlzner
- 3) Programming with Java , A primer ,Forth edition , By E. Balagurusamy
- 4) Core Java Volume-I-Fundamentals, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Press
- 5) Core Java Volume-II-Advanced Features, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Press

**SAVITRIBAI PHULE PUNE UNIVERSITY**  
**T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS**  
**TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16**  
**TITLE OF PAPER : Object Oriented Software Engineering**  
**Code No. : CS-336**

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**Semester III**

**Total Lectures: 48**

**Prerequisites**

- Knowledge of Object Oriented Concepts
- Knowledge of Classical Software Engineering

**Aim**

To Understand Object Oriented Modeling techniques and their applicability.

**Objectives**

- Understanding importance of Object Orientation in Software engineering
- Understand the components of Unified Modeling Language
- Understand techniques and diagrams related to structural modeling
- Understand techniques and diagrams related to behavioral modeling
- Understand techniques of Object Oriented analysis, design and testing

**1. Object Oriented Concepts and Principles**

**[4]**

1.1 What is Object Orientation ? - Introduction , Object , Classes and Instance , Polymorphism, Inheritance

1.2 Object Oriented System Development- Introduction, Function/Data Methods (With Visibility), Object Oriented Analysis, Object Oriented Construction

1.3 Identifying the Elements of an Object Model

1.4 Identifying Classes and Objects

1.5 Specifying the Attributes (With Visibility)

1.6 Defining Operations

1.7 Finalizing the Object Definition

**2. Introduction to UML**

**[2]**

2.1 Concept of UML

2.2 Advantages of UML

**3. Basic Structural Modeling**

**[5]**

3.1 Classes

3.2 Relationship

3.3 Common Mechanism

3.4 Class Diagram (Minimum three examples should be covered)

**4. Advanced Structural Modeling**

**[7]**

4.1 Advanced Classes

4.2 Advanced Relationship

4.3 Interface

4.4 Types and Roles

4.5 Packages

4.6 Object Diagram (Minimum three examples should be covered)

**5. Basic Behavioral Modeling**

**[9]**

- 5.1 Interactions
- 5.2 Use Cases and Use Case Diagram with stereo types (Minimum three examples should be covered)
- 5.3 Interaction Diagram (Minimum two examples should be covered)
- 5.4 Sequence Diagram (Minimum two examples should be covered)
- 5.5 Activity Diagram (Minimum two examples should be covered)
- 5.6 State Chart Diagram (Minimum two examples should be covered)

## **6. Object Oriented Analysis**

[6]

- 6.1 Iterative Development and the Rational Unified Process
- 6.2 Inception
- 6.3 Understanding Requirements
- 6.4 Use Case Model From Inception to Elaboration
- 6.5 Elaboration

## **7. Object Oriented Design**

[4]

- 7.1 The Booch Method, The Coad and Yourdon Method and Jacobson Method and Rumbaugh Method
- 7.2 The Generic Components of the OO Design Model
- 7.3 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
- 7.4 Object Design Process

## **8. Architectural modeling**

[6]

- 8.1 Component
- 8.2 Components Diagram (Minimum two examples should be covered)
- 8.3 Deployment Diagram (Minimum two examples should be covered)
- 8.4 Collaboration Diagram (Minimum two examples should be covered)

## **9. Object Oriented Testing**

[5]

- 9.1 Object Oriented Testing Strategies
- 9.2 Test Case Design for Object Oriented Software
- 9.3 Inter Class Test Case Design  
(Use of any freeware designing tool)

## **References.**

1. Grady Booch, James Rumbaugh, The Unified Modeling Language User/Reference Guide, Pearson Education INC
2. Ivar Jacobson, Object Oriented Software Engineering, Pearson Education INC
3. Craig Larman, Applying UML and Patterns Pearson Education INC
4. Bennett, Simon, Object Oriented Analysis and Design McGraw Hill

**SAVITRIBAI PHULE PUNE UNIVERSITY**  
**T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS**  
**TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16**  
**TITLE OF PAPER :Computer Graphics**  
**Code No. : CS-346**

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**Semester IV**

**Total Lectures: 48**

**Pre – Requisites**

- Computer programming skills in C programming language
- Basic understanding of use of data structures
- Basic Mathematical concepts related to matrices and geometry

**Objectives**

- To study how graphics objects are represented in Computer
- To study how graphics system in a computer supports presentation of graphics information
- To study how interaction is handled in a graphics system
- To study how to manipulate graphics object by applying different transformations
- To provide the programmer's perspective of working of computer graphics

**1. Introduction to Computer graphics** **[4]**

- 1.1 Introduction to computer graphics & graphics systems
- 1.2 Components of Computer Graphics Representation, Presentation , Interaction and Transformations
- 1.3 Applications of Computer Graphics
- 1.3 Pixel/Point ,Raster v/s Vector ,RGB color model, intensity
- 1.4 Programming essentials – event driven programming. OpenGL library

**2. Input devices and Interaction tasks** **[4]**

- 2.1 Logical Interaction – Locator, valuator , pick and choice;
- 2.2 Physical devices used for interaction – keyboard, mouse, trackball,spaceball, tablets, light pen, joy stick, touch panel, data glove;
- 2.4 Keyboard , Mouse interaction in OpenGL
- 2.5 Graphical User Interfaces- cursors , radio buttons, scroll bars, menus, icons
- 2.6 Implementing GUI in open GL

**3. Presentation and Output devices** **[4]**

- 3.1 Presentation Graphics - frame buffer, display file, lookup table;
- 3.2 Display devices, Random and Raster scan display devices; CRT,
- 3.3 Hardcopy devices - Plotters and Printers

**4. Raster Scan Graphics** **[10]**

- 4.1 Line drawing algorithms; DDA algorithm, Bresenham's line drawing algorithm, Circle generation algorithm;
- 4.2 Scan conversions- Generation of the Display, Image compression
- 4.3 Displaying Lines and characters
- 4.3 Polygon filling -Scan converting polygons, fill algorithms, Boundary fill algorithm, flood fill algorithm

**5. Transformations** **[7]**

- 5.1 Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, Reflection, shear
- 5.2 Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline
- 5.3 Window to viewport co-ordinate transformation. Setting window and viewport in OpenGL.

## **6 Clipping** [7]

- 6.1 clipping operations , point clipping ,
- 6.2 Line clipping; Cohen Sutherland algorithm, Midpoint subdivision algorithm, Cyrus beck algorithm;
- 6.3 Polygon clipping , Sutherland Hodgman algorithm, Weiler-Atherton Algorithm

## **7 3D transformation & viewing** [6]

- 7.1 3D transformations: translation, rotation, scaling & other transformations;
- 7.2 Three dimensional viewing, Parallel and Perspective projections,
- 7.3 View Volumes and General Projection Transformations.
- 7.4 3 D clipping

## **8 Hidden surfaces Elimination** [4]

- 8.1 Depth comparison, A-buffer algorithm, Back face detection; Depth -Buffer
- 8.2 Scan-line Method - BSP tree method, the Painter's algorithm, Area-subdivision algorithm;

### **Text Books:**

1. Hearn, Baker – “ Computer Graphics ( C version 2nd Ed.)” – Pearson education
2. F. S. Hill, Stephen Kelly, Computer Graphics using OpenGL, PHI Learning
3. David F. Rogers - Procedural Elements of Computer Graphics, Tata McGRAw Hill

### **Reference Books:**

4. Foley, Vandam, Feiner, Hughes – “Computer Graphics principles (2nd Ed.) – Pearson Education.
5. W. M. Newman, R. F. Sproull – “Principles of Interactive computer Graphics” – TMH.
6. D. F. Rogers, J. A. Adams – “ Mathematical Elements for Computer Graphics (2nd Ed.)” – TMH
7. Z. Xiang, R. Plastock – “ Schaum's outlines Computer Graphics (2nd Ed.)” – TMH

**SAVITRIBAI PHULE PUNE UNIVERSITY**  
**T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS**  
**TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16**  
**TITLE OF PAPER : System Programming & Operating System**  
**Code No. : CS-347**

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**Aim:**

To understand the process of designing and implementing System programs and operating system components.

**Objective :-**

1. Design and implement System programs with minimal features to understand their complexity.
2. Design and implement simulations of operating system level procedures.

**Syllabus**

Sr. No	Topic	Lectures
1	Line Editor	8 lectures
2	SMAC0 simulator	8 lectures
3	Assembler	12 Lectures
4	Macro processor	12 lectures
5	DFA driver	8 lectures
6	Development Utilities	8 lectures
7	Toy shell	8 Lectures
8	CPU Scheduler	12 lectures
9	Deadlock detection	8 lectures
10	Page Replacement Algorithms	12 lectures
11	File Allocation methods	12 Lectures

**Examination**

Internal Marks : Activity + Labbook(10+10)

External Marks : two programs(35each) oral(5) Activity(5)



**SAVITRIBAI PHULE PUNE UNIVERSITY**  
**T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS**  
**TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16**  
**TITLE OF PAPER :Lab Course II – Programming in Java**  
**Code No. : CS-348**

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**Aim:**

To understand the process of designing and implementing Core and Advanced Java programs.

**Objective :-**

1. Implement core Java programs to solve simple problems
2. Implement Client and Server end Java programs

**Syllabus**

Sr. No	Topic	Lectures
<b>Core and Advanced Java</b>		
1	Simple Java programs	8 Lectures
2	Arrays and Packages	8 Lectures
3	Inheritance and Interfaces	8 Lectures
4	Exception Handling	8 Lectures
5	File Handling	8 Lectures
6	GUI designing & Event Handling	8 Lectures
7	Database Programming	8 Lectures
8	Multithreading	4 Lectures
9	Collection	8 Lectures
10	Servlets	8 Lectures
11	JSP	8 Lectures
12	Socket Programming	4 Lectures
<b>Computer Graphics</b>		
1	Simple Graphics program using OpenGL	4 Lectures
2	Using graphics primitives to display graphics	4 Lectures
3	Window to viewport transformations and other transformations	4 Lectures
4	Using simple Keyboard and Mouse interaction	4 Lectures
5	<b>Graphics Mini project</b>	16 Lectures

**Examination**

Internal Marks : Activity(CG) + Seminar(Enhanced java+ listening) (10+10)

External Marks : two programs(30each) oral(5) Activity(5)+ Labbook(10)

**SAVITRIBAI PHULE PUNE UNIVERSITY**  
**Proposed Draft of**  
**T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS**  
**TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16**  
**TITLE OF PAPER :Lab Course III – Programming in PHP & Project**  
**Code No. : CS-349**

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**Aim:**

To understand the process of designing and implementing Web applications, using PHP.

**Objective :-**

1. Implement Simple PHP programs to solve simple problems

**Syllabus**

Sr. No	Topic	Lectures
<b>PHP</b>		
1	String manipulation	8 Lectures
2	Arrays	8 Lectures
3	Inheritance	8 Lectures
4	File Handling	8 Lectures
5	Form designing	8 Lectures
6	Database Connectivity	8 Lectures
7	Sessions and cookies	8 Lectures
8	Java script with AJAX	8 Lectures
<b>Networking</b>		
1	Setting a LAN Environment	4 Lectures
2	Configuring the Server	4 Lectures
3	Use of Service Primitives	4 Lectures
4	Use of Networking Tools	12 Lectures
<b>Project</b>		
1	Choose Project topic and Prepare problem description	
2	Study of Existing System	
3	Identifying users and functionalities of proposed system	
4	Preparing the Design of the proposed system- Data Design Screen and Report Designs	
5	Implementation	

**Examination**

Internal Marks: Project (20) Continuous Evaluation.

External Marks: One programs (30) ( large program on PHP + small program PHP), networking(10)  
– Internal, Lab book(10), Project(30) -20 Marks External + 10 Marks Internal for Project Demo  
before Final Practical Exam

# **University of Pune**

## **Two Year M.Sc. Degree Course in Computer Science**

**M.Sc. Computer Science**

**(Credit and Semester based Syllabus for affiliated colleges to be implemented  
from Academic Year 2013-14)**

### **1) Title of the Course:**

M.Sc. (Computer Science)

### **2) Preamble of the Syllabus:**

This syllabus is the extension of the existing syllabus which is currently being taught to M.Sc. (Computer Science) of University of Pune for the last few years, but modified to be placed within the credit based system to be implemented from the academic year 2013-2014. 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.

### **3) Introduction:**

#### **Salient Features of the Credit System:**

1. Master's degree in Computer Science would be of 100 credits, where one credit course of theory will be of one clock hour per week running for 15 weeks and one credit for project course will consist of 15 of laboratory hours. Thus, each credit will be equivalent to 15 hours.
2. Student will have to take admission and complete at least 75 credits incorporated in the syllabus structure of Computer Science. The remaining 25 credits can be chosen from courses offered by the other Departments subjects (other than Computer Science courses) of the College with credit system structure.
3. Every student shall complete 100 credits in a minimum of four semesters. All Semesters will have 25 credits each.
4. The student will be declared as failed if s/he does not pass in all credits within a total period of four years. After that such students will have to seek fresh admission as per admission rules prevailing at that time.

5. Academic calendar showing dates of commencement and end of teaching, internal assessment tests and term end examination will be prepared and duly notified before commencement of each semester every year.
6. Project course should not be greater than 10% of the total credits of the degree course. Project course is equivalent to 10 credits.

### **Instructions for the Students**

The students seeking admission to M.Sc. Computer Science course is hereby informed that they are supposed to adhere to the following rules:

1. A minimum of 75 % attendance for lectures / practical is the pre-requisite for grant of term.
2. There shall be tutorial / practical / surprise test / home assignment / referencing of research papers / seminar / industrial visits as a part of internal assessment in each semester. The students are supposed to attend all the tests. The students should note that re-test will not be given to the student absent for the test/s.
3. The students opting for dissertation course shall follow the rules framed for the same.

### **4) Eligibility:**

The candidate should have a B.Sc. degree with Computer Science as principal subject.

**Admission** : 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.

### **5) Examination**

#### **[A] Pattern of Examination**

Evaluation of Students:

- 1) The In-semester and End-Semester examinations will be of 50 marks each.
- 2) Student has to obtain 40% marks in the combined examination of In-Semester and End-Semester assessment with minimum passing of 30% passing in both assessments separately.
- 3) A student cannot register for third semester if s/he fails to complete the 50% credits of the total expected within two semesters.
- 4) Internal marks will not change. Student cannot repeat internal assessment. If student misses internal assessment examination, s/he will have second chance with the permission of the concerned teacher. But it will not be right of the student. It will be

the discretion of the concerned teacher and internal departmental assessment committee.

- 5) There shall be revaluation of answer script of end semester examination, but not of internal assessment papers.
- 6) Internal assessment answer scripts may be shown to the concerned student but not end semester answer script.

**i. Continuous Assessment:** Internal assessment for each course would be continuous and dates for each tutorials/practical tests will be pre-notified in the time table for teaching or placed separately as a part of time table. Department / College Internal Assessment Committee will coordinate this activity

**a) Theory Courses:** Conducting written tests should not be encouraged. More focus should be on non-written tests. Students should be encouraged to conduct various academic activities. A teacher must select a variety of the procedures for internal assessment suggested as follows.

- a) Mid-term test
- b) On-line test
- c) Open book test (concerned teacher will decide the allowed books)
- d) Tutorial
- e) Surprise test
- f) Oral
- g) Theory Assignments
- h) Review of Research paper
- i) Seminar presentation
- j) Journal/Lecture/Library notes
- k) Group Discussion
- l) Programming Assignments

Student has to preserve the documentation of the internal assessment except midterm test answer script. It is the responsibility of the student to preserve the documents.

**Project Courses :** The Project can be platform, Language and technology independent. Project will be evaluated by project guide. Assessment will be done weekly in the respective batch. Evaluation will be on the basis of weekly progress of project work, progress report, oral, results and documentation.

**ii. University Examination :** End-Semester examination for 50 marks per course would be held as per the scheduled given by University of Pune..

### **[B] Standard of Passing**

Student has to obtain 40% marks in the combined examination of In-Semester and End-Semester assessment with minimum passing of 30% passing in both assessments separately.

### **[C] ATKT Rules**

A student cannot register for third semester if s/he fails to complete the 50% credits of the total credits expected to be ordinarily completed within two semesters.

### **[D] Award of Class**

Grades will be awarded from grade point average (GPA) of the credits.

#### **GPA Rules:**

1. The formula for GPA will be based on Weighted Average. The final GPA will not be printed unless a student passes courses equivalent to minimum 100 credit hours (Science). Total credits hours means the sum of credit hours of the courses which a student has passed.
2. A seven point grade system [guided by the Government of Maharashtra Resolution No. NGO – 1298 / [4619] / UNI 4 dt. December 11, 1999 and University regulations] will be followed. The corresponding grade table is attached herewith.
3. If the GPA is higher than the indicated upper limit in the third decimal digit then the student be awarded higher final grade (e.g. a student getting GPA of 4.492 may be awarded 'A')
4. For Semester I, II, III examinations, only the grade points will be awarded for each subject. Final GPA along with final grade will be awarded only at the end of IV semester. There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. The revaluation result will be adopted if there is a change of at least 10% marks and in the grade of the course.
5. After the declaration of result, for the improvement of Grade, the student can reappear for the examination of 30 credits worth theory courses.
6. Grade improvement programme will be implemented at the end of the academic year. A student can opt for grade improvement programme only after the declaration of final semester examination i.e. at the end of next academic year after passing M.Sc. (Computer Science) examination and within two years of completion of M.Sc. (Computer Science). A student can appear for grade improvement programme only once.

Grade and Grade Point Average		
Marks	Obtained Grade	Grade Points
100 – 75	'O' Outstanding	06
74 – 65	'A' Very Good	05
64 – 55	'B' Good	04
54 – 50	'C' Average	03
49 – 45	'D' Satisfactory	02
44 – 40	'E' Pass	01
39 and less	'F' Fail	00

Final Grade Points	
Grade Points	Final Grade
5.00 – 6.00	O
4.50 – 4.99	A
3.50 – 4.49	B
2.50 – 3.49	C
1.50 – 2.49	D
0.50 – 1.49	E
0.00 – 0.49	F

Common Formula for Grade Point Average (GPA):

$$\text{GPA} = \frac{\text{Total of Grade Points earned} \times \text{Credit hours for each course}}{\text{Total Credit hours}}$$

B Grade is equivalent to at least 55% of the marks

**[E] External Students:** There shall be no external students.

**[F] Setting of Question Paper / Pattern of Question Paper**

For core (compulsory) theory courses end semester question papers set by the University of Pune and centralized assessment for theory papers done as per the University guidelines.

**[G] Verification / Revaluation**

There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. There shall be revaluation of end semester examination, but not of internal assessment.

## 6) Structure of Course

- Duration : The entire Programme is a Two year and four semester full time Programme.
- No of Courses : For first three semesters there will be Five courses. The fourth semester will be Industrial Training/Institutional Project and two theory courses.



Year/ Semester	Subject	Paper	Title of Paper	Credit	% of Assessment		
					IA	UE	Total
I Year Sem-I	Core	CS-101	Principles of Programming Languages	5	50	50	100
	Core	CS-102	Advanced Networking	5	50	50	100
	Core	CS-103	Distributed Database Concepts	5	50	50	100
	Core	CS-104	Design and Analysis of Algorithms	5	50	50	100
	Core	CS-105	Network Programming	5	50	50	100

Minimum Credit : 25 Maximum Credit : 25. Core Subject is compulsory . IA :- Internal Assessment, UE :- University Examination

Year/ Semester	Subject	Paper	Title of Paper	Hours/ Week	Credit	% of Assessment		
						IA	UE	Total
I Year Sem-II	Core	CS-201	Digital Image Processing	4	5	50	50	100
	Core	CS-202	Advanced Operating Systems	4	5	50	50	100
	Core	CS-203	Data Mining and Data Warehousing	4	5	50	50	100
	Core	CS-204	Project	4	5	50	50	100
	Elective	CS-205	Programming With DOT NET	4	5	50	50	100
	Elective	CS-206	Artificial Intelligence	4	5	50	50	100
	Elective	CS-207	Advance Design and Analysis of Algorithms	4	5	50	50	100

Minimum Credit : 25 Maximum Credit : 30. Core Subject is compulsory. From elective courses student can select one course for minimum credit and two for maximum credit. IA :- Internal Assessment, UE :- University Examination

Year/ Semester	Subject	Paper	Title of Paper	Credit	% of Assessment		
					IA	UE	Total
II Year Sem-III	Core	CS-301	Software Metrics & Project Management	5	50	50	100
	Core	CS-302	Mobile Computing	5	50	50	100
	Core	CS-303	Soft Computing	5	50	50	100
	Elective	CS-304	Project	5	50	50	100
	Elective	CS-305	Web Services	5	50	50	100
	Elective	CS-306	Database and System Administrator	5	50	50	100
	Elective	CS-307	Functional Programming	5	50	50	100
	Elective	CS-308	Business Intelligence	5	50	50	100

Minimum Credit : 25    Maximum Credit : 35, Core Subject is compulsory, From elective courses student can select two course for minimum credit and four for maximum credit. IA :- Internal Assessment, UE :- University Examination

Year/ Semester	Subject	Paper	Title of Paper	Credit	% of Assessment		
					IA	UE	Total
II Year Sem-IV	Core	CS-401	Industrial Training /Institutional project	15	50	50	100
	Elective	CS-402	Parallel Computing	5	50	50	100
	Elective	CS-403	Embedded System	5	50	50	100
	Elective	CS-404	Software Quality Assurance	5	50	50	100
	Elective	CS-405	Modeling and Simulation	5	50	50	100

Core Subject is compulsory. If student had completed 85 credit within three semesters then no need to select any elective course otherwise student should select appropriate number of elective courses to minimum complete 100 credits.

IA :- Internal Assessment, UE :- University Examination

### 7) Equivalence of Previous Syllabus:

Not Applicable

### 8) University Terms:

### 9) Qualification of Teacher:

### 10) Detail Syllabus with Recommended Books

**M.Sc.**  
**(Computer Science)**

**First Year Semester 1**

## CS-101(New): Principles of Programming Languages

[Total Lectures: 48 Hours]

### Course Prerequisites:

It is assumed that student learning this course have the following background:

- Experience with an OOP language (such as Java or C++)
- Experience with a procedural language (such as C)
- Working knowledge of C, C++, and Java programming.
- Basic algorithms and data structure concepts.

### Why to study this course?

- To allow Informed Design Decisions
- Gives insight when debugging
- Permits effective use of compilers/linkers interpreters and language oriented tools.
- Helps to understand how language features work.
- Learn features, emulate missing features.
- Develop a greater understanding of the issues involved in programming language design and implementation
- Develop an in-depth understanding of functional, logic, and object-oriented programming paradigms
- Implement several programs in languages other than the one emphasized in the core curriculum (Java/C++)
- Understand design/implementation issues involved with variable allocation and binding, control flow, types, subroutines, parameter passing
- Develop thorough understanding of the compilation process
- To introduce several different paradigms of programming
- To gain experience with these paradigms by using example programming languages
- To understand concepts of syntax, translation, abstraction, and implementation

### Course Objectives:

- This course will prepare you to think about programming languages analytically:
  - Separate syntax from semantics
  - Compare programming language designs
  - Learn new languages more quickly
  - Use standard vocabulary when discussing languages
  - Understand basic language implementation techniques
- This course focuses on both:
  - Theory is covered by the textbook readings, lectures, and on the tests
  - Implementation is covered by the homework assignments

### Unit 1. Introduction [ T1 chap. 1] [2]

- The Art of Language Design [ T1 1.1]
- The Programming Language Spectrum [ T1 1.2]
- Why Study Programming Languages? [ T1 1.3]
- Compilation and Interpretation [ T1 1.4]
- Programming Environments [ T1 1.5]

### Unit 2. Non-Imperative Programming Models: Functional, Logic Languages

[ Text books 3, 4]

[10]

### Common LISP

- Basic LISP Primitives ( FIRST, REST, SETF, CONS, APPEND, LIST, NTHCDR, BUTLAST, LAST, LENGTH, REVERSE, ASSOC)
- Procedure definition and binding, DEFUN, LET
- Predicates and Conditional, EQUAL, EQ, EQL, =, MEMBER, LISTP, ATOM, NUMBERP, SYMBOLP, NIL, NULL, IF, WHEN, UNLESS, COND, CASE
- Procedure Abstraction and Recursion

[T 4]

### Turbo Prolog

Introduction, facts, Objects and Predicates, Variables, Using Rules, Controlling execution fail and cut predicates

[ T3 chapter 1 through 9 except chapter 2 ]

### Unit 3. Names, Scopes, and Bindings [ T1 chap.3]

[5]

The Notion of Binding Time [ T1 chap.3.1]

Object Lifetime and Storage Management : [ T1 chap. 3.2]

Static Allocation, Stack-Based Allocation, Heap-Based Allocation, Garbage Collection

Scope Rules T1 chap. 3.3]

Static Scoping, Nested Subroutines, Declaration Order, Dynamic Scoping

The meaning of Names in a Scope [ T1 chap. 3.5]

Aliases, Overloading, Polymorphism and Related Concepts

The Binding of Referencing Environments [ T1 chap. 3.6]

Subroutine Closures, First-Class Values and Unlimited Extent, Object Closures

Macro Expansion [ T1 chap. 3.7]

### Unit 4. Control Flow [ T1 chap.6] [5]

Expression Evaluation [ T1 6.1]

Precedence and Associativity, Assignments, Initialization, Ordering Within Expressions, Short-Circuit Evaluation

Structured and Unstructured Flow [ T1 6.2]

Structured Alternatives to goto

Sequencing [ T1 6.3]

Selection [ T1 6.4]

Short-Circuited Conditions, Case/Switch Statements

Iteration [ T1 6.5]

Enumeration-Controlled Loops, Combination Loops, Iterators, Logically Controlled Loops

Recursion [ T1 6.6]

Iteration and Recursion, Applicative- and Normal-Order Evaluation

### Unit 5. Data Types [ T2 chap.6]

[8]

Introduction T2 6.1]

Primitive Data Types [T2 6.2]

Numeric Types [T2 6.2.1]

Integer [T2 6.2.1.1]

Floating point [T2 6.2.1.2]

- Complex [T2 6.2.1.3]
- Decimal [T2 6.2.1.4]
- Boolean Types [T2 6.2.2]
- Character Types [T2 6.2.3]
- Character String Types [T2 6.3]
  - Design Issues [T2 6.3.1]
  - Strings and Their Operations [T2 6.3.2]
  - String Length Operations [T2 6.3.3]
  - Evaluation [T2 6.3.4]
  - Implementation of Character String Types [T2 6.3.5]
- User defined Ordinal types [T2 6.4]
  - Enumeration types [T2 6.4.1]
    - Designs
    - Evaluation
  - Subrange types [T2 6.4.2]
    - Ada's design
    - Evaluation
  - Implementation fo used defined ordinal types [T2 6.4.3]
- Array types [T2 6.5]
  - Design issues [T2 6.5.1]
  - Arrays and indices [T2 6.5.2]
  - Subscript bindings and array categories [T2 6.5.3]
  - Heterogeneous arrays [T2 6.5.4]
  - Array initialization [T2 6.5.5]
  - Array operations [T2 6.5.6]
  - Rectangular and Jagged arrays [T2 6.5.7]
  - Slices [T2 6.5.8]
  - Evaluation [T2 6.5.9]
  - Implementation of Array Types [T2 6.5.10]
- Associative Arrays [T2 6.6]
  - Structure and operations [T2 6.6.1]
  - Implementing associative arrays [T2 6.6.2]
- Record types [T2 6.7]
  - Definitions of records [T2 6.7.1]
  - References to record fields [T2 6.7.2]
  - Operations on records [T2 6.7.3]
  - Evaluation [T2 6.7.4]
  - Implementation of Record types [T2 6.7.5]
- Union Types [T2 6.8]
  - Design issues [T2 6.8.1]
  - Discriminated versus Free unions [T2 6.8.2]
  - Evaluation [T2 6.8.4]
  - Implementation of Union types [T2 6.8.5]
- Pointer and Reference Types [T2 6.9]
  - Design issues [T2 6.9.1]
  - Pointer operations [T2 6.9.2]
  - Pointer problems [T2 6.9.3]

- Dangling pointers
- Lost heap dynamic variables
- Pointers in C and C++ [T2 6.9.5]
- Reference types [T2 6.9.6]
- Evaluation [T2 6.9.7]
- Implementation of pointer and reference types [T2 6.9.8]
  - Representation of pointers and references
  - Solution to dangling pointer problem
- Heap management

**Unit 6. Subroutines and Control Abstraction [ T2 chap.9,10] [5]**

- Fundamentals of Subprograms [ T2 9.2 (excluding 9.2.4)]
- 1Design Issues for subprograms [ T2 9.3]
- Local Referencing Environments [ T2 9.4]
- Parameter-Passing Methods [ T2 9.5]
- Parameters That are Subprograms [ T2 9.6]
- Overloaded Subprograms [ T2 9.7]
- Generic Subroutines [ T2 9.8]
  - Generic Functions in C++ [ T2 9.8.2]
  - Generic Methods in Java [ T2 9.8.3]
- Design Issues for Functions [ T2 9.9]
- User-Defined Overloaded Operators [ T2 9.10]
- Coroutines [ T2 9.10]
- The General Semantics of Calls and Returns [ T2 10.1]
- Implementing “Simple” Subprograms [ T2 10.2]
- Implementing Subprograms with Stack-Dynamic Local Variables [ T2 10.3]
- Nested Subprograms [ T2 10.4]
- Blocks [ T2 10.5]
- Implementing Dynamic Scoping [ T2 10.6]

**Unit 7. Data Abstraction and Object Orientation [ T1 chap.9] [8]**

- Object-Oriented Programming [ T1 9.1]
- Encapsulation and Inheritance [ T1 9.2]
  - Modules, Classes, Nesting (Inner Classes), Type Extensions, Extending without Inheritance
- Initialization and Finalization [ T1 9.3]
  - Choosing a Constructor, References and Values, Execution Order, Garbage Collection
- Dynamic Method Binding [ T1 9.4]
  - Virtual- and Non-Virtual Methods, Abstract Classes, Member Lookup, Polymorphism, Object Closures
- Multiple Inheritance [ T1 9.5]
  - Semantic Ambiguities, Replicated Inheritance, Shared Inheritance, Mix-In Inheritance

**Unit 8. Concurrency [T2 chap. 13] [5]**

- Introduction
  - Multiprocessor Architecture [T2 13.1.1]
  - Categories of concurrency [T2 13.1.2]
  - Motivations for studying concurrency [T2 13.1.3]

- Introduction to Subprogram-level concurrency
  - Fundamental concepts [T2 13.2.1]
  - Language Design for concurrency. [T2 13.2.2]
  - Design Issues [T2 13.2.3]
- Semaphores
  - Introduction [T2 13.3.1]
  - Cooperation synchronization [T2 13.3.2]
  - Competition Synchronization [T2 13.3.3]
  - Evaluation [T2 13.3.4]
- Monitors
  - Introduction [T2 13.4.1]
  - Cooperation synchronization [T2 13.4.2]
  - Competition Synchronization [T2 13.4.3]
  - Evaluation [T2 13.4.4]
- Message Passing
  - Introduction [T2 13.5.1]
  - The concept of Synchronous Message Passing [T2 13.5.2]
- Java Threads
  - The **Thread** class [T2 13.7.1]
  - Priorities [T2 13.7.2]
  - Competition Synchronization [T2 13.7.3]
  - Cooperation Synchronization [T2 13.7.4]
  - Evaluation [T2 13.4.5]

**Text Books:**

T1. Scott Programming Language Pragmatics, 3e(With CD) ISBN 9788131222560  
Kaufmann Publishers, An Imprint of Elsevier, USA

T2. Concepts of Programming Languages, Eighth Edition by Robert W. Sebesta,  
Pearson Education.

T3. Introduction to Turbo Prolog by Carl Townsend

T4. LISP 3rd edition by Patrick Henry Winston & Berthold Klaus Paul Horn (BPB)

**Additional Reading:**

Programming Languages: Principles and Paradigms, M. Gabbrielli, S. Martini, Springer,  
ISBN: 9781848829138



<b>CS102 (New) - Advanced Networking</b>	
<b>Unit 1. Review of Basic Concepts</b>	<b>[3]</b>
TCP/IP Protocol Suite [T1 2.3]	
Underlying Technologies : LAN (802.3) T 1 3.1	
Wireless Lans (802.11) T 1 3.2	
Point-to-point WANS T 1 3.3	
Switched WANS T 1 3.4	
<b>Unit 2. The Internet Layer Protocols</b>	<b>[4]</b>
Review of IPv4 Protocol T 1 7.1,7.2,7.3,7.4,7.5	
IPv6 T 1 27.1,27.2	
Transition from IPv4 to IPv6 T 1 27.3	
ICMPv4 T 1 9.1,9.2,9.3,9.4	
ICMPv6 T 1 28.1,28.2,28.3,28.4	
<b>Unit 3. Routing Protocols</b>	<b>[6]</b>
Forwarding T 1 6.2	
Structure of a Router T 1 6.3	
Routing Tables T 1 11.1	
Intra – And Inter-Domain Routing T 1 11.2	
Distance Vector Routing T 1 11.3	
RIP T 1 11.4	
OSPF T 1 11.6	
BGP T 1 11.8	
Multicast Routing T 1 .4	
<b>Unit 4. The Transport Layer</b>	<b>[6]</b>
The Transport Service T 2 6.1	
Elements of Transport Protocols T 2 6.2	
UDP T 2 6.4.1	
TCP T 2 6.5.1 to 6.5.9	
<b>Unit 5. Multimedia</b>	<b>[3]</b>
Digitizing Audio and Video T 1 25.2	
Streaming stored Audio / Video T 1 25.4	
Streaming Live Audio / Video T 1 25.5	
Real-Time Interactive Audio / Video T 1 25.6	
RTP T 1 25.7	
RTCP T 1 25.8	
Voice Over IP T 1 25.9	
<b>Unit 6. Introduction To Security</b>	<b>[2]</b>
The need for Security T 3 1.2	
Security Approaches T 3 1.3	
Principles of Security T 3 1.4	
Types of Attacks T 3 1.5	
<b>Unit 7. Cryptography: Concepts and Techniques</b>	<b>[3]</b>
Introduction T 3 2.1	
Plain Text and Cipher Text T 3 2.2	
Substitution Techniques T 3 2.3.1,2.3.2,2.3.3,2.3.7	
Transposition Techniques T 3 2.4.1,2.4.2,2.4.3	
Symmetric and Asymmetric key cryptography	T 3 2.6.1,2.6.2

<b>Unit 8. Symmetric Key Algorithms</b>	<b>[3]</b>
Algorithms types and modes T 3 3.2.1,3.2.2	
DES T 3 3.4	
<b>Unit 9. Asymmetric key Algorithms</b>	<b>[2]</b>
RSA T 3 4.4	
Symmetric and Asymmetric key Cryptography T 3 4.5	
Digital Signatures T 3 4.6.1,4.6.2	
<b>Unit 10. Digital Certificates</b>	<b>[2]</b>
Introduction T 3 5.1	
Digital Certificates T 3 5.2	
<b>Unit 11. Internet Security Protocols</b>	<b>[10]</b>
Secure Socket Layer T 3 6.3	
TLS T 3 6.4	
SHTTP T 3 6.5	
TSP T 3 6.6	
SET T 3 6.7	
SSL Verses SET T 3 6.8	
3-D Secure Protocol T 3 6.9	
Electronic Money T 3 6.10	
Email Security T 3 6.11	
Firewalls T 3 9.3	
IP Security T 3 9.4	
VPN T 3 9.5	
<b>Unit 12. User Authentication</b>	<b>[4]</b>
Passwords T 3 7.3	
Certificate-based Authentication T 3 7.5	
Kerberos T 3 7.7	
Security Handshake Pitfalls T 3 7.9	

**Text Books:**

**T1 : TCP / IP Protocol Suite Fourth Edition – Behrouz A. Forouzan**

**T2 : Computer Networks Fourth Edition – Andrew Tanenbaum**

**T3 : Cryptography and Network Security Second Edition – Atul Kahate**

**Supplementary but very useful references/texts:** (Few of the references below contain latest research and trends related to Networks and Security and are useful for seminar/ presentations by the students.)

1. Computer Network Security, Kizza, Springer, 9780387204734
2. Guide to Computer Network Security, Kizza, Springer, 978-1-84800-916-5
3. Network Security, Harrington, Elsevier, ISBN 9788131202166
4. Douglas E. Comer, Internetworking with TCP/IP, Vol. 1, Principles, Protocols and Architecture Fifth Edition, Prentice Hall, 2000, ISBN 0-13-018380-6.
5. William Stallings, Data and Computer Communications , Seventh Edition, Pearson Education
6. Douglas E. Comer, Internetworking with TCP/IP, Vol. 2, Design, Implementation and Internals, Prentice Hall Publisher.

7. Internetworking with TCP/IP, Vol. 3, Client-server Programming and Applications by Douglas E. Comer, Prentice Hall Publisher. (Excellent reference for distributed programming over TCP/IP networks)
8. Richard Stevens, TCP/IP Illustrated, Vol. 1, by, Addison Wesley (A very practical book with lots of useful network diagnostic tools and programs.)
9. Craig Hunt, TCP/IP Network Administration O'Reilly & Associates, Inc. (A must for network and system administrators dealing with internetworking.)
10. L. Peterson and B. Davie. Morgan , Computer Networks: A Systems Approach by Kaufmann Publishers Inc., ISBN 9788131210451
11. J. Kurose, K. Ross ``Computer Networking: A Top-Down Approach Featuring the Internet" Addison-Wesley, '00
12. William Stallings," Cryptography And Network Security" Prentice Hall /Pearson Education

**Guidelines to paper setters:**

Frame formats of protocols are not expected

Problems should be asked on Routing Protocols , TCP, Cryptography, RSA

## CS-103(New): Distributed Database Concepts

**Pre-requisites:** Students should be well-versed with the basic and advanced concepts of RDBMS

### **Objectives:**

Main objective is to understand the principles and foundations of distributed databases. This course addresses architecture, design issues, integrity control, query processing and optimization, transactions, and concurrency control & distributed transaction reliability.

- Unit 1. Distributed databases: An overview** [2]
  - 1.1 Features of distributed Vs centralized databases Chapter 1 from Book 2
  - 1.2 Why DDB? DDBMS
  - 1.3 Promises / problem areas in implementing a DDB Section 1.3,1.5 from Book 1
- Unit 2. DDBMS Architecture** [4]
  - 2.1 DBMS Standardization Chapter 4 from Book 1
  - 2.2 Architectural models for DDBMS
  - 2.3 DDBMS architecture
  - 2.4 Distributed catalog management Section 21.8 from Book 3
- Unit 3. Distributed database design** [10]
  - 3.1 Alternative design strategies Chapter 5 from book 1
  - 3.2 Distributed design issues
  - 3.3 Concepts of join graphs Section 4.2.1.2 from book 2
  - 3.4 Fragmentation and allocation Chapter 5 from Book1
- Unit 4. Overview of Query processing** [4]
  - 4.1 Query processing problems
  - 4.2 Objectives of query processing Chapter 7 from book 1
  - 4.3 Complexity of relational algebra operators
  - 4.4 Characterization of query processors
  - 4.5 Layers of query processing
- Unit 5. Query decomposition & data localization** [2]
  - 5.1 Query decomposition
  - Chapter 5.2 Localization of distributed data 8 from book 1
- Unit 6. Optimization of distributed queries** [10]
  - 6.1 Query optimization
    - Centralized query optimization Join ordering in Chapter 9 from book1
    - fragment queries. Distributed query optimization algorithms
  - 6.2 Centralized query optimization
  - 6.3 Join ordering in fragment queries
  - 6.4 Distributed query optimization algorithms
- Unit 7. Management of distributed transactions** [2]
  - 7.1 Framework for transaction management Chapter 7 from book 2
  - 7.2 Supporting atomicity of distributed transactions
  - 7.3 Concurrency control of distributed transactions
  - 7.4 Architectural aspects of distributed transactions
- Unit 8. Concurrency control** [6]
  - 8.1 Foundations of distributed concurrency control Chapter 8 from book 2
  - 8.2 Distributed deadlocks

- 8.3 Concurrency control based on timestamps
- 8.4 Optimistic methods for distributed concurrency control

**Unit 9. Distributed DBMS reliability**

**[8]**

- 9.1 Reliability concepts & measures
- 9.2 Failures & fault tolerance in distributed systems from book 1
- 9.3 Failures in DDBMS
- 9.4 Local reliability protocols
- 9.5 Distributed reliability protocols
- 9.6 Dealing with site failures
- 9.7 Network partitioning

**Reference Books:**

1. Principles of Distributed Database Systems; 2nd Edition By M. Tamer Ozsu and Patrick Valduriez Publishers: Pearson Education Asia ISBN: 81-7808-375-2
2. Distributed Database; Principles & Systems By Stefano Ceri and Giuseppe Pelagatti Publications: McGraw-Hill International Editions ISBN: 0-07-010829-3
3. Database systems (2nd edition) By Raghuramakrishnan and Johannes

## CS-104(New): Design and Analysis of Algorithms

### Prerequisites

- Basic algorithms and data structure concepts.
- Basic programming concepts

### Objectives

This course will prepare students in

- 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

### Unit 1. Analysis

Algorithm definition, space complexity, time complexity, worst case –best case –average case complexity, asymptotic notation, sorting algorithms (insertion sort, heap sort) , sorting in linear time, searching algorithms, recursive algorithms ( Tower of Hanoi , Permutations).

[T1 1.1 , 1.2, 1.3 ] [6]

### Unit 2. Design strategies

**Divide and conquer**-control abstraction, binary search, merge sort, Quick sort, Strassen's matrix multiplication [ T1 3.1, 3.2, 3.4,3.5,3.7] [6]

**Unit 3. Greedy method**- knapsack problem, job sequencing with deadlines, minimum-cost spanning trees, Kruskal and Prim's algorithm, optimal storage on tapes, optimal merge patterns, Huffman coding [ T1 4.1, 4.2, 4.4, 4.5, 4.6,4.7, 4.8] [8]

**Unit 4. Dynamic programming**- matrix chain multiplication, . single source shortest paths, Dijkstra's algorithm, Bellman- ford algorithm , all pairs shortest path, longest common subsequence, string editing, 0/1 knapsack problem, Traveling salesperson problem.

[T1 5.1, 5.3, 5.6, 5.7, 5.9] [8]

**Unit 5. Decrease and conquer**: - DFS and BFS, Topological sorting, connected components

[T6.1, 6.2, 6.3, 6.4] [6]

**Unit 6. Backtracking**: General method, 8 Queen's problem, Sum of subsets problem, graph coloring problem, Hamiltonian cycle

[T1 7.1 , 7.2, 7.3, 7.4, 7.5] [4]

**Unit 7. Branch and Bound Technique** : FIFO, LIFO, LCBB, TSP problem, 0/1 knapsack problem

[T1 8.1.1, 8.2, 8.3 ] [4]

**Unit 8. Transform and conquer**:- Horner's Rule and Binary Exponentiation – Problem Reduction –

[T1 9.1, 9.2 ,9.3] [4]

### Unit 9. Problem classification

Nondeterministic algorithm, The class of P, NP, NP-hard and NP- Complete problems, significance of Cook's theorem

[T1 11.1] [2]

### Text Books

**T1.** Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, Computer Algorithms, Galgotia.

**T2** T. Cormen, C. Leiserson, & R. Rivest, Algorithms, MIT Press, 1990

### References Texts

- 1) A. Aho, J. Hopcroft, & J. Ullman, The Design and Analysis of Computer Algorithms, M.Sc.(CS) syllabus for affiliated colleges

- Addison Wesley, 1974
- 2) Donald Knuth, The Art of Computer Programming (3 vols., various editions, 1973-81),  
Addison Wesley
  - 3) The Algorithm Manual, Steven Skiena, Springer ISBN:9788184898651
  - 4) Graphs, Networks and Algorithms, Jungnickel, Springer, ISBN: 3540219056

## CS-105 (New) : Network Programming

### Prerequisites:

- Working Knowledge of C
- Basic Understanding of Networking Concepts
- User Level Knowledge of Linux

### Syllabus:

[Total Lectures: 48]

#### UNIT 1: Introduction

[2]

- A Simple Daytime Client, Protocol Independence, Error Handling: Wrapper Functions, A Simple Daytime Server [Book-1]

#### UNIT 2: Sockets Introduction

[6]

- Socket Address Structures, Value-Result Arguments, Byte Ordering Functions, Byte Manipulation Functions, inet\_aton, inet\_addr, and inet\_ntoa Functions, inet\_pton and inet\_ntop Functions, sock\_ntop and Related Functions, readn, writen, and readline Functions, isfdtype Function [Book-1]
- What is a Socket?, Using Sockets [Book-2]

#### UNIT 3: Elementary TCP Sockets

[4]

- socket Function, connect Function, bind Function, listen Function, accept Function, fork and exec Functions, Concurrent Servers, close Function, getsockname and getpeername Functions [Book-1]

#### UNIT 4: TCP Client-Server Example

[6]

- TCP Echo Server: main Function, TCP Echo Server: str\_echo Function, TCP Echo Client: main Function, TCP Echo Client: str\_cli Function, Normal Startup, Normal Termination, Connection Abort before accept Returns, Termination of Server Process, SIGPIPE Signal, Crashing of Server Host, Crashing and Rebooting of Server Host, Shutdown of Server Host [Book-1]

#### UNIT 5: I/O Multiplexing: The select and poll Functions

[6]

- I/O Models, select Function, str\_cli Function (Revisited), Batch Input, shutdown Function, str\_cli Function (Revisited Again), TCP Echo Server (Revisited), pselect Function, poll Function, TCP Echo Server (Revisited Again) [Book-1]

#### UNIT 6: Socket Options

[4]

- getsockopt and setsockopt Functions, Checking If an Option Is Supported and Obtaining the Default, Socket States, Generic Socket Options, IPv4 Socket Options, ICMPv6 Socket Option, IPv6 Socket Options, TCP Socket Options [Book-1]



**UNIT 7: Elementary UDP Sockets****[8]**

- recvfrom and sendto Functions, UDP Echo Server: main Function, UDP Echo Server: dg\_echo Function, UDP Echo Client: main Function, UDP Echo Client: dg\_cli Function, Lost Datagrams, Verifying Received Response, Server Not Running, Summary of UDP example, connect Function with UDP, dg\_cli Function (Revisited), Lack of Flow Control with UDP, Determining Outgoing Interface with UDP, TCP and UDP Echo Server Using select [Book-1]
- User Datagram Protocol, File Transfer, Error Handling [Book-2]

**UNIT 8: Protocols, Sessions, State, and Implementing Custom Protocols****[4]**

- State vs. Stateless, Methods for Maintaining State, What Is a Protocol?, Designing a Custom Protocol, Our Chat Protocol, Protocol Registration [Book-2]

**UNIT 9: Elementary Name, Address Conversions and design decisions****[8]**

- Domain Name System, gethostbyname Function, RES\_USE\_INET6 Resolver Option, gethostbyname2 Function and IPv6 Support, gethostbyaddr Function, uname Function, gethostname Function, getservbyname and getservbyport Functions [Book-1]
- TCP vs. UDP, Application Protocol Choices, Client-Server Architecture, Client-Side Considerations, Server-Side Considerations [Book-2]

**References:**

**T1: Unix Network Programming, Volume 1: The Sockets Networking API, 3/E by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, PHI**

**T2: The Definitive Guide to Linux Network Programming by KEIR DAVIS, JOHN W. TURNER, AND NATHAN YOCOM, Apress.**

# **M.Sc.**

## **(Computer Science)**

# **First Year Semester 2**

## CS-201: Digital Image Processing

### Syllabus:

[Total Lectures: 48]

#### UNIT 1. Introduction

[3]

- What is Digital Image Processing?
- The origins of Digital Image Processing
- Examples of Fields that use Digital Image Processing
  - Gamma-Ray Imaging
  - X-Ray Imaging
  - Imaging in the Ultraviolet Band
  - Imaging in the Visible and Infrared Bands
  - Imaging in the Microwave Band
  - Imaging in the Radio Band
- Fundamental steps in Digital Image Processing
- Components of an Image Processing System

#### UNIT 2. Digital Image Fundamentals

[6]

- Elements of Visual Perception
- Light and the Electromagnetic Spectrum
- Image sensing and Acquisition
- Image Sampling and Quantization
- Some Basic Relationships between Pixels
- An Introduction to the Mathematical Tools Used in Digital Image Processing
  - Array versus Matrix Operations
  - Linear versus Nonlinear Operations
  - Arithmetic Operations
  - Set and Logical Operations

#### UNIT 3. Intensity Transformation and Spatial Filtering

[7]

- Background
- Some Basic Intensity Transformation Functions
- Histogram Processing
  - Histogram Equalization
  - Histogram Matching (Specification)
  - Local Histogram Processing
- Fundamentals of Spatial Filtering
- Smoothing Spatial Filters
- Sharpening Spatial Filters
- Combining Spatial Enhancement Methods

#### UNIT 4. Filtering in the Frequency Domain

[10]

- Background
- Preliminary Concepts
- Sampling and the Fourier Transform of Sampled Functions
- The Discrete Fourier Transform (DFT) of One variable
- Extension to Functions of Two Variables

- Some Properties of the 2-D Discrete Fourier Transform
- The Basics of Filtering in the Frequency Domain
- Image Smoothing Using Frequency Domain Filters
- Image Sharpening Using Frequency Domain Filters
- Selective Filtering

UNIT 5. Image Restoration and Reconstruction

[6]

- A Model of the Image Degradation / Restoration Process
- Noise Models
- Restoration in the Presence of Noise Only- Spatial Filtering
- Periodic Noise Reduction by Frequency Domain Filtering
  - Bandreject Filters
  - Bandpass Filters
  - Notch Filters
- Estimating the Degradation Function
- Inverse Filtering
- Minimum Mean Square Error(Wiener) Filtering
- Geometric Mean Filter

UNIT 6. Morphological Image Processing

[5]

- Preliminaries
- Erosion and Dilation
- Opening and Closing
- The Hit-or-Miss Transformation
- Some Basic Morphological Algorithms
  - Boundary Extraction
  - Hole Filling
  - Extraction of Connected Components
  - Convex Hull
  - Thinning
  - Thickening
  - Skeletons
  - Pruning
  - Morphological Reconstruction

UNIT 7. Image Segmentation

[7]

- Fundamentals
- Point, Line, and Edge Detection
  - Background
  - Detection of Isolated Points
  - Line Detection
  - Edge Models
  - Basic Edge Detection
  - Edge Linking and Boundary Detection
- Thresholding
  - Foundation
  - Basic Global Thresholding
  - Optimum Global Thresholding Using Otsu's Method

- Using Image Smoothing to Improve Global Thresholding
- Using Edges to Improve Global Thresholding
- Region-Based Segmentation

UNIT 8. Representation and Description

[4]

- Representation
  - Boundary (Border) Following
  - Chain Codes
  - Polygonal Approximations Using Minimum-Perimeter Polygons
  - Other Polygonal Approximation Approaches
  - Signatures
  - Boundary Segments
  - Skeletons
- Boundary Descriptors
  - Some Simple Descriptors
  - Shape Numbers
  - Fourier Descriptors
- Regional Descriptors
  - Some Simple Descriptors
  - Topological Descriptors
  - Texture

**Text Book:**

**1. Gonzalez, R. C. and Woods, R. E. [2002/2008], Digital Image Processing, 3rd ed., Prentice Hall**

Reference Books:

1. Sonka, M., Hlavac, V., Boyle, R. [1999]. Image Processing, Analysis and Machine Vision (2nd edition), PWS Publishing, or (3rd edition) Thompson Engineering, 2007
2. Gonzalez, R. C., Woods, R. E., and Eddins, S. L. [2009]. Digital Image Processing Using MATLAB, 2nd ed., Gatesmark Publishing, Knoxville, TN.
3. Anil K. Jain [2001], Fundamentals of digital image processing (2nd Edition), Prentice-Hall, NJ
4. William K. Pratt [2001], Digital Image Processing (3rd Edition), John Wiley & Sons, NY
5. Burger, Wilhelm and Burge, Mark J. [2008]. Digital Image Processing: An Algorithmic Introduction Using Java, Springer
6. Digital Image Analysis (With CD-ROM), Kropatsch, Springer, ISBN 978038795066
7. Digital Image Processing, 6e (With CD), Jähne, Springer, ISBN:978-3-540-24035-8 2

## CS-202(New): Advanced Operating Systems

### Prerequisites:

- Working knowledge of C programming.
- Basic Computer Architecture concepts.
- Basic algorithms and data structure concepts.

### Course Objectives:

This course teaches Advanced Operating Systems Concepts using Unix/Linux and Windows as representative examples. This course strikes a delicate balance between theory (covered in TextBook-2, 3) and practical applications (covered in TextBook-1, 4). 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. Finally, it concludes with an overview of Windows Threads Management. 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.

### Syllabus:

#### Unit 1. Introduction to UNIX/Linux Kernel

[03]

- System Structure, User Perspective, Assumptions about Hardware, Architecture of UNIX Operating System (TextBook-3: 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-1: Chapter 1- relevant topics)

#### Unit 2. File and Directory I/O

[13]

- 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- 3: 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 fdatasync, 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-4: Chapter Topics: 3.3, 3.4, 3.10-3.14, 3.16, 4.2-4.23)
- Scatter/Gather I/O, Mapping Files into Memory, Advice for Normal File I/O, I/O Schedulers and I/O Performance, Directories, Copying and Moving files, Device Nodes, Out-of-Band Communication (TextBook-1: Chapters: 4 and 7-relevant topics)

Unit 3. Process Environment, Process Control and Process Relationships [14]

- 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-3: 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-4: Chapter Topics: 7.3, 7.5-7.7, 7.9-7.11, 8.2-8.11, 8.13, 8.15, 8.16)
- The Process ID, Running a New Process, Terminating a Process, Waiting for Terminated Child Processes, Users and Groups, Daemons, Process Scheduling, Yielding the Processor, Process Priorities, Processor Affinity (TextBook-1: Chapter 5 and 6 [Relevant Topics])

Unit 4. Memory Management [06]

- 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-1: Chapter 8)
- Swapping, Demand Paging (TextBook-3: Chapter Topics: 9.1, 9.2)

Unit 5. Signal Handling [06]

- 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-4: Topics: 10.2-10.13, 10.15-10.19)
- Signal Concepts, Basic Signal Management, Sending a Signal, Reentrancy, Signal Sets, Blocking Signals, Advanced Signal Management, Sending a Signal with a Payload (TextBook-1: Chapter 9)

Unit 6. Windows Thread Management (TextBook-2: Chapter 5 [relevant topics]) [06]

- Thread Internals
  - Data Structures, Kernel Variables, Performance Counters, Relevant Functions, Birth of a Thread Examining Thread Activity : Limitations on Protected Process Threads, Worker Factories (Thread Pools)
- Thread Scheduling
  - Overview of Windows Scheduling, Priority Levels, Windows Scheduling APIs, Relevant Tools, Real-Time Priorities, Thread States, Dispatcher Database, Quantum, Scheduling Scenarios, Context Switching, Idle Thread, Priority Boosts

**Recommended Text:**

1. Linux System Programming, O'Reilly, by Robert Love.
2. Windows Internals, Microsoft Press, by Mark E. Russinovich and David A. Solomon.
3. The Design of the UNIX Operating System, PHI, by Maurice J. Bach.
4. Advanced Programming in the UNIX Environment, Addison-Wesley, by Richard Stevens.



## CS-203(New): Data Mining and Data Warehousing

- Unit 1. **Introduction to Data Mining** [4]
- Basic Data Mining Tasks
  - DM versus Knowledge Discovery in Databases
  - Data Mining Issues
  - Data Mining Metrics
  - Social Implications of Data Mining
  - Overview of Applications of Data Mining
- Unit 2. **Introduction to Data Warehousing** [4]
- Architecture of DW
  - OLAP and Data Cubes
  - Dimensional Data Modeling-star, snowflake schemas
  - Data Preprocessing – Need, Data Cleaning, Data Integration & Transformation, Data Reduction
  - Machine Learning
  - Pattern Matching
- Unit 3. **Data Mining Techniques** [4]
- Frequent item-sets and Association rule mining: Apriori algorithm, Use of sampling for frequent item-set, FP tree algorithm
  - Graph Mining: Frequent sub-graph mining, Tree mining, Sequence Mining
- Unit 4. **Classification & Prediction** [16]
- Decision tree learning: [3 hrs]  
Construction, performance, attribute selection  
Issues: Over-fitting, tree pruning methods, missing values, continuous classes  
Classification and Regression Trees (CART)
  - Bayesian Classification: [6 hrs]
  - Bayes Theorem, Naïve Bayes classifier,
  - Bayesian Networks
  - Inference
  - Parameter and structure learning
  - Linear classifiers [4 hrs]
  - Least squares, logistic, perceptron and SVM classifiers
  - Prediction [3 hrs]
  - Linear regression
  - Non-linear regression
- Unit 5 **Accuracy Measures** [4]
- Precision, recall, F-measure, confusion matrix, cross-validation, bootstrap
- Unit 6. **Software for data mining and applications of data mining** [4]
- R, Weka, Sample applications of data mining
- Unit 7. **Clustering** [4]
- k-means

- Expectation Maximization (EM) algorithm
- Hierarchical clustering, Correlation clustering

Unit 8. **Brief overview of advanced techniques**

[4]

- Active learning
- Reinforcement learning
- Text mining
- Graphical models
- Web Mining

**Reference Books:**

1. Data Mining: Concepts and Techniques, Han, Elsevier ISBN:9789380931913/9788131205358
2. Margaret H. Dunham, S. Sridhar, Data Mining – Introductory and Advanced Topics, Pearson Education
3. Tom Mitchell, —Machine Learning||, McGraw-Hill, 1997
4. R.O. Duda, P.E. Hart, D.G. Stork. Pattern Classification. Second edition. John Wiley and Sons, 2000.
5. Christopher M. Bishop, —Pattern Recognition and Machine Learning||, Springer 2006
6. Raghu Ramkrishnan, Johannes Gehrke, Database Management Systems, Second Edition, McGraw Hill International
7. Ian H.Witten, Eibe Frank Data Mining: Practical Machine Learning Tools and Techniques, Elsevier/(Morgan Kauffman), ISBN:9789380501864
8. [Research-Papers]: Some of the relevant research papers that contain recent results and developments in data mining field

### **CS-204 Project**

The Project can be platform, Language and technology independent. Project will be evaluated by project guide. Assessment will be done weekly in the respective batch. Evaluation will be on the basis of weekly progress of project work, progress report, oral, results and documentation and demonstration.

You should fill your status of the project work on the progress report and get the Signature of project guide regularly. Progress report should sharply focus how much time you have spent on specific task. (The format of progress report is given as follow.) You should keep all signed progress report. Project will not be accepted if progress report is not submitted and all responsibility remains with student.

## Project Progress Report

Roll No & Name of the student	
Title of the Project	
Project guide Name	

SN	From Date	To Date	Details of Project work	Project guide sign (with date)

Head,  
Deptt. of Computer Science

- You should prepare design document using SE/UML techniques depends on your project
- **Project Report Content should as follow :**
  1. College certificate
  2. Acknowledgement
  3. Problem Definition
  4. Existing System and need for the new system
  5. Scope of the work
  6. Feasibility study (Including H/W & S/W setup requirements)
  7. Requirement Analysis (including fact finding methods used)
  8. E-R diagrams
  9. Decision trees/Decision tables
  10. Normalized Database Design & Data Dictionary.
  11. Data flow Diagrams (if applicable)
  12. Use-case Diagrams
  13. Class Diagrams
  14. Object Diagrams
  15. Sequence Diagrams
  16. Collaboration Diagram
  17. Activity Diagram
  18. State Chart (if applicable)
  19. Component Diagram
  20. Deployment Diagram (if applicable)
  21. Use interface design
    - Menus
    - Input Screens using sample data
    - Reports, Graphs using sample data
  22. Testing & Implementation plan (Should contain testing strategies, techniques used & implementation approach used.)
  23. User manual

24. Drawbacks, Limitations & Proposed enhancement
25. Abbreviations used (if any)
26. Bibliography/Reference (Including book titles, authors name, editions, publications, etc)

**About project Report: -**

The report should be typed on A4 size, executive bond paper for the final submission. The report should be in the good quality Rexene bound. We suggest, using one-and-half spaced printing, Times New Roman 12 font sizes for the normal text, 14-16 font sizes for headings & page titles.

**Number of copies:**

For one project you should prepare 2 copies of the project report. One for yourself, one for college.

## **Elective Course [CS-205]: Programming with DOT NET**

Objectives:

- To understand the DOTNET framework, C# language features and Web development using ASP.NET

### **Prerequisites –**

- Knowledge of object-oriented programming concepts such as data abstraction, encapsulation, inheritance, and polymorphism.
- Familiarity with programming language such as C++ and/or Java.
- Knowledge of web development

### **Topics to be covered:**

#### **Part I : C#**

#### **Unit 1. DOTNET Framework (2)**

- a. Introduction to DOTNET
- b. DOT NET class framework
- c. Common Language Runtime
  - i. Overview
  - ii. Elements of .NET application
  - iii. Memory Management
  - iv. Garbage Collector : Faster Memory allocation, Optimizations
- d. Common Language Integration
  - i. Common type system
  - ii. Reflection API
- e. User and Program Interface

#### **Unit 2. Introduction to C# (8)**

- a. Language features
  - i. Variables and Expressions, type conversion
  - ii. Flow Control
  - iii. Functions, Delegates
  - iv. Debugging and error handling, exception handling ( System Defined and User Defined)
- b. Object Oriented Concepts
  - i. Defining classes, class members, Interfaces, properties
  - ii. Access modifiers, Implementation of class, interface and properties
  - iii. Concept of hiding base class methods, Overriding
  - iv. Event Handling
- c. Collections, Comparisons and Conversions
  - i. Defining and using collections, Indexers, iterators
  - ii. Type comparison, Value Comparison
  - iii. Overloading Conversion operators, as operator
- d. Generics
  - i. Using generics
  - ii. Defining Generics, generic Interfaces, Generic methods, Generic Delegate

#### **Unit 3. Window Programming (6)**

- a. Window Controls
  - i. Common Controls
  - ii. Container Controls
  - iii. Menus and Toolbars
  - iv. Printing
  - v. Dialogs
- b. Deploying Window Application
  - i. Deployment Overview
  - ii. Visual studio setup and Deployment project types
  - iii. Microsoft windows installer architecture
  - iv. Building the project : Installation

#### **Unit 4. Data Access (6)**

- a. File System Data
- b. XML
- c. Databases and ADO.NET
- d. Data Binding

#### **Unit 5. Web Programming (6)**

- a. Basic Web programming
- b. Advanced Web programming
- c. Web Services
- d. Deployment Web applications

#### **Unit 6. .NET Assemblies (3)**

- a. Components
- b. .NET Assembly features
- c. Structure of Assemblies
- d. Calling assemblies, private and shared assemblies

#### **Unit 7. Networking (2)**

- a. Networking overview
- b. Networking programming options
  - i. WebClient
  - ii. WebRequest and WebResponse
  - iii. TcpListener & TcpClient

#### **Unit 8. Introduction to GDI+ (2)**

- a. Overview of Graphical Drawing
- b. Pen Class, Brush Class, Font Class
- c. Using Images
- d. Clipping, Drawing2D, Imaging

### **Part II : ASP.NET**

#### **Unit 1. Introduction to ASP.NET (1)**

#### **Unit 2. Server Controls and Variables, control Structures & Functions (4)**

- a. Forms, webpages, HTML forms, Webforms
- b. Request & Response in Non-ASP.NET pages
- c. Using ASP.NET Server Controls
- d. Datatypes : Numeric, text, arrays, datacollections
- e. Overview of Control structures
- f. Functions : web controls as parameters

#### **Unit 3. Even Driven Programming and PostBack (3)**



- a. HTML events
- b. ASP.NET page events
- c. ASP.NET Web control events
- d. Event driven programming and postback

**Unit 4. Reading from Databases (3)**

- a. Data pages
- b. ADO.NET

**Unit 5. ASP.NET Server Controls (4)**

- a. ASP.NET Web Controls
- b. HTML Server Controls
- c. Web Controls

**Unit 6. DOTNET assemblies and Custom Controls (2)**

- a. Introduction to Cookies, Sessions
- b. Session events
- c. State management Recommendations

**Unit 7. Web Services (2)**

- a. HTTP, XML & Web services
- b. SOAP
- c. Building ASP.NET web service
- d. Consuming a web service

**Recommended Text and Reference books:**

Beginning Visual C#, Wrox Publication  
 Professional Visual C#, Wrox Publication  
 Inside C#, by Tom Archer ISBN: 0735612889 Microsoft Press © 2001, 403 pages  
 Beginning ASP.NET 3.5, Wrox Publication  
 Programming ASP.NET 3.5 by Jesse Liberty, Dan Maharry, Dan Hurwitz, O'Reilly  
 Illustrated C# 2008, Solis, Publication Apress, ISBN 978-81-8128-958-2  
 Professional C# 4.0 and .NET 4 by Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson,  
 Morgan Skinner, WROX  
 Beginning C# Object-Oriented Programming By Dan Clark , Apress  
 ADO.NET Examples and Best Practices for C# Programmers, By Peter D. Blackburn Apress  
 Database Programming with C#, By Carsten Thomsen, Apress

## **Elective Course [CS-206]: Artificial Intelligence**

### **Prerequisites –**

- Concepts of Data structures and Design and Analysis of algorithms

### **Objectives-**

- To understand and gain the knowledge of the subject

### **Course contents –**

#### Unit 1. Introduction to Artificial Intelligence

- What is AI?
- Early work in AI
- AI and related fields
- AI problems and Techniques

#### Unit 2. Problems, Problem Spaces and Search

- Defining AI problems as a State Space Search: example
- Production Systems
- Search and Control Strategies
- Problem Characteristics
- Issues in Design of Search Programs
- Additional Problems

#### Unit 3. Heuristic Search Techniques

- Generate-and-test
- Hill Climbing
- Best First Search
- Problem Reduction
- Constraint Satisfaction
- Mean-Ends Analysis

#### Unit 4. Knowledge Representation

- Representations and Mappings
- Approaches to Knowledge Representation
- Knowledge representation method
- Propositional Logic
- Predicate logic
- Representing Simple facts in Logic
- Representing Instances and Isa relationships
- Computable Functions and Predicates
- Resolution
- Forward and backward chaining

#### Unit 5. Slot – and – Filler Structures

- Weak Structures
- Semantic Networks
- Frames
- Strong Structures
- Conceptual Dependencies
- Scripts

#### Unit 6. Game Playing

- Minimax Search Procedures
- Adding alpha-beta cutoffs
- Uncertainty Reasoning: Basic Probability Axioms, Baye's

Rule, Bayesian Classification, Certainty Factor Theory, Dempster Shafar Theory.

Unit 7. Learning

- What is learning?
- Rote Learning
- Learning by taking advice
- Learning in problem solving
- Learning from examples
- Explanation based learning

**Internal evaluation**

- To implement the AI concepts using programming language PROLOG.

**Reference books –**

1. Computational Intelligence, Eberhart, Elsevier, ISBN 9788131217832
2. Artificial Intelligence: A New Synthesis, Nilsson, Elsevier, ISBN 9788181471901
3. Artificial Intelligence, Tata McGraw Hill, 2nd Edition, by Elaine Rich and Kevin Knight
4. Introduction to Artificial Intelligence and Expert System, Prentice Hall of India Pvt. Ltd., New Delhi, 1997, 2nd Printing, by Dan Patterson.

## **Elective Course [CS-207]: Advance Algorithms**

Unit 1 : Advanced data structures (Fibonacci heaps, splay trees, dynamic trees, B-Trees) in-memory representations and persistence of DS, Revision of Graph algorithms: Network flows (max flow and min-cost flow/circulation) **(10 Hrs)**

Unit 2 . String algorithms: **(10 Hrs)**  
1 String searching - (Knuth–Morris–Pratt algorithm, Boyer–Moore string search algorithm, Rabin–Karp string search algorithm)  
2. Suffix trees - mathematical properties of suffix trees  
3. Applications of Suffix trees:  
Regular expression searches using suffix trees;  
Finding all maximal pairs and maximal repeats, Patricia trees

Unit 3 : Intractable problems: approximation algorithms **(14 Hrs)**  
1. Steiner tree and TSP  
2. Steiner forest  
3. Group Steiner trees  
4. Set cover via primal-dual  
5. k-median on a cycle

Unit 4: Integer programming and optimization algorithms **(14 Hrs.)**  
1. Formulations, complexity and relaxations  
2. discrete optimization,  
3. cutting plane methods,  
4. enumerative and heuristic methods  
5. Convex programming algorithms: ellipsoid method, interior-point methods, proximal point methods.

### **Preliminary reading:**

- Introduction to Algorithms: by Cormen, T.H., C.E. Leiserson, R.L. Rivest, and C. Stein; MIT Press; ISBN: 9780262032933
- The Algorithm Manual, Steven Skiena, Springer ISBN:9788184898651

### **Reference Books:**

- Theory of Linear and Integer Programming: by Schrijver; John Wiley & Sons. ISBN: 9780471982326
- Convex Optimization: by Boyd and Vandenberghe; Cambridge University Press; ISBN: 9780521833783
- Approximation Algorithms: by Vazirani; Springer-Verlag: ISBN: 9783540653677
- Advances in Steiner Trees (Combinatorial Optimization) by Ding-Zhu Du (Editor), J.M. Smith (Editor), J. Hyam Rubinstein (Editor); Springer; ISBN: 978-0792361107
- Algorithms On Strings, Trees, And Sequences; by D. Gusfield; Cambridge University Press,(ISBN 052158519)

### **Additional reading:**

- Algorithmic Number Theory: by Bach and Shallit; MIT Press; ISBN: 9780262024051

**Syllabus for M.Sc. (Computer Science)  
in affiliated colleges to University of Pune**

**(To be implemented from Academic year 2014-2015)**

**Credit Based System**

Year/ Semester	Subject	Paper	Title of Paper	Hours/ Week	Credit	% of Assessment		
						IA	UE	Total
II Year Sem-III	Core	CS-301	Software Metrics & Project Management	4	5	50	50	100
	Core	CS-302	Mobile Computing	4	5	50	50	100
	Core	CS-303	Soft Computing	4	5	50	50	100
	Elective	CS-304	Project	4	5	50	50	100
	Elective	CS-305	Web Services	4	5	50	50	100
	Elective	CS-306	Database and System Administration	4	5	50	50	100
	Elective	CS-307	Functional Programming	4	5	50	50	100
	Elective	CS-308	Business Intelligence	4	5	50	50	100

Minimum Credit : 25, Maximum Credit : 35 Core Subject is compulsory, From elective courses student can select two course for minimum credit and four for maximum credit. IA :- Internal Assessment, UE :- University Examination

Year/ Semester	Subject	Paper	Title of Paper	Hours/ Week	Credit	% of Assessment		
						IA	UE	Total
II Year Sem-IV	Core	CS-401	Industrial Training /Institutional project	-	15	50	50	100
	Elective	CS-402	Parallel Computing	4	5	50	50	100
	Elective	CS-403	Embedded System	4	5	50	50	100
	Elective	CS-404	Software Quality Assurance	4	5	50	50	100
	Elective	CS-405	Modeling and Simulation	4	5	50	50	100

Core Subject is compulsory. If student had completed 85 credit within three semesters then no need to select any elective course otherwise student should select appropriate number of elective courses to minimum complete 100 credits.

IA :- Internal Assessment, UE :- University Examination

# **M.Sc (Computer Science)**

## **Part - II / Semester 3**

# (CORE) CS 301: Software Metrics & Project Management

No of lectures: 48

## Pre-requisites

- Software Engineering
- Basic testing concepts

## Objectives

- 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 and Validation and Management of Large Software Engineering Projects.
- Student 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 1 : Introduction to Project Management [4]

- What is a Project?
- What is Project management?
- Project phases and project life cycle
- Organizational structure
- Qualities of Project Manager

## Chapter 2 : Project Management Components [6]

- Project Integration Management-Project plan development and execution
- Change controls
- Configuration management

## Chapter 3 : Scope Management [4]

- Strategic planning
- Scope planning, definition
- Verification and control

## Chapter 4 : Time management [2]

- Activity planning
- Schedule development and control

<b>Chapter 5 : Cost Management</b>	<b>[2]</b>
• Cost estimation and Control	
<b>Chapter 6 : Quality Management</b>	<b>[2]</b>
• Quality planning and assurance	
<b>Chapter 7 : Human Resource Management</b>	<b>[2]</b>
• Organizational planning	
• Staff acquisition	
<b>Chapter 8 : Communication Management</b>	<b>[2]</b>
• Information distribution	
• Reporting	
<b>Chapter 9 : Risk Management</b>	<b>[2]</b>
• Risk identification	
• Quantification and control	
<b>Chapter 10 : Procurement Management</b>	<b>[2]</b>
• Solicitation	
• Contract administration	
<b>Chapter 11 : Software Metrics</b>	<b>[6]</b>
• The scope of software metrics	
• Software metrics data collection	
• Analyzing software data	
• Measuring size, structure, external attributes	
<b>Chapter 12 : Software Reliability</b>	<b>[6]</b>
• Measurement and prediction	
• Resource measurement	
• Productivity, teams and tools	
<b>Chapter 13 : Planning a measurement program</b>	<b>[4]</b>
• 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

## **Chapter 14 : Quality Standards**

[4]

- CMM
- PSP/TSP

### **Reference Books**

1. Information Technology Project Management, 6th Edition Kathy Schwalbe ISBN-13 :9781111221751 , Cenage Learning
2. Software Metrics: A rigorous and Practical Approach by Norman E. Fenton and Shari Lawrence Pfleeger, International Thomson Computer Press
3. Software Engineering: A Practioner's Approach by Roger S. Pressman ISBN: 9780071267823
4. Practical Software Metrics for Project Management and Process Improvement Robert B. Grady, Prentice hall, ISBN : 9780137203840

### **Note: -**

- Numerical should be covered on Cost Management (COCOMO), Time Management.
- For Internal Evaluation group-wise case study is compulsory.

# (CORE) CS 302: Mobile Computing

**No of Lectures: 48**

## **Prerequisites**

- Concepts of multiplexing and modulation
- Concepts of Networking
- Conversant with OS internals
- Familiar with event handling
- Web browsers
- Create and Compile Java Programs
- Brief History of wireless communication

## **Objectives**

- To familiarize the students with the buzz words and technology of mobile communication
- Understand the GSM architecture
- Understand the issues relating to Wireless applications

### **Chapter 1 : Introduction to Mobile Computing [3]**

- Introduction and need for Mobile computing
- Mobility and portability
- Mobile and Wireless devices
- Applications
- Brief History of wireless communication

### **Chapter 2 : Wireless Transmission [3]**

- General Concepts of multiplexing and modulation
- Spread Spectrum
- Cellular Systems

### **Chapter 3 : Medium Access Control Layer [4]**

- Why specialized MAC?
  - a. hidden and exposed terminals
  - b. near and far terminals
- ii. General Concepts and comparison of SDMA, FDMA, TDMA , CDMA

### **Chapter 4 : Mobile IP [8]**

- Goals, assumptions and requirements
- Entities and terminologies
- Agent Discovery
- Registration
  
- Tunneling and encapsulation

- Optimization
- Reverse Tunneling
- IPv6
- IP micro-mobility support – Cellular IP, Hawaii, Hierarchical, mobile IPv6
- Mobile Routing :
  - Destination sequence distance Vector, Dynamic Source Routing,
  - Alternative Metrics, Adhoc Routing Protocols -Flat, Hierarchical,
  - Geographic-position-assisted

## **Chapter 5 : Mobile TCP**

**[5]**

- Traditional TCP
  - Congestion Control, Slow start, Fast retransmit / Fast recovery
  - Implications on mobility
- Classical TCP improvements
  - Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit / Fast recovery, Transmission / Timeout freezing, Selective Retransmission, Transaction oriented TCP
- TCP over 2.5/3G wireless networks

## **Chapter 6 : GSM**

**[8]**

- Mobile Services (Bearer, Tele-and-supplementary services)
- System Architecture
  - Radio subsystem
  - Network and switching subsystem
  - Operation subsystem
- Protocols
- Localization and calling
- Handover
- Value Added Services
  - SMS: Architecture, Mobile Originated and Mobile Terminated procedures
  - Cell Broadcast Service: Architecture, Message Transfer Procedure
  - MMS: Architecture, Protocol framework, Message Transfer Procedure
  - Location Services: Logical Reference Model, Control Procedures, Network Architecture, determination of Location Information, Location based services
- GPRS

## **Chapter 7 : 3G mobile networks**

**[8]**

- UMTS
  - System architecture, radio interface
- UTRAN
  - Architecture, Functions of RNC, Core network
- Handover
  - Hard and soft handover

## Chapter 8 : Wireless Application Protocol

[4]

- Architecture
- Wireless datagram protocol
- Wireless transport layer security
- Wireless transaction protocol
- Wireless session protocol
- Wireless application environment
- WAP Push Architecture, protocols

## Chapter 9 : Introduction to Android Operating System& Programming

[10]

- Overview and evolution of Android
- Features of Android
- Android architecture
- Components of an Android Application, Manifest file
- Android Activity and Service Lifecycle
- UI Designing (layout designing)
- All components (e.g Button , Slider, Image view, Toast)
- Event Handling

### Reference Books

1. Mobile Communications Jochen Schiller, Pearson Education, 2nd Edition, ISBN : 9780321123817
2. Beginning Android Application Development by Wei-Meng Lee Wiley India ISBN:9788126531066
3. Mobile Networks GSM and HSCSD- Nishit Narang, Sumit Kasera, TataMcGrawHill
4. Mobile Computing: Technology, Applications, and Service Creation by Asoke K. Talukder,
5. Beginning Android 3 by Mark Murphy APress , ISBN 9788132203568
6. The Android Developers Guide [<http://developer.android.com/guide/index.html>]

### Note: -

- **For internal evaluation Android Application Development / Assignments are compulsory for 20 marks.**

## (CORE) CS 303: Soft Computing

**No of Lectures: 48**

### Objective

- To understand the concepts of how an intelligent system work and its brief development process.

### Prerequisites

- Probability
- First Order Predicate Logic
- Classical Logic
- Calculus

### Description

Intelligent systems can function as intelligent assistants, augmenting or supplementing human expertise while increasing productivity. This course exposes learners to Neural Network, Fuzzy Logic and Genetic Algorithms, which are the major building blocks of Intelligent Systems.

### Chapter 1 : Introduction to Fuzzy Logic

[16 to 20]

The Illusion : Ignoring Uncertainty and accuracy, Uncertainty and information, Fuzzy set and membership, Chance versus Fuzziness. Classical Sets, Fuzzy Sets, Cartesian Product, Crisp Relations, Fuzzy relations, Tolerance and equivalence Relations, Fuzzy Tolerance and equivalence Relations, Value assignments, Other Forms of the Composition Operations, Features of the membership Function, various forms, Fuzzification, Defuzzification to Crisp set,  $\lambda$ -Cuts for fuzzy Relations, Defuzzification to Scalars, Fuzzy Logic, Approximate Reasoning, Others forms of implication operations, Natural Language, Linguistic Hedges, Fuzzy (Ruled-Based) system, Graphical technique of inference, Membership value assignment-Intuition, Inference.

From Book 1 Chapters 1,2,3,4,5,6

### Chapter 2 : Fuzzy System and Classification

[10 to 12]

Fuzzy System Simulation- Fuzzy Relation, Equations, Nonlinear Simulation Using Fuzzy Systems, Fuzzy Associative Memories.

Fuzzy Classification- Classification by Equivalence Relations, Cluster Analysis, Cluster Validity, c-Means Clustering, Hard c-Means, Fuzzy c-Means, Classification Metric, Hardening the Fuzzy c-Partition, Similarity Relations from Clustering.

Fuzzy Arithmetic and Extension Principle-Extension Principle, Fuzzy Arithmetic, Interval Analysis in Arithmetic, Approximate Methods of Extension.

From Book 1 Chapters 8, 10, 12

### Chapter 3 : Neural Network

[20 to 22]

Neural networks: Artificial Neural Network: Definition, Advantages of Neural Networks  
Application Scope of Neural Networks

Fundamental Concept: Artificial Neural Network, Biological Neural Network, Brain vs. Computer-Comparison Between Biological Neuron and Artificial Neuron (Brain vs. Computer) Book3.

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 Descent Rules, Learning Objective for TLNs, Pattern Space and Weight Space. From Book 2

Linear Separability, Hebb Network, Perceptron Network. From Book3  
 $\alpha$ - Least Mean Square Learning, MSE Error Surface and Its Geometry, Steepest Descent Search with Exact Gradient Information,  $\mu$ -LMS: Approximate Gradient Descent, Application of LMS TO Noise Cancellation.

**From Book 2**

#### **Chapter 4 :Genetic Algorithms:**

**[2 to 4]**

A Gentle Introduction to Genetic Algorithms: What are Genetic Algorithm? , Robustance of Traditional Optimization and Search Methods, The Goals of Optimization, How are Genetic Algorithms Different from Traditional Methods?, A simple Genetic Algorithm, Genetic Algorithms at Work—a Simulation by hand, Grist for the Search Mill—Important Similarities, Similarity Templates (Schemata), Learning the Lingo.

**From Book 4**

#### **Reference Books**

1. Fuzzy Logic With Engineering Applications, 3<sup>rd</sup> Edition By Timothy Ross , Wiley Publication
2. Neural Networks By Satish Kumar, Tata McGraw Hill
3. Introduction to Soft Computing by Deepa &Shivanandan, Wiley Publication
4. Genetic Algorithms in Search, Optimization and Machine Learning By David E. Goldberg, Pearson Education

## (ELECTIVE) CS 304: Project

- The Project can be platform, Language and technology independent.
- Project will be evaluated by project guide.
- Assessment will be done weekly in the respective batch.
- Evaluation will be on the basis of weekly progress of project work, progress report, oral, results and documentation and demonstration.
- You should fill your status of the project work on the progress report and get the Signature of project guide regularly. Progress report should sharply focus how much time you have spent on specific task. (The format of progress report is given as follow.)
- You should keep all signed progress report.
- Project will not be accepted if progress report is not submitted and all responsibility remains with student.
- Students should prepare design document using SE/UML techniques depends on your project.

### About project Report: -

- The report should be typed on A4 size, executive bond paper for the final submission. The report should be in the good quality Rexene bound. We suggest, using one-and-half spaced printing, Times New Roman 12 font sizes for the normal text, 14-16 font sizes for headings & page titles.
- Number of copies:  
For one project you should prepare 2 copies of the project report. One for yourself, one for college (**College copy can be in CD**).

### Evaluation for internal 50 Marks

Description	Marks
UML Diagrams	10 M
Technology And Design Based First Demo	15 M
Project Technology Based 2 assignments	10 M
Second Demo	15M

### Evaluation for external 50 Marks

Description	Marks
Demo	15 M
Report	15 M
Presentation	15 M
Viva	05M

## (ELECTIVE) CS 305: Web Services

**No of lectures: 48**

### **Pre-requisites**

- Strong knowledge about Java programming.
- Good Understanding of Object Oriented Programming concepts.
- Must be familiar with XML.

### **Objectives**

- To Understand Web Services and implementation model for SOA
- To Understand the SOA, its Principles and Benefits
- Understanding cloud computing as a web service
- Discuss the concept of virtualization and data in cloud.

### **Chapter 1 : Web Service and SOA fundamentals**

**[ 8 ]**

Introduction, Concept of Software as a Service(SaaS), Web services versus Web based applications, Characteristics of Web services, Service interface and implementation, The Service Oriented Architecture(SOA), Quality of service (QoS), Web service interoperability, Web services versus components, RESTful services , Impact and shortcomings of Web services.

### **Chapter 2 : Web Services Architecture.**

**[ 8 ]**

Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, basic steps of implementing web services, developing web services enabled applications.

### **Chapter 3 : SOAP: Simple Object Access Protocol**

**[ 10 ]**

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.



## **Chapter 4 : Describing and Discovering Web Services**

[12]

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, 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.

## **Chapter 5 : Emerging trends: Cloud Computing**

[10]

What is Cloud Computing?, SOA meets the Cloud, Cloud Service Models, SaaS-Salesforce.com, PaaS-Google App Engine, IaaS-Amazon EC2, Cloud Deployment Models – Public, Community, Private, Hybrid. Virtualization , Virtual Machine(VM) Technology, Virtual Machine Monitor or Hypervisor - KVM, Xen, VMware hypervisors and their features, Multi-tenancy, Architecture model for Cloud Computing .

Case Study: Use Cloud Services – Amazon EC2, Google App Engine, Salesforce.com

### **Text books:**

1. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou.
2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.
3. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education.
4. Gautam Shroff, “Enterprise Cloud Computing” ,Cambridge.

### **Reference Books:**

1. Building Web Services with Java, 2<sup>nd</sup> Edition, S. Graham and others, Pearson Edn., 2008.
2. Java Web Services, D.A. Chappell & T. Jewell, O’Reilly,SPD.
3. J2EE Web Services, Richard Monson-Haefel, Pearson Education.
4. Java Web Services Programming,R.Mogha,V.V.Preetham,Wiley India Pvt.Ltd.
5. 5.Ronald Krutz and Russell Dean Vines, “Cloud Security”, Wiley-India
6. XML, Web Services, and the Data Revolution, F.P.Coyle, Pearson Education.
7. Dr. Kumar Saurabh,”Cloud Computing”, Wiley Publication
8. Borko Furht, “Handbook of Cloud Computing”, Springer

## (ELECTIVE) CS 306: Database and System Administrator

No of lectures: 48

### Pre-requisites

- Concepts of Databases
- Basic knowledge of any operating system and programming language.

### Objectives

- This curriculum offers you the opportunity to acquire a combination of both Operating Systems & Database Administration skills.
- SDBA program gives you ideal opportunity to practice what you have learned through real life case studies.

### DBMS Administration

#### Chapter 1 : Client/Server Concepts [1]

- Client server Architecture
- Invoking Client Programs

#### Chapter 2 : MySQL Client Program [4]

- Using MySQL interactively
- Statement Terminators
- Using Script Files with MySQL
- MySQL Output Formats
- Client Commands and SQL Statements
- Using Server-Side Help
- Using the – safeupdates Option

#### Chapter 3 : MySQL Architecture [3]

- Client/Server Overview
- Communication Protocols
- The SQL Parser and Storage Engine
- Tiers
- How MySQL Uses Disk Space
- How MySQL Uses Memory

#### Chapter 4 : Starting, Stopping, and Configuring MySQL [3]

- Types of MySQL Distributions
- Starting and Stopping MySQL Server on Windows
- Starting and Stopping MySQL Server on Unix
- Runtime MySQL Configuration
- Log and Status Files

- Loading Time Zone Tables
- Security-Related Configuration
- Setting the Default SQL mode
- Upgrading MySQL

**Chapter 5 : Locking** [2]

- Locking Concepts
- Explicit Table Locking
- Advisory Locking

**Chapter 6 : Storage Engines** [5]

- MySQL Storage Engines
- The MyISAM Engine
- The MERGE Engine
- The InnoDB Engine
- The MEMORY Engine
- The FEDERATED Engine
- The Cluster Storage Engine
- Other Storage engines

**Chapter 7 : Data (Table) Maintenance** [3]

- Types of Table Maintenance Operations
- SQL Statements for Table Maintenance
- Client and Utility Programs for Table Maintenance
- Repairing InnoDB Tables
- Enabling MyISAM Auto-Repair

**Chapter 8 : Data Backup and Recovery Methods** [3]

- Introduction
- Binary Versus Textual Backups
- Making Binary Backups
- Making Text Backups
- Backing Up Log and Status Files
- Replication as an Aid to Backup
- MySQL Cluster as Disaster Prevention
- Data Recovery

**System Administration**

**Chapter 9 : Introduction** [1]

- Know Your PC
- Different Linux Distribution
- Daily tasks of system Administrator
- Responsibilities of System Administrator

**Chapter 10 : Linux Installation** [2]

- Text VS Graphics
- Partitioning & Disk management
- GUI Configuration

**Chapter 11 : File manipulations Under Linux** [4]

- Copy rename, delete & move
- File & directory listing
- File handling & I/O redirection
- File systems and their types
- Names & contents of important Unix/Linux file directories
- Compatibility of file Systems
- fsck & Disk check Commands, Log files

**Chapter 12 : Command Line Interface** [3]

- Text Manipulation Commands e.g. cut, grep, egrep, split, paste
- Vi editor
- su, ps, find, make, df/du
- Introduction to Regular expression
- awk, sed, passwd, wc, Antivirs, utilities, tar, gzip/gunzip, accessing pen drive, CD

**Chapter 13 : Users and Groups** [2]

- Concept of users & groups
- Owner creator
- Primary and Secondary group
- Types of file and directory permission

**Chapter 14 : Startup/shut down** [2]

- Booting
- Run Levels
- /etc/init tab
- shut down
- handling crashes

**Chapter 15 : Basic system Administration** [6]

- Managing Users and groups (from console & GUI modes) Using command like adduser, userdel, groupadd, groupdel etc.
- Basic Network Setup Setting hostname, IP address of the machine. Setting a dialup connection.

- Installing and removing packages. Using the RPM, source package installation, URPMI.
- Managing Partitions
- Boot loader management Understanding the lilo and grub boot loader and its configuration files.
- Configuring services, chkconfig, ntsys, start, Resart & stop Service

### **Chapter 16 : Networking [2]**

- Internetworking with windows (samba)
- Ping Telnet, ftp program
- NIS, NFS, Tomcat web server

### **Chapter 17 : Print Services [2]**

- Printers Installation
- Print command

### **Reference Books**

1. Linux System Administrator's guide by Lars Wirzenius, Joanna Oja, Stephen Stafford, Alex Weeks
2. Linux Administration Made Easy by Steve Frampton
3. MySQL 5 for Professionals By Ivan Bayross, Sharanam Shah [SPD Publications]
4. High Performance MySQL By Jeremy D. Zawodny, Derek J. Balling [O'Reilly Media Publications]
5. MySQL in a Nutshell By Russell Dyer [O'Reilly Media Publications]

### **Important Links**

1. [http://www.thegeekstuff.com/2008/11/overview-of-mysql-information\\_schema-database-with-practical-examples/](http://www.thegeekstuff.com/2008/11/overview-of-mysql-information_schema-database-with-practical-examples/)
2. <http://www.learn-mysql-tutorial.com/Identifiers.cfm>

### **Note: -**

- **Some chapters are practical oriented so faculty should teach those chapter with demonstration.**
- **And, those chapters are kept for internal evaluation.**
- **Hence, hands on must be taken for these chapters.**

## (ELECTIVE) CS 307: Functional Programming

No of Lectures: 48

### Prerequisites

Anyone who has a mature understanding of programming in an imperative language (e.g., Java, C/C++, or Pascal), of basic algorithms and data structures (e.g., sorting, searching, lists, stacks, and trees), and of basic discrete mathematics (e.g., sets, relations, functions, induction, and simple algebraic concepts)

### Objectives

- Understand what functional programming is, what different variants are there and have some grasp of their history;
- Explain the semantics of different functional languages using precise formal specifications;
- Know how to implement functional languages and what optimizations are important;
- Be able to state and critique what it means for an implementation of a functional programming language to be correct;
- Be able to (in principle) formally prove correctness of their implementations, including their compilers and garbage collectors

### Chapter 1 : Introduction to FP & Mathematical Functions

[6]

Principles of FP, History, Varieties of FP languages, Declarative style of programming, Declarative style of programming, Why functional programming Mathematical functions : definition, lambda expression, Functional Forms or a higher-order function :- Function Composition, Construction, Apply-to-all, Disadvantages of FP

### Chapter 2 : Introduction to Lambda calculus

[12]

Introduction, The benefits of lambda notation, Lambda calculus as a formal system - Lambda terms (Variables, Constants, Combinations, Abstractions), Free and bound variables, Substitution, Conversions (Alpha conversion, Beta conversion, Eta conversion), Lambda equality, Lambda reduction, Reduction strategies, Combinators

### Chapter 3 : Reduction strategies and lazy evaluation

[8]

Reduction, Evaluation in a strongly typed language, What is reduction?, 2 types of reduction rules, Reduction rules, Alternate reductions, Reduction strategies - Eager evaluation and Lazy Evaluation, Advantages and disadvantages of reduction strategies, Graph Reduction, Reduction of higher order functions and currying

## **Chapter 4 : Introduction to Python**

### **Scripting versus Traditional Programming**

[2]

Why Scripting is Useful in Computational Science, Classification of Programming Languages, Productive Pairs of Programming Languages, Gluing Existing Applications, Scripting Yields Shorter Code, Efficiency, Type-Specification (Declaration) of Variables, Flexible Function Interfaces, Interactive Computing, Creating Code at Run Time, Nested Heterogeneous Data Structures, GUI Programming, Mixed Language Programming, When to Choose a Dynamically Typed Language, Why Python?, Script or Program?

## **Chapter 5 : Basic Python**

[2]

Python identifiers and reserved words, Lines and indentation, multi-line statements, comments, print and raw\_input()/input, command line arguments and processing command line arguments, standard data types - basic, none, boolean (true & False), numbers, Python strings, data type conversion, Python basic operators (Arithmetic, comparison, assignment, bitwise logical), Python membership operators (in & not in), Python identity operators (is & is not), Operator precedence, Control Statements, Python loops, Iterating by subsequence index, loop control statements (break, continue, pass) , Mathematical functions and constants (import math), Random number functions

## **Chapter 6 : Python strings**

[4]

Concept, Slicing, escape characters, String special operations, String formatting operator, Triple quotes, Raw String, Unicode strings, Built-in String methods.

Python Lists - concept, creating and accessing elements, updating & deleting lists, basic list operations, reverse, Indexing, slicing and Matrices, built-in List functions, Functional programming tools - filter(), map(), and reduce(), Using Lists as stacks and Queues, List comprehensions

## **Chapter 7 : Python tuples and sets**

[1]

Concept (immutable), creating & deleting tuples, accessing values in a tuple, updating tuples, delete tuple elements, basic tuple operations, Indexing, slicing and Matrices, built-in tuple functions. Sets - Concept, operations.

## **Chapter 8 : Python Dictionary**

[1]

Concept (mutable), creating and accessing values in a dictionary , updating dictionary, delete dictionary elements, properties of dictionary keys, built-in dictionary functions and methods.

## **Chapter 9 : Functions**

[3]

Defining a function (def), calling a function, Function arguments - Pass by value, Keyword Arguments, default arguments, Scope of var - basic rules and , Documentation Strings, Variable Number of Arguments, Call by Reference, Order of arguments (positional, extra & keyword), Anonymous functions, Recursion, Treatment of Input and Output Arguments, Unpacking argument lists, Lambda forms, Function Objects, function ducktyping & polymorphism, generators (functions and expressions) and iterators, list comprehensions

## **Chapter 10 : Working with Files and Directories**

[3]

Creating files, 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 to Directories, Traversing Directory Trees

## **Chapter 11 : Python Classes / Objects**

[3]

Object oriented programming and classes in Python - creating classes, instance objects, accessing members, data hiding (the double underscore prefix), built-in class attributes, garbage collection, the constructor, overloading methods and operators, inheritance - implementing a subclass, overriding methods, Recursive calls to methods, Class variables, class methods, and static methods

## **Chapter 12 : Python regular expressions**

[1]

Matching Vs searching, match & search functions, search & replace, option flags, RE patterns, non-greedy repetitions, grouping, back references, alternatives, anchors.

## **Chapter 13 : Python Exceptions**

[1]

Exception handling, assert statement, except clause - with no exceptions and multiple exceptions, try - finally, raising exceptions, user-defined exceptions

## **Reference Books**

1. Functional Programming: Practice and Theory by Bruce J. Maclennan
  - ISBN-10: 0201137445
  - ISBN-13: 978-0201137446
2. An Introduction to Functional Programming Through Lambda Calculus (Dover Books on Mathematics) Paperback by Greg Michaelson
  - ISBN-10: 0486478831
  - ISBN-13: 978-0486478838
3. Computational Semantics with Functional Programming by Jan van Eijck (Author), Christina Unger (Author)
  - ISBN-10: 0521757606
  - ISBN-13: 978-0521757607
4. Programming Languages: Principles and Practice By Kenneth C. Loudon
  - ISBN-10: 1575864967
  - ISBN-13: 978-1575864969
5. E-Books : python\_tutorial. pdf, python\_book\_01.pdf

**Note: -**

- **For Internal Evaluation ,  
20M Theory + 30M Programming**



## (ELECTIVE) CS 308: Business Intelligence

No of lectures: 48

### Pre-requisites

- Relational database concepts, database design and entity-relationship (E-R) modeling, data normalization, and Structured Query Language (SQL).
- Data Mining techniques

### Objectives

- Understand the role of BI in enterprise performance management and decision support.
- Understand the applications of data mining and intelligent systems in managerial work.
- Understand data warehousing and online analytical processing (OLAP) concepts, including dimensional modeling, star and snowflake schemas, attribute hierarchies, metrics, and cubes.
- Learn data analysis and reporting using an available BI software.

### Chapter 1 : Introduction to Business intelligence

[6]

Definition and History of BI, Transaction processing versus analytical processing, BI implementation , Major tools and techniques of BI

### Chapter 2 : Data warehousing

[10]

Definition and concepts, , Data warehouse architecture, ETL process, data warehouse development, Top down vs. Bottom up, Data Mart vs. EDW, Implementation issues, Real-time data warehousing

### Chapter 3 : Business performance management

[14]

Key performance indicators and operational metrics, Balanced scorecard , Six Sigma , Dashboards and scorecards

### Chapter 4 : Data Mining for Business Intelligence

[10 ]

Data mining process, Data mining methods, ANN for Data Mining

## **Chapter 5 - Text, and Web mining for Business intelligence [08]**

Text mining Applications, Process and Tools, Web content, structure and usage mining

## **Chapter 6 : BI implementation , Integration and emerging trends [10]**

Implementing BI, BI Application Life Cycle , Connecting BI to Enterprise systems, On-demand BI, Issues of legality, privacy and Ethics, Emerging topics in BI, Social Networking and BI, RFID and BI

### **Reference Books**

1. Business Intelligence: A Managerial Approach, 2nd Edition, PEARSON 2012  
Authors: EfraimTurban, Ramesh Sharda, Dursun Delen, and David King  
ISBN-10: 0-13-610066-X  
ISBN-13: 978-0-13-610066-9
2. Oracle Business Intelligence Applications, McGraw Hill Education 2013  
Authors : Simon Miller, William Hutchinson ISBN-10: 93-5134-153-4  
ISBN-13: 978-93-5134-153-6

**Note : -**

- **Group wise Case studies can be given for Internal Evaluation.**

# **M.Sc (Computer Science)**

## **Part - II / Semester 4**

## (CORE) CS 401: Full Time Industrial Training/ Industrial Project

### Period – Minimum 4 months

1. There will be a teacher coordinator for a group of students. A teacher coordinator will take care of joining letters from students along with other necessary submission listed below.
2. A student will have to submit 2 reports during the period of ITP to the Department of the college.
3. After the completion of the ITP, a student will have to submit a synopsis along with the project completion certificate from the respective industry/research institute /educational institute.
4. A student will submit one hard copy (Student Copy) and a soft copy's (preferably 2 CDs) of the work carried out towards ITP.
5. The project will be graded by the experts (One internal examiner, one external examiner(academic expert) and one industrial expert) as follows:

<b>O</b> – 75 and above	<b>C</b> – 50 and above	<b>F</b> - A student will have to carry out project once again for a complete semester
<b>A</b> – 65 and above	<b>D</b> – 45 and above	
<b>B</b> – 55 and above	<b>E</b> – 40 and above	

**Important Note:** A student can complete ITP with a research project of a teacher / an expert funded by the University of Pune/ a funding agency.

**Evaluation for internal 50 Marks will be done according to Progress Report written by Teacher Coordinator**

**Evaluation for external 50 Marks will be done by Industrial Expert, Academic Expert and One Internal Examiner.**

## (ELECTIVE) CS 402: Parallel Computing

**No. of lectures: 48**

### Pre-requisites

- Ability to program well in C, C++ or Fortran.
- Willingness to rethink how problems should be solved.
- Algorithm & Data Structures
- Basics of Computer Architecture

### Objectives

- Learning basic models of parallel machines and tools
- How to parallelize programs and how to use basic tools like MPI and POSIX threads.

### Chapter 1 : Introduction to Parallel Computing [6]

Why Parallel Computing & Scope of Parallel Computing, Sieve of Eratosthenes, Control and Data Approach, PRAM model of parallel computation, Design paradigms of Parallel Computing, examples, Bulk Synchronous Parallel (BSP) model.

### Chapter 2 : Classification [12]

Flynn's Taxonomy, MPP, SMP, CC-NUMA, Clustering of Computers, Beowulf Cluster, Use of MPI in Cluster Computing. Debugging, Evaluating and tuning of Cluster Programs, Partitioning and Divide and Conquer Strategies. Cluster: dedicated high performance (HP), high availability (HA), CoPs, PoPs, CoWs; distributed, on-demand, high-throughput, collaborative, data-intensive computing, Interconnection networks.

### Chapter 3 : An overview of Parallel Programming Paradigms [10]

Foster's design paradigm for Multi computing programming, Programmability Issues, Programming Models: Message passing, Message passing standards: PVM (Parallel Virtual Machine), MPI (Message Passing Interface) and its routines, Advanced Features of MPI

### Chapter 4 : Overview of Programming with Shared Memory [12]

Overview of Programming with Shared Memory: OpenMP (History, Overview, Programming Model, OpenMP Constructs, Performance Issues and examples, Explicit Parallelism: Advanced Features of OpenMP)

Multi-Core programming: Introduction to Multi cores Programming Software Multi-threading using Tread Building Blocks (TBB) and Cilk++ programming, GPGPU programming with CUDA

**Reference Books**

1. Quinn, M. J., Parallel Computing: Theory and Practice (McGraw-Hill Inc.).
2. Bary Wilkinson and Michael Allen: Parallel Programming Techniques using Networked of workstations and Parallel Computers, Prentice Hall, 1999.
3. R. Buyya (ed.) High Performance Cluster Computing: Programming and Applications, Prentice Hall, 1999.
4. William Gropp, Rusty Lusk, Tuning MPI Applications for Peak Performance, Pittsburgh (1996).
5. W. Gropp, E. Lusk, N. Doss, A. Skjellum, A high performance portable implementation of the message passing Interface (MPI) standard, Parallel Computing 22 (6), Sep 1996.
6. Gibbons, A., W. Rytter, Efficient Parallel Algorithms (Cambridge Uni. Press).
7. Shameem A and Jason, Multicore Programming, Intel Press, 2006.
8. CUDA Programming A Developer's Guide to Parallel Computing with GPUs Shane Cook, Morgan Kaufmann

## (ELECTIVE) CS 403: Embedded System

No of Lectures: 48

### Pre-requisites

- Knowledge of microprocessor architecture and assembly language, microprocessor peripherals, digital design, and the C programming language is a prerequisite for this course.
- An understanding of compilers, assemblers, linkers, operating systems, analog design, diodes, transistors, and electromagnetic fields and waves will be useful

### Objectives

- Understand and design embedded systems and real-time systems
- For real-time systems:
  - Identify the unique characteristics of real-time systems
  - Explain the general structure of a real-time system
  - Define the unique design problems and challenges of real-time systems
- Apply real-time systems design techniques to various software programs.
- For embedded systems, it will enable you to :
  - Understand the basics of an embedded system
  - Program an embedded system
  - Design, implement and test an embedded system.

### Chapter 1 : Introduction to ES [2]

- What is ES
- Examples of ES
- Inside ES : processor, memory, peripherals, software

### Chapter 2 : Embedded Processors , Memories & Peripherals [6]

- Microcontrollers 8051
- Discrete processors : 8-bit architecture, 16/32 bit CISC, RISC, DSP
- Integrated processors : ARM RISC
- Choosing a processor
- Memory systems : types (SRAM, DRAM, FLASH), organization, access time, validating the contents of memory
- Basic peripherals : parallel ports, timers, clocks

### Chapter 3 : Real time system concepts [12]

- Foreground/ background systems
- Critical section of code
- Resource, shared resource
- Multitasking, task, task switch

- Kernel, scheduler, non-preemptive kernel, preemptive kernel
  - Reentrancy, round-robin scheduling
  - Task priority, static priority, dynamic priority, priority inversions, assigning task priorities
  - Mutual exclusion, deadlock, synchronization, event flags, intertask communication
  - Interrupts : latency, response, recovery, ISR processing time, NMI
- (For ‘C’ implementation of above concepts, please refer to chapters 4,5,6,7 of the book “An Embedded Software Primer” by David E. Simon published by Pearson Educations)

#### **Chapter 4 : Writing software for embedded systems [8]**

- The compilation process : compile, link, load
- Cross compilers
- Run-time-libraries : processor dependent, I/O dependent, system calls,exit routines
- Writing a library, using alternative libraries
- Porting Kernels
- C extensions for embedded systems
- Buffering and other data structures
  - Linear buffers, Directional buffers, Double buffering, Buffer exchange, Linked lists, FIFO, Circular buffers, Buffer underrun and overrun, Allocating buffer memory, Buffer leakage
- Downloading

#### **Chapter 5 : Emulation and Debugging techniques [6]**

- Debugging techniques :
  - HLL simulation, low level simulation, on-board debugger, task level debugging, symbolic debug
- Emulation
- Optimization problems

#### **Chapter 6 : Basic design using RTOS [6]**

- Overview
- Principles
- Example
- Encapsulating semaphores and queues
- Hard real time scheduling considerations
- Saving memory space
- Saving power

#### **Chapter 7 : Real time without RTOS [8]**

- Choosing the SW environment
- Deriving real time performance from non-real time system
- Scheduling and data sampling
- Controlling from an external switch
- Problems



## Reference Books

1. Embedded Systems Design – Steve Heath
2. Programming Embedded Systems – Michael Barr
3. Embedded Systems Building Blocks \_ Jean J. Labrosse
4. An Embedded Software Primer \_ David E. Simon published by Pearson Educations

## (ELECTIVE) CS 404: Software Quality Assurance

No of lectures: 48

### Pre-requisites

- Basic concepts of software testing

### Objectives

- To enable student to learn Software Quality Assurance good practices with the help of various techniques, Strategies and tools

### Chapter 1 : Software quality [4]

- Definition
- Software errors, software faults and software failures
- Software quality assurance – definition and objectives
- Software quality assurance vs. software quality control
- The objectives of SQA activities

### Chapter 2 : Pre-project SQA Components [4]

- Contract Review
- Development and Quality Plan

### Chapter 3 : SQA components in Project life cycle activities assessment [10]

- Verification and Validation
- Various types of Reviews
- Inspections
- Walkthrough
- Software testing
- Impact of CASE Tools

### Chapter 4 : SQA Infrastructure Components [8]

- Procedures and procedure manuals
- Templates and Checklists
- Staff training
- Corrective and preventive actions
- Documentation control

### Chapter 5 : Software Quality Factors [5]

- McCall's Quality Model
- Product, Process quality metrics

**Chapter 6 : Standardization** [4]

- ISO 9001 and ISO 9000-3
- SEI-CMM,
- IEEE 1012 standard
- ISO/IEC 12207 standard

**Chapter 7 : Configuration Management** [4]

- Change control
- Release and version control
- Software configuration management audit

**Chapter 8 : Quality Improvement Technique** [4]

- Pareto Diagrams
- Cause-Effect Diagrams
- Scatter Diagrams
- Run Charts

**Chapter 9 : Quality Costs** [5]

- Quality Cost Measurement
- Utilizing Quality Costs for Decision-Making

**Reference books**

1. Software Quality Assurance from theory to implementation – Danial Galin
2. Software Project management - Edwin Bennatan
3. Software Engineering Roger S. Pressman, TMH, 7Th Ed.
4. Software Quality Assurance : Principles and Practices Nina Godbole,
5. Project Management Body of Knowledge – PMI
6. [www.softwarecertifications.org](http://www.softwarecertifications.org)
7. Quality, 5th ed., Prentice-Hall, 2010. Donna C. S. Summers
8. Total Quality Management, Prentice Hall, 2003. Dale H. Besterfield
9. Software engineering: An Engineering approach, John Wiley. J.F.Peters, W.Pedrycz

**Note: -**

- **Group wise case studies are expected as a part of Internal Evaluation.**

## (ELECTIVE) CS 405: Modeling and Simulation

No of lectures: 48

### Pre-requisites

- The course assumes a previous knowledge of probability and statistics.
- Basic concepts of network topologies.

### Objectives

- The purpose of this course is to provide students with an opportunity to develop skills in modeling and simulating a variety of problems.
- After learning the simulation techniques, the students are expected to be able to solve real world problems which cannot be solved strictly by mathematical approaches.

### Chapter 1 : Systems modeling [2]

Concepts of continuous and discrete formalisms. Stepped and Event-based Time in Simulations, Sources and Propagation of Error

### Chapter 2 : Types of Simulations [4]

Graph or Network Transitions Based Simulations, Actor Based Simulations, Mesh Based Simulations, Hybrid Simulations, Framework for Simulation and Modeling,

### Chapter 3 : Modeling and simulators [20]

Modeling formalisms and their simulators, discrete time, continuous time, discrete event, process based simulators. Hybrid systems and their simulators

### Chapter 4 : Probability [8]

Basic probability, probability distributions, estimation, testing of hypotheses

### Chapter 5 : Probability in modeling [8]

Selecting input probability distributions, models of arrival processes, Queues and Random Noise, Random number generators, their evaluation, generating random variates from various distributions

### Chapter 6 : Analyzing models [6]

Output analysis, transient behavior, steady state behavior of stochastic systems, computing alternative systems, variance reduction techniques. Sensitivity Analysis, Verification and Validation

### **Text books**

1. Discrete-Event System Simulation, Fourth Edition, Banks, by J., et.el. (2005), Publisher Pearson, ISBN-13: 9780131293427
2. Simulation Modeling and Analysis, Third Edition, by Law, A.M. and W.D. Kelton (2000), Publisher McGraw-Hill, ISBN-13: 978-0071165372

### **Reference Books**

1. Continuous System Simulation, by Kofman and Cellier, Publisher Springer, ISBN-13: 9780387261027
2. Theory of modeling and Simulation, 2nd ed., B. Zeigler, H. Praehofer, T. Kim, Publisher Academic Press, 2000, ISBN-13: 978-0127784557
3. Modeling with Data: Tools and Techniques for Scientific Computing, by Ben Klemens, Publisher: Princeton University Press 2008, ISBN-13: 9780691133140

### **Note: -**

- **Hands on can be taken with any simulating software.**

# **M.Sc. (Computer Science) End Semester Examination Paper Layout for Semester 3 and Semester 4**

## **CS-301: Software Metrics and Project Management**

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows:

<b>Chapter No</b>	<b>Name of the Chapter</b>	<b>Weightage in terms of marks</b>
1	Introduction to Project Management	6
2	Project Management Components	10
3	Scope Management	6
4	Time Management	4 (Numerical)
5	Cost Management	4 (Numerical)
6	Quality Management	4
7	Human Resource Management	4
8	Communication Management	4
9	Risk Management	4
10	Procurement Management	4
11	Software Metrics	10
12	Software Reliability	10
13	Planning a measurement Program	6
14	Quality Standards	4

### **Numerical weightage : 15M**

**Different Types of Numerical on topics Cost Management (COCOMO), Time Management.**

- 6 Questions are supposed to be of the format 4 + 4 + 2 ( 4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions on the same pair of units.

## CS-302: Mobile Computing

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to Mobile Computing	04
2	Wireless Transmission	06
3	Medium Access Control Layer	08
4	Mobile IP	14
5	Mobile TCP	10
6	GSM	14
7	3G mobile networks	12
8	Wireless Application Protocol	08
9	Introduction to Android Operating System & Programming	04

**Examiner should note that, there should not be any programming question for chapter 9. (Only theory must be asked.)**

- 6 Questions are supposed to be of the format 4 + 4 + 2 ( 4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions on the same pair of units

## CS-303: Soft Computing

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to Fuzzy Logic	22
2	Fuzzy System and Classification	18
3	Neural Network	30
4	Genetic Algorithms	10

Fuzzy Logic: 40

Neural Networks: 30

Genetic Algorithms: 10

**Every question from Q.1 to Q.8 must contain at least 1 numerical.**

- 6 Questions are supposed to be of the format 4 + 4 + 2 ( 4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions on the same pair of units



## CS-305: Web Services

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Web Service and SOA fundamentals	08
2	Web Services Architecture	10
3	SOAP: Simple Object Access Protocol	20
4	Describing and Discovering Web Services	22
5	Emerging trends: Cloud Computing	20

- 6 Questions are supposed to be of the format 4 + 4 + 2 ( 4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions on the same pair of units

## CS-306: Database and System Administrator

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Client/Server Concepts	4
2	MySQL Client Program	12
3	MySQL Architecture	12
4	Starting, Stopping, and Configuring MySQL	NIL
5	Locking	4
6	Storage Engines	16
7	Data (Table) Maintenance	NIL
8	Data Backup and Recovery Methods	4
9	Introduction	4
10	Linux Installation	NIL
11	File manipulations Under Linux	16
12	Command Line Interface	NIL
13	Users and Groups	4
14	Startup/shut down	NIL
15	Basic system Administration	NIL
16	Networking	4
17	Print Services	NIL

**Chapters for which weightage written as "NIL", are kept for Internal Evaluation. And, End Semester exam will have questions only from remaining chapters.**

- 6 Questions are supposed to be of the format 4 + 4 + 2 ( 4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions on the same pair of units

## CS-307: Functional Programming

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to FP & Mathematical Functions	10
2	Introduction to Lambda calculus	20
3	Reduction strategies and lazy evaluation	12
4	Introduction to Python	04
5	Basic Python	04
6	Python strings	04
7	Python tuples and sets	02
8	Python Dictionary	04
9	Functions	06
10	Working with Files and Directories	06
11	Python Classes / Objects	04
12	Python regular expressions	02
13	Python Exceptions	02

- 6 Questions are supposed to be of the format 4 + 4 + 2 ( 4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions on the same pair of units

## CS-308: Business Intelligence

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to Business intelligence	08
2	Data warehousing	14
3	Business performance management	20
4	Data Mining for Business Intelligence	14
5	Text, and Web mining for Business intelligence	12
6	BI implementation , Integration and emerging trends	12

- 6 Questions are supposed to be of the format 4 + 4 + 2 ( 4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions on the same pair of units

## (Elective) CS 402: Parallel Computing

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to Parallel Computing	10
2	Classification	20
3	An overview of Parallel Programming Paradigms	16
4	Overview of Programming with Shared Memory	18
5	Multi-Core programming	16

- 6 Questions are supposed to be of the format 4 + 4 + 2 ( 4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions on the same pair of units

## CS-403 Embedded System

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to ES	04
2	Embedded Processors , Memories & Peripherals	10
3	Real time system concepts	20
4	Writing software for embedded systems	12
5	Emulation and Debugging techniques	12
6	Basic design using RTOS	10
7	Real time without RTOS	12

- 6 Questions are supposed to be of the format 4 + 4 + 2 ( 4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions on the same pair of units

## CS-404 Software Quality Assurance

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Software quality	6
2	Pre-project SQA Components	6
3	SQA components in Project life cycle activities assessment	18
4	SQA Infrastructure Components	14
5	Software Quality Factors	8
6	Standardization	6
7	Configuration Management	6
8	Quality Improvement Technique	6
9	Quality Costs	10

- 6 Questions are supposed to be of the format 4 + 4 + 2 ( 4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions on the same pair of units

## CS 405 : Modelling and Simulation

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Systems modeling	04
2	Types of Simulations	08
3	Modeling and simulators	30
4	Probability	14
5	Probability in modeling	14
6	Analyzing models	10

- 6 Questions are supposed to be of the format 4 + 4 + 2 ( 4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions on the same pair of units



**University of Pune**

**Three Year B. Sc. Degree Course in  
Electronic Science**

## 1) Title of the Course : B. Sc. Electronic Science

### F.Y.B.Sc. Electronic Science Syllabus

(To be implemented from Academic Year 2013-14)

#### 2) Preamble:

The systematic and planned curricula from first year to the third year shall motivate and encourage the students for pursuing higher studies in Electronics and for becoming an enterprenur.

#### 3) Introduction:

At **first year of under-graduation**The basic topics related to the fundamentals of electronicsare covered. Since electronics is very close to technological advancements, the practical course is intended to achieve the basic skills required for circuit building and testing.

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 yearshall be introduced. Analog and digital circuit design concepts will be introduced at this stage.

At **third year under-graduation**:Theory papers in each semester deal with the further detailed studies of the branches of Electronics. The first two practical courses shall be based on the theory courses. Third practical course is project course in which student can independently think and carry out the project work.

#### Objectives:

- To provide indepthknowledge of scientific and technological aspects of electronics
- To familiarize withcurrent and recent technological developments
- To enrich knowledge through programmessuch asindustrial visits, hobby projects, market survey, projects etc.
- To train students in skills related to electronics industry and market.
- To creat foundation for research and development in Electronics
- To develop analytical abilities towards real world problems
- To help students build-up a progressive and successful career in Electronics

#### 4) Eligibility:

- 1 **First Year B.Sc.:**Higher Secondary School Certificate (10+2) Science stream or its equivalent Examinationas per the University of Pune eligibility norms.
- 2 **Second Year B.Sc.:** Keeping terms of First Year of B. Sc. with Electronic Science as one of the subjects. Other sudents if they fulfill the conditions approved by the equivalence committee of Faculty of Science of the University of Pune are also eligible.

- 3 **Third Year B. Sc.:** Student shall pass all First Year B. Sc. courses and satisfactorily keeping terms of Second Year of B. Sc. with Electronic Science 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.

### 5 A) Examination Pattern:

#### First Year B. Sc. Electronic Science

Pattern of Examination: Annual

Theory courses (EL-101): Annual (EL-102): Annual

Practical Course (EL-103): Annual

Paper/ Course No.	Title	Total Number of lectures/practicals per Term	Standard of passing		
			Internal marks out of <b>20</b>	External marks out of <b>80</b>	Total marks out of <b>100</b>
Theory Paper I (EL-101) (First term)	Principles of Analog Electronics	Three lectures/Week (Total 36 lectures per term)	08	32	40 *
Theory Paper I (EL-101) (Second term)	Principles of Analog Electronics	Three lectures/Week (Total 36 lectures per term)			
Theory Paper II (EL-102) (First term)	Principles of Digital Electronics	Three lectures/Week (Total 36 lectures per term)	08	32	40 *
Theory Paper II (EL-102) (Second term)	Principles of Digital Electronics	Three lectures/Week (Total 36 lectures per term)			
Practical Paper III (EL-103) (First & Second Term)	Practical	10 Practicals of 4 lectures in each term (20 practicals / year)	08	32	40 *

\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory (100 + 100 ) = 200 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks

3. Internal marks for theory papers given on the basis of internal assessment tests and for practicals on internal assessment tests + journals + attendance + study visit reports/ market survey/hobby projects etc.

**Theory examination** will be of three hours duration for each theory course. There shall be 5 questions each carrying equal marks. The pattern of question papers shall be:

Question 1	8 sub-questions, each of 2 marks; answerable in 2 -3 lines and based on entire syllabus
Question 2, 3 and 4	4 out of 6– short answer type questions; answerable in 8 – 10 lines
Question 5	4 out of 6 – problem type question; answerable in numerical or analytical fashion or circuit/logic diagrams

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each term. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain). There shall be 20 questions.

Practical: one internal assessment test + marks for journals + attendance + activity.

**Practical Examination:** Practical examination shall be conducted by the respective college at the end of the academic year. Practical examination will be of 6 hours duration (2-Sessions). Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination.

### Second Year B. Sc. Electronic Science

Pattern of examination: Semester

Theory courses (Sem I: EL211 and EL212): Semester

(Sem II: EL221 and EL222): Semester

Practical Course (EL223): Annual

Paper/ Course No.	Title	Total Number of lectures/practicals Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
Theory Paper I (EL 211)	<b>Paper I</b>	Four lectures/Week (Total 48 per Semester )	04	16	20 *

Theory Paper II (EL 212)	<b>Paper II</b>	Four lectures/Week (Total 48 per Semester )	04	16	20 *
Theory Paper I (EL 221)	<b>Paper I</b>	Four lectures/Week (Total 48 per Semester )	04	16	20 *
Theory Paper II (EL 222)	<b>Paper II</b>	Four lectures/Week (Total 48 per Semester )	04	16	20 *
Practical paper III (EL 223) (First & Second Semester)	<b>Paper III</b>	12 Practicals of 4 lectures in each Semester (24 practicals / year)	08	32	40 **

\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester (50 + 50 ) = 100 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers given on the basis of internal assessment tests and for practicals on internal assessment tests + journals + attendance + study visit reports/ market survey/hobby projects etc.

**Theory examination** will be of two hours duration for each theory course. There shall be 4 questions each carrying marks as per the table. The pattern of question papers shall be:

Question 1	4 sub-questions, each of 1 marks and 4 sub-questions, each of 2 marks on entire syllabus	12 marks
Question 2 and 3	2 out of 3 sub-questions, each of 4 marks; short answer type questions; answerable in 8–10 lines	8 marks each
Question 4	2 out of 3 sub-questions, each of 6 marks; long answer type questions (12-16 lines), problems, circuit/logic diagrams and designs	12 marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain) There shall be 20 questions.

Practicals: one internal assessment test + practical journal + attendance + activity

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of 6 hours (2-Sessions) duration. Certified journal is compulsory to appear for practical examination. There shall be one expert and two examiners per batch for the practical examination. One of the examiners will be external.

### Third Year B. Sc. Electronic Science

Pattern of examination: Semester

Theory courses:

(Sem III: EL331-EL336): Semester (Sem IV: EL341-EL346): Semester

Practical Course:

(EL347-EL349): Annual

Theory Papers					
Paper/Course No.	Title	Total Number of lectures Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
<b>SEM III</b>					
EL-331	Paper I	48	4	16	20*
EL-332	Paper II	48	4	16	20*
EL-333	Paper III	48	4	16	20*
EL-334	Paper IV	48	4	16	20*
EL-335	Paper V	48	4	16	20*
EL-336	Paper VI	48	4	16	20*
<b>SEM IV</b>					
EL-341	Paper I	48	4	16	20*
EL-342	Paper II	48	4	16	20*
EL-343	Paper III	48	4	16	20*
EL-344	Paper IV	48	4	16	20*
EL-345	Paper V	48	4	16	20*
EL-346	Paper VI	48	4	16	20*
<b>Practical Papers</b>					
EL 347 (Semester III & IV)	Practical Paper I	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **
EL 348 (Semester III & IV)	Practical Paper II	12 Practicals of 4 lectures in each	08	32	40 **

		Semester (24 / year)			
EL 349 (Semester III & IV)	Project Practical Paper III	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **

\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester ( $50 \times 6$ ) = 300 marks
2. Total marks per year 600 (Theory) + 300 marks (practicals) = 900 marks
3. Internal marks for theory papers given on the basis of internal assessment tests and for practicals on internal assessment tests + journals + attendance + study visit reports/ market survey/hobby projects etc.

**Theory examination** will be of two hours duration for each theory course. There shall be 4 questions each carrying marks as per the table. The pattern of question papers shall be:

Question 1	4 sub-questions, each of 1 marks and 4 sub-questions, each of 2 marks; on entire syllabus	12 marks
Question 2 and 3	2 out of 3 sub-questions, each of 4 marks; short answer type questions; answerable in 8–10 lines	8 marks each
Question 4	2 out of 3 sub-questions, each of 6 marks; long answer type questions (12-16 lines), problems, circuit/logic diagrams and designs	12 marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain) There shall be 20 questions.

Practicals: one internal assessment test + practical journals + attendance + activity.

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of 6 hours (2-Sessions) duration. Certified journal is compulsory to appear for practical examination. There shall be one expert and two examiners per batch for the practical examination. One of the examiners will be external.

### 5 B) Standard of Passing:

- i. In order to pass in the first year theory 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 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 16 marks out of 40 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.)

### 5 C) ATKT Rules:

While going from F.Y.B.Sc. to S.Y.B.Sc. at least 8 courses (out of total 12) should be passed; however all F.Y.B.Sc. courses should be passed 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 passed (Practical Course at S.Y.B.Sc. will be equivalent to 2 courses).

### 5 D) 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

**5 E) External Students:** There shall be no external students.

### 5 F) Setting question papers:

**F.Y.B.Sc.:** For theory papers I and II annual question papers shall be set by the University of Pune and assessment done at the respective colleges. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Paper III, papers shall be set by the University of Pune and assessment done at the respective colleges.

**S.Y.B.Sc. and T.Y.B.Sc.:** For theory papers I and II for each semester and also for the annual practical examination question papers set by the University of 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. For Practical Papers, papers shall be set by the University of Pune and assessment done by the internal examiner and external examiner appointed by University of Pune.



**5G) Verification and Revaluation Rules:**

As per university Statues and rules for verification and revaluation of marks in stipulated time after declaration of the semester examination result.

**6) Course Structure:**

**Duration:** The duration of B.Sc. Electronic Science Degree Program shall be three years.

**a) Compulsory Papers:**

F.Y.B.Sc. : 2 Theory + 1 Practical (Annual)

S .Y.B.Sc.: 2 Theory per semester + 1 Practical (Annual)

T.Y.B.Sc.: 5 Theory per semester + 3 Practical (Annual)

**b) Optional Papers:**

One theory out of two optional papers per semester for third year only

**c) Question Papers :****F.Y.B.Sc.Theory paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

**S.Y / T.Y. - B.Sc.Theory paper:**

University Examination – 40 marks (at the end of each term)

Internal Examination – 10 marks

**F.Y. / S.Y / T.Y. - B.Sc.Practical Paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

**d) Medium of Instruction:** The medium of instruction for the course shall be English.**7) Equivalence of Previous Syllabus:**

Old Course (2008 Pattern)	New Course (2013 Pattern)
Paper I: Principles of Analog Electronics	EL-101: Principles of Analog Electronics
Paper II: Principles of Digital Electronics	EL-102: Principles of Digital Electronics
PaperIII: Practical	EL-103: Practical

**8) University Terms:** Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

**9) Qualification of Teachers:**M.Sc. Electronic Science or equivalent master degree in science with class/grades and NET/SET as per prevailing University/Government /UGC rules.

**10) Detail Syllabus with Recommended Books:****F.Y. B. Sc. Electronic Science****Paper I****EL-101: Principles of Analog Electronics****Objectives:**

1. To get familiar with basic circuit elements and passive components
2. To understand DC circuit theorems and their use in circuit analysis
3. To study characteristic features of semiconductor devices
4. To study elementary electronic circuits and applications
5. To understand basics of operational amplifiers.

**Term I****Unit 1: Passive Components (12)**

Study of basic circuit elements and passive components (with special reference to working principle, circuit symbols, types, specifications and applications): Resistor, Capacitor, Inductor, Transformer, Cables, Connectors, Switches, Fuses, Relays, Batteries.

**Unit 2: Basic Electrical Circuits and Circuit Theorems (14)**

Concept of Ideal Voltage and Current source, internal resistance, dc sources (voltage/current) and sinusoidal ac source (amplitude, wavelength, period, frequency, phase angle), Network terminology, Ohms law, series and parallel circuits of resistors, capacitors and inductors, voltage and current dividers, Kirchhoff's Laws (KCL, KVL), Superposition theorem, concept of black box, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem (numerical problems with maximum two meshes), Charging-discharging of capacitor, AC applied to R, C and L, concept of impedance, LCR series resonant circuit, concept of phase difference, RC low pass and high pass filter

**Unit 3: Semiconductor Diodes and Circuits (10)**

Study of semiconductor devices with reference to symbol, working principle, I-V characteristics, parameters, specifications: diode, zener diode, light emitting diode, photo diode, optocoupler, varactor diode, solar cell, clipper and clamper circuits Rectifiers (half and full wave), rectifier with capacitor-filter, Zener regulator, Block diagram of power supply

**Term II****Unit 4: Bipolar Junction Transistor and Circuits (14)**

Bipolar Junction Transistor (BJT) symbol, types, construction, working principle, I-V characteristics, parameters, specifications. Concept of amplification, voltage and current amplifier. Transistor amplifier configurations - CB, CC and CE, biasing circuits- voltage divider, collector feedback bias and emitter feedback bias, DC load line (CE), Q point and factors affecting the stability, transistor as a switch, concept of

class A, B and class C amplifiers, emitter follower amplifier, Single stage RC coupled CE amplifier, concept of frequency response and bandwidth

**Unit-5:UJT,FETs and Applications** (10)

Symbol, types, construction, working principle, I-V characteristics, Specifications parameters of:Uni-Junction Transistor (UJT),Junction Field Effect Transistor (JFET), Metal Oxide Semiconductor FET (MOSFET), comparison of JFET, MOSFET and BJT

Applications: JFET as voltage variable resistor, MOSFET as a switch

**Unit 6: Operational Amplifier** (12)

Symbol, block diagram, Opamp characteristics, basic parameters (ideal and practical) such as input and output impedance, bandwidth, differential and common mode gain, CMRR, slew rate, Concept of virtual ground, concept of feedback, Information about IC741

Opamp as inverting and non-inverting amplifier, voltage follower, adder, subtractor

Opamp as a comparator and Schmitt trigger

**Text/ Reference Books:**

1. Basic Electronics:Bernard Grob, McGraw Hill Publication, 8<sup>th</sup> Revised Edition, 2010
2. Electronic Principles:Albert Malvino, David J Bates, McGraw Hill 7<sup>th</sup> Edition. 2012
3. Principles of Electronics: V.K. Mehta, S.Chand and Co.
4. A text book of electrical technology: B.L.Theraja, S.Chand and Co.
5. Basic Electronics and Linear Circuits: Bhargava N.N., Kulshreshtha D.C., Gupta S.C., Tata McGraw Hill.
6. A First Course in Electronics: Khan Anwar, K.K.Day, PHI learning Pvt.Ltd.
7. Electronic Devices and Circuits: Bolyestad, Tata McGraw Hill.
8. Electronic Devices and circuits: A. Motorshed, Prentice Hall of India.
9. Basic Electronic Devices and Circuits: R.Y.Borse, 1<sup>st</sup>Edition 2012, Adhyayan Publishers and Distributors, New Delhi.

**Paper II**

**EL-102: Principles of Digital Electronics**

**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
5. To study comparative aspects of logic families.

**Term I**

**Unit 1: Number Systems and Logic Gates** (12)

Introduction to decimal, Binary and hexadecimal number systems and their inter-conversions,Signed and fractional binary number representations, BCD, Excess-3 and Graycodes, Alphanumeric representation in ASCII codes.

Positive and Negative Logic, Basic Logic gates (NOT, OR, AND) & derived gates (NAND, NOR, EX-OR) Symbol and truth table, Applications of Ex-OR gates as parity checker and generator.

### **Unit 2: Boolean Algebra and Karnaughmaps** (12)

Boolean algebra rules and Boolean laws: Commutative, Associative, Distributive, AND, OR and Inversion laws, DeMorgan's theorem, Universal gates. Min terms, Max terms, Boolean expression in SOP and POS form, conversion of SOP/POS expression to its standard SOP/POS form., Simplifications of Logic equations using Boolean algebra rules and Karnaugh map (up to 3 variables).

### **Unit 3: Arithmetic Circuits** (12)

Rules of binary addition and subtraction, subtraction using 1's and 2's complements, half adder, full adder, Half subtractor, Full subtractor, Four bit parallel adder, Universal adder / subtractor, Digital comparator, Introduction to ALU.

## **Term II**

### **Unit 4: Combinational Circuits** (14)

Multiplexer (2:1, 4:1), demultiplexer (1:2, 1:4) and their applications, Code converters - Decimal to binary, Hexadecimal to binary, BCD to decimal, Encoder & decoder 3x4 matrix keyboard encoder, priority encoder, BCD to seven segment decoder.

### **Unit 5: Sequential Circuits** (14)

**Flip flops** :RS using NAND/NOR, latch, clocked RS, JK, Master slave JK, D and T. **Counters**: Ripple Binary counter, up down counter, concept of modulus counters, Decade counter, Counters for high-speed applications ( Synchronous counters) with timing diagrams.

**Shift registers**: SISO, SIPO, PISO, PIPO shift registers, ring counter, universal 4-bit shift register and Applications.

### **Unit 6: Logic Families** (8)

Introduction to Integrated circuit technologies TTL, ECL, CMOS  
IC parameters: Logic levels, switching speed, propagation delay, power dissipation, noise margins and fanout of TTL and CMOS.  
TTL NAND & NOT gate, Open collector gates, Wired OR operation. CMOS - NOT, NAND, NOR gate, precautions while handling CMOS gates, tri-state logic.

### **Text/ Reference Books:**

1. Digital Electronics: Jain R.P., Tata McGraw Hill
2. Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill.
3. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education

## Paper III

### EL-103: Practical Course

- 1 The practical course consists of 20 experiments.
- 2 Any two of the following activities with proper documentation will be considered as equivalent of 4 experiments weightage in term work.
  - i. Preparatory experiments
  - ii. Hobby projects
  - iii. Internet browsing
  - iv. industrial visit / live work experience
  - v. PCB Making
  - vi. Market Survey of Electronic Systems
  - vii. Circuit Simulations and CAD tools
  - viii. Study Tour and its report writing

These will be evaluated in an oral examination for 20% marks at internal and term end examination.

**3. All the students are required to complete a minimum of 16 experiments (four from each group) from the following list.**

#### **Group A Any Four**

1. Study of forward and Reverse biased characteristics of PN Junction Diode
2. Study of breakdown characteristics and voltage regulation action of Zener diode
3. Study of output characteristics of Bipolar Junction Transistor in CE mode
4. Study of output and transfer characteristics JFET/MOSFET
5. Study of I-V characteristics of UJT and Demonstration of UJT based relaxation oscillator .
6. Study of solar cell.

#### **Group B Any four**

1. Verification of network theorems: KCL / KVL, Thevenin, Norton.
2. Verification of network theorems: Maximum Power Transfer, Superposition theorem.
3. Design, build and test Low pass and High pass RC filters.
4. Study of low voltage Half-wave, Full-wave and Bridge rectifier circuits.
5. Study of amplification action of BJT.
6. Study of potential divider biasing of BJT and its use in DC motor driving.
7. Build and test Inverting and non inverting amplifier using OPAMP.
8. Build and test adder and subtractor circuits using OPAMP.
9. Study of clipping and clamping circuits.

#### **Group C Any Four**

\* Minimum Two experiments may be carriedout with CMOS ICs

1. Basic Logic gates using Diodes and transistors
2. Interconversions and realizations of logic expressions using ICs
3. Study of RS, JK and D flip flops using NAND gates
4. Study of Up/Down Counter

5. Study of decade counter IC circuit configurations
6. Study of 4-bit Shift register IC

### **Group D Any Four**

1. Build and Test 4 bit parity checker/ generator using X-OR gate IC
2. Build and Test Half Adder, Full Adder and Subtractor using basic gate
3. Build and Test 2:1 Multiplexer and 1:2 Demultiplexer using gates
4. Build and Test 3X4 matrix Keyboard Encoder
5. Build and Test a Debounce switch using NAND or NOR gate IC
6. Build and Test Diode matrix ROM
7. Study of Four bit Universal Adder/Subtractor / ALU

### **Preparatory Experiments**

1. Identification of Components / Tools
  - Minimum 10 different types of components must be given
  - Identification based on visual inspection / data sheets be carried out
2. Use of Multimeters (Analog and Digital)
  - Measurement of AC/DC voltage and Current – on different ranges
  - Measurement of R & C
  - Testing of Diodes & Transistors
  - Measurement of  $h_{fe}$
  - Use of Multimeter in measurement of Variation of Resistance of LDR.
  - Thermister
3. Study of Signal Generator/CRO
  - Understand how to use Signal Generator/CRO
  - Study of front panel controls
  - 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

### **Hobby Project Examples**

Build and Test gadgets like

- Water level Indicator
  - Photo relay / smoke detector
  - Burglar Alarm
  - Fan regulator
  - Logic Probe
  - Experiments with some software's like PSPICE / LTSPICE
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**S.Y.B.Sc. (Electronic Science)**  
**Revised Syllabus**  
**To be implemented from A.Y. 2014-15**

**Structure of S. Y. B. Sc. (Electronic Science) course**

<b>Sem-I</b>	<b>Paper-I : Analog Circuit Design (EL211)</b>	<b>Paper-II: Digital Circuit Design (EL212)</b>
<b>Sem-II</b>	<b>Paper-I: Electronic Instrumentation (EL221)</b>	<b>Paper-II: Communication Electronics (EL222)</b>
<b>Sem-I &amp; II</b>	<b>Paper- III: Practical Course (EL 203)</b>	

**Equivalence Subject/Paper and Transitory Provision**

<b>Semester</b>	<b>Old Syllabus</b>	<b>New Syllabus</b>
Semester I	Paper - I : Analog Circuits and Systems	Paper-I : Analog Circuit Design <b>(EL 211)</b>
	Paper - II: Digital System Design	Paper-II: Digital Circuit Design <b>(EL 212)</b>
Semester II	Paper – I: Electronic Instrumentation	Paper-I: Electronic Instrumentation <b>(EL221)</b>
	Paper – II: Communications system	Paper-II: Communication Electronics <b>(EL222)</b>
Semester I and II	Practical Course	<b>Paper- III: Practical Course (EL 203)</b>

## **S.Y.B.Sc. Electronic Science -Semester I**

### **Paper - I: Analog Circuit Design (EL 211)**

#### **Objectives:**

1. To study basic principles of amplifiers and oscillators.
2. To understand the working of various analog circuits.
3. To develop analog circuit design skills.
4. To apply the knowledge of analog circuits in different applications.

#### **UNIT- 1: Transistor Amplifiers: (12)**

General classification of amplifiers: with respect to signal amplitude, frequency and configuration. Small signal amplifier: A.C.-D.C. analysis, frequency response, gain Bandwidth product. Design of single stage amplifier. Types of coupling (quantitative analysis): RC coupled, transformer coupled and direct coupled. Multi-stage RC coupled CE amplifier: effect of coupling capacitor and bypass capacitor on frequency response (qualitative approach) and application area.

#### **UNIT-2:Power Amplifiers : (12)**

Concept: Difference between voltage and power amplifier, Comparison of small signal and large signal amplifiers: with respect to gain, efficiency, and distortion. 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. Concept, use and types of heat sinks.

#### **UNIT-3: Feedback Systems : (12)**

Concept of negative and positive feedback and Barkhausen criterion. Types of feedback circuits: current shunt, current series, voltage shunt and voltage series, comparison and applications. Effect of negative feedback: on gain ,Bandwidth, input and output impedance, stability of an amplifier. Positive feedback: oscillator circuits -Wien bridge , Phase Shift , Hartley , Colpitts and Crystal. Design of oscillators for given feedback factor and frequency of oscillation.

#### **UNIT-4: Differential Amplifiers and Applications of Operational Amplifier: (12)**

Concept and working of differential amplifier. Configurations of differential amplifier: Single ended, double ended. Differential and Common mode gains, Use of constant current source and its effect on CMRR.



Op-amp Applications: Integrator, Differentiator, Voltage to current converter, Current to voltage converter, Bridge amplifier, Instrumentation amplifiers with three op-amp, Precision rectifier, First order Butterworth active filters -Low pass and High pass filters.and its design for cut off frequency.

**Recommended Books:**

1. Electronic Principles by Malvino A.P TMH
2. Operational amplifiers and linear Integrated Circuits by Gaykawad R. PHP
3. Operational amplifier by Clayton G.B. ELBS
4. Electronic devices and circuits by Millman, Halkias McGrawHill
5. Electronic devices and circuits by Boylestead PHP
6. Principles of Electronics by Meheta V.K. S.Chand and Company
7. Principles of Electronics by B.L. Thereja S.Chand and Company
8. Basic Electronic Devices and Circuits: R.Y. Borse 1<sup>st</sup> Edition 2012 Adhayan Publishers and distributors, New Delhi.

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**S.Y.B.Sc. (Electronic Science)-Semester-I**

**Paper- II: Digital Circuit Design (EL 212)**

**Objectives:**

1. To utilize k-maps in the design of combinational circuits.
2. To understand the design principles of sequential circuits.
3. To study the design and working of various data converters
4. To configure the digital circuits in system interfacing and applications.

**UNIT -1: Combinational Circuits: (12)**

Revision of K maps, Design of code converters: BCD to Seven segments, Binary to Gray and Gray to binary. Serial adder, Priority encoder, Parity generator/Checker, Magnitude comparator.

**UNIT -2: Sequential Circuits: (12)**

State table, State diagram, excitation table and transition table, Design of counters using state machines: Synchronous, asynchronous, modulus and up-down counter, Sequence generator

**UNIT -3: Data Converters : (12)**

Digital to analog converters : weighted resistive network, R-2R ladder network, D/A accuracy and resolution, Analog to Digital converters: Simultaneous conversion, counter method, Tracking method, successive approximation method, Single slope, dual slope, A/D accuracy and resolution

**UNIT -4: Digital System Interfacing and Applications : (12)**

Interfacing of LED's, single and multi digit 7 segment display/ driver, Switches, Keypad, Thumb wheel switches, Relays, Interface considerations for ADC/DAC with digital systems.

Applications of counters:- Totalizer, Digital clock, auto-parking, two digit bank token display.

**Recommended Books:**

1. Digital Fundamentals by Floyd Thomas (Pearson)
2. Digital Circuit design by Morris Mano (PHP)
3. Digital Principles and applications by Malvino Leach (TMH)
4. Modern digital Electronics by R.P.Jain (TMH)
5. Practical Digital IC's by Willams (TMH)

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**S. Y. B. Sc. Electronic Science – Semester II**  
**Paper - I : Electronic Instrumentation (EL 221)**

**Objectives:**

1. To study the block diagram of electronic instruments
2. To understand the working principles of frequently used instruments.
3. To know important technical specifications of an instruments.
4. To learn the operating procedure of instruments.

**UNIT- 1: Measurement Principles and Basic Instruments (12)**

Measurement of physical parameters, measurement system block diagram, Measurement characteristics like accuracy, precision, sensitivity, linearity, resolution, reliability, repeatability, errors. Construction and working principles of Volt meter, Current meter, Ohm meter, multi-range meters, multi-meter, AC Voltmeter.

**UNIT- 2: Signal Sources and Oscilloscope (12)**

Principle, block diagram, working and important specifications of signal and function generators, sweep generators, dual channel and dual trace CRO, digital storage oscilloscope (DSO).

**UNIT- 3: Digital Instruments (12)**

Block diagram, working principle and specifications of DPM, DMM, DFM, LCR meter, Digital thermometer, Lux meter, Speedometer, pH meter, energy meter, power factor meter and decibel meter .

**UNIT- 4: Power Supplies (12)**

Principle, block diagram, working, important specifications and operating procedures for- Fixed voltage power supply, variable power supply, dual power supply, CVCC supply, SMPS, DC to DC converter, UPS.

**Recommended Books:**

1. Helfrik A. & Copper W., Modern Electronic Instrumentation and measurement techniques, PHI.
2. Kalsi H. S., Electronic Instrumentation, TMH.
3. Bouwens, Digital Instrumentations, TMH
4. Rashid Muhammad H, Power Electronics, PHI
5. B. S. Sonde, Power Supplies, TMH

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## **S.Y.B.Sc. (Electronic Science)-Semester-II**

### **Paper - II: Communication Electronics (EL 222)**

#### **Objectives:**

1. To study basics of communication systems and telephone system.
2. To understand Amplitude and Frequency Modulation.
3. To understand basics of AM and FM Receivers.
4. To study the digital communication system.

#### **UNIT- 1: Basics of Communication and Telephone Systems (12)**

Block diagram of communication system, types of communication system: simplex, duplex, analog and digital communication, Electromagnetic spectrum, base band and broad band communication. noise concept and types, signal to noise ratio, noise figure, noise temperature. Problems based on noise calculations.

Block diagram of Telephone handset, types of dialing, Block diagram of PSTN.

#### **UNIT- 2: Amplitude Modulation and AM Receiver (12)**

Need of modulation, concept of modulation, AM waveform, mathematical expression of AM, concept of sideband, Definition and problems: modulation index, power distribution. AM using diode/transistor, demodulation principles, demodulator circuit using diode.

AM Receiver: TRF and super-heterodyne receiver, characteristics of receiver: selectivity, sensitivity, Image frequency and dynamic range.

#### **UNIT-3: Frequency Modulation and FM receiver (12)**

FM modulation: definition, mathematical representation, frequency spectrum, bandwidth and modulation index. FM using varactor diode, problems based on modulation index, frequency deviation, average power. FM Demodulator: Slope detector, Foster-Seeley detector.

Block Diagram of FM Receiver.

#### **UNIT- 4: Pulse and Digital Communication Systems (12)**

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, concept of ASK, PSK, FSK, PAM, PWM, PPM, PCM, Concept of FDM and TDM, Concept of MODEM, Concept of Set Top Box.

**Recommended Books:**

1. Communication Electronics :Principles and applications by Louis E Frenzel 3<sup>rd</sup> edition  
TMH Publications.
2. Electronics Communication Systems by Keneddy
3. Telecommunication Switching Systems and Network by Vishwanathan Thiagarajan, PHI  
publication.
4. Electronics Communication Systems by Denis Roddy, John Coolen, PHI publication.

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## S.Y.B.Sc. (Electronic Science)

### Paper- III: Practical Course (EL 203)

#### Objectives:

1. To make use of basic concepts for building different electronic circuits..
  2. To understand design procedures of different electronic circuit as per requirement
  3. To build experimental setup and test the circuits.
  4. To develop skills of analyzing test results of given experiments .
- Total Practical to be conducted :20.
  - 16 experiments compulsory: At least four practical from each of the A B C D groups.
  - One activity equivalent to 2 experiments by the student.
    - a. Continuation of F. Y. activity.
    - b. PSPICE Simulation
    - c. Documentation type experiments
    - d. Presentation/Seminar on Electronics /advanced topic/research topics.
  - One activity equivalent to 2 experiments to be arranged by the teacher – Arrange at least two practical demonstrations / Workshops /Industrial visit which will enhance quality and skills of the student.
  - Examination will be conducted on 16 experiments as well as on activities.

#### Practical Examination –

A) Internal Marks 20: 16 marks for experiments and 04 marks for activities

B) Annual examination: 80 Marks **in Two session of 3 Hrs as usual practice.**

Session I 40 marks

Practical work 32 marks , Oral based on the student's own activities 8 marks

Session II 40 marks

Practical work 32 marks,Oral based on Common activities arranged by teachers 8 marks

32 Marks can be divided as -Circuit diagram	10
Connection	05
Demonstration and working explanation	10
Results	05
Result analysis / conclusion / comments	02

**Group A :List of Practicals (Digital Circuit Design): Any Four**

1. Code conversion using logic gates – binary to gray , gray to binary
2. 3 bit synchronous counter using flip flops
3. Decimal to BCD encoder using logic gates
4. Study of RAM
5. Study of 4- Bit Arithmetic Unit using IC 74181
6. DAC using R-2R ladder network
7. ADC using IC 0808/IC 7109/IC 741/IC 324
8. Sequence generator for stepper motor

**Group B: List of Practicals (Analog Circuit Design): Any Four**

1. Design of Low Pass Filter and High Pass Filter using OPAMP IC-741
2. Wein bridge oscillator/Phase shift oscillator
3. Design and build two stage amplifier using transistor
4. Effect of negative feedback on amplifier parameters
5. Push pull amplifier
6. Design and build V to I converter using opamp

**Group C: List of Practicals (Communication Electronics): Any Four**

1. Design, Build and test Amplitude Modulator and Demodulator.
2. Time Division Multiplexing circuit.
3. Frequency Shift Keying(FSK) using XR 2206
4. Delta Modulation circuit using opamp
5. Hamming Code generation and error detection.
6. Demonstration of PAM,PPM and PWM
7. Study of radiation pattern of antenna

**Group D : List of Practicals (Electronic Instrumentation): Any Four**

1. Design and build three opamp Instrumentation Amplifier
2. Variable power supply using IC 317.
3. Temperature measurement system using LM – 35
4. Study of UPS.
5. Study of Function generator
6. Multirange voltmeter
7. Study of CVCC/SMPS.
8. Design and build bridge amplifier for temperature sensors thermistor/RTD/PT100
9. Study of LDR based system
10. Study of LVDT

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**SAVITRIBAI PHULE PUNE UNIVERSITY**  
**T.Y.B.Sc. Electronic Science**  
**Revised Syllabus**

**To be implemented from June 2015**

**SAVITRIBAI PHULE PUNE UNIVERSITY**  
**T.Y.B.Sc. Electronic Science**  
**Revised Syllabus**

**To be implemented from June 2015**

**1) Title of the course:** Third Year B.Sc. Electronic Science

**2) Introduction:**

Semester Pattern is followed at S.Y.B.Sc. Electronic Science. Third year B.Sc. syllabus is designed to provide an insight into applications of various circuit blocks, design analog and digital systems, methods to analyze working of systems and some of consumer products. Training on system design and simulations, learning programming languages like "C" and tools like "MATLAB" is included. A course in Project work is maintained in new syllabus and a guideline for it is framed.

In the theory courses adequate knowledge of Analog systems design, digital system design, communication systems, basics of nanotechnology, nanoelectronics will be acquired by the students.

Student taking admission at T.Y.B.Sc. Electronic Science have to complete 12 theory courses six each semester, two practical courses (Annual) and one project course (Practical III, Annual). In the practical course of 100 marks there are compulsory experiments along with the one activity to be done for practical course I and II. The details are mentioned in the syllabus.

**3) Aim and Objectives:**

The aim of the course is to generate trained manpower with adequate theoretical and practical knowledge of the various facets of electronic circuits and systems. Due care is taken to inculcate conceptual understanding in basic phenomena, materials, devices, circuits and products and development of appropriate practical skills suitable for industrial needs. Following are the objectives -

- i. To design the syllabus with specific focus on key Learning Areas.
- ii. To equip student with necessary fundamental concepts and knowledge base.
- iii. To develop specific practical skills.
- iv. To impart training on circuit design, analysis, building and testing.
- v. To prepare students for demonstrating the acquired knowledge.
- vi. To encourage student to develop skills for accepting challenges of upcoming technological advancements.

**4) Eligibility:** Second Year B.Sc. Pass / ATKT, with all subjects cleared at F.Y.B.Sc.

**5) Examination -**

**A) Pattern of Examination :**

**i) Semester III**

**Theory Papers** - Six Theory papers of 50 marks per semester  
(Internal examination 10 + Semester Examination 40, Total 50)

**ii) Semester IV**

**Theory Papers** - Six Theory papers of 50 marks per semester  
(Internal examination 10 + Semester Examination 40, Total 50)

**Practical** - Three Practical courses, out of which Course III is Project work.

**iii) Pattern of the question Paper:**

The pattern adopted for theory and practical examination is as below.

**Theory:**

The topic wise weightage is decided as per lecture allotted to cover the syllabus for the topics. The Internal option is also taken into consideration in the process. Equal weightage is given for each topic. No topic can be given as optional.

**Internal Examination 10 Marks**

It is a continuous evaluation process and is executed by the teacher conducting the course.

Four types of questions -

Objective, Fill in the blanks, True or False and One Sentence Answer.

There are two or three different sets of the question papers used for internal examination in the same class for same paper.

**External Examination 40 Marks**

Pattern is as follows-

Q.1 Answer all of the following : 12 marks

Compulsory no internal option, contains one mark , two mark objective and numerical questions.

Q.2 Answer any TWO. : 08 marks

Three questions are given, each having 4 marks, any two are to be solved.

Q.3 Answer any TWO. : 08 marks

Three questions are given, each having 4 marks, any two are to be solved.

Q.4 Answer any TWO. : 12 marks

Three questions are given, each having 6 marks, any two are to be solved.

There is complete option question for Q.4 having three compulsory numerical Problems having weightage of 4 marks each.

**Practical :**

**Internal Marks 20 :**

Continuous assessment

**External Examination 80 Marks.**

Have to perform 2 experiments of 40 marks of the duration 3 hours each.

(Practical Examination is scheduled in two sessions.)

**B) Standard of passing:**

Candidate must score 40% marks at the semester examination in each course. **i.e. 16 marks at semester theory paper and 32 marks at the practical course.** There is no separate passing for internal course, however the total marks of internal and external should be 40% of the total marks to be awarded.

**C) ATKT Rules:** As per University rules.

**D) Award of Class:**

Overall class at Third Year B.Sc. Electronic Science will as per University rules as follows -

- Above 70% First class with distinction
- Between 60% to 70% First Class
- Between 50% to 60% Second Class
- From 40% to 50 % Pass class.

**However the marks in the Electronic Science papers at Second Year B.Sc. course will be taken into account, for awarding the ultimate class of the course at T.Y.B.Sc.**

**E) External Students:**

Not applicable for this course. External Students are not allowed.

**F) Setting of Questions paper/ Pattern of Question paper:**

Setting of the question paper is as per University Schedule and it is centralized system adopted by University of Pune. Pattern of question paper will be as per decided by Board of Electronic Science, University of Pune.

**G) Verification of Revaluation:** As per University Statutes and rules for verification and revaluation of marks in stipulated time after declaration of the semester examination result.

**6) Structure of the course : Total six Theory in each semester and Three Practical courses.**

i) a) **Compulsory Paper** : Five theory papers in Semester III and Semester IV

b) **Optional Paper** : One ( Paper VI)

**Course Structure**

Paper	Semester-III		Semester-IV	
Paper I	EL-331	Advanced Digital System Design	EL-341	Advanced Communication Systems
Paper-II	EL-332	Microcontrollers	EL-342	Microcontroller and its Applications
Paper III	EL-333	Analog Circuit Design and Applications of Linear IC's	EL-343	Power Electronics
Paper IV	EL-334	Principles of Semiconductors Devices	EL-344	Foundations of Nanoelectronics
Paper V	EL-335	'C' Programming	EL-345	Mathematical Methods and Circuit Analysis using MATLAB
Paper VI	A)	Optional Course Fiber Optic Communication	A)	Optional Course Industrial Automation
	B)	Electronic Product Design and Entrepreneurship	B)	Consumer Electronics
Paper –VII	EL-347	Practical Course I		
Paper –VIII	EL-348	Practical Course II		
Paper –IX	EL-349	Practical Course (Project)		

**Note : Vocational courses will be substituted in place of PAPER V AND VI**

c) **Question paper : Theory -**

- For Internal Examination 10 Marks
- For Semester Examination 40 Marks

**Practical-**

- For Internal Examination 20 Marks
- For Semester Examination 80 Marks

- ii) Medium of instructions: ENGLISH  
7) Equivalence subject/Paper and Transitory Provision:

### T.Y.B.Sc. Electronic Science Semester III

Old Syllabus			New Syllabus	
<b>Paper I</b>	<b>EL331</b>	Advanced Digital System Design	<b>EL331</b>	Advanced Digital System Design
<b>Paper II</b>	<b>EL332</b>	Microcontroller	<b>EL332</b>	Microcontrollers
<b>Paper III</b>	<b>EL333</b>	Analog Circuit Design and Application of Linear IC's	<b>EL333</b>	Analog Circuit Design and Applications of Linear IC's
<b>Paper IV</b>	<b>EL334</b>	Foundation of Nanoelectronics	<b>EL344</b>	Foundation of Nanoelectronics
<b>Paper V</b>	<b>EL335</b>	'C' Programming	<b>EL335</b>	'C' Programming
<b>Paper VI</b>	<b>EL336</b>	Optional Courses	<b>EL336</b>	Optional Courses
	<b>A)</b>	Fiber Optic and Fiber Optic communication	<b>A)</b>	Fiber Optic Communication
	<b>B)</b>	Sensor & Actuators	<b>B)</b>	Industrial Automation
<b>Paper VII</b>	<b>EL-347</b>	Practical Course- I	<b>EL-347</b>	Practical Course- I
<b>Paper VIII</b>	<b>EL-348</b>	Practical Course- II	<b>EL-348</b>	Practical Course- II
<b>Paper IX</b>	<b>EL-349</b>	Practical Course- III (Project Course)	<b>EL-349</b>	Practical Course- III (Project Course)

### T.Y.B.Sc. Electronic Science Semester IV

Old Syllabus			New Syllabus	
<b>Paper I</b>	<b>EL341</b>	Advanced Communication Systems	<b>EL341</b>	Advanced Communication Systems
<b>Paper II</b>	<b>EL342</b>	Embedded System	<b>EL342</b>	Microcontroller and its Applications
<b>Paper III</b>	<b>EL343</b>	Power Electronics	<b>EL343</b>	Power Electronics
<b>Paper IV</b>	<b>EL344</b>	Electronic Material and Devices	<b>EL334</b>	Principles of Semiconductors Devices
<b>Paper V</b>	<b>EL345</b>	Mathematical methods and Analysis using MATLAB	<b>EL345</b>	Mathematical methods and Analysis using MATLAB
<b>Paper VI</b>	<b>EL346</b>	Optional Courses	<b>EL346</b>	Optional Courses
	<b>A)</b>	Instrumentation	<b>A)</b>	Industrial Automation
	<b>B)</b>	Consumer Electronics	<b>B)</b>	Consumer Electronics
<b>Paper VII</b>	<b>EL-347</b>	Practical Course- I	<b>EL-347</b>	Practical Course- I
<b>Paper VIII</b>	<b>EL-348</b>	Practical Course- II	<b>EL-348</b>	Practical Course- II
<b>Paper IX</b>	<b>EL-349</b>	Practical Course- III (Project Course)	<b>EL-349</b>	Practical Course- III (Project Course)

#### 8) University Terms:

- More than 75% attendance is necessary for the course as per University rules.
- 12 Weeks will be available for completion of theory course.
- Practical course I , II and III (Project work) will be throughout the year.

#### 9) Subject wise Detail Syllabus and Recommended books as follows:

## **Paper I: Semester III**

### **EL 331: Advanced Digital System Design**

#### **Unit 1: Digital System**

[14]

Digital system design process- Basic design loop, design flow for logic circuits, Mealy & Moore sequential machine models, state machine notation, state equivalence, state reduction, Equivalence classes, Implication charts, state reduction of incompletely specified state tables, Merger graphs, only importance of state assignment techniques, state assignment permutations formula, ASM symbols

#### **Unit 2: Verilog Hardware Description Language**

[20]

Importance of HDL's, features of Verilog HDL, Overview of Digital Design with Verilog HDL, Hierarchical modeling concepts, Basic concepts of Verilog- Operators, comments, Number specifications, strings, Identifiers & keywords, Data types, system tasks & Compiler Directives, Modules & ports.

Gate level Modeling- Gate types, Gate delays

Data flow modeling- Continuous Assignments, Delays expression, operators & operands

Behavioral Modeling- Structured Procedures, Procedural Assignments, Timing Controls, Conditional statements, Multiway Branching, Loops

Examples of Verilog Design- Multiplexer, Demultiplexer, Encoder, Decoder, Half Adder, Full Adder, Subtractor, Flip Flop, Counter, and Shift register.

#### **Unit 3: Programmable Logic Design**

[08]

Introduction, fixed function IC's, ASICs, PLD, ROM as PLD, SPLD- PLA, PAL, GAL, CPLD, FPGA

#### **Unit 4: Case Study**

[06]

Traffic light controller, Stepper motor sequence generator, Vending machine, Tablet filling system

#### **Recommended Books:**

1. Digital logic: Applications & design by John M. Yarbrough, cengage Learning India(Thompson)
2. Verilog HDL A guide to digital design & synthesis By Samir Palnitkar, Pearson Second Edition
3. Fundamental of digital logic with Verilog By Stephen Brown, Zvonko Vranesic, Tata McGraw Hill
4. Digital fundamentals By Floyd, Thoms, Jain R.P., Pearson

**Paper II: Semester III**  
**EL-332: Microcontrollers**

**Learning objectives**

1. To learn architecture of 8-bit microcontroller.
2. To use instruction set and addressing modes of microcontroller.
3. To develop assembly language programming skills.
4. To interface memory and I/O devices.

**Unit 1: Microcontroller architecture**

[16]

Introduction to microcontrollers, 8051 Core microcontroller block diagram, program counter, Data pointer, A and B registers, Flags and PSW, internal RAM and ROM, stack and stack pointer, SFRs, Pin configuration, I/O ports, clock and reset circuitry, External memory, Timers and counters, Serial I/O, interrupts.

**Unit 2: Instruction set**

[16]

Addressing modes, Different groups of instructions- Data transfer instructions, Logical operations, Arithmetic operations, Jump and call instructions. Programs based on arithmetic, logical, code conversion, block data transfer.

Timers and counters, delay generation using timer, waveform generation using timer

**Unit 3: Development tools and integrated development Environment**

[4]

Algorithms, Flow charts, Program Designing, Editors, Assemblers, Compilers, Linkers, Cross compiler, Simulator, Debugger and Emulator, Keil IDE and Proteus.

**Unit 4: Interfacing memory and I/O devices**

[12]

LED/s, relay, DC motor, Stepper motor, seven segment display, LCD, DAC, switch/s, Thumb wheel Switch, keys, matrix keyboard.

External memory interfacing – RAM, ROM, EPROM

**Recommended Books-**

1. The 8051 Microcontroller Architecture, Programming and application [Second Edition] Kenneth J. Ayala, Penram International (1999)
2. The 8051 Microcontroller and Embedded Systems using Assembly and C M.A.Mazidi, J.G.Mazidi, R.D.Mckinlay. Pearson Education Second Edition 2009
3. The 8051 Microcontroller and Embedded Systems using Assembly and C, Kenneth J. Ayala, Dhananjay V. Gadre. Cengage Learning
4. Microcontrollers [Theory and Applications] Deshmukh Ajay V. TMH



## **Paper III: Semester III**

### **EL-333 Analog Circuit Design and Applications of Linear ICs**

#### **Learning objectives:**

1. To study the practical design aspects while using Opamps
2. To study the basic application circuits of Opamps
3. To Learn the specifications and selection criterion for linear ICs
4. To obtain information about different special purpose ICs and their applications
5. To refer and understand data manuals.

#### **Unit 1: Practical Considerations for Op-amp Circuit Design [10]**

Practical consideration with Op-amps: selecting Op-amps for dc, low frequency and high frequency applications, earth loops, interference noise/ shielding and guarding, supply bypassing, offset compensation / balancing techniques, stability of op-amp circuits and technique for frequency compensation.

#### **Unit 2: Basic Application Circuits using Opamp [12]**

Design of basic and practical integrator and differentiator circuits  
Active filters: 2<sup>nd</sup> and higher order, Design of LP, HP and BP filters  
Log and antilog amplifiers: transdiode configuration and diode connected transistor configuration for log amplifier, Practical log and antilog amplifiers, Precision half wave rectifier, precise full wave rectifiers with equal resistor and one with high input impedance, peak detectors, sample and hold circuits.  
Introduction to operational transconductance amplifier (OTA) - LM13600 or equivalent.

#### **Unit 3: Basic Application Circuits using Linear ICs [14]**

Voltage comparators using op-amp as well as comparator IC (LM311), design of inverting and non-inverting Schmitt trigger, ON-OFF controller using comparator  
Astable and mono stable multivibrators using op-amp.  
Timer IC555: Block diagram, astable and mono stable multivibrators  
Function generators: LM 566, ICL8038  
Four quadrant multiplier and its applications - AD534 or equivalent  
Balanced modulator - IC1496/ 1596

#### **Unit 4: Voltage Regulators and Phase Lock Loops [12]**

Voltage references: band gap reference, LM385  
Linear Regulators: Fixed three terminal regulators ICs-78XX, 79XX; Adjustable Three terminal regulators ICs LM317, LM337, LM723- Block diagram, working, Design for Low and high voltage regulators, design for high and low output current, PWM controller IC3524  
Phase lock loop (PLL): Monolithic IC LM565, operating principle, block diagram, PLL characteristics, applications of PLL such as frequency multiplier and FSK

**Recommended Books:**

1. George Clayton and Steve Winder, "Operational Amplifiers," 5th Edition Newnes An Imprint of Elsevier
2. Sergio Franco, "Design With operational Amplifiers and analog integrated circuits," TMH
3. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits," 4th Edition PHI
4. R.F. Coughlin, F.F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits," Prentice Hall.
5. James M Fiore, "Operational Amplifiers and Linear Integrated Circuits," Jaico Publishing house.

## **Paper IV: Semester III**

### **EL-334: Principles of Semiconductor Devices**

#### **Learning Objectives:**

1. To introduce crystal structure with reference to semiconductors
2. To study the theory of metal-semiconductor and p-n junctions
3. To understand the characteristics of semiconductor devices
4. To introduce theoretical background of BJT and FETs

#### **Unit 1: Fundamentals of Semiconductors**

[14]

Crystal structure: Basic Lattice Types, Basic Crystal Structures, Miller Indices, bulk semiconductor growth and epitaxial growth techniques

Photoelectric effect, Bohr model, hydrogen atom

Electronic levels in semiconductors bonding forces and energy bands in semiconductors, metal semiconductors and insulators, direct and indirect semiconductors, charge carriers, Fermi level and temperature dependence, carrier drift in electric and magnetic field

Excess carriers in semiconductors: optical absorption, photo and electro-luminescence, carrier lifetime and photoconductivity, diffusion of carriers

#### **Unit 2: Junctions**

[12]

Equilibrium conditions: contact potential, space charge at junction.

Forward and reverse bias junctions: steady state conditions.

Reverse bias breakdown: Zener and avalanche breakdown mechanism

Metal Semiconductor Junction: Schottky barriers, Current Flow across a Schottky Barrier, rectifying contacts, Ohmic Contacts

#### **Unit 3: Bipolar Junction Transistors**

[10]

BJT structure and operation, BJT Characteristics, Minority carrier distributions and terminal currents, current transfer ratio. Coupled diode model (Ebers-Moll Model).

Switching: cutoff, saturation, switching cycle.

Effects: Drift in the Base region, Avalanche Breakdown, base resistance and emitter Crowding Effect, Injection and Thermal Effects

#### **Unit 4: Field Effect Transistors (FETs)**

[12]

Junction FETs (JFETs) and Metal Semiconductor FETs (MESFETs): The Ohmic Region, Pinch-off and saturation, GaAs MESFET, Current-Voltage Characteristics.

MOSFET: Basic operation of Metal Insulator Semiconductor FETs, Metal-Oxide-Semiconductor Capacitor, Capacitance-voltage relation of MOS structure

Output and transfer Characteristics of MOSFET, Mobility model, control of threshold voltage, Substrate Bias Effects, Sub-threshold Characteristics, Electrical equivalent circuit of MOSFET

**Text / Reference Books:**

1. Solid State Electronics Devices, Ben G. Streetman and Sanjay Kumar Banerjee, PHI, 6<sup>th</sup> Edition.
2. Semiconductor Physics and Devices Basic Principles, Donald A. Neamen, TMH, 3<sup>rd</sup> Edition.
3. Semiconductor Device Physics and Design, Umesh K. Mishra and Jasprit Singh, Springer.
4. Semiconductor Device fundamentals, Robert F. Pierret, Pearson Education.

**Paper V: Semester III**  
**EL -335: 'C' Programming**

**Learning Objectives:**

1. To understand fundamentals of C language.
2. To develop algorithm/flowcharts for problem solving and writing programs.
3. To learn to use functions, arrays, pointers and file handling in C language.
4. To study different types of algorithm.

**Unit 1: C- Fundamentals**

[16]

Introduction, character set, constants and variables, Key words, Symbolic constant, statements, entering and executing C program, input and output simple and formatted functions, operators and expressions, control structures and loops and programming examples.

**Unit 2: Functions, Arrays and Pointers**

[14]

Defining a function, Accessing a function, function prototype, passing argument, recursion e.g. Defining and processing of an array, passing array to a function, Pointers declarations, passing pointers to a function, operations of Pointers, pointers as function parameters and programming examples.

**Unit 3: String and File handling**

[08]

Operations on string, string length, string size, string copy, string concatenation, string compare, Opening and closing of data file, read and write data file, processing data file and append data file.

**Unit 4: Algorithms**

[10]

Algorithm definition, properties of algorithm, sorting algorithm, Bubble sort algorithm, selection sort algorithm, Insertion sort algorithm, quick sort algorithm, linear search algorithm and Binary search algorithm.

**Recommended Books:**

1. J. Jayasri The 'C Language Trainer with C Graphics and C++ WILEY
2. Byron. S. Gottfried Schaum's Outline of Programming with C TMH
3. E Balaguruswamy Programming in –C BPB
4. Stephens Cochan Programming in C Prentice hall of India Ltd
5. V. Rajaraman Computer Programming in C Prentice hall of India Ltd.
6. Madhusudan Mothe C for Beginner shroff / the x team reprints

## Paper VI: Semester III

### EL-336: A) Fiber Optic Communication

#### Learning Objectives:

1. To understand the principles of fiber optic communication system.
2. To learn measure different parameter of optical fibers.
3. To understand essential optical components of Fiber Optic Communication.
4. To study the applications of fiber optic communication systems.

#### Unit 1: Introduction

[12]

Basic structure of optical fiber, ray transmission theory, propagation of light in optical fiber, acceptance angle, numerical aperture, skew rays, Dispersion in optical fiber.

Types and specification of single mode, multimode, step index, graded index, glass and plastic fibers and advanced optical fiber.

#### Unit 2: Optical sources and detectors

[12]

LED and LASER diode, Principles of operation, concepts of line-width, phase noise, switching and modulation characteristics-typical LED and LD structures

PN detector, PIN detector, avalanche photodiode-principles of operation, concepts of responsivity, sensitivity and quantum efficiency.

#### Unit 3: Fiber optic Losses and Measurement.

[12]

Attenuation in optical fibers, material or impurity losses, scattering losses, absorption losses, bending losses. Fiber optic link structure and link losses, connector and splicing losses. Fiber attenuation measurement, Dispersion measurement, profile measurement, Numerical aperture measurement, Diameter measurement.

#### Unit 4: Fiber optic communication

[12]

Block Diagram of fiber optic communication, selection of optical fiber types for short haul, long haul and high speed data links, optical power and dispersion budget calculations of fiber optic communication link, Repeaters, optical fiber amplifiers, optical fiber transmitter and optical fiber receiver design considerations.

#### Recommended Books:

1. G. Kaiser Optical fiber communication McGraw Hill
2. Subir kumar Sarkar Optical fibers and fiber optic communication systems S.Chand and Company
3. R. P. Khare Fiber optics and optoelectronics oxford University Press
4. John M. Senior Optical fiber communications Principles and Practice, (2nd edition) PHI
5. Ajoy Ghatak and K. Thyagarajan Introduction to fiber optics Cambridge University Press
6. D. C. Agarwal Fiber optic communication wheeler Publication

## Paper VI: Semester III

### EL-336: B) Electronic Product Design and Entrepreneurship

#### Learning Objective:

1. To provide a basic understanding of electronic product design..
2. To get fundamental knowledge of □ Entrepreneurship.
3. To design small scale projects for Enterprises. □
4. After successfully completing the course students will be able to search / develop self employments.

#### Unit 1: Product Design and Development [12]

Introduction, Product development basics, Product development stages, Identification of customer requirements, Designing the product, Techno commercial feasibility of a product, Pilot production batch, Product assessment, Failure rates of electronic components, Touch screen, Multi- touch technology.

#### Unit 2: Entrepreneurship Development [12]

Introduction to entrepreneurship, Identification of opportunities for entrepreneurship, Concept of different occupations: - business, employment and profession. Functions of an entrepreneur. Business idea and plan, Types of businesses / ownerships – Sole Proprietorship, Partnership, Private limited company, Public limited company, Joint stock Company, Co-operative society.

#### Unit 3: Sources of Finance [12]

Preparation of project report for business, Sources of finance – government and nongovernment agencies, Working capital, Cash flow, Fund flow, Preparation of basics of financial statements, costing and pricing, Policies and incentives for small business development, Government policies and incentives,

#### Unit 4: Marketing Management [12]

Small business management and entrepreneurship, Woman entrepreneurship, Features of small business firms, Process of management in small business, Concept of data and information, Information as a commodity, Study of marketing strategy and marketing mix, Decision-making models, Types of decisions, Decision Support Systems, Introduction to e-commerce, types – B2B, B2C, C2B, C2C etc. Case study on Small scale industries in India.

#### Recommended Books:

1. R. G. Kaduskar, V. B. Baru. Electronic Product Design. Second edition Wiley India
2. Alpana Trehan. Entrepreneurship. Wiley India
3. G. N. Pandey. A complete guide to successful Entrepreneurship, Vikas Publishing house Pvt. Ltd. 576, Masjd Road Jangpura, New Delhi 110014.

4. Waman S. Jawadekar, "Management Information Systems", Mc-Graw-Hill Education ( India ) Pvt. Ltd.
5. G. S. Batra , "Development of Entrepreneurship ", Deep and Deep Publications, New Delhi
6. Ashwathappa, "Human Resource Management", Mc-Graw-Hill Education ( India ) Pvt. Ltd.
7. M.Y. Khan and P. K. Jain, "Financial Management", Mc-Graw-Hill Education (India) Pvt. Ltd.
8. Ravi M. Kishore, "Project Management", Mc-Graw-Hill Education ( India ) Pvt. Ltd.



**Paper I: Semester IV**  
**EL-341: Advanced Communication Systems**

**Unit 1: Antenna & Propagation** **[14]**

**Antenna:** Basic consideration, Evolution of Dipole antenna, Parameters of Antenna, Effect of ground on Antennas. Resonant Antenna- Radiation patterns & length considerations, Non-Resonant antenna, Directional high frequency antennas, UHF & Microwave antenna, Wide-band & special purpose antennas

**Propagation of Waves:** Ground (Surface waves), sky wave propagation, space waves, Tropospheric scatter propagation.

**Unit 2: Modulation & Demodulation** **[12]**

Balanced Modulator- Using diodes & FETs

SSBSC- Filter Method, Phase shift method (third method)

Synchronous Demodulation, Product Demodulator,

Phase modulation & demodulation using PLL, Indirect method of FM generation.

**Unit 3: Transmitter & Receiver** **[12]**

AM transmitters: Block diagram,

FM Transmitters: Using Frequency multiplication & mixing, Frequency stabilized reactance FM transmitter, FM achieved through phase modulation

TV transmitter (monochrome/colour) Mobile receiver block diagram (800MHz), Doppler RADAR, Speed Gun, Low noise amplifier block diagram

**Unit 4: Digital Communication** **[10]**

Pulse modulation, Pulse code modulation, Differential Pulse Code Modulation, Delta modulation, Adaptive delta modulation, Companding, TDM, FDM, Vocoders

Block diagram- Digital Communication System

**Recommended Books:**

1. Electronic Communication By Dennis Roddy & John Coolean, Pearson Education
2. Principles of Communication Systems By Taub Schilling, McGraw Hill.
3. Antenna Theory: Design & Analysis By Balanis, Wiley Eastern
4. Electronic Communication systems By Kennedy & Davis, Tata McGraw Hill

## **Paper II: Semester IV**

### **EL-342: Microcontroller and its Applications**

#### **Learning objective:-**

- 1) Use 'C' language for programming the microcontrollers
- 2) Learn to use Timers, Interrupts and Serial Communication in Microcontroller.
- 3) Apply the knowledge in real world applications

#### **Unit 1: Microcontroller programming [12]**

C Data types for 8051, C Programs for Time Delays & I/O Operation, I/O Bit Manipulation, Arithmetic and Logical Operations, ASCII and BCD Data Conversion.

#### **Unit 2: UART, INTERRUPT, TIMER Programming [14]**

Timer programming - Timers and counters, delay generation using timer, waveform generation using timer. Serial Port Programming in C, Serial Data Transfer to Microcontroller from PC and from PC to Microcontroller, Interrupt programming

#### **Unit 3: Microcontroller applications using embedded 'C' [12]**

Interfacing with 8051 and programming using C – LED/s, SSD, LCD, Stepper Motor, DC motor, DAC, ADC, Keys, Matrix keyboard, Switches, TWS, RTC (DS 12887).

#### **Unit 4: Introduction to PIC microcontroller [10]**

Comparison of CISC and RISC architecture, Architecture (WREG register, PIC file register, SFRs, GPR, GP RAM, File register and access bank in the PIC18, PIC status register), Feature of PIC 18F4580, reset and oscillator circuit, Pin configuration (18F4580), Port description, Memory organization, Introduction of PIC programming using MPLAB.

#### **Recommended Books-**

1. M.A. Mazidi, J. G. Mazidi, R.D. Mckinlay The 8051 Microcontroller And Embedded Systems, Using Assembly and C Pearson Education , Second Edition (2009)
2. Kenneth J. Ayala,Dhanjay V. Gadre The 8051 Microcontroller And Embedded Systems, Using Assembly and C Cengage Learning
3. M.A. Mazidi, R.D. Mckinlay, Danny Causey PIC Microcontroller and Embedded System using Assembly and C Pearson Education.

**Paper III: Semester IV**  
**EL- 343: Power Electronics**

**Learning objectives:**

1. To get introduced to basics of power electronics and familiar with Power Electronic Devices, circuits and applications
2. To learn about power devices and protections of devices
3. To study various types of power circuits
4. To study applications of power electronics

*Note:* Scope of the syllabus is limited to **single phase circuit** unless otherwise specified.

**Unit 1: Introduction to Power Electronics** **[8]**

Definition of power electronics, Applications of power electronics, classification of power semiconductor devices, control characteristics of devices, characteristics of power devices as a switch, switching power losses, types of Power circuits, Concept of single phase and three phase using phasors, basics of magnetic circuits

**Unit 2: Power Devices, Protection and Driving circuits** **[10]**

Power Diode (P-i-N): construction, Reverse recovery characteristics, diode in series and parallel, freewheeling diode

Power BJT, power MOSFET, IGBT: Steady state and Switching Characteristic, Driving circuits

Thyristors: Types of Thyristors, SCR characteristics, Two transistor static and transient model, turn-on methods, turn-off characteristics,  $dv/dt$  and  $di/dt$  protection, gate protection circuits, gate driving circuits using BJT, UJT and PUT

Thermal management of heat sinks for power devices and its design from Safe operating Area (SOA).

**Unit 3: Power Circuits** **[18]**

Rectifiers: Performance parameters, Half wave, Full wave centre tapped and bridge rectifier with resistive and inductive loads, DC Filters: concept of C, L and LC filters

Controlled rectifiers: Principle, Semi, Full and Dual Converters

AC voltage controllers: on-off control, Phase angle control, Bi-directional control with Resistive load, transformer tap changer, Cycloconverter

Choppers: Step-up, Step-down, concepts of choppers operating in various quadrants

Regulators: Buck and Boost regulators

Inverters: Performance parameters, principle, Half Bridge and full Bridge inverter, Voltage control methods, Inverter filters, introduction to current source inverter

DC Switches, Solid state relays, AC Switches and Microelectronic relays

**Unit 4: Applications** **[12]**

Power Supplies: Switch mode power supply (DC) using flyback, forward, half bridge and full bridge converters, Uninterrupted power supply (UPS) .

Electrical motor drives: DC motor drives using Choppers, Introduction to Induction (AC) and synchronous motor drives using three phase inverters.

High frequency florescent lighting, Induction heating and electric welding.

**Recommended Books:-**

1. M.H. Rashid Power electronics: Circuits, Devices and Applications , third Edition (2004)  
Pearson Education
2. Ned Mohan , undeland, Robbins Power Electronics , Third Edition (2006) John Wiley & Sons
3. O.P. Arora Power electronics Laboratory : theory , Practice & Organization Narosa Publishing  
house (2007)
4. P.C. Sen Power Electronics Tata Mc Graw Hill, (1998)

## Paper IV: Semester IV

### EL -344: Foundation of Nanoelectronics

#### Learning Objectives:

1. To learn essential principles of Electromagnetics
2. To know the principles of quantum mechanical aspects
3. To study the basics of nanoelectronics.

#### Unit 1: Essential Electromagnetics

[14]

Lorentz force-Motion of charged particle in E-M fields, cyclotron frequency, Hall effect, Maxwell's equations, Relation with laws of Electrodynamics, Equation of continuity, Poynting vector theorem, Wave equation for E and H, properties of EM waves in conducting and nonconducting media, Skin depth.

#### Unit 2: Quantum mechanical aspects

[12]

Particles and Waves: Classical particles, Light as wave and particle, Wave particle duality and Uncertainty principle, Wave mechanics: The Schrödinger wave equation, wave mechanics of particles, Infinite potential well, Qualitative treatment of square wave potential with special reference to tunneling phenomenon, atoms and atomic orbital.

#### Unit 3: Statistical aspects

[10]

Classical statistics, Gaussian distribution, Poisson distribution, Fermi-Dirac, Bose Einstein, Maxwell Boltzmann statistics, Time and length scales of the electrons in solids, statistics of electrons in solids and nanostructures, Density of states of electrons, electron transport, Conductivity of metals.

#### 4. Nanoelectronics

[12]

Importance of nanoelectronics, Top down approach, Bottom up approach, Lithography, Nanostructure devices like resonant-tunneling diode, electrons in quantum wells, electrons in quantum wire, electrons in quantum dots, Quantum dot applications, Flash Memory.

#### Recommended Books:

1. George W. Hanson "Fundamentals of nanoelectronics", LPE, Pearson Education  
V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio Vladimir
2. "Introduction to Nanoelectronics Science, nanotechnology, Engineering and Applications"  
Cambridge University Press 2008
3. Ben G. Streetman, Sanjaykumar Banerjee "Solid State Electronic Devices", 6th Edition
4. Kraus and Fleisch "Electromagnetics with applications" McGraw Hill, 5th edition
5. Electromagnetics by B.B. Laud, Wiley Edition
6. Donald A. Neaman, "Semiconductor Physics and devices" 3rd edition TMH

## Paper V: Semester IV

### EL- 345: Mathematical Methods and Circuit Analysis using MATLAB

#### Learning Objectives:

1. To learn features of MATLAB as a programming tool.
2. To promote new teaching model that will help to develop programming skills and technique to solve mathematical problems.
3. To understand Laplace Transform and Fourier series and its applications.
4. To use MATLAB as a simulation tool.

#### Teaching Methods

1. This course should be taught in classroom and computer laboratory simultaneously.
2. No separate practical are to be conducted for this course.
3. Exercises /programs (or equivalent) from this course are to be demonstrated using computer.
4. Equipped computer laboratory with sufficient number of computers is to be made available for teaching of this course along with projector facility.

#### Unit-1: Introduction to MATLAB

[20]

Working in command window, Built in function, Array-1D, 2D & mathematical operations with array, Script files, 2D & 3D plots.

Functions: -inline, functional evaluation feval.

Programming: -Conditional statement, Switch-case statement, loops, nested loops, break & continue statement, polynomial operations.

#### Unit-2. Fourier Series

[10]

Definition, Evaluation of Fourier Coefficient, Fourier series for square wave, triangular, sawtooth wave, half wave & full wave rectifiers.

MATLAB exercise: To evaluate Fourier coefficients for given waveform function.

#### Unit-3. Laplace Transform and its applications

[12]

Definition, Laplace transform of simple functions, properties of L.T. (Linearity, shifting, change of scale), Inverse L.T., Partial fraction technique to find inverse L.T.function

**Applications.** Series RC circuit, RL circuit, RLC circuit for dc input.

**MATLAB Exercises:** 1.To find Laplace Transform and Inverse LT of any given function.

2.Transient analysis of RC / RL/RLC (series) circuit

#### Unit-4. Mathematical Applications

[6]

Curve fitting(Straight line, Exponential ) and its application to

1. Diode characteristics
2. Ohm's Law
3. RC Filter

**MATLAB Exercises:** Real root of algebraic equation

**Recommended Books:**

1. Amos Gilat MATLAB : An introduction with applications Wiley India
2. G K Mittal Network Analysis Khanna Publishers , New Delhi
3. Van Valkenberg Network Analysis, 3rd Edition Dorling Kindersley (India) Pvt Ltd
4. Umesh Sinha Network Analysis and Synthesis Satya Prakashan, Delhi.
5. RudraPratap Getting Started with MATLAB , 7th Edition Oxford University Press, N Delhi
6. Stephen J. Chapman MATLAB Programming For Engineers. Thomas Learning

## Paper VI: Semester IV

### EL-346: A) Industrial Automation

#### **Unit-1: Generalized configuration and performance characteristics of instrumentation system (14)**

Functional Elements of an instrument, active and passive transducers, Working principle and specification of thermal sensors like thermister, thermocouple, optical sensors photodetector, and optical encoder, Mechanical sensors LVDT, magnetic sensor hall effect etc. Analog and Digital Modes of Operation, Null and Deflection Methods, Input Output configuration of Instruments and measuring systems. Working principle of electromechanical relay, heater, LED/LCD display.

Generalized measurements, zero-order System, First-order System, Second-order System,

Dead-Time Element, Specifications and Testing of Dynamic Response.

#### **Unit 2 :Manipulating, Computing and Compensating devices (10)**

Bridge circuits, Operational Amplifiers, Instrumentation Amplifiers, Transconductance and Transimpedance Amplifiers, Noise Problems, Shielding and Grounding,

Generalized Data Acquisition system- Elements of a data acquisition system, Single channel Data Acquisition system, Multichannel Data Acquisition system, Sample and Hold circuits, ADC, DAC, Multiplexers.

#### **Unit 3: Fundamentals of Process automation (12)**

Process control system: Continuous control, discrete state control, composite discrete/continuous control, Ladder Diagram: Ladder diagram elements with examples.

Process Characteristics: Process equation, Process load, Process lag, self regulation

Control system parameters: Error, Variable range, control parameter range, control lag, dead time, cycling,

#### **Unit 4: Controller modes (12)**

Discontinuous controller modes: Two position mode, Multiposition mode, floating control mode

Continuous controller modes: Proportional control, Integral control, Derivative control and composite modes Proportional-Integral , Proportional derivative, Proportional-integral –derivative(PID).

#### **Recommended Books:**

1. C.D. Johnson, Process control Instrumentation Technology John Willy and Sons, Inc., 3<sup>rd</sup> Edition
2. C S Rangan,G R Sarma,V S Mani:Instrumentation Devices & Systems , 2nd Edition TMH
3. Ernest O Doebelin, Dhanesh N Manik:MEASUREMENT SYSTEMS Application and Design , 5th Edition Tata McGrawHill
4. Joseph J. Carr:Elements of Electronic Instrumentation and Measurement , 3rd Edition Pearson Education
5. H S Kalsi:Electronic Instrumentation, Second edition, Tata McGraw Hill Pub.



**Paper-VI: Semester IV**  
**EL-346: B) Consumer Electronics**

**Unit-1: Audio Systems** **(08)**

**Introduction to:** Microphone, Loudspeaker and Music System: Principle, construction, working and characteristics

**Microphone:** Different types of microphone: Electret & carbon microphones

Special Microphones: Lavalier microphone, Tie-clip microphone, Radio microphone and Noise cancelling microphone.

**Loudspeakers:** Characteristics of Loudspeaker, Horn type, Multiway speaker system (Woofers & Tweeters).

**P.A. System:** Block diagram of P.A. system, requirements of P A system, typical P.A. Installation planning (P.A. system for a public meeting in Public Park and P.A. System for an auditorium having large capacity)

**Unit 2: TV and Video Systems** **(12)**

Television: standards, B/W/Colour, CRT/HDTV

Video Systems: VCR/VCD/DVD players, MP4 players, Set top Box, CATV and Dish TV, LCD, Plasma and LED TV, Projectors, Home theaters

**Unit 3: Telephone Systems** **(08)**

Basic land line equipment, Telephone set, working, telephone exchange, Initiating call, calling a no., pulse dialing and tone dialing, signal to /from exchange, dial tone, dial back and engage signals, making connection, answering call, conversion, ending call, Modems, telex, PBX, PABX, transmitter and receiver. Cordless Phones: Principle of operation, Block diagram of the base unit, Block diagram of the Handset, Features and specifications.

Cellular Phones - Operating principle, the cell approach, Block diagram, Functions performed by cell phones, features/ specifications.

GPRS and Bluetooth, GPS Navigation system

**Unit 4: Office Equipments and Modern Home Appliances** **(20)**

Office Equipments: Scanners-Barcode/Flatbed, Printers, Xerox machine, Multifunction Unit (Print, scan, fax, copy)

Home Appliances: Microwave Oven – Principle of operation, Block Diagram, features and specifications

Washing Machine/ Dish washers - Principle of operation, fuzzy logic, Washing machine with fuzzy logic, Block Diagram, features and specifications.

Remote Control: Operating Principle, Block Diagram, Operation and features.

Electronic Weighing Systems - Operating principle, Block diagram, features.

Digital Camera, Handicam, Home security System

**Reference Books:**

1. Audio and Video systems by R.G. Gupta Tata McGraw Hill (2004)
2. Modern CD player servicing Manual by Manahar Lotiya
3. Modern Telephone and cordless servicing by Manahar Lotiya
4. Consumer Electronics by J. S. Chitode Technical Publications, Jan-2007
5. Television- By Gulati, New Age International.
6. Mobile cellular telecommunications analog and digital system- By Lee.
8. Mobile cellular communication- By William C. Y. Lee, 2nd edn 1985, McGraw Hill Publication.
9. Consumer Electronics by R.P. Bali, Pearson Education (2008)

**T.Y.B.Sc. (Electronic Science)****Practical Courses****Aim and Objectives:**

1. The practical activities are self learning process, there are three practical courses.
2. There are TWO activities i.e. one for Practical course-I and other for Practical course-II. One activity is equivalent to 4 experiments.
3. There will be no change in the workload in taking 16 experiments and one activity instead of 20 experiments.
4. There will be 16 experiments and one activity in each course. Student select the activity throughout the year he/ she will work on it and at the end submit full activity report individually.
5. Student will prepare **a report on each activity**. It will be evaluated both at internal and university practical examination.
6. The progress of the student activity will access time to time/ weekly/ monthly by the teacher during regular practical timing.
7. This activity will generate good quality of work and prepare good report (study material with practical experience) which will be useful to the teachers, departments, other students etc.

In the practical course examination of 100 marks, 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	No. of Expt.
<b>EL-347: Practical Course-I</b>			
Section I	1	Analog Circuit Design and Applications of Linear ICs	4
	2	Power Electronics	3
	3	Advanced Communication Systems	3
<b>Total Experiments</b>			<b>10</b>
Section II	4	Principles of Semiconductor Devices	3
	5	Fiber optic Communication	3
		Electronic Product Design and Entrepreneurship	
		Industrial Automation	
		Consumer Electronics	
Activity (Equivalent to 4 Experiments)			4
<b>Total Experiments</b>			<b>10</b>
<b>EL-348: Practical Course-II</b>			
Section I	1	Assembly and C Programming for Microcontrollers	6
	2	Digital System Design using Verilog HDL	4
<b>Total Experiments</b>			<b>10</b>
Section II	3	C Programming	6
Activity (Equivalent to 4 Experiments)			4
<b>Total Experiments</b>			<b>10</b>

## **T.Y. B.Sc. (Electronic Science)**

### **Paper VII EL-347 Practical Course- I**

#### **(2015 Pattern)**

There are 20 Experiments in Paper VII EL-347 Practical Course- I

One activity as directed in practical course which will be equivalent to 4 experiments

Internal Practical Examination (Out of 20)

- 16 Marks to Experiments, 04 Marks to Activity

University Annual Practical Examination (Out of 80)

- Two experiments of each of 3 hours duration (40 Marks)
- Section I: 32 Marks for Experiment, 8 marks for oral
- Section II: 24 Marks for Experiment, 16 marks for oral of experiment and activity

#### **Objectives:**

1. To refer the various datasheets of the electronic devices and integrated circuits
2. To learn how to select the devices, sensors, actuators and ICs for a particular application
3. To develop the basic skills required to handle the various instruments
4. To learn the designing aspects of circuits/ systems

### **Section I**

Total 10 Experiments to be conducted in the Laboratory

#### **Group 1: Total 4 Experiments**

#### **Analog Circuit Design and Applications of Linear ICs**

1. Wave shaping circuits (Integrator / differentiator circuit)
2. Op-amp based clipper and clampers
3. Log amplifier using opamp
4. To study gain bandwidth product of inverting/ non-inverting amplifier.
5. Regulated power supply using IC 723 (Low and High Voltage, 1A Current)
6. Function generator using 8038/2206 or any equivalent IC
7. Active second order Butterworth Low Pass/ High Pass/ Band Pass/ Band Reject Filter (any two)
8. Astable and monostable multivibrator using IC555.
9. Study of PLL Characteristics IC565/ CD4046/ XR2211 or any equivalent IC

#### **Group 2: Total 3 Experiments**

#### **Power Electronics**

1. SCR/MOSFET/IGBT static characteristics
2. Controlled rectifier
3. Light Dimmer / fan regulator circuit

4. Electronic Ballast
5. PWM based PMDC motor control
6. Buck/Boost Regulator
7. Study of SMPS
8. Emergency light
9. Mains Over voltage/under voltage Protector
10. AC and DC static switches

**Group 3: Total 3 Experiments**

**Communication Systems**

1. Amplitude modulation using OTA CA3080 and demodulator
2. FM modulator using VCO
3. FSK modulator and demodulator using XR 2206 and XR2211
4. QASK/ BPSK using op-amp and analog multiplexer ( IC CD 4051/52/53)
5. SSB generation using IC 1496/1596 or equivalent and demodulation

**Section II**

Total 6 Experiments to be conducted in the Laboratory

**Group 4: Total 3 Experiments**

**Principles of Semiconductor Devices**

1. Hall effect
2. Four probe method
3. Measurement of Efficiency and fill factor of solar cell.
4. Energy band gap measurement
5. Reverse recovery time measurement of diodes (any two).
6. Angular displacement measurement using Hall Effect sensor.
7. Transfer characteristic of phototransistor/ Photodiode

**Group 5: Total 3 Experiments**

**Fiber Optics and fiber optic Communication**

1. Study of propagation loss in optical fibers
2. Study of bending loss in fibers
3. Setting up of fiber optic voice link
4. Measurement of Numerical Aperture
5. Fiber terminations and polishing
6. Fiber in sensor application
7. Design of fiber optic Transmitter
8. Design of fiber optic Receiver
9. Visit to telecom facility for observing splicing, alignment, fusing, OTDR operation, connectorization, types of connectors, couplers and cables

**Electronic Product Design and Entrepreneurship**

- 1: Interview a successful entrepreneur.
- 2: Visit a small business- project report.
- 3: Identify business opportunities.
- 4: Market Survey

### **Industrial Automation**

1. Measurement of displacement using potentiometer.
2. LVDT Characteristics- Sensitivity measurement
3. Level measurement using capacitive transducers.
4. Pressure measurement using piezoelectric transducers.
5. Study of Hall Effect transducer
6. Design of Wheatstone's bridge for resistive transducer.
7. Simulation PI, PD and PID controller modes
8. PLC simulation using ladder diagram
9. ON-OFF controller using microcontroller/op amp

### **Consumer Electronics**

1. Study of PA systems
2. Installation of Audio /Video systems
3. Market Survey of Products
4. Identification of block and tracing the system.

### **[C] Activity:**

Circuit design using PSpice (Equivalent to 4 Experiments) **OR** Industrial Visit

## T.Y. B.Sc. (Electronic Science)

### Paper VII EL-348 Practical Course- II

There are 20 Experiments in Paper VII EL-348 Practical Course- I

One activity as directed in practical course which will be equivalent to 4 experiments

Internal Practical Examination (Out of 20)

- 16 Marks to Experiments, 04 Marks to Activity

University Annual Practical Examination (Out of 80)

- Two experiments of each of 3 hours duration (40 Marks)
- Section I: 32 Marks for Experiment, 8 marks for oral for
- Section II: 24 Marks for Experiment, 16 marks for oral of experiment and activity

#### Objectives:

1. To learn the basic C-Programming
2. To learn Verilog HDL to design basic combinational and sequential circuits
3. To get familiar with structural, data flow and behavioral modeling
4. To learn assembly level language of 8051 microcontroller
5. To use cross compiler to develop C-programs for microcontroller
6. To study the various interfacing circuits to 8051 microcontroller

#### Section I

Total 10 Experiments to be conducted in the Laboratory

##### Group 1: Total 6 Experiments

##### Assembly and C Programming for Microcontrollers

8051 Practical (Practical 1 and 2 in Assembly are compulsory and Practicals 3 to 13 may use in both assembly or C or both)

1. Basic exercises on arithmetic, logical and data transfer operation ,largest, smallest of numbers
2. Programs on code conversion: dec-hex, hex-dec, ASCII – HEX, HEX – ASCII, BCD – seven segment
3. Serial Communication sending string on Hyper terminal , receiving data from Keyboard.
4. LCD interface. a) To display message on both lines b) To display 2-digit BCD counter on second line
5. Interfacing of Keypad / Matrix KBD to 8051
6. Interfacing of DIP switches/TWS to 8051
7. Interfacing SSDs – Non-multiplexed / Multiplexed type
8. Interfacing Stepper Motor – Continuous clockwise , anticlockwise , rotation for fixed angle
9. Interfacing LED Bank / dot matrix display
10. Interfacing ADC (Implement digital voltmeter)
11. Interfacing DAC- Waveform generator (Ramp , Triangular , square ) , with different amplitude
12. Event counter, Frequency Counter using Timer/Counter of 8051.

13. Traffic Light Controller(Generate delay using for loop , using Timer/Counter)
14. Design of target board.
15. Program for Flashing of LED on any port of PIC microcontroller.

**Group 2: Total 4 Experiments**

**Digital System Design using Verilog HDL**

1. Design 4 to 1 line MUX/ 1 to 4 DEMUX  
Use a) gate level b) data flow c) Structural d) Behavioral style of modeling
2. Design 2-4, 3-8 decoder using a. gate level b. Structural d. Behavioral - modeling) and BCD to Seven Segment Decoder (using Behavioral modeling)
3. Arithmetic circuits: Half adder, Full adder (using gate level , Data flow modeling ) and Parallel adder using structural modeling
4. Four bit ALU design using behavioral modeling
5. Design a) 2-bit magnitude comparator using gate level modeling b) 4-bit magnitude comparator using structural modeling
6. Design of flip-flops using : RS, D and T using behavioral modeling and Design of Counter using T flip-flops (Use Structural modeling): Asynchronous counter and Asynchronous up/down counter
7. Design the following
  - a. Up-down bit binary counter (minimum 4-bit) using behavioral modeling
  - b. Shift register using D flip flops(Structural )
  - c. Shift register using behavioral modeling
8. Designing of Traffic light Controller
9. Code converter – binary to gray, gray to binary using data flow modeling
10. Encoder- 8 to 3 encoder, priority encoder using behavioral modeling
11. Stepper motor sequence generator

**Section II**

Total 6 Experiments to be conducted in the Laboratory

**Group 3: Total 6 Experiments**

**‘C’ Programming**

1. Program to compute the following :
  - a) Parallel equivalent resistance of n resistors.
  - b) Reactance of Inductor , Capacitor in  $\Omega$  at given frequency
  - c) To determine impedance of the series LR circuit.
  - d) Resonant frequency of series L(mH),C( $\mu$ F)
  - e) Program to compute Vdc and Vrms values of half wave/Full wave controlled rectifiers for different values of firing angle(study of controlled characteristics)
  - f) Program to compute Vdc and Vrms values of ac voltage controller for different values of firing angle(study of controlled characteristics)
  - g) Program to compute parameters of opamp in inverting and non-inverting amplifiers for given open loop parameters values.
2. Program to compute the following :



- a) Generate truth table for boolean function.
- b) Determine binary equivalent of an 8-bit integer
- c) Convert i) binary to gray ii) binary to decimal iii) hex to decimal
3. Program to compute the following :
  - a) Determine the drain current in a FET with an entered threshold voltage, beta and Supply voltage.
  - b) Program to determine current flowing in a diode accepting diode voltage, reverse saturation current and junction temperature in Kelvin
4. Transient response of an RC circuit.
5. Develop a program for the following
  - a) Determine classification of radio wave.
  - b) Solve the given quadratic equation.
  - c) Calculate frequency of i) Astable multivibrator using 555 ii) Wein bridge Oscillator iii) Phase shift oscillator
6. Program the following
  - a) Determine determinant of matrix
  - b) Solve solution of network equation using matrix.
7. Sorting of a) array of numbers b) list of names of students (Bubble Sort).
8. Calculate  $\sin x$  and  $\cos x$  by Taylor's series.
9. Recursive functions - Factorial of a number, Fibonacci Series.
10. Prime numbers generation.
11. Program on structure – read 10 records, process on data and display the result.

**Reference Books:**

1. C for Electronics and Computer Engineering Technology.-Peter J. Holsberg
2. C for Electronic Engineering: With Applied Software Engineering -by William Buchanan

**Activity:** Circuit design using PSpice OR MATLAB Programming (Equivalent to 4 experiments)

## **T.Y. B.Sc. (Electronic Science)**

### **Paper IX: EL-349 Practical Course- III**

#### **Project Work**

#### **Guideline to conduct Practical Course III**

Practical Course III is a project work of 100 Marks.

- Internal project Examination (Out of 20)
- University Annual project Examination (Out of 80)

The project work should be followed with following guidelines.

- a) The name and subject of the project type must be well defined.
- b) Planning of the work must be specified.
- c) Theoretical, reference work must be provided.
- d) Pilot experimentations / Preparations must be specified.
- e) Typical design aspects, theoretical aspects, aim and objectives of the work must be specified in detail.
- f) The actual work done must be reported along with experimentation procedures.
- g) There must be observations, interpretations, conclusions, results of the project work.
- h) Algorithm, program strategy, module wise description of parts etc be provided in case of projects related with development of computer software.
- i) Applications, usefulness, student's contribution in it must be clearly specified.
- j) Further extension work may be suggested for better outcome of the project.
- k) It is recommended to present the projects in competitions / project exhibitions organized by various authorities.

**University of Pune**

**Two Year M.Sc. Degree Course in  
Electronic Science**

**M.Sc. Electronic Science**

**(Credit and Semester based Syllabus to be implemented from Academic Year  
2013-14)**

**1) Title of the Course:**

M.Sc. Electronic Science

**2) Preamble of the Syllabus:**

Master of Science (M.Sc.) in Electronic science is a post graduation course of University of Pune. The credit system to be implemented through this curriculum, would allow students to develop a strong footing in the fundamentals and specialize in the disciplines of his/her liking and abilities.

The students pursuing this course would have to develop in depth understanding various aspects of the subject. The working principles, design guidelines and experimental skills associated with different semiconductor devices and circuits, underlying mathematical and analysis techniques, electromagnetic and instrumentation principles, design methodologies for digital and embedded systems, communication electronics and control systems and various applications of electronic devices, circuits and systems are among such important aspects.

**3) Introduction:****Salient Features of the Credit System:**

1. Master's degree course in Electronic Science would be of 100 credits, where one credit course of theory will be of one clock hour per week running for 15 weeks and one credit for practical course will consist of 15 of laboratory exercise including the revision and setting up the practical. Thus, each credit will be equivalent to 15 hours.
2. Student will have to take admission in Electronic Science Department and complete 75 credits incorporated in the syllabus structure of Electronic Science. The remaining 25 credits shall be chosen from courses offered by the Electronic Science Department or other Departments of the University/College with credit system structure.
3. Except practical credits wherever applicable, students may be allowed to complete less courses per semester on the condition they complete the degree in maximum of four years. This facility will be available subject to the availability of concerned courses in a given semester and with a maximum variation of 25 credits (in case of fresh credits) per semester.
4. Every student shall complete 100 credits in a minimum of four semesters. All Semesters will have 25 credits each.
5. The student will be declared as failed if s/he does not pass in all credits within a total period of four years. After that such students will have to seek fresh admission as per admission rules prevailing at that time.
6. Academic calendar showing dates of commencement and end of teaching, internal assessment tests and term end examination will be prepared and duly notified before commencement of each semester every year.
7. Project course should not be greater than 10% of the total credits of the degree course. Project course is equivalent to 10 credits.

## Instructions for the Students

The students seeking admission to M.Sc. Electronic Science course is hereby informed that they are supposed to adhere to the following rules:

1. A minimum of 75 % attendance for lectures / practical is the pre-requisite for grant of term.
2. There shall be tutorial / practical / surprise test / home assignment / referencing of research papers / seminar / industrial visits / training course as a part of internal assessment in each semester. The students are supposed to attend all the tests. The students should note that re-test will not be given to the student absent for the test/s.
3. The students opting for dissertation course shall follow the rules framed for the same.
4. Industrial / Institute - Visit and or Industrial Workshops / Laboratory Workshops / Training Programme is a compulsory component of the syllabus. The students are supposed to attend all the Industrial Workshops / Laboratory Workshops / Training Programme organized by the department. The students shall attend these programmes at their own cost.

### 4) Eligibility:

The candidate should have a B.Sc. degree with Electronic Science as principal subject **OR** B.Sc. (General) degree with Electronic Science (Electronics) as one of the subsidiary subjects.

Admission: 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.

### 5) Examination

#### [A] Pattern of Examination

Evaluation of Students:

- 1) The In-semester and End-Semester examinations will be of 50 marks each.
- 2) Student has to obtain 40% marks in the combined examination of In-Semester and End-Semester assessment with minimum passing of 30% passing in both assessments separately.
- 3) A student cannot register for third semester if s/he fails to complete the 50% credits of the total expected within two semesters.
- 4) Internal marks will not change. Student cannot repeat internal assessment. If student misses internal assessment examination, s/he will have second chance with the permission of the concerned teacher. But it will not be right of the student. It will be the discretion of the concerned teacher and internal departmental assessment committee. In case s/he wants to repeat Internal, s/he can do so only by registering for the said courses during 5<sup>th</sup>/6<sup>th</sup> semester whichever is applicable.
- 5) There shall be revaluation of answer script of end semester examination, but not of internal assessment papers.
- 6) Internal assessment answer scripts may be shown to the concerned student but not end semester answer script.

i. **In-semester Examination:** Internal assessment for each course would be continuous and dates for each tutorials/practical tests will be pre-notified in the time table for teaching or placed separately as a part of time table. Department / College Internal Assessment Committee will coordinate this activity

a) **Theory Courses:** Conducting written tests should not be encouraged. More focus should be on non-written tests. Students should be encouraged to conduct various academic activities. A teacher must select a variety of the procedures for internal assessment suggested as follows.

- a) Mid-term test
- b) On-line test
- c) Computer based examination
- d) Open book test (concerned teacher will decide the allowed books)
- e) Tutorial
- f) Surprise test
- g) Oral
- h) Assignments
- i) Review of research paper
- j) Seminar presentation
- k) Journal / Lecture / Library notes

Student has to preserve the documentation of the internal assessment except midterm test answer script. It is the responsibility of the student to preserve the documents.

b) **Practical Courses:** It is a continuous evaluation process. Practical courses will be evaluated on the basis of the following

1. Performance assessment of each experiment on the basis of attendance, punctuality, journal completion, practical skills, results, oral and analysis.
2. Test on practical may be conducted before the end-semester examination.
3. Assessment of each experiment shall be done for each practical weekly.
4. Assessment of the Activity will be based on any one of the following per practical course.
  - i. Special training programs (on C / MATLAB / LABVIEW / ORCAD / DSP / Image processing / RTOS / Special processor board etc.)
  - ii. Mini-project (hardware, software or system design based)
  - iii. Industrial / Institution Visit
  - iv. Market survey (Analysis of existing products, scope for new product)
  - v. Techno-commercial analysis of laboratory equipment (technical specification comparison, cost analysis, taxation, logistics etc.)

The student strength of practical batch should be eight. Note that one practical session is of 4 hour duration of one practical batch.

5. Assessment of Project Like Experiment (PLE) shall be carried out every fortnight for continuous assessment and log book shall be verified. . Evaluation will be on the basis of weekly progress of project work, progress report, referencing, oral, results and documentation.

**Project Course:** Project will be evaluated by In-Charge of project batch in concern with project guide. Assessment will be done weekly in the respective

batch. Evaluation will be on the basis of weekly progress of project work, progress report, referencing, oral, results and documentation.

- ii. **End-Semester Examination:** End-Semester examination for 50 marks per course would be held about two weeks after completion of teaching for the semester. Paper setting and assessment for a particular course would be the responsibility of the course In-charge, and these activities would be coordinated by the Department Examination Committee. The Department Examination committee would undertake preparation of the result-sheets for the student

### **[B] Standard of Passing**

Student has to obtain 40% marks in the combined examination of In-Semester and End-Semester assessment with minimum passing of 30% passing in both assessments separately.

### **[C] ATKT Rules**

A student cannot register for third semester if s/he fails to complete the 50% credits of the total credits expected to be ordinarily completed within two semesters.

### **[D] Award of Class**

Grades will be awarded from grade point average (GPA) of the credits.

### **GPA Rules:**

1. The formula for GPA will be based on Weighted Average. The final GPA will not be printed unless a student passes courses equivalent to minimum 100 credit hours (Science). Total credits hours means the sum of credit hours of the courses which a student has passed.
2. A seven point grade system [guided by the Government of Maharashtra Resolution No. NGO – 1298 / [4619] / UNI 4 dt. December 11, 1999 and University regulations] will be followed. The corresponding grade table is attached herewith.
3. If the GPA is higher than the indicated upper limit in the third decimal digit then the student be awarded higher final grade (e.g. a student getting GPA of 4.492 may be awarded 'A')
4. For Semester I, II, III examinations, only the grade points will be awarded for each subject. Final GPA along with final grade will be awarded only at the end of IV semester. There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. The revaluation result will be adopted if there is a change of at least 10% marks and in the grade of the course.
5. After the declaration of result, for the improvement of Grade, the student can reappear for the examination of 30 credits worth theory courses.
6. Grade improvement programme will be implemented at the end of the academic year. A student can opt for grade improvement programme only after the declaration of final semester examination i.e. at the end of next academic year after passing M.Sc. (Electronic Science) examination and within two years of completion of M.Sc. (Electronic Science). A student can appear for grade improvement programme only once.

Grade and Grade Point Average		
Marks	Obtained Grade	Grade Points
100 – 75	'O' Outstanding	06
74 – 65	'A' Very Good	05
64 – 55	'B' Good	04
54 – 50	'C' Average	03
49 – 45	'D' Satisfactory	02
44 – 40	'E' Pass	01
39 and less	'F' Fail	00

Final Grade Points	
Grade Points	Final Grade
5.00 – 6.00	<b>O</b>
4.50 – 4.99	<b>A</b>
3.50 – 4.49	<b>B</b>
2.50 – 3.49	<b>C</b>
1.50 – 2.49	<b>D</b>
0.50 – 1.49	<b>E</b>
0.00 – 0.49	<b>F</b>

Common Formula for Grade Point Average (GPA):

$$\text{GPA} = \frac{\text{Total of Grade Points earned} \times \text{Credit hours for each course}}{\text{Total Credit hours}}$$

B Grade is equivalent to at least 55% of the marks

**[E] External Students:** There shall be no external students.

**[F] Setting of Question Paper / Pattern of Question Paper**

For core (compulsory) theory courses end semester question papers set by the University of Pune and 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. In case of EL1UT01 and EL1UT04 the at least 80% question paper must be on problem solving. In the rest of the theory papers at least 50% of the question paper should be on designing, problem solving. Question 1 should contain definitions, theorems, short problems based on concepts or programming or logic designs.

Theory examination will be of 2 hours duration for each theory course of 4 credits and 1½ hrs for 3 credit course. There shall be 3 questions each carrying marks as shown below. The pattern of question papers shall be:

Question 1 (10 Marks)	5 compulsory sub-questions, each of 2 marks; answerable in 2 -3 lines
Question 2 (20 Marks)	5 out of 7– short answer type questions; answerable in 8 – 10 lines (For 3 Credit course: 2 out of 3 of 4 marks and 1 compulsory of 2 marks- 10 marks)
Question 3 (10 Marks)	2 out of 3 – problem type question; answerable in numerical or analytical fashion or circuit / logic diagrams or designing



## [G] Verification / Revaluation

There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. The revaluation result will be adopted if there is a change of at least 10% marks and in the grade of the course. There shall be revaluation of answer script of end semester examination, but not of internal assessment papers.

## 6) 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 Pune University.

### a) Compulsory Papers

Theory: EL1UT01, EL1UT02, EL1UT03, EL1UT04, EL2UT05, EL2UT06, EL2UT07, EL2UT08, EL3UT09, EL3UT10

Practical: EL1UP01, EL1UP02, EL1UP03, EL2UP04, EL2UP05, EL2UP06, EL3UP07, EL3UP08, EL3UP09, EL4UP10

### b) Optional Papers

Theory: All elective courses are represented by code ELDTxx

### M.Sc. Electronic Science - Course structure & Credits Distribution

Semester	Course Code	Course Title	No. of Units	No. of credits
Sem-I	EL1UT01	Mathematical Methods in Electronics and Network Analysis	04	04
	EL1UT02	Analogue Circuit Design	04	04
	EL1UT03	Digital System Design	04	04
	EL1UT04	Advanced 'C' Programming	03	03
	EL1UP01	Practical Course –I	12 Practical Sessions	04
	EL1UP02	Practical Course –II	12 Practical Sessions	04
	EL1UP03	Practical Course –III	Project Like Experiment	02
Sem-II	EL2UT05	Applied Electromagnetics, Microwaves and Antennas	04	04
	EL2UT06	Instrumentation and Measurement Techniques	04	04
	EL2UT07	Embedded System Design	04	04

	EL2UT08	Foundation of Semiconductor Devices	03	03
	EL2UP03	Practical Course – IV	12 Practical Sessions	04
	EL2UP04	Practical Course – V	12 Practical Sessions	04
	EL2UP04	Practical Course – VI	Project Like Experiment	02

Semester	Course Code	Course Title	No. of Units	No. of credits
Sem-III	EL3UT09	Communication Electronics	04	04
	ELDTxx	Elective Theory	04	04
	ELDTxx	Elective Theory	04	04
	ELDTxx	Elective Theory	03	03
	EL3UP07	Practical Course –VII	12 Practical Sessions	04
	EL3UP08	Practical Course –VIII	12 Practical Sessions	04
	EL3UP09	Practical Course –IX	Project Like Experiment	02
Sem-IV	EL4UT10	Control Systems	04	04
	ELDTxx	Elective Theory	04	04
	ELDTxx	Elective Theory	04	04
	ELDTxx	Elective Theory	03	03
	EL4UP10	Practical Course –X (Project)	-	10

**c) Question Papers and papers etc.:**

Theory

In-Semester Examination : 40/30/20 Marks (4/3/2 Credits)

End-Semester Examination : 40/30/20 Marks (4/3/2 Credits)

Practical

In-Semester Examination : 40/30/20 Marks (4/3/2 Credits)

End-Semester Examination : 40/30/20 Marks (4/3/2 Credits)

**d) Medium of Instructions:** English.

**7) Equivalence of Previous Syllabus:**

<b>Old Course (2008 Pattern)</b>	<b>New Course (2013 Pattern)</b>
EL1UT01: Foundation of Semiconductor Devices	EL2UT08: Foundation of Semiconductor Devices
EL1UT02: Analog Circuit Design and Analysis	EL1UT02: Analogue Circuit Design
EL1UT03: Instrumentation and Measurement Techniques	EL2UT06: Instrumentation and Measurement Techniques
EL1UP01: Practical course –I	EL1UP01: Practical Course –I
EL1UP02: Practical course –II	EL1UP02: Practical Course –II
EL2UT04: Applied Electromagnetics, RF and Microwave	EL2UT05: Applied Electromagnetics, Microwaves and Antennas
EL2UT05: Communication Electronics	EL3UT09: Communication Electronics
EL2UT06: Digital System Design using VHDL	EL1UT03: Digital System Design
EL2UP03: Practical course –III	EL2UP04: Practical Course –IV
EL2UP04: Practical course –IV	EL2UP05: Practical Course –V
EL3UT05: Embedded Systems	EL2UT07: Embedded System Design
EL4UT06: Control System: Theory & Application	EL4UT10: Control Systems

**8) University Terms:**

Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only for duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

**9) Qualification of Teacher:**

- i. M.Sc. (Electronic Science) degree with NET / SET qualification.
- ii. Recognition of Pune University as a post graduate teacher, by papers.
- iii. Other criteria as per the guidelines of UGC and University of Pune.

## 10) Detail Syllabus with Recommended Books

### M.Sc. Electronic Science

#### First Year

#### SEM-I and SEM-II

#### Credit and Semester based Syllabus to be implemented

#### From

#### Academic Year 2013-14

### EL1UT01: Mathematical Methods in Electronics and Network Analysis

#### 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

#### Unit-1: Mathematical modeling of Electrical and Electronic Systems

Concept of modeling, types, mathematical modeling using differential equations, transfer function, analogous physical and electrical quantities

#### Unit-2: Differential Equations

Differential Equation, Ordinary Differential Equations (ODE), DE and their occurrences in real life 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-3: Electronic Signals and Mathematical Tools for Circuit Analysis

Signals: periodic, aperiodic, 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, LT of derivatives and Integrals, solution of DE using LT, concept of Transient and steady state response

Z-Transform (ZT): definition, inverse ZT (partial fraction and residue method), ZT of standard electronic signals, properties, difference equation and solutions using ZT

Concept of transfer function of CT and DT systems, Laplace transformation of electrical circuits, two port network functions, time and frequency domain 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), Butterworth filters, stability criterion, Routh-Hurwitz criterion, synthesis of transfer function using poles and zeros

#### **Unit-4: Network Analysis**

Network Topology (nodes, tree, graph, branch, mesh, and loop)

Network Theorems and Applications to DC and AC Circuits: Thevenin's, Norton's, superposition, maximum power transfer – theorems

Mesh, loop and nodal analysis of circuits, T and  $\pi$  networks, state variable method with simple examples

#### **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, 3<sup>rd</sup> Edition, PHI, 2002.

## **EL1UT02: Analogue Circuit Design**

### **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**

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**

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**

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**

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 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, 3<sup>rd</sup> Edn, McGraw Hill.
2. Electronic Devices and Circuit Theory, Robert Boylestead, Louis Nashelsky, PHI.
3. Design with Operational Amplifiers and Linear IC, Sergio Franco, 3<sup>rd</sup> 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.

## **EL1UT03: Digital System Design**

### **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**

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**

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**

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**

Need of PLD, antifuse, architecture of simple PLD (SPLD)-PAL, PLA, Complex Programmable 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, 2<sup>nd</sup> 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, 2<sup>nd</sup> 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.

## EL1UT04: Advanced 'C' Programming

### Objectives:

1. To understand basic concepts of C programming language.
2. To learn various advanced features, graphics and interfacing
3. To learn concepts of object oriented programming in C++

### Unit-1: Basics of C

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.

### Unit-2: Advanced Features and Interfacing

Miscellaneous and advanced features: command line argument, dynamic memory allocation, Data files in C, file handling in C.

Graphics in C: graphics-video modes, video adapters, drawing various object on screen.

Interfacing: interfacing to external hardware, via serial/parallel port using C, applying C to electronic circuit problems.

### Unit-3: Introduction to C++

Introduction to object –oriented programming and C++, characteristics, objects, classes, inheritance, polymorphism, overloading.

### Text / Reference Books:

1. Computer programming in C, V. Rajaraman, Pearson Education, 2<sup>nd</sup> edition, 2003.
2. The C programming language, Dennis Ritchie, Pearson Education, 2<sup>nd</sup> edition, 2003.
3. Graphics programming in C, Roger T. Stevens, BPB Publications.
4. Object oriented programming in C++, Robert Lafore, Galgotia Publications.
5. Programming with C++, John Hubbard, Schaum Outline Series, Tata McGraw Hill.
6. Programming with C, Byron S. Gottfried, Schaum Outline Series, Tata McGraw Hill.
7. Programming in C, Stephen G. Kochan. CBS.

## **EL2UT05: Applied Electromagnetics, Microwaves and Antennas**

### **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**

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**

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**

Concept of waveguides, frequency range, relation to transmission lines  
 Rectangular Waveguides: TM and TE Modes, concept of cut-off frequency, guide impedance, 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**

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, 3<sup>rd</sup> Edition, 2002.
2. Principles of Electromagnetics, N. Sadiku, Oxford University Press.
3. Electromagnetics with Applications, Kraus and Fleiseh, McGraw Hill, 5<sup>th</sup> Edn, 1999.
4. Electromagnetics, J.D. Kraus, 4<sup>th</sup> Edn, McGraw Hill, 1992.

## **EL2UT06: 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**

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**

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**

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  $\Delta x$  and  $\Delta t$ , 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**

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:**

1. Measurement Systems, Applications and Design, Ernest O. Doebelin and Dhanesh N. Manik, 5<sup>th</sup> Edition, Tata McGraw Hill.
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.

## **EL2UT07: Embedded System Design**

### **Objectives:**

1. To understand the basics of embedded system
2. To understand the architecture, assembly language and interfacing of different 8-bit microcontrollers
3. To learn embedded C programming
4. To learn software techniques to embed codes in to the systems
5. To learn communication standards and protocols

### **Unit-1: Introduction to Embedded System**

Embedded System: components, examples, development cycle of embedded system, embedded System Development Environment - algorithm, flow chart, IDE, ICE, programmer

Processor Architectures: Harvard architecture, Von-Neumann architecture, RISC and CISC

### **Unit-2: Bus Standards and Communication**

Communication Protocols: I2C bus- specification, general characteristics, bus signals, address mechanism,

Serial Peripheral Interface (SPI): specifications, master slave configuration,

Bus Standards- RS 232, RS 485, USB, Bluetooth, Zigbee

Controller Area Network (CAN): specifications, basic concepts, frame types, bus signals, error handling and addressing

### **Unit-3: AVR Microcontroller**

Architecture (Atmega16), instruction set, addressing modes, memory organization, timers, I/O, ADC, interrupts, serial communication

Design of General Purpose Target Board: reset, oscillator circuit, derivatives of AVR

Basic Assembly Programs: arithmetic, logical, code converter, block data transfer, I/O programming

C Programs: ADC, timer, I/O ports, interrupts, Inter-Integrated Circuit (I2C), serial communication, PWM.

Real world interfacing with the microcontrollers and programming in C: DAC, LED, SSD, 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, coding assembly in C and code optimization

### **Unit-4: PIC Microcontroller**

Architecture (PIC18F4550, 18F458), instruction set, addressing modes, memory organization, timers, I/O, ADC, interrupts, serial communication

Design of General Purpose Target Board: reset, oscillator circuit, derivatives of PIC

Basic Assembly Programs: arithmetic, logical, code converter, block data transfer, I/O programming

C Programs: ADC, timer, I/O ports, interrupts, I2C, serial communication, PWM

Real world interfacing with the microcontrollers and programming in C: DAC, LED, SSD, 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, coding assembly in C and code optimization

**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.



## **EL2UT08: Foundation of Semiconductor Devices**

### **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, quantum and statistical mechanics**

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.

Introduction to Quantum Mechanics: 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-2: Physics of semiconductors**

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, ambipolar transport, quasi-Fermi energy levels, excess carrier lifetime, surface effects

### **Unit-3: Basics of Semiconductor Devices**

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 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,  $I_D - V_D$  Relationship, ac response, spice models.

### **Text / Reference Books:**

1. Semiconductor Physics and Devices Basic Principles, Donald A. Neamen, TMH, 3<sup>rd</sup> Edition (2003)
2. Semiconductor Device fundamentals, Robert F. Pierret, Pearson Education
3. Solid State Electronics Devices, Streetman, PHI, 5th Edition, (2006)

### EL1UP01: Practical Course –I

**Group A:** Analog Circuit Design → 7

**Group B:** Digital Electronics (hardware) → 3

**Group C:** Activity → 2

Note that for Group C: Activity, please refer Section 5) Examination of this document.

#### **[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

**EL1UP02: Practical Course –II**

**Group A:** VEILOG programming, CPLD/FPGA → 6

**Group B:** Mathematical Methods for Electronics (C/MATLAB/PSICE) → 4

**Group C:** Activity → 2

Note that for Group C: Activity, please refer Section 5) Examination of this document.

**[A] Practical Based on VERILOG Programming and Implementation on CPLD or FPGA**

1. Combinational Logic
  - a. Parity Generator and checker
  - b. Hamming Code Generator
  - c. Manchester code Generator
2. Sequential Logic
  - a. Up-down bit binary counter (minimum 4-bit)
  - b. Universal shift register
3. Four bit ALU design (structural modelling)
4. Keyboard Scanning
5. Designing of Traffic light Controller
6. Implementation of 8 bit multiplexer
7. LCD controller
8. Code Converter (BCD to seven Segment)
9. Practical based on state machine (Stepper sequence generator/Vending Machine/ Washing Machine)
10. Barrel shifter

**[B] 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

**EL1UP03: Practical Course –III (PLE)**

Candidate should carry out a Project Like Experiment (PLE). PLE is a **small project** equivalent to 5 practical experiments. A project report should be submitted to the department. Log book of the continuous progress of the work should be maintained by candidate.

### EL2UP04: Practical Course –IV

**Group A:** Instrumentation → 7

**Group B:** Electromagnetics, Microwave → 3

**Group C:** Activity → 2

Note that for Group C: Activity, please refer Section 5) Examination of this document.

#### **[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)

### EL2UP05: Practical Course –V

**Group A:** Microcontrollers → 7

**Group B:** Electromagnetics (C/MATLAB) → 3

**Group C:** Activity → 2

Note that for Group C: Activity please refer section 5) Examination of this document.

**[A] Practical on AVR/PIC Interfacing** Students should design of target board of AVR / PIC

#### Practical on AVR (3/4)

1. Interfacing of LED array to generate different sequences, use of timer for delay generation
2. Matrix Keyboard interface with LCD
3. DAC interfacing (sine, staircase, triangular, square wave) use of timer
4. Use of ADC
5. DC motor control using PWM / Intensity control of LED – with CCP
6. Serial EEPROM / EEPROM interface using SPI protocol
7. Real time clock (RTC)
8. Stepper motor Interfacing
9. Dot matrix rolling display

#### Practical on PIC (3/4)

Any four Practical 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

#### **[B] 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

### EL2UP06: Practical Course –VI (PLE)

Candidate should carry out a **Project** Like Experiment (PLE). PLE is a **small project** equivalent to 5 practical experiments. A project report should be submitted to the department. Log book of the continuous progress of the work should be maintained by candidate.

**University of Pune**

**Two Year M.Sc. Degree Course in  
Electronic Science**

**M.Sc. Electronic Science (Part II)**

**(Credit and Semester based Syllabus to be implemented from Academic Year 2014-15)**

## Second Year M.Sc. Electronic Science

### M.Sc. Electronic Science - Course structure & Credits Distribution Semester

<b>COURSE</b>	<b>UNIVERSITY THEORY</b>	<b>No. of Units</b>	<b>Credits</b>
EL3UT09	Communication Electronics (Sem III)	4	4
EL4UT10	Control Systems (Sem IV)	4	4
	<b>ELECTIVE THEORY (Sem III and Sem IV)</b>		
ELDT01	Advanced Power Electronics	4	4
ELDT02	Advanced Embedded Systems	4	4
ELDT03	Digital Signal Processing	4	4
ELDT04	Mechatronics	4	4
ELDT05	Digital Image Processing	4	4
ELDT06	Optoelectronics and Fibre Optic Communication	4	4
ELDT07	Nanoelectronics and Devices	4	4
ELDT08	Programmable Logic Controllers and Applications	3	3
ELDT09	VLSI System Design	3	3
ELDT10	Robotics-Kinematics and Control	3	3
ELDT11	Wireless Sensor Networks	3	3
ELDT12	Digital Communication	3	3
ELDT13	Computational Methods for Electronics	3	3

### Practical Courses: Sem III and IV

<b>Course Code</b>	<b>Course Title</b>	<b>No. of Units</b>	<b>No. of credits</b>
<b>Sem III</b>			
EL3UP07	Practical Course –VII	12 Practical Sessions	04
EL3UP08	Practical Course –VIII	12 Practical Sessions	04
EL3UP09	Practical Course – IX	Project Like Experiment	02
<b>Sem IV</b>			
EL4UP10	Project Practical Course –X	Project Course	10

### **Semester III: EL3UT09: Communication Electronics (4 Credits)**

#### **Objectives:**

1. To learn analog modulation techniques
2. To study basics of information theory and digital communication
3. To study various data digital communication systems
4. To learn fundamentals of radio wave propagation and Antennas
5. To make students aware of various communication technologies

#### **Unit 1: Analog communication**

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: Digital Communication**

Information theory, Pulse modulation, Pulse amplitude modulation, Delta modulation, Adaptive delta modulation, Time division multiplexing, Frequency division multiplexing, Pulse-time modulation, Pulse systems

Digital technology, Fundamentals of data communication systems, Data sets and interconnection requirements, network and control considerations

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**

Local Loop, PSTN, ISDN, digital exchanges, satellite communication and VSAT

Wireless communication technologies: spread spectrum techniques, OFDM, Cellular phones, 3G wireless, IP telephony, Bluetooth, IrDA, CDMA

Principles of light transmission in fiber, Optical fiber and fiber cables, Losses in fiber, Fiber optic components and Fiber optic communication link, system testing and repair



### **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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## Semester IV:EL4UT10: Control Systems (4 Credits)

### Objectives:

1. To make student familiar with basic concepts of control theory
2. To understand different control strategies
3. To develop problem solving attitude
4. To impart information about control instrumentation
5. To make students familiar with latest trends in industrial control / production systems

### 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 optimal 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 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 2<sup>nd</sup> Edition.
2. Control Engineering Noel. M. Morris, 3<sup>rd</sup> 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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## Elective Theory (Semester III and IV)

### ELDT01: Advanced Power Electronics (4 Credits)

#### Objectives:

1. To study the basic principles and applications of power electronics
2. To understand the solid-state devices required for power electronic circuits
3. To study and understand the power conversion and power transmission principles
4. To study the industrial and domestic applications

#### Unit-1: Introduction to Power Devices and Circuits

Comparison of Power Electronics and linear electronics, power devices, power circuits, concept of load, Application areas, and Basic concepts of electrical and magnetic circuits

Power diodes: I-V characteristics, switching characteristics, types, SiC diodes, Power BJT, MOSFET, IGBTs: Construction, working, steady state and switching characteristics, switching limits, base /gate drive circuits

Thyristors: SCR Characteristics, two-transistor model, turn-on and turn-off methods, thyristor types, gate drive circuits, Introduction to Power Integrated Circuits

#### Unit-2: Power Circuits

Rectifiers: single phase half-wave, center tapped full wave and bridge rectifiers performance parameters, three phase bridge rectifiers

Controlled rectifiers: Single phase and three phase – half-wave, semi-full wave and dual converters, Single phase series converters, 12-pulse converters, Powerfactor improvement techniques

AC voltage controllers: ON-OFF control, phase control, single phase Bidirectional controller, 3-phase Bi-directional controller and their types, PWM control, Single phase and 3- phase cycloconverter and their types

DC-DC converters: step-up and step-down converters, performance parameters, switch mode regulators: Buck, Boost, Buck-Boost and Cuk regulators

Inverters: Performance parameters, single-phase bridge inverter, 3 Phase inverters-120° and 180° conduction, voltage control methods for inverters, harmonic reduction, current source inverters, Introduction to resonant pulse inverters

Static Switches: Single phase and three phase AC switches, AC switches for Bus transfer, DC switches. Solid state and Microelectronic Relays

#### Unit-3: Applications of Power Electronics

DC power supplies: switch mode DC power supplies, flyback, forward, push pull, half bridge, full bridge-converters, resonant DC power supplies, resonant power supplies, bi-directional power supplies

AC Power supplies (UPS): switch mode AC Power supplies, resonant and bidirectional AC Power supplies

DC drives: Basic characteristics of DC motors, Operating modes, single phase and 3 phase drives, DC –DC converter Drives, Closed loop control of DC drives

AC drives: Induction motors drives-squirrel cage and wound rotor motor, Performance characteristics, control methods

Synchronous motor drives-cylindrical rotor, salient pole, Reluctance, Permanent magnet, switched reluctance- motors, control methods

Brushless DC and AC Motors and Stepper Motor: types and Control  
Electric Utility Applications: High voltage DC transmission, shunt and series VAR compensators, Flexible AC Transmission systems (FACTS),  
Integral half cycle /cycle control, space heating and air conditioning, HF fluorescent lighting, Induction and capacitive heating, modern electric welding

**Unit-4: Practical Design Considerations**

Snubber circuits for diodes, SCRs and transistors, Turn-on and turn-off and over voltage snubbers, isolation methods  
Control Circuits: Current mode and voltage mode PWM  
Cooling and heat sinks, reverse recovery transients, supply and load side transients, Selenium diodes and MOVs for voltage protections, Current protection methods, EMI standards, sources and shielding methods

**Text /Reference books:**

1. Power Electronics: Circuits, Devices and Applications, Muhammad H. Rashid, 3rd Edition, Pearson.
2. Power Electronics: Converters, Applications, and Design, Ned Mohan, Tore M. Undeland, William P. Robbins, 3rd Edition, Wiley.
3. Power Electronics, P. C. Sen, Tata McGraw-Hill Education.
4. Power Electronics: A First Course, Ned Mohan, 2012.
5. Power Electronics Handbook, edited by Muhammad Rashid, Elsevier
6. Fundamentals of Power Electronics, Robert W. Erickson, Dragan Maksimovic, Springer
7. Power Electronics, Daniel Hart, Tata McGraw-Hill Education, 2011

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## **Elective Theory (Semester III and IV)**

### **ELDT02: Advanced Embedded Systems (4 Credits)**

#### **Objectives:**

1. To study the architecture of Advanced RISC machine (ARM7)
2. To learn assembly level programming of ARM-7 and interfacing hardware
3. To get acquainted to fundamentals of operating system
4. To get familiar with real time operating system (RTOS)
5. To introduce one of RTOS in detail

#### **Unit-1: Advanced Risc Machine (ARM-7)**

ARM7 CPU Core, Processor Architecture (32-bit), ARM Programmer's Model, ARM Development Tools, Introduction to ARM families, ARM7TDMI Features, Pipelining, Exceptions, Interrupt Vector Table, ARM Instruction Set, Thumb Instruction System Peripherals: Bus Structure, Memory Map, Register Programming, PLL User Peripherals: GPIO, PWM Modulator, RTC, Watchdog Timer, UART, I2C, SPI, ADC, DAC, CAN

Writing and Optimizing ARM Assembly Code: Writing Assembly Code, Profiling and Cycle Counting, Instruction Scheduling, Register Allocation, Conditional Execution, Looping Constructs, Bit Manipulation, Efficient Switches

Overview of ARM Cortex M1, Cortex M2, Cortex M3

#### **Unit-2 : Introduction to Operating Systems**

Brief history of OS, Operating system basics and types of operating systems

The BIOS and Boot Process: BIOS Actions, Operating System, Boot Process

System calls, files, processes, design and implementation of processes, communication between processes

Memory Management: segmentation and paging

Memories: virtual, cache etc.

Introduction: mainframe, desktop, multiprocessor, distributed, clustered, real-time, handheld systems, computer system structures

#### **Unit-3: Real Time Operating Systems (RTOS)**

Concepts and Definitions: foreground / background systems, critical section of code, resources, shared resources, task, process and threads, multiprocessing and multitasking, task scheduling. IPC mechanisms shared memory, context switches (or task switches), kernels schedulers, preemptive and non-preemptive kernels, reentrant functions, round-robin scheduling, priorities (task, static, dynamic), priority inversions, deadlock, semaphores, intertask communication, message mailboxes, message queues, interrupt, clock tick, real time system, issues in real time computing, structure of a real time system, hard real time system vs. soft real time system, advantage and disadvantages of real-time kernels

Case Studies of RTOS on any one platform: RT Linux, MicroC/OS-II, Vx Works, Embedded Linux, LynxOS, OSE, QNX, Windows CE, Xenomai and Basic Concepts of Android OS.

#### **Unit-4: Embedded Real Time Systems**

Host and target machines, Linker/locator for embedded software, Getting embedded software into the target systems, debugging techniques, testing on your host machine.

Kernel Structure: Critical Sections, Task Control Blocks, Task Level context Switch.

Task Management - Creating a task, Task Stacks, Stack Checking, Deleting a Task, Suspending a Task, Resume a Task.

Time Management - Delaying a Task, Resuming a Delayed Task, System time.

Semaphore Management- Creating a Semaphore, Deleting a Semaphore, Waiting on a Semaphore, Creating a Mutex, Deleting Mutex, Waiting on Mutex.

Message Mailbox Management- Crating a Mailbox, Deleting Mailbox, Waiting for a Message at a Mailbox

Porting an Operating System like  $\mu$ COS / RT Linux / Free RTOS or any other equivalent on an Embedded Platform

#### **Text / Reference Books:**

1. "ARM System On Chip Architecture", By Steve Furber, Pearson
2. ARM System Developer's Guide Designing and Optimizing Systems Software, by Andrew Sloss, Elsevier
3. The insider's guide to the PHILIPS ARM7 based Microcontrollers, An Engineer Introduction LPC2100 Series, Trevor Martin, Hitex ltd
4. LPC 214x User Manual
5. Operating System Concepts and Techniques, M. Naghibzadeh.
6. Operating Systems Concept, Galvin, John Willey and Sons
7. Operating Systems by Achyut Godbole, TMH
8. MicroC/OS-II The Real-Time Kernel, Jean J. Labrosse, Elsevier

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## Elective Theory (Semester III and IV)

### ELDT03: Digital Signal Processing (4 Credits)

#### Objectives:

1. To get acquainted to fundamental aspects of Digital Signal Processing (DSP)
2. To become aware of mathematical background required for DSP
3. To learn design of digital filters and implementation on digital Signal Processor
4. To study DSP applications

**Prerequisites:** Laplace transform, z-transform (ZT), inverse z-transform (IZT), ROC, IZT methods - power series, partial fraction expansion, residue and their comparison

#### Unit-1: Signals and Systems

Classification of Signals and Systems: continuous time and discrete time, signal types, amplitude and phase spectrum, classification of systems

Real time DSP system and interfacing A-D conversion process, sampling, quantization and encoding, oversampling and antialiasing, one bit ADC, DAC conversion process, oversampling

#### Unit-2: Mathematical Tools for DSP

Fourier series, Fourier Transform (FT), discrete Fourier Transform (DFT) and its inverse DFT, properties of DFT, computational complexity, decimation-in-time, Fast Fourier Transform (FFT) algorithm, butterfly algorithm and its computational advantage

Inverse FFT, implementation of FFT, DIT and DIF algorithm

Correlation, convolution, types of convolution, deconvolution, implementation and application examples of convolution and correlation

#### Unit-3: Digital Filter Design

Frame work of digital filter design: introduction, types – infinite impulse response (IIR), finite impulse response (FIR)

FIR filter: features, filter design steps, design, filter specifications, coefficient calculation methods, window method, optimal method, frequency sampling method, realization structure for FIR filter, finite word length effects, and implementation of FIR filters

IIR Filter: basic features, design steps, coefficient calculation, poles-zeros placement, impulse invariant method, bilinear transform, Matched z-transform, Nyquist effect, realization structure for IIR filter, finite word length effects, implementation of IIR filters

Multirate digital signal processing, sampling rate reduction/Increase, conversion, software implementation and decimator and interpolator

#### Unit-4: DSP Processor and Application Areas

Complete architecture for signal processing, fixed time digital signal processors, floating time digital signal processors, implementation of DSP algorithm for FIR, IIR filtering, FFT and multirate processing, processor and application areas



**Text /Reference Books:**

1. Digital Signal Processing: A Practical Approach, Emmanuel Ifeachor, Barrie Jervis, Prentice Hall.
2. Digital Signal Processing: S. Salivahan, A. Valuraj, C.Gnanapriya, Tata McGraw Hill, Pub. Co. Ltd. Edn. 2006.
3. Digital Signal Processing: A Hands on Approach: Charles Schuller, Mahesh Chugani, Tata McGraw Hill Pub. Co. Ltd. Edn. 2006.
4. Digital Signal Processing: - Principles, Algorithms and Applications: John G Proakis, Dimitris G Monolkis, and Pub. Person 2005.Operating Systems Concept, Galvin, John Willey and Sons.
5. Digital Signal Processing and Applications with the C6713 and C6416 DSK, Rulph Chassaing, a John Wiley & Sons, Inc.
6. The Scientist and Engineer's Guide toDigital Signal Processing, Steven W. Smith Second Edition California Technical Publishing.

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## **Elective Theory (Semester III and IV)**

### **ELDT04: Mechatronics (4 Credits)**

#### **Objectives:**

1. To introduce the students of Electronic Science to the subject of mechatronics
2. To review the concepts of sensors, transducers and actuators, with a view to use them in mechatronic systems
3. Enable the learner to acquire basic knowledge of mechanical systems to be used with electronic systems
4. To introduce the concept of models for electrical and mechanical systems and their combinations for building system models for predicting the behavior of electromechanical systems
5. To provide a quick overview of the communication systems and protocols used in mechatronics

#### **Unit-1: Introduction to Mechatronics, Sensors and Transducers**

**Introduction to Mechatronics:** what is mechatronics, an overview of - the design process, various systems in mechatronics such as embedded systems, modeling systems, measurement systems, control systems, examples of mechatronic systems

**Sensors and Transducers:** Introduction to sensors and transducers, sensitivity analysis, effect of component variation, measurement of motion, digital sensors for motion measurement, force, torque and tactile sensors, vibration- acceleration sensors, flow measurement, temperature sensors and devices, applications of sensors

#### **Unit-2: 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, 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-3: System Models and Dynamic responses of systems**

**Basic system models:** Mechanical (translational and rotational) system building blocks, electrical system building blocks, electrical and mechanical analogies and their use in analysis, basic idea of fluid system building blocks and thermal system building blocks  
System models- Engineering system models, rotational-translational systems, electromechanical systems, linearity

**Dynamic responses of systems:** modeling dynamic systems, terminology of first order and second order system, performance measures for second order system, system identification

**Unit-4: Mechatronic System Design**

Artificial intelligence-basic ideas, meaning, perception and cognition, reasoning and learning  
Communication Systems- meaning of centralized hierarchical and distributed control. Parallel and serial data transmission, modes of serial data transmission, types of networks and methods of network access control

Meaning of and basic elements of protocols, open systems interconnection communication model, serial communication interfaces, parallel communication interfaces, wireless protocols

Mechatronic systems - Mechatronic designs and case studies

**Text / Recommended Books:**

1. Mechatronics by W.Bolton, 4<sup>th</sup> Edition, Pearson.
2. Mechatronics System Design, by DevdasShetty and Richard Kolk, 2<sup>nd</sup> Edition, Cengage Learning.
3. Robotics Engineering – An integrated approach. By Richard W. Klafter, Thomas A. Chmielewski and Michael Negin, PHI Learning Pvt. Ltd.

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## **Elective Theory (Semester III and IV)**

### **ELDT05: Digital Image Processing (4 Credits)**

#### **Objectives:**

1. To make the students aware of basic mathematics required for image processing
2. To make students familiar with different image processing algorithms
3. To provide the students with the knowledge of practically implementing the algorithms for various applications

#### **Unit-1: Introduction to Digital Image Processing**

Introduction to DIP, examples of application fields that use image processing e.g. Gamma ray imaging, X-ray imaging, UV band imaging, visible and IR band imaging etc., components of an image processing system, introduction to image sensing and acquisition, digital camera working principal, image storage, processing, communication and display, overview of image representation and modeling techniques

Light and electromagnetic spectrum, elements of visual perception, luminance, brightness, contrast, hue, saturation, mach band effect, color image fundamentals- RGB, HIS models, basic concepts of sampling and quantization and companding in imaging, two dimensional sampling theory, practical limitations in sampling (aliasing effect), digital image representation, spatial and intensity resolution, image interpolation, relationship between image pixels- neighbours, logical and arithmetic operation on images

#### **Unit-2: Image Enhancement, Image Filtering and restoration**

Some basic intensity transformation function, histogram processing, fundamentals of spatial filtering, spatial operations like smoothing and sharpening spatial filters, multispectral image enhancement, false color and pseudo color, color image processing, typical example for image enhancement and spatial filtering.

Basic concepts of Fourier transform and Fourier series, 2D Fourier transform and 2D discrete fourier transform, basics of filtering in frequency domain, image smoothing (LP), sharpening (HP), selective filtering (BP and BR) in frequency domain & their implementation(Using Image processing Tools),, homo morphic filtering. Image observation and noise Models, image restoration in presence of noise using spatial filtering, periodic noise reduction by frequency domain filtering, estimating the degrading function, inverse filtering, Least squares filtering, geometric mean filter, image reconstruction from projections, typical example for frequency domain filtering

#### **Unit-3: Image Analysis and Computer Vision**

Spatial and Transform Features extraction-image pyramids, sub band coding, the Haar transform, Hough transform,, multi resolution expansion, Image Segmentation: - fundamentals, point, line and edge detection, edge detection, thresholding, region based segmentation, segmentation using morphological watersheds, the use of motion in segmentation, region representation and description:- boundary extraction, boundary representation, region representation, moment representation, structure, shape features, textures, scene matching and detection, classification techniques, image understanding, typical examples illustrating above algorithms

#### **Unit-4: Image compression, MATLAB implementation and case studies**

Pixel and data redundancy, fidelity criteria, information theory, error free coding, lossy compression, transform coding (DCT and wavelet)

Image file formats, TGA, GIF, TIFF, BMP, JPEG, CDR

Applications and case studies: feature enhancement using equalization methods, salt and pepper noise removal using spatial as well as frequency domain filters, study of a biometric system for finger print reading covering the points like the sensor device, data quality assessment, comparison and matching, database etc, applications of digital image processing in medical spectroscopy

#### **Text / Reference Books:**

1. Rafael.C.Gonzalez, Richard .E.Woods, “Digital Image Processing”, Pearson Third Edition, 2008.
2. Rafael.C.Gonzalez, Richard .E.Woods and Steven L. Eddins “Digital Image Processing usind MATLAB”, Pearson 2004.
3. Anil.K.Jain, “ Fundamentals of Digital Image Processing”, Pearson, 2002.
4. Keenneth R Castleman, "Digital Image Processing", Pearson Education, 1995.

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## **Elective Theory (Semester III and IV)**

### **ELDT06: Optoelectronics and Fiber Optic Communication (4 Credits)**

#### **Objectives:**

1. To become aware of different optoelectronic devices and systems
2. To acquire Knowledge of optical fiber communication system
3. To study optical fiber sensors and their applications

#### **Unit-1: Light Sources**

Light Emitting Diodes: Variable band gap semi-material idea of hetero-junction, simple and double hetero-structure light sources, quantum efficiency, internal and external quantum efficiency, expression for total and internal quantum efficiency, reasons for external quantum efficiency to be less than internal quantum efficiency, intensity distribution of LED, Lambertian sources, encapsulation of LED's, types of LED's surface and edge emitting, Burus LED

LASER: LASER as an amplifier of light and necessary conditions for amplification, special properties of LASER-monochromatic, coherent and light power nature, directionality, divergence and attenuation of LASER beam, study of three level LASER (Ruby LASER), four level laser, tunable laser, semiconductor laser and applications of high power, low power continuous wave and pulse lasers

#### **Unit-2: Light detectors**

Idea of light detectors and their basic types, natural and specialized light detectors, type of specialized light detectors, thermal, quantum light detectors, types of quantum photo detectors, photo resistive, photovoltaic, photo emissive detectors. Study of quantum detectors-photoelectric cell, photomultiplier tube, photodiode, important characteristics of light detector-spectral response, viewing angle, efficiency, and material used for photo-detectors

#### **Unit-3: Optical Fiber –Theory and Applications**

Action of optical fiber as wave guide, advantages of optical fiber communication over normal medium, necessary conditions for wave guiding mechanisms of optical fibers, construction of optical fiber cable, role of strength of material, types of optical fibers. Step index and graded index fibers, comparison of wave guiding action of both expression for angle of acceptance and cone of acceptance, numerical aperture, time dispersion, splicing and fiber connections - what is splicing, requirements of splicing, practical methods of splicing, various types of optical fiber connectors, losses in optical fiber communication, Losses due to fibers, intrinsic and extrinsic losses, intrinsic losses due to atomic scattering and molecular absorption. Expression for loss factor, extrinsic losses due to mechanical effects, micro bends, cracks etc. losses due to connectors, core longitudinal, angular misalignment, mismatch of refractive indices of fiber material etc., comparison between losses due to splicing and connectors, Expression for Electromagnetic wave guided by fiber, modes of transmission, expression to 'V' number and number of maximum modes of transmission, dispersion in optical fibers, wavelength and time dispersion, intermodal dispersion, double crucible and chemical deposition methods of manufacturing of optical fibers

#### **Unit-4: Measurements on Optical Fibre and Optical Fibre Systems**

Optical fibre experimental setup, launching light into fiber, detection etc

Fiber attenuation measurement, dispersion measurement profiles measurement, numerical aperture measurement, diameter measurement

Optical transmitter / receiver circuits, driver circuits for LED, detector circuit design using photodiode, phototransistors, and fiber choice

Communication special fibers – DS fiber, NZDS fiber, integrated optics, slab and strip waveguide, and Electro-optic devices – phase shifters, interferometer modulators, use of optical fibers as sensors

#### **Text / Reference Books:**

1. Optoelectronics, Kaiser, TMH(1992)
2. Optical fiber communication – Principles and practice, J.M. Senior, PHI (1990)
3. An introduction to fiber optics: Ajoy Ghatak, K. Thygarajan, Cambridge University Press (1998)
4. Fiber optics and Optoelectronics, R.P. Khare, Oxford University Press.

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## **Elective Theory (Semester III and IV)**

### **ELDT07: Nanoelectronics and Devices (4 Credits)**

#### **Objectives:**

1. To become aware of basics of quantum and statistical techniques
2. To study various growth techniques of nanomaterials
3. To study characterization techniques of nanomaterials
4. To become aware of nanomaterials and some nanostructured devices

#### **Unit-1: Introductory Quantum and Statistical Techniques for Nano-electronics**

The Schrodinger time dependent and time independent wave equations, wave equation of particles, atoms and atomic orbital's, concept of tunnelling  
Gaussian, Poisson, Maxwell – Distribution functions, Fermi-Dirac, Bose Einstein  
Maxwell Boltzmann - statistics, statistics of electronics in solids and nanostructures, Fermi levels in intrinsic and extrinsic semiconductor, density of states at low dimensional structure, electron transport in nanostructures (Qualitative approach)

#### **Unit-2: Growth Techniques of Nanomaterials**

Top-down and bottom-up techniques, lithographic process and its limitations, non-lithographic techniques, plasma arc discharge, sputtering, evaporation, chemical vapour deposition (CVD), pulse laser deposition, molecular beam epitaxy (MBE), sol-gel techniques, electro-deposition

#### **Unit-3: Characterization tools of Nanomaterials**

Basic concepts of scanning probe microscopy (SPM), general concept and defining characteristics of Atomic Force Microscope (AFM,) Scanning Electron Microscope (SEM), Transmission electron microscope (TEM), thickness measurement techniques, contact-step height, optical-reflectance and ellipsometry, atomic force microscope, practical implementation of XRD / AFM / SEM / TEM results

#### **Unit-3: Nanoelectronic Devices**

Fundamentals of logic devices, requirements, dynamic properties, threshold gates, physical limit to computation, carbon nanotubes, fullerene, types of nanotubes, concept of logic devices classification, two terminal devices, field effect devices, coulomb blockade devices, spintronics, quantum computing, DNA computers  
Nanostructured devices: tunneling diode, resonant tunneling diode, single electron-transistor, molecular electronic devices simulation and circuit design fabrication, MEMs, robot, random access devices, flash memory



**Text / Reference Books:**

1. Introduction to Nanoelectronics Science, Nanotechnology, Engineering and Applications, Vladimir V. Mitin, Viatchaelslav A. Strosccio, Cambridge University press.
2. Foundations of Nanomechanics from Solid -State Theory to Device Applications, Andrew N. Cleland , Springer International Edition.
3. Nanotechnology: Basic Science and Emerging Technology, Raguse , Chapman Hall/CRC,2002.
4. Understanding Nanoscience and Nanotechnology, T. Pradeep TMH, 2007.
5. Nanoelectronics and Infromation Technology Advanced Electronic Materials and Novel Devices, Rainer Waser Wiley, VCH, 2003.
6. Introduction to Nanoscience and Nanotechnology, K.K. Chattopadhyay, A.N. Banerjee, PHI Learning Private Limited, 2012.
7. Solid State Electronics Devices, 6<sup>th</sup> Edn, Ben G. Streetman, S. Banerjee.

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## Elective Theory (Semester III and IV)

### ELDT08: Programmable Logic Controllers and Applications (3 Credits)

#### Objectives:

1. To make the students aware of programmable logic controller hardware
2. To introduce students to PLC programming
3. To study some case studies using PLC and introduce distributed control systems

#### Unit 1: Programmable logic controllers

Historical background, programmable controller and features, principle of operation, architecture, memory, Input/output module with reference to sink or source, output module-relay, transistor, triac, power supply, signal conditioning, remote connections, networks, PLC versus other control e.g. relay logic, PC, PLC product application range, selection of PLC, documentation of PLC, Examples of applications

AC mains interfaces, PLC wiring, device wiring, 24V DC input interfaces, sourcing devices, sinking devices, output interface configurations and wiring

#### Unit 2: PLC Programming

Programming methods- ladder diagrams, function blocks, statement list, programming a PLC, programming terminals, ladder relay instructions, ladder relay programming (digital gates, boolean expression, flip flop), timers, counters and shift registers: types of timers, programming timers, off-delay timers, pulse timers, programming examples, forms of counter, programming, up and down counting, timers with counters, sequencer, data handling: registers and bits, data handling, arithmetic functions, closed loop control shift registers, ladder programs

#### Unit 3: Case studies and Introduction to Distributed Control Systems (DCS)

Program development, safe systems, commissioning, fault finding, system documentation programs- temperature control, valve sequencing, conveyor belt control, control of a process, traffic lights, controller, alarm monitor program, parking garage counter, vending machine, automatic stacking program, AC motor drive interface, elevator, water level controller SCADA system and DCS architecture, local control unit, programming language, communication facilities, operator interface, engineering interfaces

#### Text /Reference Books:

1. John W. Webb and Ronald A. Reis, "Programmable Logic Controllers Principles and Applications", Fifth Edition, Prentice Hall Publication, New Delhi, 2002.
2. L.A. Bryan, E.A. Bryan, "Programmable controllers theory and Implementations" second edition, An Industrial Text Company Publication.
3. W.Bolton, "Programmable Logic Controllers", Fifth Edition, Elsevier Publication
4. Gary Dunning, "Introduction To Programmable Logic Controllers", Third Edition.
5. John R. Hackworth, Frederick D. Hackworth, "Programmable Logic Controllers Programming Methods and Applications", Pearson Publication.
6. Frank D. Petruzella, "Programmable Logic Controllers", Third Edition, Tata McGraw Hill Education Private Limited, 2010.
7. John F. Kennedy "Programmable Controllers An engineer's guide" 3rd Newnes Publications
8. Hugh Jack "Automating Manufacturing Systems with PLCs"

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## Elective Theory (Semester III and IV)

### ELDT09: VLSI System Design (3 Credits)

#### Objectives:

1. To study MOS transistor, its characteristics, MOS models
2. To study the various MOS technologies used for VLSI
3. To learn VLSI design and layout design rules
4. To design simple combinational and sequential digital logic circuits

#### Unit-1: Basic Electrical Properties of MOS and CMOS Circuits

MOS transistor – threshold voltage, threshold voltage equations, MOS device equations, basic DC equations, second order effects

MOS Models, small signal AC characteristics, NMOS inverter, depletion mode and enhancement mode pull ups, CMOS inverter–DC Characteristics, inverter delay, pass transistor, transmission gate, power consumption in CMOS gates, static dissipation, dynamic dissipation

#### Unit-2: Layout Design Rules

Need for design rules, Mead Conway design rules for the silicon gate NMOS process, CMOS based design rules, simple layout examples, sheet resistance, area capacitance, wiring capacitance, driving large capacitive loads

#### Unit-3: Digital Logic Design

Switch logic, pass transistor and transmission gate based design, gate logic, inverter, two input NAND gate–NOR gate, other forms of CMOS logic, clocked CMOS, Logic, recharged Domino CMOS Logic, Structured design

Simple combinational logic design examples: parity generator, multiplexers,

Clocked sequential circuits: two phase clocking, charge storage, dynamic shift register semi static register, JK flip flop circuit

#### Text / Recommended Books:

1. Kamran Eshraghian, Douglas A Puknel and Sholeh Eshraghian, “Essentials of VLSI.
2. “Circuits and Systems,” prentice Hall of India, New Delhi, 2005.
3. Neil H.E West and Kamran Eshranghian, “Principles of CMOS VLSI Design: A system perspective “, Addison-Wesley, 2nd Edition, 2004.
4. Sung-Mo Kang and Yusuf Leblebici,” CMOS Digital integrated circuits”, Tata McGraw Hill 3rd Edition, New Delhi, 2008.
5. Jan M Rabaey, Chandrasekaran A and Nikolic B, “Digital Integrated Circuits,” Pearson Education, 3rd edition, 2004.
6. Amar Mukharjee, “Introduction to NMOS and CMOS VLSI System,” Prentice Hall, USA, 1986.
7. Wayne wolf,” Modern VLSI Design : System on chip design”, Pearson Education Inc., 3<sup>rd</sup> Edition, Indian Reprint, 2007.
8. Allen Holberg, “Analog CMOS Design”, Oxford University Press.
9. Randall L. Geiger, Phillip E. Allen “VLSI Design techniques for Analog and Digital Circuits” McGraw Hill International Editions

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## Elective Theory (Semester III and IV)

### ELDT10: Robotics-Kinematics and Control (3 Credits)

#### Objectives:

1. To familiarize the learner with terminologies used in robotics.
2. To provide a background of representations of axis rotations, homogeneous transformations and their use in kinematics.
3. To introduce robot dynamics and robot joint control systems

#### Unit-1: Introduction and Transformations

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

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-2: Kinematics

Forward kinematics: kinematic chains, homogeneous transformations of kinematic chains. Denavit-Hartenberg (D-H) representation, examples

Inverse kinematics: difficulty in obtaining inverse kinematic solutions, kinematic decoupling – inverse position and inverse orientation, examples

Velocity Kinematics: Deriving Manipulator Jacobian, finding angular velocity and linear velocity to determine Jacobian

Singularities – decoupling of singularities, wrist singularities and arm singularities

#### Unit-3: 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. Robot Dynamics and Control, Spong and M. Vidyasagar, Wiley Student Edition
2. Robotics: Fundamental Concepts and Analysis, Ashitava Ghoshal, Oxford Higher Education
3. Robotic Engineering: An integrated approach, Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, Prentice-Hall India

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## Elective Theory (Semester III and IV)

### ELDT11: Wireless Sensor Networks (3 Credits)

#### Objectives:

1. To familiarize with wireless sensor network.
2. To provide a background of single-node architecture and wireless networking protocols
3. To study currently available sensor platforms and tools

#### Unit-1: Introduction and Overview of Wireless Sensor Networks

Introduction, background of sensor network technology, challenges and hurdles Examples of WSN applications: home control, industrial automation, medical applications. Radio technology primer: propagation and propagation impairments, modulation, ISM band, Specifications of WSN devices

#### Unit-2: Architecture Considerations and Networking Sensors

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts

Physical Layer and Transceiver Design considerations, Introduction to protocols, Overview of Communication Protocols for Sensor Networks, wireless networking protocols (IEEE 802.11, 802.15, 802.16, GPRS, MAC protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing

#### Unit-3: Infrastructure formation, Available Sensor Platforms and Tools

Introduction to the RF Modules, architecture of the Zigbee module, on-chip resources of the Zigbee Pro, programming the Zigbee, designing of WSN with Zigbee modules  
Topology Control, Clustering, Time Synchronization, Localization.

Hardware platforms – Berkeley Motes or equivalent, Programming Challenges, Introduction to Simulators: NS2, OPNET, OMNET, WSN Planner Tool etc.  
Case studies

#### Text / Recommended Books:

1. Kazem Sohraby, Daniel Minoli and Taieb Znati, “ Wireless Sensor Networks Technology- Protocols and Applications”, John Wiley & Sons, 2007.
2. Ananthram Swami, Qing Zhao, Yao-Win Hong, Lang Tong, “Wireless Sensor Networks- Signal Processing and Communications Perspectives” John Wiley & Sons, 2009
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, ELSEVIER publications, 2005.
4. Kaveh Pahlavan and Prashant Krishnamurthy, “Principle of Wireless network- A unified approach”, Prentice Hall, 2006.
5. “Theoretical and algorithmic aspects of sensor, Ad Hoc Wireless and Peer to Peer Networks”, Edited by Jie Wu, Auerbach Publications.
6. Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems, CRC PRESS Publication, Edited by Mohammad Ilyas and Imad Mougoub.

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## Elective Theory (Semester III and IV)

### ELDT12: Digital Communication (3 Credits)

#### Objectives:

1. To provide a background of signals, their characteristics and mathematical representations and noise in signals
2. To introduce various digital modulation techniques
3. To study get introduced with information and coding theory of digital communication

#### Unit-1: Signals and Noise

Fourier series and Fourier transform, autocorrelation and cross correlation, cross correlation of energy and power signal.

Noise: Sources of noise, signal to noise ratio, noise figure, noise temperature, Sampling theorem, Rayleigh energy theorem, probability theory, Gaussian Process

#### Unit-2: Digital Modulation Techniques

Quantization, pulse Code Modulation (PCM), PCM generation and receiver, companding in PCM, Delta Modulation, Adaptive Delta Modulation, Differential PCM, ASK, PSK, FSK, MSK, QPSK, BPSK, detection of binary modulation techniques in the presence of noise, error probability in ASK, PSK, FSK

#### Unit-3: Information and Coding Theory

Concept of information and entropy, Shannon Theorem, channel capacity, self information, discrete and continuous entropy, mutual and joint information, redundancy

Coding Theory - Source encoding and channel encoding, error detection and correction, various codes for channel coding, rate distortion function

Error Control Code: Introduction to block coding and optimal decoding, binary hamming code, structure of linear code, decoding of linear block code, Reed Muller code, structure of cyclic code, Bose Chaudhary Hocquenghem (BCH) codes, cyclic Hamming Code

#### Text / Recommended Books:

1. Digital communication, J. G. Proakis, Tata McGraw-hill (TMH) Publication, 3rd edition, 1990.
2. Digital Modulation and Coding, S.G.Wilson, PHI, 1996.
3. Digital communications: Fundamentals and applications, Bernard Sklar, PHI, 2003.
4. Communication System, Simon Hawkins, John Wiley, 3rd edition, 2004.

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## Elective Theory (Semester III and IV)

### ELDT13: Computational Methods for Electronics (3 Credits)

#### Objectives:

1. To learn with the help of relevant illustrations in electronics.
2. Use of MATLAB and other software tools be made while discussing the importance of each of the topics.
3. Activities based on the survey and use of online sources available on internet be given to the students.

#### Unit-1: Errors and Statistical Techniques

Different types of errors, significant figures, data types, measures of central tendency-mean, mode, median, variance, concept of probability, probability distribution functions, Gaussian, Poisson and binomial distribution functions

#### Unit-2: Matrices

Solving linear equations  $AX + B = C$ , LU factorization, Gauss Seidal method, Gauss elimination method, inverse of a matrix, Applications of matrices in electronic circuit analysis

#### Unit-3: Numerical methods

Roots of an algebraic equation: bisection method, Newton- Raphson Method, secant method, applications to stability of control system

Interpolation, Finite differences, Newton Forward difference and backward difference formulae, Lagrange's interpolation

Curve fitting techniques: linear regression, cubic spline, exponential curve fitting, polynomial curve fitting, application to smoothen the data by reduction in noise, linearization of electrical systems

Solution of Ordinary and partial differential equations, two dimensional Laplace equation, Poisson equation-application to diode, wave equation,

Integration: Trapezoidal and Simpson's  $1/3^{\text{rd}}$  and  $3/8^{\text{th}}$  rules, R-K method

#### Text / Reference Books:

1. Computer Oriented Numerical Methos, V. Rajaraman, PHI Learning.
2. Introductory Mthods of Numerical Analysis, S. S. Shastry, Prentice Hall of India.
3. Numerical Recipies in C, The art of Scientific Computing, William H.P, S.A. Teukolsky, Second Edition, Cambridge University Press.
4. Getting Started with MATLAB: a Quick introduction for Scientists and Engineers, Rudra Pratap, Oxford University Press.
5. MATLAB and Introduction with applications, Amos Gilat, Wiley Student edition.

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### **EL3UP07: Practical Course –VII (4 Credits)**

General Electronics + Special Laboratory: Any 10 Practicals from following sections

#### **EL3UT09: Communication Electronics**

1. Design of AM transmitter and receiver
2. Design of FM transmitter and receiver
3. Delta modulation
4. Design PCM encoder and decoder system
5. Design of ASK / FSK transmitter and receiver
6. Time division Multiplexing
7. Telemetry Applications
8. Varactor diode characteristics and its application in FM

#### **EL4UT10: Control Systems and Process Instrumentation**

1. Signal conditioning circuits for analog controller
2. Design and implement ON-OFF Controller
3. Design and implement P / PI / PID controller
4. To study the position / velocity control of dc servo motor
5. Study of stability of process control system
6. Study of time domain performance of control system
7. Problem solving using root locus method
8. Flow control using solenoid valve

#### **ELDT01: Advanced Power Electronics**

1. Designing of testing of Boost converter and Buck Boost converter.
2. Stepper motor control using current mode PWM
3. AC motor speed control
4. DC power supply using fly back / forward / half bridge / full bridge converter
5. Emergency light control
6. Measurement of transformer parameters
7. DC motor speed control using PWM
8. Design and study of Integral half cycle/full cycle control.
9. Study of synchronous motor drive

#### **ELDT04: Mechatronics**

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

#### **ELDT06: Optoelectronics and Fiber Optic Communication**

1. Optical Fiber parameter testing
2. Measurement of mode field diameter
3. Measure and plot LASER beam Profile
4. Plotting and study of LED profile
5. Study of optical position encoder



6. Setting up fiber optic voice link
7. Design Build and test digital data communication system

**ELDT07: Nanoelectronics and Devices**

1. Processing and development of nanoparticle gas sensor
2. Magnetic separation / identification studies of thermally-blocked nanoparticles
3. Electrodeposition and corrosion behavior of nanostructured composite film
4. Photocatalytic activity of nanomaterials

**ELDT10: Robotics-Kinematics and Control**

1. Build a mobile robot that responds to light intensity and moves towards/away from light
2. Build a robot that responds to voice commands
3. Test a robotic gripper that is pressure sensitive
4. Build a mobile robot that detects a object and moves away from object

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### **EL3UP08: Practical Course –VIII (4 Credits)**

Computer - Microcontroller Laboratory: Any 10 Practicals from following sections

#### **ELDT02: Advanced Embedded Systems**

1. Interfacing Alphanumeric LCD to 16/32 bit microcontroller
2. Interfacing key board to 16/32 bit microcontroller
3. Programming ADC of 16/32 bit microcontroller
4. Programming DAC of 16/32 bit microcontroller
5. Interfacing external interrupt.
6. Programming RTC / EEPROM / I2C of 16/32 bit microcontroller
7. Programming UART of 16/32 bit microcontroller
8. Creating Process / Tasks / Threads and display their PIDs
9. Implementation of priority based execution of 3 task using RTOS
10. Implementation of Semaphore using RTOS
11. Interfacing of LCD and SSD to ARM using RTOS for counter application

#### **ELDT03: Digital Signal Processing**

##### Simulation using Matlab

1. Generation of signals
2. Impulse, Step, Exponential and Ramp functions
3. Design of FIR filter
4. Design of IIR filter
5. Linear and circular convolution
6. Concept of Aliasing

##### On DSP Board

1. DFT computations
2. FFT Computations
3. Convolution of two discrete signals
4. Waveform generation
5. FIR Filter design
6. IIR filter design

#### **ELDT05: Digital Image Processing**

1. Implementation of image enhancement techniques in MATLAB
2. Implementation of histogram processing techniques in MATLAB
3. Build a GUI in MATLAB for image noise filtering & edge detection technique in MATLAB
4. Study & implementation of a segmentation algorithm in MATLAB
5. Development of Photoshop type application for image processing

#### **ELDT07: Nanoelectronics and Devices**

1. Process and Device Simulation of Single-Electron Transistor (SET)
2. SOI based nanowire single-electron transistor - Design, simulation
3. Simulation study of nanowire TFET device.
4. Process and device simulation of Silicon Nanowire FinFET device

#### **ELDT08: Programmable Logic Controllers and Applications**

1. Relay programming (all logic gates, boolean equation like multiplexer, demultiplexer, encoder, decoder, latch etc.)
2. Temperature controller
3. Conveyor belt control

4. Alarm monitor program
5. Car parking System
6. Vending machine
7. AC motor drive programming Elevator
8. Water level controller

#### **ELDT09: VLSI System Design**

To design following logic, calculate W/L ratios, prepare layout in multi metal layers and simulate Assume suitable technology, load capacitance, free running frequency, switching timings etc.

1. CMOS Inverter.
2. CMOS NAND, NOR.
3. 2:1 MUX by conventional method and by transmission gates
4. CMOS Combinational logic for minimum 4 variables
5. RS latch, D latch
6. Edge triggered D register
7. Clock divider
8. Synchronous Counter/ Shift register

#### **ELDT11: Wireless Sensor Networks**

1. Study of 802.15.4-interfacing and configuration
2. Setting up communication between 2 zigbee nodes
3. Home automation- related experiments
4. Study of effect of various modes of Microcontrollers on Network performance.
5. Experiments on crossbow or equivalent platform:
  - a. Study of network topology,
  - b. Study of various sensors on the nodes,
  - c. Interfacing external sensor to the node,
  - d. Study of other networking parameters of the hardware platform.
6. Simulation study of WSN to
  - a. Plan a network for given area and given range with various deployment strategies (Random, Cartesian, Radial, Hexagonal)
  - b. Find critical nodes in the network under consideration
  - c. Study the effect of obstacles on the network.

#### **ELDT12: Digital Communication**

Experiments using MATLAB

1. Study of DM & ADM systems.
2. Generation and reception of BPSK
3. Generation and reception of FSK
4. Generation and reception of QPSK
5. Continuous Phase FSK
6. Coherent FSK-Demodulation
7. Quadrature-Amplitudemodulation (QAM)
8. Phase shift keying (PSK)
9. Generation of Hamming codes
10. Huffman coding

**ELDT13: Computational Methods for Electronics**

1. Estimate the error in surface and volume density of charge
2. Estimation of probability of an event using Poisson and Gaussian distribution
3. Solution of state equations for a given electrical circuit
4. Roots of Bessel's function of kind of 1<sup>st</sup> order
5. Estimation of average electric power of different signals
6. Eigen values and eigen vectors of matrix
7. Solution of 2 dimensional boundary value problem using Laplace equation
8. Fit a polynomial of order 1 / 2/ 3 for a given data
9. Exponential curve fitting for discharging of a capacitor
10. Estimation of a function at a given point using Lagrange's interpolation

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**EL3UP09: Practical Course –IX PLE (2 Credits)**

Candidate should carry out a Project Like Experiment (PLE). PLE is a **small project** equivalent to 6 practical experiments. PLE of this semester can be a part of final semester project. A project report should be submitted to the department. Log book of the continuous progress of the work should be maintained by candidate. The guidelines of the assessment of the project for in-semester examination as well as end-semester examination are as follows

Sr. No.	Performance Criteria	Max. %	Rating (%)				
			Excel- lent	Very Good	Good	Fair	Poor
1.	Quality of Performance	10	10	8	6	4	2
2.	Regularity of Work carried	10	10	8	6	4	2
3.	Self Expression, Presentation Communication Skill and Demonstration	10	10	8	6	4	2
4.	Viva-Voce	10	10	8	6	4	2
	<b>TOTAL</b>	40	40	32	24	16	8

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**EL3UP10: Practical Course X Project (10 Credits)**

Candidate should carry out a Project equivalent to 10 credits in the semester IV. The student should report about a progress of a project to the guide at least twice in the week. Log book of the continuous progress of the work should be maintained by candidate. A one copy of project report should be submitted to the department. The assessment of the project work is a continuous process. The guidelines of the assessment of the project for in-semester examination as well as end-semester examination are as follows

Sr. No.	Performance Criteria	Max. %	Rating (%)				
			Excel- lent	Very Good	Good	Fair	Poor
1.	Selection of Project	10	10	8	6	4	2
2.	Planning and Implementation	20	20	16	12	8	4
3.	Quality of Performance	20	20	16	12	8	4
4.	Regularity of Work carried	10	10	8	6	4	2
5.	Report Writing Skills	10	10	8	6	4	2
6.	Self Expression, Communication Skill and Presentation	10	10	8	6	4	2
7.	Viva-Voce	20	20	16	12	8	4
	<b>TOTAL</b>	100	100	80	60	40	20

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# **University of Pune**

**Three Year B. Sc. Degree Course in**

## **GEOLOGY**

**F.Y.B.Sc. Syllabus**

**(To be implemented from Academic Year 2013-14)**

**Preamble:**

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.

**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.

**Objectives to be achieved:**

- To help students build-up a progressive and successful career in Geology
- To enrich students' knowledge and train them in the pure geological sciences.
- Provide an updated education.
- To impart more field oriented knowledge.
- To inculcate sense of scientific responsibilities and social and environment awareness.
- To introduce the concepts of application and research in Geology.
- Create a sense of preservation and conservation of natural resources.



## Eligibility

### 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 40 marks out of 100 in each course. (Minimum 32 marks out of 80 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 16 marks out of 40 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.)

### 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

### **ATKT Rules**

While going from F. Y. B. Sc. to S. Y. B. Sc. at least 8 courses (out of total 12) 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).

### **Equivalence of Previous Syllabus**

No equivalence required at F. Y. B. Sc. level for Theory Paper I and Practical Paper III as the course titles are same as previous syllabus. For Theory Paper II equivalence with the old course shall be Paper II General Geology & Palaeontology.

### **External Students**

There shall be no external students.

### **University Terms**

Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only duly admitted students. The term shall be granted only on minimum 80 percent attendance at theory and practical course and satisfactory performance during the term.

### **Course Structure:**

**Duration:** The duration of B.Sc. (Geology) Degree Program shall be three years.

**Medium of Instruction:** The medium of instruction for the course shall be **English**.

As geology is not taught at the Pre-University (10+2 level) except in few schools and Junior colleges teaching of geology would require special attention and treatment. The students of the first year of the undergraduate course are given exposure to some of the fundamental branches of geology. Hence emphasis has been given to those aspects of geology which would make students aware of larger perspectives of the subject and develop interest in the study of earth processes. In the second and third year the same sub-branches and some new branches of geology will be covered at higher academic levels, incorporating certain topics which are normally covered at the Post-Graduate levels.

At **first year of under-graduation**, the basic topics are covered related to the fundamental branches of Geology such as Mineralogy, Petrology, Structural

Geology, Physical Geology and Palaeontology. Mineralogy deals with the study of Minerals. These are the basic constituents of the rocks. It deals with the formation, physics, chemistry and occurrence of the minerals. Petrology covers the study of Igneous, Sedimentary and Metamorphic rocks with reference to their formation, distribution, type, composition etc. Structural Geology comprises the study of deformation of rocks and the architecture of the Earth. Physical Geology deals with the external agents, processes of deposition and erosion of the earth's surface. Mainly the depositional and erosional works of the rivers, lakes, glaciers, wind, sea etc are studied. Earth phenomena like earthquakes, volcanoes, formation of mountain chains, plate tectonics, isostasy, and continental drift are also included. Palaeontology deals with the study of ancient life, preserved in the form of fossils. Practicals related to the above topics are formulated in the practical course. In addition geological field work for at least two days and also preparation of laboratory journal will be a compulsory part of the syllabus.

At **second year under-graduation**: Mineralogy and Petrology shall be continued in one of the theory papers with more details and depths. Structural Geology which deals with the study of Faults, Folds, joints, unconformities in the rocks can be taken up in detail in one semester along with Stratigraphy and Paleontology in the second semester. Stratigraphy deals with the relative ages of rocks. It mainly deals with the study of layered rocks and their arrangement according to the geological age. The Practicals shall be more exhaustive and students will be made familiar with solving structural problems and Geological maps which are essential tools for unraveling many mysteries of the earth. Field work for 4 to 7 days in a region with geologically diversified rock types and structures in any suitable Indian occurrences under the guidance of a teacher is a compulsory component of the practical course. Students along with the practical journals should also submit a written field study report along with representative field samples.

At **third year under-graduation**, six theory papers in each semester deal with the further detail studies of the fundamental branches of Geology namely Mineralogy, Petrology, Structural Geology, Stratigraphy of India, Economic Geology and applied branches like environmental Geology, Remote Sensing, Geotectonics etc are taken up to cover up the essential aspects of geological studies at the undergraduate level. The three practical courses shall be based on the theory courses. Field work for about two weeks, in an area of geological interest anywhere in India, systematic collection of geological samples, data collection and preparation of geological field report along with the preparation of Laboratory journals for all the practical courses is a compulsory part of the curricula. The systematic and planned curricula from first year to the third year shall motivate and encourage the students for pursuing higher studies in Geology with confidence.

## First Year B. Sc. Geology

Paper/Course No.	Title	Pattern of examination	Total Number of lectures/practicals Per Term	Standard of passing		
				Internal marks out of <b>20</b>	External marks out of <b>80</b>	Total passing marks out of <b>100</b>
Theory Paper I (First term)	Mineralogy	Annual	Three lectures/Week (Total 36 per term)	08	32	40 *
Theory Paper I (Second term)	Petrology		Three lectures/Week (Total 36 per term)			
Theory Paper II (First term)	Physical Geology	Annual	Three lectures/Week (Total 36 per term)	08	32	40 *
Theory Paper II (Second term)	Palaeontology		Three lectures/Week (Total 36 per term)			
<b>Practical paper III</b> <b>(First &amp; Second Term)</b>	<b>Practicals</b>	<b>Annual</b>	11 Practicals of four lectures in each term (In all 22 practicals per year)	08	32	40 *
<p>* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100</p> <p><b>Note:</b> Total marks: Theory 200 + Practical 100 = 300 marks</p>						

## Examination Pattern

Theory paper:	University Examination	– 80 marks (at the end of 2 <sup>nd</sup> term)
	Internal Examination	– 20 marks
Practical course:	University Examination	– 80 marks (at the end of 2 <sup>nd</sup> term)
	Internal Examination	– 20 marks

**Theory examination** will be of three hours duration for each theory course. There shall be 5 questions each carrying equal marks. The pattern of question papers shall be:

Question 1	8 sub-questions, each of 2 marks; answerable in 2 -3 line and based on entire syllabus
Question 2 and 3	4 out of 6– short answer type questions; answerable in 6 – 8 lines
Question 4	2 out of 4 – long answer type questions; answerable in 12 – 16 lines
Question 5	1 out of 2 –essay / long answer type question; answerable in 25 – 30 lines

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each term. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain). There shall be 20 questions, each question of 0.5 marks.

For practicals: one internal assessment tests + marks for journals + attendance + tour report. One practical internal assessment test to be taken.

**Practical Examination:** Practical examination shall be conducted by the respective college at the end of the academic year. Practical examination will be of minimum 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be one expert and two examiners per batch for the practical examination.

**Setting question papers:** For theory papers I and II annual question papers set by the university of Pune and assessment done at the respective colleges. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject.

### Second Year B. Sc. Geology

Paper/ Course No.	Title	Pattern of examination	Total Number of lectures/practicals Per Semester	Standard of passing		
				Internal marks out of 10 (theory)  Out of 20 (practicals)	External marks out of 40 (theory)  Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
Theory Paper I (GL 211)	Mineralogy	Semester I	Four lectures/Week (Total 45 per Semester )	04	16	20 *
Theory Paper II (GL 212)	Structural Geology		Four lectures/Week (Total 45 per Semester )	04	16	20 *
Theory Paper I (GL 221)	Petrology	Semester II	Four lectures/Week (Total 45 per Semester )	04	16	20 *
Theory Paper II (GL 222)	Stratigraphy and Palaeontology		Four lectures/Week (Total 45 per Semester )	04	16	20 *
Practical paper III (GL 223) (First & Second	Practicals	Annual	10 Practicals of four lectures in each Semester (In all 20	08	32	40 **

Semester )			practicals per year)			
<p>* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50</p> <p>** Subject to compulsory passing in external examination and getting minimum 40 marks out of 100</p> <p>Notes:</p> <ol style="list-style-type: none"> <li>1. Total marks: Theory for each semester (50 + 50 ) = 100 marks</li> <li>2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks</li> <li>3. Internal marks for theory papers given on the basis of internal assessment tests and for practicals on internal assessment tests + journals + attendance + tour reports.</li> <li>4. For all theory papers of both the semesters and practicals question papers set and assessed by the university of Pune</li> </ol>						

### Examination Pattern

Theory paper:	University Examination	– 40 marks (at the end of each semester)
	Internal Examination	– 10 marks
Practical course:	University Examination	– 80 marks (at the end of 2 <sup>nd</sup> semester)
	Internal Examination	– 20 marks

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

Question 1	10 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.

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain). There shall be 20 questions, each question of 0.5 marks.

For practicals: one internal assessment test + marks for journals + attendance + tour report.

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of minimum 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be one expert and two examiners per batch for the practical examination. One of the examiners will be external.

**Setting question papers:** For theory papers I and II for each semester and also for the annual practical examination question papers set by the University of 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.



### Third Year B. Sc. Geology

#### Theory Papers

Paper/ Course No.	Title	Pattern of examinat ion	Total Number of lectures Per Semester	Standard of passing		
				Internal marks out of 10 (theory)	External marks out of 40 (theory)	Total passing marks out of 50 (theory)
GL-331	Mineralogy	<b>SEMEST ER III</b>	45	4	16	20*
GL-332	Igneous Petrology		45	4	16	20*
GL-333	Sedimentary Petrology		45	4	16	20*
GL-334	Structural Geology		45	4	16	20*
GL-335	Precambrian Stratigraphy of India		45	4	16	20*
GL-336	Applied Geology -I		45	4	16	20*
GL-341	Metamorphic Petrology	<b>SEMEST ER IV</b>	45	4	16	20*
GL-342	Environmental Geology		45	4	16	20*
GL-343	Economic Geology		45	4	16	20*
GL-344	Geotectonics		45	4	16	20*
GL-345	Phanerozoic Stratigraphy of India and Palaeontology		45	4	16	20*
GL-346	Applied Geology -II		45	4	16	20*

### Practical Papers

Paper/Course No.	Title	Pattern of examination	Total Number of Practicals Per Semester	Standard of passing		
				Internal marks out of 20)	External marks out of 80	Total passing marks out of 100
Practical Paper I (GL 347)  (Third & Fourth Semester)	Mineralogy and Petrology	Annual	10 Practicals of four lectures in each Semester (In all 20 practicals per year)	08	32	40 **
Practical paper II (GL 348)  (Third & Fourth Semester)	Structural Geology, Economic Geology, Palaeontology and Indian Stratigraphy	Annual	10 Practicals of four lectures in each Semester (In all 20 practicals per year)	08	32	40 **
Practical paper III (GL 349)  (Third & Fourth Semester)	Applied Geology	Annual	10 Practicals of four lectures in each Semester (In all 20 practicals per year)	08	32	40 **

\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester ( $50 \times 6$ ) = 300 marks
2. Total marks per year 600 (Theory) + 300 marks (practicals) = 900 marks

### Examination Pattern

Theory paper:	University Examination	– 40 marks (at the end of each semester)
	Internal Examination	– 10 marks
Practical course:	University Examination	– 80 marks (at the end of 2 <sup>nd</sup> semester)
	Internal Examination	– 20 marks

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

Question 1	10 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

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain). There shall be 20 questions, each question of 0.5 marks.

For practicals: one internal assessment test + marks for journals + attendance + tour report.

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of minimum 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be one expert and two examiners per batch for the practical examination. One of the examiners will be external

**Setting question papers:** For all theory papers of both the semesters and practical question papers, setting and assessment by the University of Pune. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject.

**Qualification of Teachers:**

With minimum postgraduate degree in Geology (M. Sc. Geology) and qualified as per UGC regulations.

**University Of Pune**  
**F.Y. B.Sc. - Geology; Revised syllabus wef. June 2013**  
**Paper-I**  
**Mineralogy**  
**(Term – I)**

Unit	Topics	No. of lectures
I	<p><b>A) Introduction:</b> Definition, branches and scope of mineralogy. Importance and conservation of minerals.</p> <p><b>B) Formation of minerals:</b>            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)</p> <p><b>C) Utility of Minerals in Industries:</b>            Ceramic, Refractory, Pharmaceutical, Paint, Glass, Cement, Fertilizer, Oil Industry, Electrical and Electronics.</p>	<p>2</p> <p>4</p> <p>3</p>
II	<p><b>Crystallography</b></p> <p>a. Definition and conditions conducive for the formation of crystals.            b. Crystal morphology – faces, forms, edges, solid angles, interfacial angle and its measurement by contact Goniometer, law of constancy of interfacial angle.            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.            d. Study of following crystallographic systems with respect to their elements of symmetry, crystallographic axes and their forms with indices.</p> <p>i. Orthorhombic (Type: Barytes)            ii. Tetragonal (Type: Zircon)            iii. Cubic (Type: Galena)            iv. Hexagonal (Type: Beryl)            v. Monoclinic (Type: Gypsum)            vi. Triclinic (Type: Axinite)</p>	9

III	<p><b>A) Physical properties of minerals</b></p> <p>a. Colour, streak, lustre, cleavage, fracture, hardness, form, magnetism, electrical property, radioactivity, specific gravity &amp; luminescence. (Phosphorescence and Fluorescence)</p> <p>b. Methods of determining specific gravity – Chemical balance, Walker’s steelyard, Jolly’s spring balance, pycnometer, heavy liquids.</p> <p><b>B) Optical mineralogy</b></p> <p>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. Introduction to optical properties:–</p> <ul style="list-style-type: none"> <li>• In plane polarized light: Colour, form, cleavage, cracks, relief, twinkling, pleochroism.</li> <li>• In between Crossed Nicols: Isotropism, anisotropism, extinction positions (straight, oblique and symmetrical), extinction angle, interference colours, twinning, cross hatching.</li> </ul>	5
IV	<p><b>Crystal Chemistry</b></p> <p>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 constituents of minerals. d. Geochemical affinity &amp; geochemical classification of elements. e. Geometrical and electrical stability of minerals. (concept of relative size of ions, radius ratio ,co-ordination number &amp; ionic substitution) f. Isomorphism, polymorphism, pseudomorphism. g. Silicate structures</p>	9
	<b>Total lectures</b>	36

**Paper-I**  
**Petrology and Structural Geology**  
**(Term – II)**

Unit	Topics	No. of lectures
I	<p><b>Petrology</b></p> <p><b>A) Definition and major divisions</b></p> <p>a. Definition of petrology, lithology, petrography, petrogenesis.  b. Major divisions and diagnostic characteristic of rocks : igneous, Sedimentary and metamorphic.  c. Rock cycle.</p> <p><b>Igneous Petrology</b></p> <p><b>B) Magma</b></p> <p>a. Magma and its composition.  b. Formation of crystals and glass.</p> <p><b>C) Forms of Igneous bodies</b></p> <p>a. Intrusive: Concordant and discordant intrusions  1. Concordant: sill, laccolith, lopolith.  2. Discordant: dyke and veins, batholith.  b. Extrusive: lava flows</p> <p><b>D) Textures and Structures</b></p> <p>a. Textures: Definition and factors controlling textures: Equigranular (granitic), Inequigranular (porphyritic), glassy  b. Structures: Vesicular, amygdaloidal, blocky, pillow, flow and columnar.</p> <p><b>E) Classification of Igneous Rocks</b></p> <p>a. Basis of Classification: Depth of formation, silica percentage, Type of feldspar content and colour index.  b. Tabular classification.</p>	<p>1</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p>

II	<p><b>Sedimentary Petrology</b></p> <p><b>A)</b> Sediments, sedimentation, sedimentary environment (definition and types) and formation of sedimentary rocks - Weathering (mechanical and chemical), erosion, denudation, transportation, deposition, compaction, cementation and lithification</p> <p><b>B)</b> Textures and structures of sedimentary rocks:</p> <p>a. Clastic and non-clastic textures.</p> <p>b. Structures: Lamination, bedding (concordant and discordant), graded bedding and ripple marks.</p>	<p>6</p> <p>3</p>
III	<p><b>Metamorphic Petrology</b></p> <p><b>A)</b> Definition of metamorphism, agents of metamorphism, kinds of metamorphism, characteristics of different types of metamorphism</p> <p><b>B)</b> Tabular classification giving original rock, predominant agent of metamorphism, type of metamorphism and their metamorphic product of the following rocks: Slate, Quartzite, Marble, Hornblende schist, Mica schist, Hornblende gneiss.</p> <p><b>C)</b> Structures in metamorphic rocks: maculose, slaty cleavage, granulose, schistose, gneissose</p>	<p>5</p> <p>2</p> <p>2</p>
IV	<p><b>Structural Geology</b></p> <p><b>A)</b> Introduction and definition.</p> <p><b>B)</b> Planar features and their measurements, Clinometer compass (construction and uses)</p> <p><b>C)</b> Folds: Definition, parts of fold, anticline, syncline, symmetrical, asymmetrical.</p> <p><b>D)</b> Faults: Definition terms associated with fault, normal fault, reverse fault, step fault, horst and graben.</p> <p><b>E)</b> Joints: Definition, general characteristics, sheet joints, columnar joints.</p> <p><b>F)</b> Unconformities: Definition and types (disconformity, angular unconformity, nonconformity)</p>	<p>1</p> <p>2</p> <p>2</p> <p>2</p> <p>1</p> <p>1</p>
	<b>Total lectures</b>	36



**Paper-II  
Physical Geology  
(Term – I)**

Unit	Topics	No. of lectures
I	<p><b>A) Introduction:</b> Definition of geology, Its divisions, sub-divisions and scope</p> <p><b>B) Planet Earth</b> Origin of the Universe (Big Bang Theory), Origin of the Solar System (Nebular, Encounter and Tidal theory)</p> <p>a. Earth: Its size, shape and density. Temperature, pressure and magnetism within the earth, Present day hypsographic curve</p> <p>b. Age of the Earth: A brief account of the historical methods. Determination of age by the K/Ar, U/Th and Carbon dating methods</p> <p>c. Geological Time Scale: Concept and Criteria.</p>	1  8
II	<p><b>A) The Earth's Atmosphere</b> (Introduction to Atmospheric circulation, weather and climate changes, land-air-sea interactions, global climatic changes), Hydrosphere (Introduction to ocean currents, types and causes, significance), Lithosphere (Structure and composition) and Biosphere (Ecology and food chain)</p> <p><b>B) Earth's crust, mantle and core.</b></p> <p><b>C) Continental Drift:</b> Concept and evidences – continental fit, Geological and palaeontological.</p> <p><b>D) Plate Tectonics:</b> A brief introduction.</p> <p><b>E) Concept of Isostasy:</b> Pratt's and Airy's model.</p>	3  1  2  2  1
III	<p><b>A) Weathering, erosion and denudation</b> Types of weathering:</p> <ul style="list-style-type: none"> <li>• Mechanical – frost wedging, frost action, insolation, activities of organic life and exfoliation</li> <li>• Chemical-hydrolysis, hydration, solution, carbonation and oxidation</li> </ul>	2

	<p><b>B) The dynamics of erosional and depositional landforms resulting from the action of</b></p> <ul style="list-style-type: none"> <li>• <b>River</b>  <b>Erosional landforms</b> – Waterfall, Potholes, mesa and butte  Meandering and Ox-bow lake.  <b>Depositional</b> landforms-Delta and types, alluvial fans, Flood Plain and river terraces.</li> <li>• <b>Wind</b>  <b>Erosional landforms</b> - Deflation and Deflation armour, Yardangs, Mushroom rock.  <b>Depositional</b> landforms - Sand Dunes and its types, loess.</li> <li>• <b>Sea</b>  <b>Erosional landforms</b> - Sea cliff ,sea cave, natural arch, stack  <b>Depositional landforms</b> - Beach and long shore drift deposits</li> <li>• <b>Glaciers</b>  <b>Erosional landforms</b> - Valleys (U shaped and Hanging valley), crevasse, cirque, crag and tail  <b>Depositional landforms</b> - Moraines and its types, Drumlins, Eskers.</li> </ul>	7
IV	<p>A. <b>Types of Mountains:</b> Fold, fault block, volcanic and residual. 1</p> <p>B. <b>Volcanoes:</b> Genesis of volcanoes, Central and fissure type of eruptions. Products of volcanoes, effects of volcanoes, earth's volcanic belts. 2</p> <p>C. <b>Earthquakes:</b> Definition, terminology, causes, intensity and magnitude. Recording of earthquakes (Modern recording method). 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. 3</p> <p>D. <b>Disasters and Disaster Management:</b> 3  Disaster: Definition, types, effects, phases, prevention, mitigation and preparedness. A case study of any one Indian disaster. Disaster Management: Definition, types, warning, precautions, mitigation and management.</p>	
	<b>Total lectures</b>	36

**Paper-II  
Palaeontology  
(Term – II)**

Unit	Topics	No. of lectures
I	<p><b>A)</b> Palaeontology: Definition, branches, Importance and scope.</p> <p><b>B)</b> Fossils: Definition, conditions and modes of preservation of fossils. techniques used in collection (Spot and channel), preservation and illustration of mega fossils.</p>	1 8
II	<p>Systematic position, morphology of hard parts, geological and geographical distribution of the following:</p> <p><b>A) Phylum Mollusca:</b></p> <p>I. Class Lamellibranchia or Bivalvia: Morphology of hard parts of the shell, ornamentation and types of hinge lines.</p> <p>II. Class Gastropoda: Morphology of hard parts of the shell and forms of the gastropod shell.</p> <p>III. Class Cephalopoda: Morphology of hard parts of Nautilus, Ammonoids, Belemnites and type of suture lines. Comparison between Nautilus and Ammonoids.</p>	3 3 3
III	<p><b>A) Phylum Brachiopoda</b> Morphology of hard parts of Class Articulata and Inarticulata. Types of brachial skeleton. Comparison between Lamellibranchs and Brachiopods.</p> <p><b>B) Phylum Echinodermata</b> Class Echinoidea: Morphology of hard parts of Regularia. Variation in the apical disc in echinoids.</p>	5 4
IV	<p><b>A) Phylum Arthropoda</b> Class Trilobita – Morphology of hard parts of Trilobites.</p> <p><b>B) Phylum Coelenterata</b> Class Anthozoa- Madreporaria, polyp, medusa, types of septa.</p> <p><b>C)</b> Origin and evolution of life over geological time.</p> <p><b>D)</b> Uses and Importance of fossils.</p>	2 2 3 2
<b>Total lectures</b>		36

**Paper-III**  
**Geology Practical**  
**(Term – I)**

**No of Practicals: 11**

Unit	Topics	No. of Practicals
I	<p><b>Mineralogy</b></p> <p><b>A)</b> Physical properties of minerals:</p> <p style="padding-left: 40px;">Colour, form, streak, luster, cleavage, fracture, hardness and specific gravity.</p> <p><b>B)</b> Identification of following Megascopic minerals in hand specimens with the help of physical properties:</p> <p style="padding-left: 40px;">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.</p> <p><b>C)</b> Identification of following Megascopic Ore minerals in hand specimens with the help of physical properties:</p> <p style="padding-left: 40px;">Magnetite, Haematite, Chromite, Chalcopyrite, Galena, Pyrolusite, Bauxite and Graphite.</p> <p><b>D) Experiment</b> To find out the specific gravity of minerals using Walker's Steelyard.</p>	<p>2</p> <p>2</p> <p>1</p>
II	<p><b>Crystallography</b></p> <p>Study of elements of symmetry, crystallographic axes and forms with indices of the following crystal systems representing all the fundamental crystal forms:</p> <p>a) Orthorhombic System (Type: Barytes)</p> <p>b) Tetragonal System (Type: Zircon)</p> <p>c) Cubic system (Type: Galena)</p> <p>d) Hexagonal System (Type: Beryl)</p> <p>e) Monoclinic System (Type: Gypsum)</p> <p>f) Triclinic System (Type: Axinite)</p> <p>g) Measurement of interfacial angle with Contact Goniometer.</p>	6

**Paper-III**  
**Geology Practical**  
**(Term – II)**

**No of Practicals: 11**

Unit	Topics	No.of Practicals
III	<p><b>Optical Mineralogy:</b>            Study of optical properties of minerals in plane polarised light and between crossed nicols.            Study of the following minerals:            Olivine, augite, hornblende, microcline, plagioclase, muscovite, biotite, calcite, garnet, quartz and orthoclase.</p>	1  2
IV	<p><b>Toposheets and study of structural models:</b></p> <p>Reading of toposheets with reference to toposheet number, latitude and longitude, state/districts, scale, adjacent toposheet number and conventional signs.</p> <p>Study of structural models showing faults, folds and unconformities ( 2 structural models of each)</p>	1
V	<p><b>Topographic maps and Geological maps :</b>            Study of topographic maps with section drawing            Study of geological maps with horizontal beds with reference to section drawing and description( topography, geology of map and geological history)</p>	2
VI	<p><b>Petrology</b>            Identification of the following megascopic rocks with respect to their texture/structure, mineral composition and classification</p> <p><b>A) Igneous:</b> Granite, gabbro, rhyolite, basalt (its varieties), pegmatite (Classification based on colour index, mineral composition and texture)</p> <p><b>B) Secondary:</b> Laterite, bauxite, breccia, conglomerate, sandstone, shale, mudstone and limestone.</p> <p><b>C) Metamorphic:</b> Slate, marble, quartzite, mica schist, hornblende schist, mica gneiss and hornblende gneiss.</p>	1  1  1

VII	<b>Palaeontology</b> Study of at least two specimens from each Phylum/Class (Total number of specimens should not be less than 15)  A) Phylum Mollusca – Class Lamellibranchia, Class Gastropoda, Class – Cephalopoda. B) Phylum Brachiopoda. C) Phylum Echinodermata. D) Phylum Arthropoda. E) Phylum Coelenterata.	2
VIII	Geological Fieldwork to be conducted in an area of geological interest for at least two days and geological report to be submitted for the same.	

**List of Reference Books:**

1. Rutley's Elements of Mineralogy: H.H. Read
2. Text Book of Mineralogy: Dana and Ford
3. Rock Forming Minerals: Deer, Howie, Zussman
4. Manual of Mineralogy: Cornelius, S. Hurlbut and Cornel Klein
5. Principles of Mineralogy: W.H. Blackburn, W.H. Denman
6. Mineralogy: Berry Mason, Dietrich
7. Principles of Petrology: Tyrrell
8. Invertebrate Palaeontology: Henry Woods
9. General Geology: Radhakrishnan
10. Holmes' Principles of Physical Geology: Edited by P. McL. D.Duff
11. Structural Geology: M.P. Billings
12. Invertebrate Paleontology: Shrock & Twenhofel

# **University of Pune**

**Three Year B. Sc. Degree Course in**

## **GEOLOGY**

**S.Y.B.Sc. Syllabus**

**(To be implemented from Academic Year 2014-15)**

## SEMESTER-I

### Paper-I: GL: 211 –Mineralogy

<b>UNIT I</b>	<b>DESCRIPTIVE MINERALOGY (No. of Lecture 12)</b> <b>A)</b> Mineral Kingdom: Crystalline and Non-Crystalline minerals. <b>B)</b> Classification of minerals based on Chemical Composition and Silicate Structure. <b>C)</b> Study of the following mineral groups with respect to Silicate Structure, Chemical Composition, Physical and Optical properties and Paragenesis. i. Olivine (Olivine) ii. Pyroxene (Augite + Hypersthene) iii. Amphibole (Hornblende + Actinolite)
<b>UNIT II</b>	<b>DESCRIPTIVE MINERALOGY (No. of Lecture 12)</b> Study of the following mineral groups with respect to Silicate Structure, Chemical Composition, Physical and Optical properties and Paragenesis. i. Mica (Muscovite, Biotite) ii. Feldspar (Orthoclase, Microcline, Plagioclase) iii. Silica (Quartz) iv. Felspathoid. (Sanidine, Leucite, Hauyene-Nosean)
<b>UNIT III</b>	<b>CRYSTALLOGRAPHY: (No. of Lecture 12)</b> <b>A)</b> Definition of a Crystal, External and Internal Imperfections in Crystals, Growth of crystals in Cavities, Etch figures and Solution Pits. <b>B)</b> Study of Holohedral, Hemihedral and Hemimorphic forms of crystals with suitable examples <b>C)</b> i) Study of Cubic system (Type- Pyrite and Type Tetrahedrite) Comparative study of three types of Cubic system. ii) Study of Hexagonal system (Type-Calcite, Type- Quartz, &Type- Tourmaline), Comparative study of four Types of Hexagonal system. <b>D)</b> Twinning in crystals: Definition, Causes terms related to Twinning, Types of Twins and Laws of Twinning in the different crystal systems.



<b>UNIT IV</b>	<p><b>OPTICS &amp; GEM STONES (No. of Lecture 12)</b></p> <p><b>A) Optics</b></p> <ul style="list-style-type: none"> <li>i) Isotropism and Anisotropism in minerals</li> <li>ii) Phenomenon of Extinction, Extinction Position in minerals of different Crystal System with respect to Vibration Direction and Optic Orientation.</li> <li>iii) Phenomenon of Interference Colours and Newton's Scale of Interference Colours.</li> <li>iv) Twinning (simple, multiple, cross hatching) &amp; Zoning in Minerals</li> </ul> <p><b>B) Gemstones</b></p> <ul style="list-style-type: none"> <li>i) Introduction (Three basic attributes of Gemstones, Beauty, Durability and Rarity)</li> <li>ii) Scope and Importance</li> <li>iii) Study of the following gemstones with respect to their Physical Properties (Crystal System, Hardness and Sp Gravity), Optical Properties (Colour, Luster, Singly Refracting / Doubly Refracting and Refractive Index) and Indian geographical occurrences. <ul style="list-style-type: none"> <li>a) Diamond</li> <li>b) Corundum (Ruby, Sapphire)</li> <li>c) Beryl (Aquamarine, Emerald)</li> <li>d) Silica (Rock crystal, Amethyst, Citrine, Tiger's eye, Opal)</li> <li>e) Tourmaline</li> <li>f) Topaz</li> <li>g) Garnet (Almandine)</li> </ul> </li> </ul>
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**(Total Lectures=48)**

**SEMESTER-II**  
**Paper-I: GL: 221-Petrology**

<b>UNIT I</b>	<p><b>IGNEOUS PETROLOGY: (12 Lectures)</b></p> <p><b>(A)</b> Physico-chemical constitution of Magma.</p> <ul style="list-style-type: none"> <li>a) Temperature</li> <li>b) Pressure</li> <li>c) Viscosity</li> <li>d) Volatiles</li> </ul> <p><b>(B)</b> Crystallization of Magma.</p> <ul style="list-style-type: none"> <li>a) i) Unicomponent Magma <ul style="list-style-type: none"> <li>ii) Factors controlling grain size of igneous rocks</li> </ul> </li> <li>b) Bicomponent Magma <ul style="list-style-type: none"> <li>i) Eutectic crystallization</li> <li>ii) Solid solutions (Plagioclase series)</li> </ul> </li> </ul> <p><b>(C)</b> Textures and Microstructures:</p> <ul style="list-style-type: none"> <li>a) Definition, factors determining the texture of rocks</li> <li>b) Study of following texture with respect to characters examples and genesis -  Poikilitic, Ophitic, Subophitic, Intergranular, Intersertal, Directive, Intergrowth (Graphic)</li> <li>c) Study of following structures / micro structures with respect to characters, examples and genesis- Orbicular, Spherulitic, Perlitic, Expansion Cracks and Reaction Rims.</li> </ul>
<b>UNIT II</b>	<p><b>SEDIMENTARY PETROLOGY (12 Lectures)</b></p> <p><b>(A)</b> Derivation of sediments.</p> <ul style="list-style-type: none"> <li>i. Sources of sediments</li> <li>ii. Mineral composition of clastic / detrital sediments</li> <li>iii. Concept of matrix and cement and its effect on porosity and permeability</li> </ul>

	<p><b>(B) Transportation of Detrital/ Clastic sediments:</b></p> <ol style="list-style-type: none"> <li>i. Modes of Transportation (Including phases of traction)</li> <li>ii. Definition of Competence, Capacity and Load of transporting Medium</li> <li>iii. Progressive changes in sediments during transport with respect to size, shape and mineral composition.</li> </ol> <p><b>(C) Diagenesis:</b></p> <p>Outline of following diagenetic processes:- Cementation, Authigenesis, Diagenetic Metasomatism, Diagenetic Differentiation and Intrastratal Solution.</p> <p><b>D) Primary Sedimentary Structures:</b></p> <p>Description of following primary structures with respect to their origin and environmental significance:- Lamination, Bedding, Cross Bedding, Graded Bedding, Ripple Marks, Mud-Cracks.</p>
<b>UNIT III</b>	<p><b>METAMORPHIC PETROLOGY (12 Lectures)</b></p> <p><b>A) Metamorphism and Metamorphic minerals:</b></p> <ol style="list-style-type: none"> <li>a) Salient features of metamorphism as a process</li> <li>b) Difference between Metamorphism, Weathering, Diagenesis and Metasomatism</li> <li>c) Metamorphic minerals- Stress and anti-stress minerals, Idioblastic and Xenoblastic crystals.</li> </ol> <p><b>B) Metamorphism and Metamorphic Products:</b></p> <p>Definition, general characteristics, textures/structures and mineral transformation involved during -</p> <ol style="list-style-type: none"> <li>a) Regional Metamorphism of       <ol style="list-style-type: none"> <li>i) Argillaceous rocks</li> <li>ii) Quartzofeldspathic rocks</li> <li>iii) Basic igneous rocks</li> </ol> </li> </ol>

	<p>b) Cataclasis and its products- Crush Breccia, Crush Conglomerate, Cataclasite</p> <p>c) Thermal Metamorphism of</p> <p>i) Pure and impure limestones</p> <p>ii) Arenaceous rocks</p>
<b>UNIT IV</b>	<p><b>CLASSIFICATION OF ROCKS AND FIELD WORK (12 Lectures)</b></p> <p><b>A)</b> Tabular classification of igneous rocks based on Colour Index, Depth of Formation, Feldspar Content, Chemical Composition and Saturation Concept showing the position of the following rocks- Granite, Gabbro, Dunite, Pegmatite, Dolerite, Rhyolite, Pumice, Basalt, Syenite, Diorite, Trachyte, Andesite, Graphic granite, Porphyries, Obsidian and Pitchstone.</p> <p><b>B)</b> Study of following secondary deposits with respect to 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><b>C)</b> Description of megascopic Metamorphic rocks.</p> <p><b>D) Field Work.</b></p>

(Total Lectures=48)

**Paper-II:SEMESTER I GL-212: Structural Geology**

<b>UNIT I</b>	<p><b>A. INTRODUCTION: (12 Lectures)</b></p> <ul style="list-style-type: none"> <li>i) Definition and its relation with other branches of geology</li> <li>ii) Tectonic and Non-tectonic structures.</li> <li>iii) Scale of tectonic structures (Micro, Meso, Macro &amp; Regional)</li> </ul> <p><b>B. PLANAR/LINEAR STRUCTURES, OUTLIER/INLIER</b></p> <ul style="list-style-type: none"> <li>i) Attitude of planar feature - Strike and Dip</li> <li>ii) True &amp; Apparent Dip, True &amp; Apparent thickness, True &amp; Apparent Width of Outcrop and Vertical Thickness of planar feature.</li> <li>iii) Attitude of Linear Feature, Bearing, Plunge and Rake of Linear Feature in given Planar Feature.</li> <li>iv) Outlier and Inlier- Definition &amp; Formation.</li> <li>v) Brunton Compass &amp; its uses.</li> </ul>
<b>UNIT II</b>	<p><b>A. FOLDS: (12 Lectures)</b></p> <ul style="list-style-type: none"> <li>i) Introduction: Definition, causes and parts of folds: - axis, axial plane, limb, hinge, crystal line, crystal plane, trough line and trough plane.</li> <li>ii) Definition, causes and characters of the following types of folds: - anticline, syncline, anticlinorium, synclinorium, symmetrical, asymmetrical, overturned, recumbent, isoclinal, chevron, box, fan, monocline, homocline, Structural terrace, open, close, drag, plunging and nonplunging, doubly plunging, dome and basin. Decollement, diapir, disharmonic, suprataneous.</li> <li>iii) Concepts of fold systems and refolding</li> <li>iv) Method to determine the depth of folding- Principle, assumptions, merits and limitations.</li> <li>v) Recognition of folds by direct observation, plotting attitude of beds on map, topographic studies, drilling and mining data.</li> <li>vi) Methods of representation of folds</li> </ul>
<b>UNIT III</b>	<p><b>FAULTS : (12 Lectures)</b></p> <ul style="list-style-type: none"> <li>i) Definition of fault as a Planar zone, terms associated with Faults / fault zones</li> <li>ii) Movements along faults- absolute, relative, apparent, translational and rotational</li> <li>iii) Slips, separations, shift along faults</li> <li>iv) Effects of faulting on disrupted strata</li> </ul>

	<ul style="list-style-type: none"> <li>v) Geometric classification of faults</li> <li>vi) Genetic classification of faults</li> <li>vii) Recognition of faults in the field</li> </ul>
<b>UNIT IV</b>	<p><b>A) JOINTS: (12 Lectures)</b></p> <ul style="list-style-type: none"> <li>i) Definition and general characteristics of joints</li> <li>ii) Rupturing under tension, compression, couple and torsion</li> <li>iii) Geometric and genetic classification of joints with examples</li> </ul> <p><b>B) UNCONFORMITY:</b></p> <ul style="list-style-type: none"> <li>i) Definition, stages in development of unconformities,</li> <li>ii) Structural classification of unconformities, Recognition of unconformity in the field.</li> <li>iii) Distinguishing unconformable contacts from intrusive contacts and faults.</li> </ul> <p><b>C) LANDFORMS ASSOCIATED WITH TECTONIC STRUCTURES</b></p> <p><b>D) DETERMINATION OF TOP OF BED WITH THE HELP OF PRIMARY STRUCTURES (SEDIMENTARY &amp; IGNEOUS) AND INTERPRETATION OF MAJOR STRUCTURES WITH WHICH THEY ARE ASSOCIATED.</b></p>

(Total Lectures: 48)

## SEMESTER-II

### Paper-II: GL: 222 - Stratigraphy and Palaeontology

<b>STRATIGRAPHY</b>	
<b>UNIT I</b>	<b>(12 Lectures)</b> 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 and subsurface)
<b>UNIT II</b>	<b>(12 Lectures)</b> i) Stratification : processes, Controlling stratification-physical, chemical and biological. Vertical succession, alternations, varves, cycles (symmetrical and asymmetrical) ii) Unconformity: definition, importance in stratigraphy environmental classification and stratigraphic evidence of unconformities. iii) Correlation: definition and evidence for correlation-physical and palaeontological.
<b>PALAEONTOLOGY</b>	
<b>UNIT III</b>	<b>(12 Lectures)</b> i) Concepts of organic evolution. (Definition, Evidence of evolution, Macro & Micro evolution, Darwinism, Lamarckism & Mutation) ii) Evolutionary trends in Ammonoids and Trilobites iii) Introduction to Micropalaeontology iv) Definition, different types of microfossils, their size range and composition. v) Different branches of Micropalaeontology. Uses of microfossils
<b>UNIT IV</b>	<b>(12 Lectures)</b> A) Field and Laboratory Techniques (i) Field techniques for collection of microfossils (sampling methods) (ii) Laboratory techniques for separation- Mechanical and chemicals methods, Recovery of microfossils from shale and limestone. Separation of microfossils from coal (maceration), Preservation and Illustration. B) Study of the following microfossils: (with respect to their morphology, environmental and paleo-ecological significance) (i) Foraminifers (ii) Ostracods (iii) Pollens and Spores (iv) Diatoms, Dinoflagellates, Radiolarian

**(Total Lectures: 48)**

**Paper III: GL:-223 - Geology Practical**

**Total Practicals-20**

**Total Units-8**

**Unit I: MINERALOGY**

**No. of Practicals-3**

**a) Megascopic:** (At least 15 minerals from amongst the following) Study & identification of the following minerals in hand specimens):

Neso silicates: Staurolite, Topaz.

Inosilicates (Single chain):Hypersthene, Wollastonite.

Inosilicates (Double chain): Actinolite, Tremolite, Asbestos.

Phyllosilicates: Phlogopite, Chlorite, Serpentine, Kaolinite.

Tectosilicates: Sanidine, Labradorite, Sodalite, Leucite.

Cyclosilicates: Beryl, Tourmaline, Apatite, Corundum.

Sorosilicate: Epidote.

**b) i) Ore minerals (any four)-**

Wolframite, Stibnite, Malachite, Azurite, Iron pyrite, Iron glance, Psilomalaene.

**ii) Gemstones (any four)-**

Corundum (ruby, sapphire), Tourmaline, Beryl (aquamarine, emerald), Amethyst, Garnet.

**c) Microscopic :**

Study and identification of the following minerals under microscope:

Colourless Minerals: Tremolite, Quartz, Orthoclase, Sanidine, Leucite, Hauyne / Nosean.

Coloured Minerals: Staurolite, Andalusite, Sphene, Hypersthene, Diopside, Actinolite, Chlorite, Tourmalene.



## **Unit II: CRYSTALLOGRAPHY**

**No. of Practicals-2**

### **A) Study of Crystallographic Axes, Elements of Symmetry and Forms**

**with Indices of:-**

- i) Cubic system ( Type-Pyrite and Type-Tetrahedrite)
- ii) Hexagonal system (Type- calcite, Type-Tourmaline and Type- Quartz)

### **B) Study of the Twinned crystals**

At least one twin crystal from each crystal system representing different types of twins.

## **Unit III: IGNEOUS PETROLOGY**

**No. of Practicals-2**

Megascopeic and Microscopic study and identification of the following rocks.

### **a) Megascopeic:-**

Plutonic: Syenite, Diorite, Dunite.

Hypabyssal: Graphic granite, Pitchstone, Syenite - Porphyry, Dolerite.

Volcanic: Obsidian, Trachyte, Andesite

### **b) Microscopic:-**

Plutonic: Granite, Syenite, Gabbro, Dunite.

Hypabyssal: Graphic granite, Pitchstone.

Volcanic: Rhyolite, Trachyte, Andesite, Basalt.

## **B) SEDIMENTARY PETROLOGY:**

**No. of Practicals-3**

### **a) Megascopeic:-**

Arkose, Grit, Sandstones (siliceous, ferruginous and calcareous), Nummulitic Limestone, Meliolitic Limestone, Oolitic Limestone.

### **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.

**c) Microscopic:-**

Ferruginous Sandstone, Arkose, Oolitic Limestone, Nummulitic Limestone.

**C) METAMORPHIC PETROLOGY:**

**No. of Practicals-2**

**a) Megascopic:**

Any two varieties of Marble, Banded Haematite Quartzite, Phyllite, Chlorite schist, Mica garnet schist, Actinolite schist, Kyanite schist, Staurolite schist. Granite gneiss.

**b) Microscopic:**

Quartzite, Marble, Mica garnet schist, Hornblende schist, Biotite gneiss, Hornblende gneiss.

**4. MICRO-PALAEONTOLOGY:**

**No. of Practicals-1**

**Micro fossils- Two each from Foraminifera, Ostracod, Pollens/ Spores.**

**5. STRUCTURAL GEOLOGY**

**A) Study of Geological Maps:**

- a) One conformable series A with one vertical dyke.
- b) Two conformable series.
- c) One conformable series with one/ two vertical faults.
- d) One unconformity and one vertical fault.

**B) Structural problems:**

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 the bed.

b) Problems involving true and apparent Dip, true and apparent thickness, true and apparent width of outcrop and vertical thickness of the bed (True dip & true thickness/ Vertical thickness/ width of the outcrop given).

c) Problems involving true and apparent dip of the bed-

i) True dip of the bed given- To find out apparent dip amount in the given apparent dip direction

ii) True dip of the bed given- To determine apparent dip direction for given apparent dip amount.

iii) Two apparent dip amounts in two different directions given-

To find out strike direction, true dip direction and true dip amount.

Note- (Problems B and C to be solved by using descriptive geometry method involving construction of vertical section in desired directions)

\*Dip angle to be given in degrees.

\***Field Work**- Compulsory Geology field work for 4 to 7 days in a region with geologically diversified rock types and structures in any suitable Indian occurrences under the guidance of a teacher. **Students should submit a written field study report along with representative field samples.**

## REFERENCE BOOKS:

1. Structural Geology: M.P. Billings
2. Invertebrate Palaeontology : Henry Wood
3. Elements of Micropalaeontology : G.Bignot
4. Invertebrate Palaentology and Evolution: Clarkson
5. Principles of Invertebrate Palaentology:  
Robert Shrock and William Twenhofel
6. Principles of Palaentology:  
David Romp and Steven Stanely
7. Principles of Palaentology: T. Olivier
8. Basic Concepts of Historical Geology: E.W.Spencer
9. Historical Geology: Dunbar
10. Principles of Stratigraphy: Weller
11. Fundamentals of Historical Geology and  
Stratigraphy of India: Ravindra Kumar
12. Introduction to Microfossils: Danial Jones
13. Structural Geology: Miyashiro
14. Principles of Stratigraphy: Leman
15. Sedimentation and Stratigraphy:  
Krumbein and Sloss.
16. Calcareous Algae: John Wray

# **Savitribai Phule Pune University**

**Three Year B. Sc. Degree Course in**

**GEOLOGY**

**T.Y.B.Sc. Syllabus**

**(To be implemented from Academic Year 2015-16)**

**Equivalences for the Old Courses with New Courses in Geology  
T.Y.B.Sc. Geology**

<b>Papers in Old Course</b>	<b>Equivalent papers in New Course</b>
GL331: Mineralogy	GL331: Mineralogy
GL332: Igneous Petrology	GL332: Igneous Petrology
GL333: Sedimentary Petrology	GL333: Sedimentary Petrology
GL334: Structural Geology	GL334: Structural Geology
GL335: Precambrian Stratigraphy of India	GL335: Precambrian Stratigraphy of India
GL336: Applied Geology I (Field Geology & Remote Sensing)	GL336: Applied Geology I (Geomorphology, Remote-Sensing, GIS and Field Geology)
GL341: Metamorphic Petrology	GL341: Metamorphic Petrology
GL342: Environmental Geology	GL342: Environmental Geology
GL343: Economic Geology	GL343: Economic Geology
GL344: Geotectonics	GL344: Geotectonics
GL345: Phanerozoic Stratigraphy of India & Palaeontology	GL345: Phanerozoic Stratigraphy of India & Palaeontology
GL346: Applied Geology II (Prospecting, Engineering Geology & Hydrogeology)	GL346: Applied Geology II (Prospecting, Engineering Geology & Hydrogeology)
<b>Practicals-</b> GL 347: Mineralogy & Petrology	<b>GL 347: Mineralogy &amp; Petrology</b>
GL348: Structural Geology, Economic Geology, Paleontology & Indian Stratigraphy	<b>GL348: Structural Geology, Economic Geology, Paleontology &amp; Indian Stratigraphy</b>
GL349: Applied Geology (Remote Sensing, Geohydrology, Geophysical Prospecting, Field Geology & Environmental Geology)	<b>GL349: Applied Geology (Remote Sensing, Geohydrology, Geophysical Prospecting, Field Geology &amp; Environmental Geology)</b>

## GL-331 : Mineralogy

### Unit I) Mineral Optics & Mineral Chemistry

12 Lectures

#### A) Mineral Optics:

(9 Lectures)

- a) Refractive index & methods of comparing R.I of minerals: Becke line, shadow method & immersion method
- b) Relief of minerals
- c) Uniaxial & biaxial minerals, indicatrices
- d) Vibration direction & optic orientation
- e) Pleochroism & absorption
- f) Accessory plates: Quartz wedge, Mica plate & Gypsum plate
- g) Compensation & Determination of interference colours
- h) Sign of minerals
- i) Sign of elongation of uniaxial minerals where C axis is known

#### B) Mineral Chemistry:

(3 Lectures)

- a) Isomorphism
- b) Polymorphism
- c) Pseudomorphism

### Unit II) Descriptive Mineralogy-I

12 Lectures

#### A) Study of the following mineral groups (silicates) with reference to their silicate structure, chemical & optical characters, paragenesis & alteration products

- a) Olivine group
- b) Garnet group
- c) Aluminosilicates: Sillimanite, Kyanite & Andalusite
- d) Pyroxene group
- e) Amphibole group
- f) Mica group

### Unit III) Descriptive Mineralogy-II

12 Lectures

#### A) Study of the following mineral groups (silicates) with reference to their silicate structure, chemical & optical characters, paragenesis & alteration products

(8 Lectures)

- a) Chlorite group
- b) Clay group
- c) Felspar group
- d) Zeolite group

#### B) Study of following non metallic mineral deposits with reference to their mineralogy, properties, occurrences & uses

(4 Lectures)

- a) Refractory minerals : Fire clay, Kyanite, Chromite, Graphite, Magnesite, Dolomite
- b) Precious & Semiprecious stones

#### Unit IV) Descriptive Mineralogy-III

12 Lectures

**Study of following non-silicates with reference to their crystal structure,  
chemical composition, physical properties & uses**

- a) Oxides & Hydroxide : Corundum, Hematite, Ilmenite, Rutile & Limonite
- b) Sulphides : Pyrite, Sphalerite, Galena
- c) Sulphates : Gypsum & Baryte
- d) Carbonates : Calcite, Aragonite, Rhodochrosite, Siderite
- e) Phosphates : Apatite & Monazite
- f) Halides : Fluorite & Halite

#### **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 Kleine & 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 check  
D.T.
- 9) Dana's textbook of Mineralogy by William E. Ford.
- 10) Optical Mineralogy by S.Ray and PRJ Naidu



## GL 332 - Igneous Petrology

### **UNIT I) Characteristics and generation of magmas in the interior of the earth** **12 Lectures**

#### **A) Characteristics and generation of magmas (6 Lectures)**

- a) The physico-chemical nature of magma – density, viscosity, chemical constituents and temperature-pressure.
- b) Role of magma in geological processes: melting of rocks and generation of magmas, temperature- pressure conditions and volatile constituents. Generation of magmas in different tectonic settings.

#### **B) Types of magma: Primary and derivative (1 Lecture)**

#### **C) Crystallization of magmas (5 Lectures)**

- a) Binary magma with an incongruent melting compounds: Leucite – silica system
- b) Ternary system: Albite-Anorthite-Diopside system.
- c) Reaction series and its importance

### **UNIT II) Magmatic evolution** **12 Lectures**

#### **A) Magmatic Differentiation (6 Lecture)**

- a) Crystal fractionation: Forsterite - Fayalite, Forsterite - Silica systems.
- i) Separation mechanisms: Gravitational settling, flow differentiation, flow crystallisation, filter pressing, selective nucleation, gas streaming, gravitational liquid separation.
- b) Liquid immiscibility in silicate – silicate and silicate – water systems.
- c) Liquid fractionation : Thermal diffusion and gravitational diffusion.

#### **B) Contamination : (3 Lecture)**

Assimilation by melting, without melting and equilibration of xenoliths, incorporation of the equilibrated foreign matter, contaminated granites. Significance of contamination.

#### **C) Zone Melting (1 Lecture)**

#### **D) Mixing of magmas : Similar and dissimilar magmas (1 Lecture)**

#### **E) Role of volatile constituents in differentiation of magma (1 Lecture)**

### **UNIT III) Textures, Structures and Classification of Igneous rocks** **12 Lectures**

#### **A) textures/structures in igneous rocks & their significance (7 Lectures)**

**Textures** : Granitic, porphyritic, glomero-porphyritic, poikilitic, ophitic & sub-ophitic, inter-granular, inter-sertal, cummulate, glassy, corona/ reaction rim, myrmeketic,

**Structures** : Ropy, vesicular, amygdaloidal, columnar, graphic, Orbicular, expansion cracks, flow,

#### **B) Classification of igneous rocks (5 Lectures)**

- a) Complexity in classification
- b) Types of classification,
  - i) Shand's classification
  - ii) CIPW classification
  - iii) IUGS (plutonic, volcanic) classifications

### **UNIT IV) Petrographic Provinces, Rock Kindreds and Description of Igneous Rocks** **12 Lectures**

#### **A) Concept of tectono-magmatic association (2 Lectures)**

#### **B) Petrographic Provinces & Rock Kindreds (4 Lectures)**

#### **C) Description of rock types (6 Lectures)**

Description of rock types with regard to their characteristics, composition, Origin and occurrence in relation to their tectonic setting:

- i) Peridotite clan rocks
- ii) Basalt

- iii) Anorthosite
- iv) Andesite
- v) Granite
- vi) Pegmatite
- vii) Aplite

### **REFERENCE BOOKS -**

- 1) Igneous Petrology : Anthony Hall
- 2) Igneous rocks : McBirney
- 3) Igneous and Metamorphic Petrology : Myron Best
- 4) Principles of Petrology : GW Tyrrell.
- 5) Igneous, metamorphic and sedimentary Rocks : Elher and Blatt
- 6) Igneous and metamorphic Petrology : Turner and Verhoogen
- 7) Principles of Igneous & metamorphic Petrology : Philpotts and Ague
- 8) Petrology of the Igneous rocks : Hatch, Wells and Wells
- 9) Petrography and Petrology : Grout
- 10) Igneous Petrology : Barker D. S.
- 11) Igneous and Metamorphic petrology : Raymond Loren
- 12) Principles of Igneous and Metamorphic Petrology: John D. Winter
- 13) Petrology by Blatt, Tray and Owens

## GL – 333: Sedimentary Petrology

<b>UNIT I) Introduction to Sedimentary Petrology</b>	<b>12 Lectures</b>
<b>A) Introduction:</b>	<b>(3 Lectures)</b>
a) Introduction to terms Sedimentology and Sedimentary Petrology	
b) Branches of Sedimentology	
c) Methodology: Field & Laboratory studies (in brief)	
d) Application of Sedimentology in prospecting of hydrocarbons & sedimentary ores (Placer, Syngenetic & Epigenetic)	
<b>B) Role of weathering in sedimentation:</b>	<b>(5 Lectures)</b>
a) Surface processes of rock weathering	
b) Chemistry of the weathering processes & mobility of oxides	
c) Mineral stability series	
<b>C) Dispersal of sediments:</b>	<b>(4 Lectures)</b>
a) Dynamics of transportation	
b) Concept of dispersal based on: size, roundness & sphericity, mineral composition & processes ( Selective abrasion, Selective sorting & progressive dilution)	
<b>UNIT II) Texture &amp; Structures of Sedimentary Rocks</b>	<b>12 Lectures</b>
a) Definition of texture & factors controlling textures of sedimentary rocks	
b) Concept of shape & size classification	
c) Classification of sedimentary aggregates	
d) Grade scales (Udden, Wentworth, Krumbein & Phi scale)	
e) Mechanical / Sieve analysis: procedures & format for plotting & interpretation in brief.	
f) Inorganic primary sedimentary structures & their significance (a brief mention of their varieties):	
1. Bedding	
2. Lamination	
3 Cross bedding	
4 Graded bedding	
5 Ripple marks	
6. Chemical structures: stylolites, concretions, nodules	
7. Penecontemporaneous sedimentary Structures: Load-cast, flute-cast, mud-cracks, ball & pillow, clastic dykes, slump folds, Dewatering folds	
g) Study of organic sedimentary structures (in brief)	
<b>UNIT III) Provenance, Classification of Sedimentary Rocks And Sedimentary Basins</b>	<b>12 Lectures</b>
<b>A) Concept of provenance:</b>	<b>(3 Lectures)</b>
a) Introduction	
b) Based on petrography, light & heavy mineral suites	
<b>B) Classification of sandstones &amp; limestones:</b>	<b>(3 Lectures)</b>
a) Dot's Classification of sandstones	
b) Dunham's classification of limestones	
<b>C) Sedimentary basins &amp; control on sedimentation:</b>	<b>(6 Lectures)</b>
a) Sedimentary basins their formation & classification (Kingston et al).	
b) Climatic control.	
<b>UNIT-IV: Sedimentary Environments &amp; Facies</b>	<b>12 Lectures</b>
A) Sedimentary environments: Depositional & Erosional	
B) Physical & Chemical parameters of depositional sedimentary environments	
C) Classification of depositional sedimentary environments	

D) Concept of sedimentary facies: Definition, nomenclature & types of Sedimentary facies, Walther's Law of Facies.

**REFERENCE BOOKS -**

- 1) Igneous, Metamorphic & Sedimentary petrology by Ehler & Blatt
- 2) Sedimentary Petrology by Pettijohn
- 3) Introduction to Sedimentology by Sengupta
- 4) Stratigraphy & Sedimentation by Krumbein & Sloss
- 5) Applied Sedimentology by R.K. Sukhatankar
- 6) Sand & Sandstones by Pettijohn, Potter & Siever.
- 7) Sedimentary basins and Environments by Reineck and Singh
- 8) Petrology of Sedimentary Rocks by S.J.Boggs (1992)
- 9) Sedimentary Petrology: an Introduction to the Origin Sedimentary Rocks by M.E.Tucker (2001)
- 10) Sedimentary Environment, Processes and Facies by Harold Reading
- 11) Sedimentary Basin, Budget and Facies, by Gerhard Einsele, (1995)
- 12) Sedimentary Structures by Collinson and Thompson

**GL 334: Structural Geology.**

**Unit I) Fundamental Principles of Rock Deformation** **12 Lectures**

**A) Objectives and applications of Structural Geology.** **(2 Lectures)**

**B) Rock Deformation- Definition, Concept & fundamental principles** **(7 Lectures)**

- a) Force: Definition, representation, types (balanced & unbalanced) & unit of force.
- b) Confining / Hydrostatic pressure & differential forces.
- c) Stress & Strain-Definition and concept.
- d) Stress-Strain diagram with reference to following :
- e) Elastic & Plastic deformation
- f) Brittle & Ductile substance
- g) Rupture strength, Ultimate strength & Fundamental strength.
- h) Factors controlling rock deformation: Confining pressure, temperature, time, solution, anisotropy & inhomogeneity of rocks.
- i) Rheology (definition & concept).

**C) Mechanics of Plastic deformation:** **(3 Lectures)**

- a) Definition & examples of plastic deformation
- b) Mechanisms of plastic deformation: Intergranular & intragranular movements, recrystallization with & without change in shape, Reckie's principle.

**Unit II) Concept & Mechanics of folding:** **12 Lectures**

**(Based on internal processes operative within the rock)**

**A) Study of the following genetic styles of folding:** **(8 Lectures)**

- a) Flexure / Flexure-slip folding
- b) Flow / Incompetent folding
- c) Shear / Slip folding
- d) Folds due to vertical movements

**B) Introduction to Dip Isogons and Ramsay's classification** **(1 Lecture)**

**C) Introduction to Flutey's Classification** **(1 Lecture)**

**D) Introduction to Analytical techniques- pi & beta diagrams** **(2 Lectures)**

**Unit III) Mechanics of Rupturing & Faulting:** **12 Lectures**

**A) Mechanics of Rupturing** **(3 Lectures)**

- a) Concept of mechanics of rupturing
- b) Two genetic types of fractures-tension & shear fractures
- c) Rupturing under differential forces
- d) Stress & Strain ellipsoid – Concept & their relation with rupture

**B) Mechanics of faulting:** **(9 Lectures).**

- a) Concept of mechanics of faulting
- b) Faulting along tension & shear fractures
- c) Direction of displacement along shear fractures`
- d) Mechanics of gravity, thrust & strike slip faults
- e) Introduction to Analytical Techniques – Orthographic Projections
- f) Ultimate causes of folding & faulting

**Unit IV) Foliations & Lineations:** **12 Lectures**

**A) Foliations** **(6 Lectures)**

- a) Definition, types & examples of foliations
- b) Map symbols to express attitude of foliations & rock cleavages
- c) Types of cleavages & schistosity (Secondary foliations):
  - i) Slaty cleavages / schistosity
  - ii) Fracture cleavages
  - iii) Slip cleavages

- iv) Bedding cleavages
- d) Origin of slaty cleavages / schistosity:
  - i) Slaty cleavages as flow cleavages
  - ii) Slaty cleavages as shear cleavages
- e) Origin of fracture cleavages, slip cleavages & bedding cleavages
- f) Cleavage banding & Segregation banding
- g) Introduction to Superimpose Deformation

**B) Lineations:**

**(6 Lectures)**

- a) Definition, types & examples of lineations (Primary & Secondary)
- b) Types of secondary lineations & their origin:
  - i) Linear parallelism of stretched pebbles / prismatic minerals / elliptical mica plates
  - ii) Intersecting planar features
  - iii) Cenulations
  - iv) Slicken-sides
  - v) Boudins or Boudinage structures
  - vi) Rodings
  - vii) Axes of folds
  - viii) Mullion structure
- c) Map symbols to express attitude of lineations
- d) Lineations in relation to major structures

**REFERENCE BOOKS –**

- 1) Structural Geology : M.P.Billings
- 2) Techniques of Modern Structural Geology : Ramsay and Huber
- 3) Structural Geology : De Sitter
- 4) Structural Geology : Ramsay
- 5) Structural Geology for Petroleum Geologists : Russel
- 6) Folding and fracturing of rocks : Ramsay J G
- 7) Structural and Tectonic Principles: Badgley
- 8) Analysis of metamorphic tectonites : Turner and Weiss
- 9) Introduction to Geology : Sander
- 10) Structural Geology : Dennis
- 11) Modern Structural Geology (Vol. 1 and 2) : Ramsay and Huber
- 12) Analysis of Geological structural : Price N.J. and Cosgrove
- 13) Mechanics in Structural Geology : Bayly B.
- 14) Structural Geology : Fundamentals of Modern Developments : S.K.Ghosh
- 15) Structural Geology of rocks and region : Davis, Reynolds, & Kluth
- 16) An outline of Structural Geology : Hobbs B E, Means W.D & Williams P. F.
- 17) Structure and Tectonics : Badgley P C
- 18) Tectonics : Moore & Twiss

## GL – 335: Precambrian Stratigraphy of India

### **Unit I) Introduction to Indian and World Precambrian History** **12 Lectures**

- A)** Physiographic / Tectonic divisions of India and their comparisons
- B)** a) Definition of Tectonic Elements of continents (cratons, shield, folded mountain belts) and oceans (mid oceanic ridges, trenches and transform faults)  
b) Cratons of India and associated Proterozoic basins  
c) General review of Indian Stratigraphy & Classification of the Indian litho-stratigraphic units, according to the Geological time scale.  
d) Earlier and current classification of Precambrian formations of India by- Sir T.H. Holland, Sarkar et al (1976) and Ramkrishna and Vaidhyanathan (ICS, 2014)
- C)** a) World Precambrian history in brief  
b) Cratons and mobile belts of the World

### **Unit II) Precambrian rocks of Peninsular India** **12 Lectures**

Brief account of their distribution, Geographical location, classification lithological succession, structure and economic importance, with a broad stratigraphic correlation.

- a) The Dharwar Craton:** General Stratigraphy of Dharwar craton (in tabular form), distinction between older and younger Greenstone belts: Sargur Supergroup, Peninsular Gneisses, Dharwar Supergroup, Clospet Granite, Chamundi Granite.
- b) The Singhbhum – Odisha Iron Ore Craton:** General Stratigraphy of the region (in tabular form) Older Metamorphic Group (OMG), Iron Ore Group (IOG), Singhbhum Granite, Singhbhum Group, Extrusive and intrusive phases in the craton.
- c) The Central Indian Craton/ Bastar Craton:** General Stratigraphy of the region (in tabular form). Sakoli Group and Dongargarh Supergroup.
- d) Aravalli Craton:** General Stratigraphy in the Bhilwara Supergroup (Mangalwar Complex Sandmata Complex, Hindoli Group), Aravalli Supergroup
- e) Bundelkhand Craton:** Supracrustal and gneisses, Bundelkhand Granite and mafic dyke swarm

### **Unit III) The Precambrian Mobile belts and Precambrians of the Extra-Peninsula:**

**12 lectures**

#### **A) The Precambrian mobile belts**

- a) The Eastern Ghat mobile belt: Description and distribution of the Chalk Hills, Anorthosites of Salem, Sitampundi Complex, Khondalites and Kodurites.
- b) The Satpura mobile belt/ CITZ (Central Indian Tectonic Zone): Constituents and extent, N-S tabular cross section of CITZ, lithostratigraphy in brief of Mahakoshal belt/Group, Betul belt and Sausar belt/Group

#### **B) The Precambrians of the Extra-Peninsula:**

- a) The Tectonic sub-divisions of the Himalayas  
b) Precambrians of the Western and Central Lesser Himalayas  
c) Precambrians of the Western and Central Tethyan Himalayas

### **Unit IV) The Proterozoic rocks of India:**

**12 lectures**

- A)** a) The Archaean – Proterozoic boundary.  
b) Proterozoic history in brief, changes in marine and terrestrial environments, tectonic zonation in platformal and geosynclinal basins
- B)** Classification, Succession, lithology, fossils and economic importance of:
- a) The Delhi Supergroup  
b) Cuddapah Supergroup  
c) The Vindhyan Supergroup  
d) The Kaladgi Supergroup.  
e) The Chhattisgarh Supergroup.

## **REFERENCE BOOKS -**

- 1) Singhum - Orissa Iron Ore Craton : Geological Society of India –Special Publication  
By Sinha Roy
- 2) Geology of Karnataka: Geological Society of India – Special Publication  
By Radhakrishna B.P.
- 3) Geological of Maharashtra- Geological Society of India – Special Publication  
By G.G. Deshpande
- 4) Purana Basins of India: Geological Society of India – Special Publication
- 5) Geology of Western and Central India: Geological Society of India – Special Publication
- 6) Stratigraphy of Lesser Himalaya- By K.S. Valdiya
- 7) A Geological Time Scale- By Brian Harland et. al.
- 8) Stratigraphy of India and Burma- By M.S. Krishnan
- 9) Fundamentals of Historical Geology and Stratigraphy of India- By Ravindra Kumar
- 10) Geology of India Vol 1 &2. Ramkrishna-Vaidhyanathan- Geological Society of India  
Special Publication
- 11) The Making of India: Geodynamic Evolution- by K.S. Valdiya
- 12) Geological Evolution of the Indian Plate (From Haedean to Holocene -4Ga to 4Ka)- by  
Naqvi, S.M., 2005.



**GL: 336- Applied Geology I**  
**(Geomorphology, Remote-Sensing, GIS and Field Geology)**

- Unit I) Geomorphology and Principles of Remote Sensing** **12 lectures**
- A) Geomorphology**
- a) Introduction to Geomorphic Concepts **(2 Lectures)**
  - b) Landforms: Role Of Lithology, Endogenous And Exogenous Processes, Climatic And Tectonic Forces **(1 Lecture)**
  - c) Study Of Different Landforms Like: Mesa, Butte, Cuesta, Hogback, Ridge and valley topography, Tor topography, Badland topography, Karstic topography- sinkholes, disappearing streams, Sand dunes, Moraines, River terraces, Alluvial fans **(3 Lectures)**
- B) Principles of Remote Sensing**
- a) Definition, Types of Remote sensing Systems (Active & Passive), Elements of passive Remote sensing system (data acquisition & data analysis) **(2 Lectures)**
  - b) Energy source and radiation principles (EM wave, Wave theory, EM spectrum, particle theory, Stefan-Boltzman's law, Emissivity, Black, white & grey bodies) **(2 Lectures)**
  - 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. **(2 Lectures)**
- Unit II) Photogeology** **12 lectures**
- A) Aerial Photography** **(2 Lectures)**
- 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
- B) Planning of Aerial photography** **(3 Lectures)**
- a) Time of photography, Acquiring stereographic photography, Discrepancies in aerial photographs (tip, tilt, drift, crab, gap) and their effects.
  - 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.
  - c) Mirror and pocket stereoscopes.
- C) Photo recognition Elements** **(3 Lectures)**
- Tone, texture, pattern, shape, size, site, shadow, associations. Basic drainage patterns and their geological significance. Advantages and limitations of Aerial photos.
- D) Photo-geological interpretations** **(4 Lectures)**
- Photo characters of Sedimentary, igneous and metamorphic rocks. Interpretation of geologic structures (folds & faults), Interpretation of photo-lineament maps.
- Unit III) Satellites, Satellite data and Applications of Remote Sensing** **12 lectures**
- A) Introduction to Satellites, Sensors & their applications** **(6 Lectures)**
- 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)
- B) Scanners - Hyperspectral Scanners, Active Remote Sensing Systems -RADAR and LIDAR (Principles & applications)** **(3 Lectures)**

- C) **Image characteristics & Spectral responses of various features like Lithology, geologic structures, geomorphic features, vegetation (cultivated, forest), land use, water bodies (shallow, deep, clear, polluted), Utility (traffic, telecom, power, settlement etc.) & soils (2 Lectures)**
- D) **Applications of Remote sensing in studying the natural resources like minerals, ground water, soil, forests & in geo-technical investigations (1 Lecture)**

**Unit IV) GIS, GPS and Field Geology 12 lectures**

**A) GPS, GIS and its applications (3 Lectures)**

- a) GPS - What is GPS? Working of GPS.
- b) GIS- What is GIS, Components of GIS, Data base management systems, Raster and vector data
- c) Applications of remotely sensed data using GPS & GIS

**B) Field Geology (9 Lectures)**

- a) Literature review
- b) Toposheets and other tools for base map preparation
- c) Aims, objectives of **fieldwork**, reconnaissance survey
- d) Study of rock outcrops
- e) Determination of attitude of beds, Field correlation
- f) Recording observations in Igneous, Sedimentary and Metamorphic terrain
- g) Instruments used in the field and their proper utilization
- h) Sketching the field area, collection of selective rock/mineral samples, preparing sketches, taking photographs
- i) Traverse mapping
- j) Preparation of **field report**

**REFERENCE BOOKS –**

- 1) Manual of Field Geology : Compton R.J
- 2) Field Geology : Lahee
- 3) Remote Sensing and Image Interpretation : Kiefer & Lillesand
- 4) Principles and Applications of Photogeology : Pandey S.N.
- 5) Remote Sensing: Principles and Applications : Sabins F.F.
- 6) Remote Sensing & GIS : B. Bhatta
- 7) An Introduction to Geographical Information Systems : Ian Heywood e.tal.
- 8) Remote Sensing of the Environment. An earth resource perspective : by John R. Jenson (2003)
- 9) Introduction to Geographical Information Systems : Kang-tsung Chang (2002)
- 10) Geomorphology: Thornburry
- 11) Concepts of Geomorphology: Gupta and Kale
- 12) Photogeology: Gupta
- 13) Landforms and Tectonics: Olier

**GL – 341: Metamorphic Petrology:**

**UNIT I) Introduction to Metamorphism: 12 Lectures**

- A) Introduction, Definition & Characteristics.
- B) Domain of metamorphism
- C) Metamorphic recrystallization as distinct from igneous crystallization
- D) The concept of metamorphic facies: Diagrammatic representation of pressure temperature conditions (with depth) of the different facies of contact, regional & Plutonic metamorphism
- E) Introduction to mineralogical phase rule- system, component and phase
- F) Introduction to phase diagrams of metamorphic rocks- ACF, A'KF and AFM diagrams

**Unit II) Types of metamorphism I 12 Lectures**

**A) Thermal Metamorphism (6 Lectures)**

- a) Definition & General characteristics of the sub types of thermal metamorphism
- b) Factors controlling Thermal metamorphism
- c) Attainment of Chemical equilibrium
- d) Chemically active fluids in heat dominant metamorphism
- e) Aureoles of Thermal metamorphism
- f) Effects of thermal metamorphism on :
  - i) Igneous rocks (Intermediate & basic)
  - ii) Aluminous & ferruginous deposits
  - iii) Non – calcareous argillaceous sediments

**B) Dynamic/ Cataclastic metamorphism: (6 Lectures)**

- a) Definition & General characteristics
- b) Rock deformation involved
- c) Stress & metamorphic chemical reactions
- d) Stress & solubility of minerals
- e) Mechanics of the formation of slaty cleavages
- f) Strain & solution effects in the crystalline rocks
- g) Mineralogical changes in cleaved & crystallized rocks.

**Unit III) Types of metamorphism II 12 Lectures**

**A) Regional Metamorphism & its products (7 Lectures)**

- a) Definition & general characteristics of the sub types of regional metamorphism
- b) Depth zones & characteristic minerals
- c) Diagrammatic representation of the conditions controlling metamorphism
- d) Barrovian zones of regional metamorphism.
- e) Development of textures & structures of regionally metamorphosed rocks
- f) Crystal growth under stress
- g) Effects of regional metamorphism:
  - i. Argillaceous (Non – calcareous) sediments – (Barrovian zones)
  - ii. Ferruginous & aluminous sediments
  - iii. Calcareous sediments
  - iv. Igneous ( acidic & basic)

**B) Plutonic metamorphism (2 Lectures)**

- a) Definition & General characteristics
- b) Formation of Granulites, Charnockites & Eclogites

**C) Pneumatolysis / Metasomatism (3 Lectures)**

- a) Definition & General characteristics of the various types of metasomatism
- b) Pneumatolytic processes – Tourmalinisation, Greissening, Scapolitisation & Autometasomatism

#### **UNIT IV) Metamorphic texture & structure**

**12 Lectures**

- A) Residual structures & textures.
- B) Metamorphic reconstitution (Limit set to diffusion)
- C) Characteristics of crystal growth in the solid state.
- D) Significance of inclusions in metamorphic crystals
- E) Forces of crystallization & the concept of the crystalloblastic series
- F) Common habits of metamorphic crystals.
- G) Diagnostic structures of thermally metamorphosed rocks.
- H) Diagnostic structures of cataclastically metamorphosed rocks
- I) Diagnostic structures of regionally metamorphosed rocks & their development-  
foliations, schistosity, gneissosity & cleavage
- J) Textures & structures formed due to metasomatism

#### **REFERENCE BOOKS -**

- 1) Igneous & Metamorphic petrology : by Myron Best
- 2) Principles of Petrology : by G.W. Tyrell
- 3) Igneous, Metamorphic & Sedimentary petrology : by Ehler & Blatt
- 4) Igneous & Metamorphic petrology : by Turner & Verhoogen.
- 5) Metamorphism : by Alfred Harker.
- 6) Principles of Igneous and Metamorphic Petrology: John D. Winter
- 7) Principles of metamorphic petrology by Vernon and Clarke, 2008
- 8) Petrology of metamorphic rocks, Roger Mason

## GL-342: Environmental Geology

### **Unit I) Concept, Objective and Scope of Environmental Geology: 12 lectures**

- A) Seven concepts, Objectives, and Scope of Environmental Geology; Physical, Biological, and Socio-geological Environment, Bio-geochemical cycles. (4 lectures)**
- B) Deterioration of land surface: Dimensions of Erosion, processes, causes of accelerated erosion, remedial measures. (2 lectures)**
- C) Desertification and degradation of land: meaning, extent, causes and preventive measures. (4 lectures)**
- D) Soil conservation, badland topography, alkalinity and salinity of soils (2 lectures)**

### **Unit II) Natural Hazard and Mitigation: I 12 lectures**

- A) Natural hazards:** Definition, type, Natural hazard zones and Impact assessment, Natural hazard zonation maps, Role of Geologists in disaster management plan  
**(2 lectures)**
- B) Distinction between:** hazard and disaster (with examples), local and regional context, disaster profile of India  
**(1 lecture)**
- C) Earthquakes:** Introduction, general characteristics, effects of disaster on human life and habitation, origin and severity of earthquakes, precursors (instrumental and natural), vulnerability, seismic zones of India, Impact assessment and mitigation measures  
**(3 lectures)**
- D) Volcanoes:** Introduction, types of volcanic activity and their origin, distribution, hazards, effects (lava flows, pyroclastic activity, toxic gases, mud flows, fires), Prediction and mitigation measures  
**(3 lectures)**
- E) Mass movement:** Introduction, causes and types of mass movements, Identification of landslides zones, control measures, avalanches and their causes, mitigation and concept of safety factor  
**(3 lectures)**

### **Unit III: Natural Hazard and Mitigation: II : 12 lectures**

- A) Floods:** Introduction, definition, classification, causative factors, vulnerability, predictability (forecasting), mitigation measures, flood hazards in India  
**(3 lectures)**
- B) Coastal hazards:** Introduction, causes and impacts of coastal erosion, tsunami, storms and their predictability and mitigation measures  
**(3 lectures)**
- C) Mining hazards:** Types of mining hazards and restoration techniques  
**(3 lectures)**
- D) Subsidence of land:** Causes of subsidence of land, prediction and mitigation measures  
**(3 lectures)**

**Unit IV: Crises, Conservation of natural resources and pollution: 12 lectures**

**A)** Classification and types of natural resources (renewable and non-renewable, conservation and development of natural resources, Crises faced by mankind with regards to conventional and non-conventional energy resources **(2 lectures)**

**B) Pollution:**

a) **Water Pollution:** Sources of water pollution (natural and man-made), Case histories related to water pollution: Minamata disease (Japan), Arsenic poisoning (West Bengal), and Fluorosis (Bhandara) **(3 lectures)**

b) **Soil Pollution:** Sources of soil pollution (use of pesticides, fertilizers, industrial domestic water, and their effects) **(2 lectures)**

c) **Air pollution:** Sources of air pollution, (aerosols, particulate matters in urban and industrial area), case histories: Chernobyl disaster and Bhopal gas disaster **(2 lectures)**

**C) Solid waste disposal:** Solid waste disposal methods (deep well disposal, ocean dumping, hazardous chemical wastes), its effects with geological perspective **(3 lectures)**

**REFERENCE BOOKS -**

1. Environmental Geology : By K.S. Valdiya
2. Environmental Geology : by E.A. Keller (Latest Edition)
3. Mining & Environment : by Bharat B. Dhar
4. Mineral Economics : by Sinha R.K.
5. Geology in Environmental planning : by A.D. Howard.

## GL-343 : Economic Geology

### **Unit I) Basics of Economic Geology & Primary processes of formation of mineral deposits: 12 Lectures**

#### **A) Introduction: (2 Lectures)**

- a) Definition of ore minerals, gangue, tenor, overburden, country rock, syngenetic & epigenetic deposits
- b) Classification of economically important metalliferous & non metalliferous mineral deposits
- c) Processes of formation of mineral deposits

#### **B) Magmatic Concentration: (3 Lectures)**

- a) Early magmatic deposits
- b) Late magmatic deposits

#### **C) Hydrothermal processes: (7 Lectures)**

- a) Principles of hydrothermal processes, characters of solutions, types of openings in rocks, factors affecting deposition from hydrothermal solution, wall rock alterations.
- b) Types of hydrothermal deposits (Cavity filling & Metasomatic replacements)  
Cavity filling deposits:
  - i) Processes & characteristic features
  - ii) 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
- c) Metasomatic replacement: Definition, Criteria of replacement & resulting mineral deposits

### **Unit II) Secondary processes of formation of mineral deposits: 12 Lectures**

#### **A) Oxidation & Supergene enrichment: (6 Lectures)**

- 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:
  - i) Requirements for supergene enrichment
  - ii) Factors influencing supergene enrichment
  - iii) Recognition of supergene enrichment

#### **B) Evaporation, Residual concentration & Mechanical concentration: (6 Lectures)**

- a) **Evaporation:**
  - i) Process of mineral formation by evaporation
  - ii) Evaporation deposits: Brief account of deposits of oceanic water, lake water, ground water & hot springs
- b) **Residual concentration (residual deposits):**
  - i) Conditions favouring of residual deposits
  - ii) Brief account of residual deposits: Bauxite, clay & iron formation
- c) **Mechanical concentration (placer deposits):**

- i) Principles involved in the process of mechanical concentration
- ii) Study of placer deposits: Eluvial, Alluvial, Beach & Aeolian

**Unit III) Metallic & Radioactive deposits of India**

**12 Lectures**

**A) Study of following metallic deposits with reference to mineralogy, properties, uses & their geological & geographical distribution (8 Lectures)**

- i) Precious metals : Gold, Silver.
- ii) Non-ferrous metals : Copper, Lead, Zinc & Aluminium
- iii) Iron & Ferro alloy metals – Iron, Manganese, Nickel & Chromium
- iv) Polymetallic Nodules

**B) Plate tectonics & mineral deposits: (1 Lecture)**

Mineral deposits associated with different plate boundaries

**C) Radioactive minerals: (3 Lectures)**

Study of Uranium & Thorium deposits of India with reference to mineralogy, mode of occurrence, properties, uses & their geological & geographical distribution

**Unit IV] Fossil Fuels:**

**12 Lectures**

**A) Petroleum & Natural Gas: Origin & Entrapment, Types of traps, Formation of oil & gas pools, Surface indicators, description of oil fields in India (Cambay, Assam, Bombay High & Krishna Godavari Basins) (6 Lectures)**

**B) Coal: Origin, mode of occurrence, types of coal, Important Indian occurrences. (4 Lectures)**

**C) Introduction to coal bed methane, Shale gas & Gas hydrates. (2 Lectures)**

**REFERENCE BOOKS-**

- |   |                              |
|---|------------------------------|
| 1. Economic mineral deposits                  | :by Bateman                  |
| 2. Ore deposits of India                      | :by Gokhale & Rao            |
| 3. India's Mineral Resources                  | :by Krishnaswami             |
| 4. India's Minerals                           | :by D.N Wadia                |
| 5. Industrial Minerals                        | :by Deb.                     |
| 6. Geology Of the industrial rocks & minerals | :by Rober L.Bates            |
| 7. Economic Geology                           | :by Umeshwar Prasad          |
| 8. Geology of Petroleum                       | :by A.I. Levorsen            |
| 9. Economic mineral deposits of India         | :by Umate (IBM)              |
| 10. Elements of Petroleum geology             | :by R.C. Selly (2002)        |
| 11. Economic Ore Deposits                     | :by Park & Mc-dermitt (1997) |



## GL: 344-Geotectonics

### **Unit I) Introduction to Geodynamics 12 Lectures**

#### **A) Evolution & formation of the solar system & earth & its physical properties (2 Lectures)**

- a) Formation and evolution of solar system
- b) Meteorites- Types, Origin

#### **B) Interior of the Earth: (10 Lectures)**

- a) Direct & indirect observations in exploration of Earth's interior
  - i) The variable interior- evidences:
  - ii) Seismic waves & Earth's interior:- Types of seismic waves & their characteristics, Seismic wave velocity & depth curve to indicate layered structure of the Earth
- b) Physical-chemical characteristics of the different layers of the Interior of the earth
  - i) Composition, physical properties & characteristics of three spherical zones of the Earth namely crust, mantle (including LVZ) & core
  - ii) Concept of Lithosphere, Asthenosphere & Mesosphere
  - iii) Concept & types of discontinuities –Conrad, Moho, Guttenberg & Lehman's Discontinuity
  - iv) Introduction to Convection Currents & mantle dynamics

### **Unit II) Global tectonics I – Geomagnetism & Introduction to Plate Tectonics**

**12 Lectures**

#### **A) Introduction to Palaeomagnetism (5 Lectures)**

- a) Earth's Magnetic field & Geodynamo
- b) Remnant magnetisation – TRM, DRM, CRM, VRM.
- c) Concept of Polar wandering & its application in plate – tectonics, Apparent & True Polar wandering paths ( with example)
- d) Magnetic anomalies & sea floor Spreading- Mechanics & applications
- e) Magnetic reversal & geomagnetic time scale.

#### **B) Plate Tectonics (7 Lectures)**

- a) Historical background of the plate tectonics theory, Plate tectonics as a unifying theory
- b) Introduction to Wilson's cycle & Concept of plate tectonics
- c) Characteristics of lithospheric plates
- d) Concept of plate margin & plate boundary
- e) Migration & motion of the plate boundaries
- f) Present motion of world's large plates

### **Unit III) Global tectonics II- Plate Tectonics II**

**12 Lectures**

#### **A) Three plate boundaries- (Divergent, Convergent & Transform faults-description & examples). (7 Lectures)**

##### **a) Divergent plate boundary**

- i) Divergent boundary as a constructive plate boundary & source of new oceanic crust
- ii) Concept of a rift valley & mid-oceanic ridges
- iii) Structural environment at divergent plate boundary
- iv) Examples of divergent plate boundary

##### **b) Convergent boundary as a destructive plate boundary :**

Description & examples of the following types of convergent plate boundaries:

- i) Oceanic-oceanic subduction.
- ii) Oceanic-continental subduction
- iii) Continent-continent collision- case study of Alpine- Himalyan Orogeny
- iv) Concept of trench, subduction zone, Benioff zone & Ophiolite suites

- c) **Transform fault boundary**
  - i) Transform fault boundary as conservative plate boundary-
  - ii) Distinction between Transform & Transcurrent faults
  - iii) Examples of Transform fault boundary
- d) **Assumptions & problems in plate tectonics** (1 Lecture)
- e) **Concept of triple junctions with their examples** (1 Lecture)
- f) **Basin tectonics – Introduction to fore arc, back arc, foreland & rift basins.** (1 Lecture)
- g) **Concept of hot plumes & hot spots with examples** (1 Lecture)
- h) **Overview of Phanerozoic Tectonics- Spatial and Temporal evolution of palaeo supercontinents to present continents.** (1 Lecture)

**Unit IV) Global Tectonics III- Origin of Mountains and Introduction to Archaean and Neotectonics** **12 Lectures**

- A) Origin of mountains** (4 Lectures)
  - a) Plate tectonic model
  - b) Deformation of sedimentary basins,
  - c) Plutonism & metamorphism
  - d) Orogenies in space & time
- B) Introduction to Archaean Tectonics** (4 Lectures)
  - a) Early crustal evolution of the earth and Introduction to concepts of Cratons, Shields, Platform, Mobile belt with suitable Indian examples.
  - b) Difference between Orogenic Belts and Mobile Belts
- C) Introduction to Neotectonics** (2 Lectures)
- D) Brief overview of Tectonic Evolution of India** (2 Lectures)

**REFERENCE BOOKS -**

1. General Geology : V. Radhakrishnan
2. Plate tectonics and Crustal evolution : Condie
3. Aspects of Tectonics : Valdiya K. S.
4. Tectonics : Moore and Twiss
5. Introducing Tectonics, Rock Structures and Mountain Belts by Graham Park
6. Geotectonics : V. V. Belousov
7. Physical Geology : Arthur Holmes
8. Global Tectonics : Keray P and Vine F.J
9. Our evolving planet : Bergen, Alma Mater Fortag
10. Dynamic Himalaya : Valdiya K. S.
11. Geomorphology and Global Tectonics : Summerfield M. A.
12. Cratons and Fold belts of India: Ram S. Sharma
13. Global Tectonics: Kerry, Klepeis, Vine
14. Planetary Tectonics- Edited by Thomas R. Watters and Richard A. Schultz
15. Plate Tectonics: Continental Drift and Mountain Building by Frisch, Meschede and Blackey
16. Paleomagnetism: Continents and Oceans by McElhinny and McFadden
17. Essentials of Paleomagnetism by Lisa Tauxe, 2010
18. PALEOMAGNETISM: Magnetic Domains to Geologic Terranes By Robert F. Butler, (1992)

**GL – 345: Phanerozoic Stratigraphy of India and Palaeontology**

**Unit I) Introduction to Phanerozoic Stratigraphy: 12 Lectures**

**A) Precambrian – Cambrian boundary**

**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

**Unit II) The Paleozoic and Mesozoic Formations of Peninsular India: 12 Lectures**

**A) Palaeozoic Formations of Peninsular India**

- a) A brief history of the Paleozoic Formations,
- b) Gondwana Supergroup: 1. Geographical distribution, 2. Stratigraphic classification- bipartite and tripartite, 3. Lithology, 4. Age, 5. Palaeoclimatic conditions, 6. Flora, 7. Fauna, 8. Igneous activity, 9. Marine intercalations, 10. Economic importance.

**B) The Mesozoic Formations of Peninsular India:**

- a) A brief history of the Mesozoic formations.
- b) Jurassic of Kachchh
- c) Cretaceous of Narmada Valley/Bagh beds.
- d) Cretaceous of Cauvery basin.

**Unit III) Cenozoic Formations of Peninsular India and Geology of Maharashtra**

**12 Lectures**

**A) The Deccan Volcanic Province :** Distribution, extent, age, structure, mode of eruption and occurrence, Petrological characters and variations, Lithostratigraphic classification, Infra trapeans and Intertrappean beds.

**B) The Cenozoic Formations of Peninsular India:**

- a) Tertiary of Assam
- b) Tertiary of the K-G basin
- c) Tertiary formations along the West Coast.
- C) Laterites: Definition, Origin, Types and distribution.
- D) The Geology and Stratigraphy of Maharashtra

**Unit 4. The Phanerozoic Stratigraphy of Extra-Peninsular India and Palaeontology:**

**12 Lectures**

**A) The Phanerozoic Stratigraphy of Extra-Peninsular India:**

Classification, lithological succession and fossil content of the:

- a) Spiti area b) Siwaliks c) Karewas

**B) Palaeontology:**

- a) Morphology, Classification & distribution of Graptolites.
- b) Mass extinction, causes, evidence, five major mass extinctions.
- c) Palaeobotany: Definition, Conditions and different modes of preservation of plants through the geological ages.

Study of following genera with respect to their classification, generic definition, characteristic and distribution – Ptillophyllum, Glossopteris, Gangamopteris, Vertebraria, Elatocladus, Equisetales, Cladophlebis, Brachyphyllum and Gleichenites.

### **REFERENCE BOOKS -**

- 1 Evolutionary trends in Invertebrates Swinnerton
- 2 Microfossils Brassier
- 3 Invertebrate Palaeontology Clarkson
- 4 Micropaleontology Daniel Jones
- 5 Paleobotany Arnold
- 6 Geology and Evolution of the Indian Plate S.M. Naqvi
- 7 Invertebrate Palaeontology M.A.Koregave
- 8 Geology of Maharashtra: Geological Society of India  
Special Publication  
G.G. Deshpande
- 9 Geology of Western & Central India: Geological Society of  
India  
Special Publication
- 10 Stratigraphy of Lesser Himalaya by K. S. Valdiya
- 11 A Geological Time Scale Brian Harland et.al
- 12 Stratigraphy of India and Burma M. S. Krishnan
- 13 Fundamentals of Historical Geology & Stratigraphy of India Ravindra Kumar
- 14 Geology of India Vol 1 &2. Ramkrishna-Vaidhyanathan: : Geological Society of India  
Special Publication

## GL: 346-Applied Geology II (Engineering Geology, Geohydrology & Prospecting)

### **UNIT I) Engineering Properties Of Construction Material**

**12 Lectures**

#### **A) Introduction:**

Significance of geology in Civil engineering, knowledge of geomorphology, petrology, mineralogy, stratigraphy, photo geology and structural geology as applied to Civil engineering projects.

#### **B) Engineering properties of rocks:** Specific gravity, porosity, sorption, strength of rocks (Compressive, shear & tensile), elasticity of rocks, residual and shear stresses in rocks. Hardness test and Impact test for aggregates in brief.

#### **C) Rocks as Construction Material:** How are they obtained in nature? Use of rocks as facing stone. Factors influencing engineering usefulness of the rocks.

#### **D) Use of rocks as an aggregate:** Use of rocks as an aggregate in different types of constructions, source of different grades of aggregates, Properties of aggregates (shape, size, surface texture, roundness and coatings), cement aggregates reaction, thermal effects on aggregates. Types of aggregates (Highway, railway ballast and runway).

### **UNIT II) Geological And Geotechnical Investigations For Civil Engineering Projects**

**12 Lectures**

#### **A) Tunnels:**

Terminology, geological conditions for tunnel sites, tunnel in bedded rocks and folded rocks, influence of divisional planes, effects of faults and crushed zones. Tunnels in the vicinity of slopes. Role of groundwater in tunnelling. Tunnels in the Deccan Traps. Names and locations of at least six very important tunnels in India, Case study: Jawahar Tunnel

#### **B) Dams and Reservoirs:**

Geological conditions for the selection of dam and reservoir sites, terminology associated with dams. Types of dams (Gravity, buttress, arch and earthen), types of spillways. Location with type of all the important dams and hydroelectric projects in India.

Case study: Sardar Sarovar Dam

#### **C) Road and Railways**

### **Unit III: Geohydrology**

**12 Lectures**

#### **A) Introduction:**

- a) Definition- Hydrology, Geo-hydrology, Hydrogeology.
- b) Scope & groundwater development in India.
- c) Vertical distribution of groundwater, Origin & rock properties affecting groundwater (porosity, permeability, their types & effects)

#### **B) Aquifers, Darcy's law, Groundwater distribution & fluctuations:**

- a) Geologic formations as aquifers.
- b) Types of aquifers (Confined, Unconfined, and Perched).
- c) Groundwater movement (Darcy's law).
- d) Groundwater fluctuations due to seasonal changes, stream-flow changes, evapo-transpiration changes.
- e) Springs (cold & hot), conditions for formation of springs.
- f) Factors controlling groundwater distribution (topography, climate, structural, geological, proximity of tanks, rivers etc.)

#### **C) Groundwater recharge methods:**

- a) Introduction to artificial recharge methods.
- b) Types of recharge methods: -
  - i) Water spreading methods (Flooding, Basin, Ditch & furrow, Natural channel, Irrigation).
  - ii) Recharge through Pits & Shafts, Recharge through wells.

- iii) Rain water harvesting.
- iv) Groundwater recharge methods in Maharashtra (bore-blast & jacket-well techniques).

#### **Unit IV) Prospecting And Mining Geology**

**12 Lectures**

##### **A) Objectives, stages & types of prospecting.**

##### **B) Geological Prospecting:**

- a) Geological Criteria: Climatic, Stratigraphic, Lithological, Structural, Geochemical, - Magmagenic and - Geomorphological.
- b) Physiographic Guides: Topographic expressions, Physiographic environment of the ore deposits, physiography in relation to oxidation & environment.
- c) Mineralogical Guides: Rock alteration, Target rings of mineral distribution, Significance of accessory & gangue minerals. iv) Stratigraphic & lithologic guides for Syngenetic & Epigenetic deposits, Fracture pattern as guides, Contacts & folds as guides

##### **C) Broad outline of geophysical prospecting:**

Principles and applications of following geophysical methods along with their measured parameters, operative physical properties and names of the instruments used.

- i) Electrical (S.P. & Resistivity)
- ii) Magnetic
- iii) Gravity
- iv) Seismic refraction.

**D) Mining Geology:** Definition, Sampling, Mining methods – opencast and underground with two examples ( Mansar and Zawar underground Mine; Panna and Umred opencast Mine.

##### **REFERENCE BOOKS -**

- 1) Principles of Geophysical Prospecting : M.B. Ramchandran
- 2) Geophysical Prospecting : Dobrin
- 3) Ground water Hydrology : Todd
- 4) Ground water : H.M. Raghunathan
- 5) Principles of Engineering Geology : Krynine & Judd
- 6) Engineering Geology : Parbin Singh
- 7) Fundamentals of Engineering Geology: R. S. Khurami
- 8) Mining Geology: Arogya Swami
- 9) Groundwater : Freeze and Cherry

**GL – 347: Practical I**  
**Mineralogy and Petrology**

- Unit I) Mineralogy & Igneous Petrology** **5 Practicals**
- A) Mineralogy**
- a) Megascopic Mineralogy** **(1 Practical)**  
Identification and the study of the following minerals with reference to physical properties and geological occurrence  
Diopside, Mesolite, Andalusite, Albite, Phlogopite, Garnet, limonite, dolomite, halite, olivine, hornblende, augite, kaolinite **(any 10)**
- b) Microscopic mineralogy** **(1 Practical)**  
Identification and the study of the following minerals with reference to optical properties:  
Glaucofane, glauconite, staurolite, zircon, apatite, aegerine, hornblende, garnet, biotite, augite, plagioclase, microcline, olivine, chlorite **(any 10)**
- c) Mineral Optics** **(1 Practical)**  
a) Comparison of R.I of mineral / mounting medium using Becke line method  
b) Study of accessory plates: Quartz wedge, gypsum and mica plate  
c) Sign of elongation of minerals.
- B) Igneous Petrology**
- a) Description, genesis and significance of the following microscopic textures and structures** **(2 Practicals)**  
Granitic, porphyritic (intergranular/ intersertal, poikilitic, ophitic and sub-ophitic), graphic, glassy, flow, serrate, vitrophyric, microlitic, spherulitic, orbicular, reaction rims, expansion cracks, spinifex, perlitic cracks, myrmekitic **(any 8)**
- Unit II) Igneous Petrology** **5 Practicals**
- A) Description, genesis and significance of the following megascopic textures and structures** **(1 Practical)**  
Granitic, porphyritic, graphic, ropy, glassy, columnar, vesicular/ amygdaloidal.
- B) Megascopic igneous petrology** **(2 Practicals)**  
Study of the following megascopic igneous rocks with regard to their texture, mineral composition, colour index, identification and classification:  
Varieties of gabbro (anorthosite, troctolite, norite), felsites, peridotite, lamprophyre, serpentinite, varieties of basalt, carbonatite, granite, rhyolite. **(any 10)**
- C) Microscopic igneous petrology** **(2 Practicals)**  
Study of the following megascopic igneous rocks with regard to their texture, mineral composition, identification and classification:  
Norite, troctolite, anorthosite, peridotite lamprophyre, olivine basalt, granite, carbonatite, rhyolite, andesite **(any 8)**
- Unit III) Igneous Petrology & Sedimentology** **5 Practicals**
- A) Igneous Petrology** **(1 Practical)**  
**Problems related to CIPW Norm calculation for silica saturated igneous rocks**  
**(3 problems)**
- B) Sedimentology**
- a) Study of Megascopic sedimentary rocks** with regard to their texture / structure, mineral composition, identification, classification and sedimentological significance:  
Laterite, bauxite, Conglomerate, breccias, grit, arkose, speckled sandstone, sandstone with dendritic markings, ferruginous and carbonaceous shale, limestone (Chemical and Organic), calc-tuffa. **(2 Practicals)**
- b) Thin section study of the following sedimentary rocks:** Sandstone, arkose, greywacke, nummulitic and oolitic limestones, varieties of limestones with micrites and sparites. **(any 8)** **(1 Practical)**

**c) Interpretation of the sedimentary structures giving their geological significance:**

Sandstone showing parallel bedding, cross bedding, graded bedding, ripple marks, Mud / sun cracks, laminations, tracks and trails, Ball & Pillow, Flame, Load cast, Flute marks **(any 7)** **(1 Practical)**

**Unit IV) Metamorphic Petrology**

**5 Practicals**

**A) Study of the following metamorphic megascopic rocks with regard to their texture / structure, mineral composition, colour, type of metamorphism, grade facies and the original rocks** **(2 Practicals)**

Slate, phyllite, chlorite schist, mica(Biotite) schist, hornblende schist, staurolite schist, Kyanite schist, talc – tremolite schists, mica gneiss, hornblende gneiss, sillimanite gneiss, augen gneiss, eclogite, charnockite, fuschite quartzite, banded haematite quartzite, marbles (White, Pink, Black, Green and dolomite varieties), schorl, skarn. **(any 8)**

**B) Study of the thin sections of the following metamorphic rocks with regard to their / structure, mineral composition, colour, type of metamorphism, grade, facies and the original rock** **(2 Practicals)**

Chiastolite slate, chlorite schist, staurolite schist, kyanite schist, mica gneiss, sillimanite gneiss, augen gneiss, eclogite, charnockite, khondalite, banded haematite quartzite. **(any 8)**

**C) Plotting of Chemical Composition of Metamorphic rocks on ACF diagrams.** **(3 problems)** **(1 Practical)**



**GL348: Practical II**  
**Structural Geology, Economic Geology, Palaeontology & Indian Stratigraphy**

**Unit I) Geological maps: (At least 8 maps) 5 practicals**  
Description of topography & geology of the map. Drawing vertical section of the map along given direction.

**(Note:** Geological maps should contain different topographic patterns & all possible structural complexities like unconformity, vertical / inclined faults (strike /dip /oblique), vertical/ inclined dykes, lava flows, sills & symmetrical non-plunging folds.)

**Unit II) Geological maps, Economic Geology & Precambrian Stratigraphy of India**

**A) Completion of outcrops: (At least 10 maps) 5 practicals (3 practicals)**

Completion of an outcrop with the help of given topographic & lithological data

**Note:** One junction line may be partly shown or location of one junction line at three noncollinear

points may be given along with geologic / stratigraphic column. Such maps should also contain different topographic patterns & structural complexities like unconformity, vertical faults (strike /dip).

**B) Economic Geology (1 practical)**

**a) Megascopic**

**Ore minerals-** To study at least 10 selected ore minerals

**Industrial minerals-** - To study at least 10 selected industrial minerals.

**b) Preparation of an ore mineral map of India for the following:**

Fe, Mn, Cr, Cu, Pb, Zn & Al.

**C) Precambrian Stratigraphy of India (1practical)**

**Preparation of maps showing geographical distribution of the following stratigraphic units of India:**

- a. Dharwar Supergroup,
- b. Orissa – Singhbhum belt,
- c. Aravalli Supergroup
- d. Cuddapah Supergroup,
- e. Vindhyan Supergroup,

**Unit III- Structural problems 5 practicals**

**A) Graphical problems-(To be solved by using method of descriptive geometry)**

**Type I)**

Hill slope, attitude of the exposures of top & bottom of the bed on the hill slope along with true thickness of the bed given, finding out true dip direction, true dip amount & other geometrical parameters of the bed. With comment on normal or overturned bed.

**Type II) Problems involving a single planar feature containing a linear feature:**

**a)** Attitude of planar feature along with the bearing of a linear feature contained in it given, finding out plunge & rake of a linear feature in the given planar feature.

**b)** Attitude of a planar feature along with rake of a linear feature contained in it given, finding out bearing & plunge of the linear feature.

**Type III)**

Problems involving intersection of two planar features whose attitude readings are taken at the same elevation and to find out the bearing and plunge of the line of intersection and the

rake of the line of intersection in both the planar features.

**Type IV)**

Three point problems:-

Drill hole data for a hidden planar feature at three non-collinear points given in the form of

location, elevation & absolute depth of planar feature, finding out strike, true dip direction & true dip amount of the planar feature. Also determining one of the three parameters (location, elevation & absolute depth) where the other two parameters are known.

**UNIT IV) Stereographic Problems, Phanerozoic stratigraphy of India & Palaeobotany**  
**5 practicals**

**A) Stereographic Problems, (To be solved by using stereographic net)**  
**(3 practicals)**

**Type I) Problems involving strike, true & apparent dip of a bed**

**a)** Strike & true dip of the bed given, finding out apparent dip amount of the bed in the given apparent dip direction.

**b)** Strike & true dip of the bed given, finding out apparent dip directions for the given apparent dip amount.

**c)** Apparent dip amount of the bed in two different apparent dip directions given, finding out strike direction, true dip direction & true dip amount of the bed.

**Type II) Problems involving a single planar feature containing a linear feature.**

**Types (a,b) are same as types (a,b) from the graphical problems respectively.**

**Type III) Problems involving two intersecting planar features- Same as type III from graphical problems.**

**Type IV) Stereographic projections of the following types of folds-**

- i) Upright fold ii) Recumbent fold iii) Inverted fold iv) Reclined fold v) Inclined fold
- vi) Plunging fold

**B) Phanerozoic Indian Stratigraphy:**

**Preparation of maps showing geographical distribution of the following stratigraphic units of India**  
**(1 practical)**

- a. Palaeozoic of Spiti
- b. Gondawana Supergroup,
- c. Jurassic of Kachchh, Cretaceous of Trichinopoly, Bagh Beds,
- d. Deccan Traps,
- e. Siwaliks,
- f. Tertiaries.

**C) Palaeobotany:** **(1 practical)**

**Generic definition, geological & geographic distribution of the following plant genera (any 5):**

Glossopteris, Gangamopteris, Pterophyllum, Ptilophyllum, Vertebraria, Equisetales, Cladophlebis, Gleicherites, Elatocladus, Brachyphyllum

**GL – 349: Practical – III**

**Remote Sensing, Geohydrology, Environmental Geology, Geophysical Prospecting & Field Geology:**

- Unit I) Geomorphology and Satellite Imagery interpretation: 5 Practicals**
- A) Drainage Basin Analysis: Stream ordering by Strahler method and calculation of Bifurcation Ratio, Area of basin and stream frequency **(2 practicals)**
  - B) Visual interpretation of false colour composite (FCC) OR B/W satellite imageries: Identification of the lithology, structures, vegetation (Crops & forest cover), Land use and drainage patterns **(1 practical)**
  - C) Tracing of the drainage of an area with the on satellite imageries and identification of its type **(1 practical)**
  - D) Tracing of lineaments from satellite imageries and its analysis **(1 practical)**
- Unit II) Photogeology and Soil Analysis: 5 Practicals**
- A) Problems related to:  
Scale of aerial photographs & relief displacement – Type A to D **(1 practical)**
  - B) Problems related to:  
Scale of aerial photographs & relief displacement – Type E and mixed type **(1 practical)**
  - C) To identify geomorphology of an area from aerial photographs **(1 practical)**
  - D) Lithological & structural interpretation of aerial photographs **(1 practical)**
  - E) Textural classification of soil based on sand, silt and clay fractions **(1 practical)**
- Unit III) Engineering Geology and Hydrogeology 5 Practicals**
- A) Engineering problems in the form of maps with respect to tunnel and dam site- **(2 practicals)**
  - B) Preparation of hydrographs from given waterlevel data **(1 practical)**
  - C) Preparation of water table contour maps from given waterlevel data **(1 practical)**
  - D) To find Water Quality Index **(1 practical)**
- Unit IV) Environmental Geology, Prospecting and Field Geology 5 Practicals**
- A) Preparation of Hazard zonation maps for India and World **(1 practical)**
  - B) Problems related to Resistivity data (VES) for location of bore /dug well **(2 practicals)**
  - C) Field work for about two weeks, in an area of geological interest anywhere in India. Systematic collection of geological samples, data collection & preparation of geological field report **(2 practicals)**

**UNIVERSITY OF PUNE, PUNE.**

**Syllabus for F.Y.B.Sc**

**Subject: MATHEMATICS**

(With effect from June 2013)

**Introduction:**

University of Pune has decided to change the syllabi of various faculties from June,2013. 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 University of Pune 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.
- 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.

**Eligibility:** 12<sup>th</sup> science with mathematics or equivalent examination.

**Structure of the course:**

Sr. No.	Paper	Theory	Oral	Internal	Total
1	MT 101 (Algebra and Geometry )	80 Marks	-	20 Marks	100 Marks
2	MT 102 (Calculus and Differential equations )	80 Marks	-	20 Marks	100 Marks
3	MT 103 (Mathematics Practicals )	72 Marks	08 Marks	20 Marks	100 Marks

All 3 above courses are compulsory.

**Medium of Instruction:** English

**Examination:**

**A) Pattern of examination:** Annual.

**B) Standard of passing** : 40 Marks out of 100 marks for each papers.

But for MT 101 and MT 102 for passing a student should obtain minimum 32 marks out of 80 in the theory examination and overall total marks for theory and internal should be minimum 40.

**C)Pattern of question papers:** For MT 101 and MT 102

Q1. Attempt any 08 out of 10 questions each of 02 marks. [16 Marks]  
(05 questions from each term)

Q2. Attempt any 04 out of 06 questions each of 04 marks. [16 Marks].  
(Based on term I)

Q.3. Attempt any 02 out of 03 questions each of 08 marks. [16 Marks].  
(Based on term I)

Q4. Attempt any 04 out of 06 questions each of 04 marks. [16 Marks].  
(Based on term II)

Q.5. Attempt any 02 out of 03 questions each of 08 marks. [16 Marks].  
(Based on term II)

The pattern of question paper for MT 103 is given in the detailed syllabus.

**D) External Students:** Not allowed.

**E)Verification/Revaluation:** Allowed for MT 101,MT 102.

**Equivalence of Previous syllabus along with new syllabus:**

Sr.No	New Courses	Old Courses
1	MT 101 (Algebra and Geometry )	Paper I (Algebra and Geometry )
2	MT 102 (Calculus and Differential equations )	Paper II (Calculus )
3	MT 103 (Mathematics Practicals )	Paper III (Mathematics Practicals )

**Qualifications for Teacher:** M.Sc. Mathematics (with NET /SET as per existing rules)

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## Details of Syllabus:

### MT 101: Algebra & Geometry

#### FIRST TERM (Algebra)

##### Unit 01: Integers

15 Lectures

1.1 Well Ordering Principle for  $\mathbb{N}$ . Principle of Mathematical induction (strong form).

1.2 Divisibility in  $\mathbb{Z}$ : Definition and elementary properties. Division Algorithm, Euclidean Algorithm (Without proof) G.C.D. and L.C.M of integers, Relatively prime integers, Definition Prime numbers, Euclid's lemma, Basic properties of G.C.D., G.C.D of any two integers  $a$  and  $b$  if it exists is unique and can be expressed in the form  $ax + by$ , where  $x, y \in \mathbb{Z}$ .

1.3 Equivalence Relations, Equivalences classes, properties of Equivalences classes, Definition of partition, every partition gives an equivalence relation and vice-versa, Definition of Congruence, Congruence as equivalence relation on  $\mathbb{Z}$ , Residue classes, Partition of  $\mathbb{Z}$ , Addition modulo  $n$ , Multiplication modulo  $n$ .

##### Unit 02: Polynomials

6 Lectures

2.1 Definition of polynomial, Degree of polynomial, Algebra of polynomials, Division algorithm (without proof). G.C.D of two polynomials (without proof).

2.2 Remainder Theorem, Factor Theorem.

2.3 Relation between the roots and the coefficients of a polynomial, Examples.

##### Unit 03: Matrices and System of linear equations.

15 Lectures

3.1 Matrices, Echelon and Reduced echelon form of a matrix, Reduction of matrix to its echelon form, Definition of rank of a matrix by using echelon form.

3.2 System of linear equations, Matrix form of system of linear equations, Homogeneous and non-homogeneous system of linear equations, Gauss Elimination and Gauss Jordan Method.

3.3 Consistency of a system of linear equations, condition of consistency (without proof).

3.4 Eigen values, Eigen vectors, characteristic equation of a matrix of order up to  $3 \times 3$

3.5 Statement of Cayley Hamilton theorem and its use to find the inverse of a matrix.

## SECOND TERM (Geometry)

### Unit 04: Analytical Geometry of two dimensions:

10 Lectures

4.1) Change of axes, Translation and rotation.

4.2) Conic Section: General equation of second degree in  $x$  and  $y$ . Centre of conic, Nature of conic, Reduction to standard form.

### Unit 05: Planes in 3-dimension:

6 Lectures

Revision: Equations of the first degree in  $x, y, z$ , Transformation to the normal form, determination of plane under given conditions, Equations of the plane through three given points.

5.1 Systems of planes, two sides of a plane.

5.2 Length of the perpendicular from a point to a plane, bisectors of angles between two planes.

5.3 Joint equation of two planes, Angle between planes.

### Unit 06: Lines in 3-dimension:

6 Lectures

Revision: Equations of a line, equations of a straight line in terms of its direction cosines and the co-ordinates of a point on it, equations of a line through two points, Symmetrical and unsymmetrical forms of the equations of a line. transformation of the equations of a line to the symmetrical form. Angle between a line and a plane.

6.1 The condition that a given line may lie in a given plane, the condition that two given lines are coplanar.

6.2 Number of arbitrary constants in the equations of a straight line, sets of conditions which determine a line.

6.3 The shortest distance between two lines, the length and equations of the line of shortest distance between two straight lines, length of perpendicular from a given point to a given line.

### Unit 07: Sphere

8 Lectures

7.1 Definition and equation of the sphere in various forms.

7.2 Plane section of a sphere, intersection of two spheres.

7.3 Equation of a circle, sphere through a given circle, intersection of a sphere and a line.

7.4 Equation of a tangent plane.

**Unit 08: Cones and Cylinders:****6 Lectures****8.1** Definition of cone and cylinder.**8.2**Equation of cone and cylinder with vertex at origin and  $(\alpha, \beta, \gamma)$ .**8.3** The right circular cone, equation of a right circular cone.**8.4** The right circular cylinder, equation of a right circular cylinder.**Text Book:** Text book of Algebra &Geometry, Prepared by B.O.S. in Mathematics, University of Pune, Pune.(2013).**Reference Books:**

1. Shantinayakan: Analytical Solid Geometry, S. Chand and Company Ltd, New Delhi, 1998.
2. David Burton, Elementary Number Theory, Tata McGraw Hill, Indian Edition.
3. H. Anton and C. Rorres, Elementary Linear Algebra with Applications, Seventh Ed Wiley, (1994).
4. P.K.Jain and Khalil Ahmad,A Text Book of Analytical Geometry of Three Dimensions, Wiley Estern Ltd. 1999.
5. K.B.Datta, Matrix and Linear Algebra, Prentice hall of India Pvt.Ltd, New Delhi 2000.

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**MT 102: Calculus and Differential Equations****FIRST TERM (Calculus)****Unit 1. The Real Numbers :****8 Lectures****1.1** Algebraic properties of  $\mathbb{R}$  ,**1.2**Order properties of  $\mathbb{R}$ , lintervals in  $\mathbb{R}$  , neighborhoods and deleted neighborhoods of a real number, bounded subsets of  $\mathbb{R}$ .**1.3** The Completeness Property of  $\mathbb{R}$ , denseness of  $\mathbb{Q}$  in  $\mathbb{R}$ .**Unit 2.Limit and Continuity****10Lectures****2.1**  $\epsilon - \delta$  definition of limit of a function, Basic properties of limits.**2.2** Continuity of function at a point, Types of discontinuity.**2.3** Continuous functions on intervals.**2.4** Properties of continuous functions on closed and bounded interval.  
(i) Boundedness. (ii) Attains its bounds. (iii) Intermediate value theorem



### Unit 3. Differentiation

18 Lectures

3.1 Definition of derivative of a real valued function at a point, notion of differentiability, geometric interpretation of a derivative of a real valued function at a point.

3.2 Differentiability of a function over an interval.

3.3 Statement of rules of differentiability, chain rule of finding derivative of composite of differentiable functions (without proof), derivative of an inverse function.

3.4. Mean Value Theorems: Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean Value Theorem

3.5 Indeterminate forms. L-Hospital's rule.

3.6 Higher order derivatives, examples, Leibnitz Theorem and its applications

3.7 Taylor's and Maclaurin's Theorem with Lagrange's form of remainder (without proof), Examples with assuming convergence of series.

## SECOND TERM (Differential Equations)

### Unit 4. Integration

08 Lectures

4.1 Integration of rational function by using partial fraction.

4.2 Integration of some irrational functions:

i)  $\int (ax + b)^{\frac{1}{n}} dx$  where  $n$  is a positive integer, ii)  $\int \frac{Ax + B}{\sqrt{ax^2 + bx + c}} dx$   
iii)  $\int (Ax + B)\sqrt{ax^2 + bx + c} dx$

4.3 Reduction formula

i)  $\int \frac{x^n}{\sqrt{ax^2 + bx + c}} dx$  ii)  $\int \frac{dx}{(x^2 + a^2)^n}$ ,  $n$  is a positive integer iii)  $\int (x^2 + a^2)^{n/2} dx$   
iv)  $\int_0^{\pi/2} \sin^n x dx$  v)  $\int_0^{\pi/2} \cos^n x dx$

### Unit 5. Differential Equations of first order and first degree:

16 Lectures

5.1 Introduction to function of two, three variables, homogenous functions, Partial derivatives.

5.2 Differential equations, General solution of Differential equations.

5.3 Methods of finding solution of Differential equations of first order and first degree, Variable separable form, Homogenous Differential equations, Differential equations reducible to homogeneous form. Exact Differential equations. Differential equations reducible to exact Differential equations, Integrating factors, Linear Differential equations. Bernoulli's Differential equations.

**Unit 6. Application of Differential Equations :**

**06 Lectures**

- 6.1 Orthogonal trajectories.
- 6.2 Kirchhoff's law of electrical circuit (RC & LR Circuit)

**Unit 7. Methods of finding general solution of Differential Equations of first order and higher degree:**

**06 Lectures**

- 7.1 Equations solvable for  $p$ .
- 7.2 Equations solvable for  $x$ .
- 7.3 Equations solvable for  $y$ .
- 7.4 Equation in Clairaut's form.

**Text Book:** Text book of Calculus and Differential Equations, Prepared by B.O.S. in Mathematics, University of Pune, Pune.(2013).

**Reference Books:**

1. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, Third Edition, John Wiley and Sons, 2002
2. Integral Calculus, Shantinayakan, S.K.Mittal, S. Chand and Co. Publication 2006.
3. R.Courant and F.John, Introduction to Calculus and Analysis, Vol. 1, Reprint of the first Ed., Springer-Verlag, New York, 1999.
4. Principles of Mathematical Analysis, W. Rudin, Third Edition, McGrawHill, 1976
5. Elementary Differential Equations, Macmillan Publication ,by Rainville and Bedient.
6. Ordinary and partial Differential equations, M.D. Raisingania, S. Chand and Company, 2009.

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**MT 103: Mathematics Practical**

(Practicals based on the applications of articles in MT 101 and MT 102)

**List of Practicals:**

**TERM I**

1. Integers.
2. Partition and residue class in  $\mathbb{Z}$ .
3. Polynomials.
4. Solution of system of linear equations.
5. Eigen values and Eigen vectors.
6. Miscellaneous.
7. Real numbers.
8. Limit and Continuity
9. Differentiation.
10. Application of differentiation
11. Integration..
12. Drawing graphs of elementary functions

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## **TERM II**

13. Changes of axes and conic section.
14. Planes in three dimensions.
15. Lines in three dimensions.
16. Sphere.
17. Cone and Cylinder.
18. Miscellaneous.
19. Preliminaries of differentials equation.
20. Solution of differential equation of first order and first degree-I
21. Solution of differential equation of first order and first degree-II
22. Application of differential equation.
23. Differential equation of first order and higher degree.
24. Miscellaneous.

## **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) A question bank consisting of 100 problems in all for the whole year, distributed in four Sections: 50 questions for each term (25 questions on MT 101 and 25 on MT 102) will be the course work for this paper. Question Bank will be prepared by the individual subject teacher and the problems included should be changed every year, based on the list of practicals given above. The question bank of each year should be preserved by the subject teachers, which can be reviewed by the L.I.C. members visiting college.
  - 3) 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 72 marks and oral examination of 08 marks.
  - 4) There will be no external examiner, the practical exam will be of the duration of 3 hours.
  - 5) The subject teacher will set a question paper based on pattern as follows:
    - Q1.** (a) Any 1 out of 2 worth 8 marks on MT101 (first term).  
(b) Any 1 out of 2 worth 8 marks on MT 102. (first term).
    - Q2\*.** Any 5 out of 7 each of 4 marks on MT 101.
    - Q3\*.** Any 5 out of 7 each of 4 marks on MT 102..
    - Q4.** (a) Any 1 out of 2 of 10 marks on MT 101(second term).  
(b) Any 1 out of 2 worth 10 marks on MT 102 (second term).
- (\*In Q2 and Q3, there will be 3 questions from first term and 4 questions from the second term or vice-versa)
- 6) Each student will maintain a journal to be provided by the college.

7) The internal 20 marks will be given on the basis of journal prepared by student and the cumulative performance of student at practicals.

8) It is recommended that concept may be illustrated using computer software and graphing calculators wherever possible.

9) The subject teachers can include computer practicals based on use of free mathematical software's like Scilab, Maxima, mu-pad, etc. for solving problems in the miscellaneous practical mentioned above.

10) Study tours may be arranged at places having important mathematical institutes or historical places.

11) **Special Instruction:** Before starting each practical necessary introduction, basic definitions, intuitive inspiring ideas and prerequisites must be discussed.

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**UNIVERSITY OF PUNE, PUNE.**  
**BOARD OF STUDIES IN MATHEMATICS**  
**Syllabus for S.Y.B.Sc**  
**Subject: MATHEMATICS**  
**(With effect from June 2014)**

**Introduction:**

University of Pune has decided to change the syllabi of various faculties from June,2013.

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 University of Pune has prepared the syllabus of S.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.
- 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.

**Eligibility:** F.Y.B.Sc. ,as per University rules

**Structure of the course:**

	Semester I		Semester II	
<b>Paper I</b>	MT 211	Multivariable Calculus I	MT 221	Linear Algebra
<b>Paper II</b>	MT 212(A)	Discrete Mathematics	MT 222(A)	Multivariable Calculus II
	MT212(B)	Laplace Transform and Fourier Series	MT222(B)	Numerical methods and it's applications
<b>Paper III</b>	MT213	Practical based on MT211,MT212	MT223	Practical based on MT221,MT222

Paper I, Paper III is compulsory .In Paper II student can opt for ,any one of MT 212(A), MT212(B) in first semester and any one of MT221(A),MT222(B) in second semester.

In paper I and II, each course is of 50 marks ( 40 marks theory and 10 marks internal examination)

Paper III each course is of 50 marks(32 marks theory,8 marks oral and 10 marks internal examination)

Medium of Instruction: English

**Examination:**

A) Pattern of examination: Semester wise

B) Standard of passing : 20 Marks out of 50 marks for each papers.

But for passing a student should obtain minimum 16 marks out of 40 in the theory and oral examination and overall total marks for theory, oral and internal should be minimum 20.

**C)Pattern of question papers: For Paper I and Paper II**

Q1. Attempt any 05 out of 07 questions each of 02 marks. [10Marks]

Q2. Attempt any 02 out of 03 questions each of 05 marks. [10 Marks].

Q.3. Attempt any 02 out of 03 questions each of 05 marks. [10 Marks].

Q.4. Attempt any 01 out of 02 questions each of 10 marks. [10 Marks].

**The pattern of question paper for Paper III**

Q1.A) Attempt any 01 out of 02 questions each of 08 marks. (Based on Paper I) [08 Marks]

B) Attempt any 02 out of 03 questions each of 04 marks. (Based on Paper I) [08 Marks]

Q2. A) Attempt any 01 out of 02 questions each of 08 marks. (Based on Paper II) [08 Marks]

B) Attempt any 02 out of 03 questions each of 04 marks. (Based on Paper II) [08 Marks]

**D) External Students:** Not allowed.

**E) Variation / Revaluation:** Allowed for Paper I and II.

**F) Qualifications for Teacher:** M.Sc. Mathematics (with NET /SET as per existing rules )

- **Textbooks will be prepared by the BOS Mathematics, University of Pune.**

**Equivalence of Previous syllabus along with new syllabus:**

<b>Semester I</b>		<b>Semester II</b>	
<b>New Course</b>	<b>Old Course</b>	<b>New Course</b>	<b>Old Course</b>
MT 211 Multivariable Calculus I	MT 211 Calculus of Several Variables	MT 221 Linear Algebra	MT:221 Linear Algebra
MT 212(A) Discrete Mathematics	MT:222(B)) Discrete Mathematics	MT 222(A) Multivariable Calculus II	MT:222(A)) Vector Calculus
MT212(B) Laplace Transform and Fourier Series	MT:212(A) Differential Equations	MT222(B) Numerical methods and it's applications	MT:212(B) Numerical Analysis
MT213 Practical based on MT211,MT212	MT213 Practical based on MT211,MT212	MT223 Practical based on MT221,MT222	MT213 Practical based on MT211,MT212

**Details of Syllabus:**



## Paper I MT 211: Multivariable Calculus I

- 1. Limit and Continuity of Multivariable functions:** [06]
  - 1.1. Functions of several variables, graphs and level curves of function of two variables.
  - 1.2. Limit and Continuity in higher dimensions.
- 2. Partial Derivatives:** [04]
  - 2.1. Definition and examples.
  - 2.2. Second order partial derivative, the mixed derivative theorem.
  - 2.3. Partial derivatives of higher order.
- 3. Differentiability:** [12]
  - 3.1. Differentiability, the increment theorem for functions of two variables (without proof).
  - 3.2. Chain rules for composite function.
  - 3.3. Directional derivatives, gradient vectors.
  - 3.4. Tangent planes, normal lines and differentials.
- 4. Extreme Values:** [10]
  - 4.1. Extreme values, First derivative test and Second derivative test for local extreme values.
  - 4.2. Lagrange's multipliers method for finding extreme values of constraint function (One Constraint)
  - 4.3. Taylors Formula for two variables.
- 5. Multiple Integrals:** [16]
  - 5.1. Double Integral over rectangles, Fubini's theorem for calculating double integrals (Without proof).
  - 5.2. Double integrals in polar form.
  - 5.3. Triple integrals in rectangular coordinates.
  - 5.4. Triple integral in cylindrical and spherical coordinates.
  - 5.5. Substitution in multiple integrals, Application to area and volumes.

**Text book: Prepared by the BOS Mathematics, University of Pune.**

**Recommended Book:** Thomas' Calculus, 11<sup>th</sup> Edition, G. B. Thomas.

Revised by Maurice D. Weir, Joel Hass and Frank R. Giordano.

Pearson Edition 2012.

Articles: 14.1 to 14.10, 15.1, 15.3, 15.4, 15.6, 15.7

### 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 (2<sup>nd</sup> Edition), Prentice Hall of India, New Delhi, (1944).
4. T.M. Apostol, Calculus Vol. II (2<sup>nd</sup> Edition), John Wiley, New York, (1967).

## **Paper II(A) MT 212(A):Discrete Mathematics**

- 1. Logic and Proofs:** [24]
  - 1.1 Propositional logic.
  - 1.2 Propositional equivalences.
  - 1.3 Predicates and quantifiers.
  - 1.4 Nested quantifiers.
  - 1.5 Rules of inference.
  - 1.6 Introduction to proofs.
- 2. Counting:** [20]
  - 2.1 The basics of counting.
  - 2.2 Permutation and combinations.
  - 2.3 Generalized permutation and combinations.
- 3. Advanced Counting Technique:** [04]
  - 3.1 Inclusion-Exclusion (without proof).

**Text book: Prepared by the BOS Mathematics, University of Pune.**

### **Recommended Book:**

1. Discrete Mathematics and Its Applications, Kenneth H Rosen, Seventh Edition, McGraw Hill.

Sections: 1.1 to 1.6, 5.1, 5.3, 5.5, 6.5

### **Reference Books:**

1. Symbolic Logic, I.M. Copi, Fifth Edition, Prentice Hall of India, 1995.
2. Bernard Kolman, Robert C. Busby, Sharon Cutler Ross and Nadeem-ur-Rehman: Discrete Mathematical Structures, Fifth Edition, Pearson Education, Inc., 2004.
3. Applied Combinatorics, Fourth Edition, by Alan Tucker.

## **Paper II(B) MT 212(B):Laplace Transforms and Fourier Series**

- 1. The Laplace Transform:** [18]
  - 1.1 Definition, Laplace Transform of some elementary functions.
  - 1.2 Some important properties of Laplace Transform.
  - 1.3 Laplace Transform of derivatives, Laplace Transform of Integrals.
  - 1.4 Methods of finding Laplace Transform, Evaluation of Integrals.
  - 1.5 The Gamma function, Unit step function and Dirac delta function.

**2. The Inverse Laplace Transform:** [18]

2.1 Definition, Some inverse Laplace Transform.

2.2 Some important properties of Inverse Laplace Transform.

2.3 Inverse Laplace Transform of derivative, Inverse Laplace Transform of integrals.

2.4 Convolution Theorem, Evaluation of Integrals.

**3. Applications of Laplace Transform:** [04]

3.1 Solution of Ordinary Differential Equations with constant coefficients.

**4. Fourier Series** [08]

4.1 Definition and examples of Fourier Series.

**Text-Book: Prepared by the BOS Mathematics, University of Pune.**

**Recommended Book:**

1. Schaum's Outline Series - Theory and Problems of Laplace Transform by

Murray R. Spiegel. Articles 1, 2, 3.

2. Richard R. Goldberg, Methods of Real Analysis, Oxford and IBH Publishing Co.

Pvt. Ltd. (1970). Art. 12.1

**Reference Books**

1. Joel L. Schiff : The Laplace Transforms - Theory and Applications, Springer-Verlag New York 1999.

2. Dyke : An Introduction to Laplace Transforms and Fourier Series, Springer International Edition, Indian Reprint 2005.

## TERM -II

### Paper I MT 221: Linear Algebra

- 1. Vector Spaces** [16]  
Definition, examples, linear dependence, basis and dimension, vector subspace, Necessary and sufficient condition for subspace, vector space as a direct sum of subspaces
- 2. Inner Product Spaces** [16]  
Inner product, norm as length of a vector, distance between two vectors, orthonormal basis, orthonormal projection, Gram Schmidt process of orthogonalization, null space, range space, rank, nullity, Sylvester Inequality
- 3. Linear Transformations** [16]  
Definition, examples, properties of linear transformations, equality of linear transformations, kernel and rank of linear transformations, composite transformations, Inverse of a linear transformation, Matrix of a linear transformation, change of basis, similar matrices

**Textbook:** Prepared by the BOS Mathematics, University of Pune.

**Recommended Book:**

Matrix and Linear Algebra aided with MATLAB, Kanti Bhushan Datta, PHI learning Pvt.Ltd, New Delhi(2009) (Sections:5.1,5.2,5.3,5.4,5.5,5.7,6.1,6.2,6.3,6.4

**Reference Books:**

1. Howard Anton, Chris Rorres., Elementary Linear Algebra, John Wiley & Sons, Inc
2. K. Hoffmann and R. Kunze Linear Algebra, Second Ed. Prentice Hall of India , New Delhi, (1998).
3. S. Lang, Introduction to Linear Algebra, Second Ed. Springer-Verlag, New York.
4. A. Ramchandra Rao and P. Bhimasankaran, Linear Algebra, Tata McGraw Hill, New Delhi (1994).
5. G. Strang, Linear Algebra and its Applications. Third Ed. Harcourt Brace Jovanovich, Orlando, (1988).

## Paper II (A) MT 222(A): Multivariable Calculus II

1. **Vector valued function:** [14]
  - 1.1 Vector valued function.
  - 1.2 Limit and Continuity of vector function.
  - 1.3 Derivative of vector function and motion.
  - 1.4 Differentiations rules.
  - 1.5 Constant vector function and its necessary and sufficient condition.
  - 1.6 Integration of vector function of one scalar variable.
  - 1.7 Arc length and unit tangent vector T. Curvature and the unit normal vector N.
2. **Line Integrals:** [16]
  - 2.1 Definition and evaluation of line integral.
  - 2.2 Properties of line integrals.
  - 2.3 Vector fields, work, circulation and flux across smooth curves.
  - 2.4 Path independence, Potential functions, Conservative fields.
  - 2.5 Green's theorem in plane, evaluating integrals using Green's theorem.
3. **Surface and volume integrals:** [18]
  - 3.1 Surface area and surface integrals.
  - 3.2 Surface integral for parameterized surfaces.
  - 3.3 Stokes theorem (without proof).
  - 3.4 The Gauss divergence theorem (proof for special regions).

**Textbook:** Prepared by the BOS Mathematics, University of Pune.

### Recommended Book:

Thomas' Calculus, 11<sup>th</sup> Edition, G. B. Thomas. Revised by Maurice D. Weir, Joel Hass and Frank R. Giordano. Pearson Edition 2012. Articles: 13.1, 13.3, 13.4, 16.1 to 16.8.

### 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. John M. H. Olmsted, Advanced Calculus, Eurasia Publishing House, New Delhi (1970).
4. T.M. Apostol, Calculus Vol. II (2<sup>nd</sup> Edition), John Wiley, New York, (1967).

## Paper II(B) MT 222(B): Numerical Methods and its applications

### 1. Errors:

[4]

- 1.1 Errors and Their Computations
- 1.2 Rounding off numbers to n significant digits, to n decimal places.
- 1.3 Absolute, relative and percentage errors.
- 1.4 A general error formula.

### 2. Solution of Algebraic and Transcendental Equations: [10]

- 2.1 Bisection method.
- 2.2 The method of False position.
- 2.3 The iteration method, Aitken's  $\Delta^2$  process
- 2.4 Newton- Raphson Method.

### 3. Interpolation:

[16]

- 3.1 Finite Difference Operators and their relations.
- 3.2 Detection of Errors using difference table.
- 3.3 Differences of a polynomial
- 3.4 Newton's Interpolation Formulae (Forward and Backward )
- 3.5 Lagrange's Interpolation Formula
- 3.6 Divided differences and Newton's General Interpolation formula.

### 4. Least Squares Curve Fitting Procedures

[4]

- 4.1 Fitting a Straight Line
- 4.2 Nonlinear curve fitting: Power function  $y = ax^c$ , polynomials of degree 2 and 3, Exponential function  $y = cx^d$

### 5. Numerical Differentiation and Integration:

[8]

- 5.1 Numerical Differentiation
- 5.2 Numerical Integration, General quadrature formula.
- 5.3 Trapezoidal rule.
- 5.4 Simpson's  $\frac{1}{3}$  rule.
- 5.5 Simpson's  $\frac{3}{8}$  rule.

### 6. Numerical solution of first order ordinary differential equations:

[6]

- 6.1 Taylor Series method
- 6.2 Euler's method.
- 6.3 Modified Euler's methods.
- 6.4 Runge - Kutta Methods 2<sup>nd</sup> and 4<sup>th</sup> order.

**Text Books : Prepared by the BOS Mathematics, University of Pune.**

### Recommended Book:

1. S.S. Sastry; Introductory Methods of Numerical Analysis, 3<sup>rd</sup> edition, Prentice Hall of India.

**Sections:** 1.3, 1.4, 2.1, 2.2, 2.3, 2.4, 2.5, 3.3, 3.4, 3.5, 3.6, 3.9.1, 3.10 (3.10.1 only),  
4.2.1, 4.2.2, 5.2 (excluding 5.2.1, 5.2.2), 5.4.1, 5.4.2, 5.4.3, 7.2, 7.4, 7.4.1, 7.4.2, 7.5

### Reference Book:

1. K.E. Atkinson; An Introduction to Numerical Analysis, Wiley Publications.
2. H.C. Saxena; Finite differences and Numerical Analysis, S. Chand and Company.

### **Modalities For Conducting The Practical and The Practical Examination:**

- 1) There will be one 3 hour practical session for each batch of 12 students per week
- 2) A question bank consisting of 60 questions in all for each semester, distributed in two sections: 25 questions each of Paper I and Paper II will be the course work for this paper. Question Bank will be prepared by the individual subject teacher based on pattern of questions provided by university. The question bank of each year should be preserved by the subject teachers, which can be reviewed by the L.I.C. members visiting college.
- 3) University will conduct the Practical Examination each semester twice a year. The practical examination will consist of written examination of 32 marks and oral examination of 08 marks.
- 4) The practical exam will be of the duration of 3 hours duration.

#### **5) The pattern of question paper for Paper III**

- Q1.A) Attempt any 01 out of 02 questions each of 08 marks. (Based on Paper I) [08 Marks]
- B) Attempt any 02 out of 03 questions each of 04 marks. (Based on Paper I) [08 Marks]
- Q2. A) Attempt any 01 out of 02 questions each of 08 marks. (Based on Paper II) [08 Marks]
- B) Attempt any 02 out of 03 questions each of 04 marks. (Based on Paper II) [08 Marks]

- 6) Each student will maintain a journal to be provided by the college.
- 7) The internal 20 marks will be given on the basis of journal prepared by student and the cumulative performance of student at practicals.
- 8) It is recommended that concept may be illustrated using computer software and graphing calculators wherever possible.
- 9) Trips/Study tours may be arranged at places having important mathematical institutes or historical places.
- 11) Special Instruction: Before starting each practical necessary introduction, basic definitions, intuitive inspiring ideas and prerequisites must be discussed.

# **SAVITRIBAI PHULE PUNE UNIVERSITY,PUNE**

## **BOARD OF STUDIES IN MATHEMATICS**

**Syllabus for T.Y.B.Sc (2013 Course)**

**Subject: MATHEMATICS**

**(With effect from June 2015)**

### **Introduction:**

University of Pune has decided to change the syllabi of various faculties from June, 2013. 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 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.

### **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.

**Eligibility:** S.Y.B.Sc.(With Mathematics)or T.Y.B.Sc Computer Science as per University rules.

**Structure of the course:**

Semester- III		Semester- IV	
MT 331 :	Metric Spaces	MT 341:	Complex Analysis
MT 332 :	Real Analysis-I	MT 342:	Real Analysis-II
MT 333 :	Problem Course on MT 331 and MT 332	MT 343:	Problem Course on MT 341 and MT 342
MT 334 :	Group Theory	MT 344:	Ring Theory
MT 335 :	Ordinary Differential Equations	MT 345:	Partial Differential Equations
MT 336 :	Problem Course on MT 334 and MT 334	MT 346:	Problem Course on MT 344 and MT 345
<b>Select Any Two out of six courses</b>		<b>Select Any Two out of six courses</b>	
MT 337:A.	Operations Research	MT 347: A	Optimization Techniques
MT 337:B.	Dynamical System	MT 347:B	Differential Geometry
MT 337: C	C- Programming I	MT 347 :C	C- Programming II
MT 337:D.	Lattice Theory	MT 347: D	Graph theory
MT 337: E	Financial Mathematics	MT 347: E	Lebesgue Integration
MT 337:F	Number Theory	MT 347: F	Computational Geometry
<b>MT 338:</b>	<b>Practical based on papers selected from 337 A to 337 F</b>	<b>MT 348 :</b>	<b>Practical based on papers selected from 347 A to 347 F</b>

**Note.**

1.Papers MT 331 to MT 336 are compulsory , a student can opt any two papers from MT337 A to MT 337 F in first semester.

2.Papers MT 341 to MT 346 are compulsory , a student can opt any two papers from MT347 A to MT 347 F in second semester.

3.For MT 331 to MT 337 and MT 341 to MT 347 each course is of 50 marks ( 40 marks theory and 10 marks internal examination).

4.Papers MT 338 and MT 348 are practicals and each course is of 50 marks (32 marks theory, 8 marks oral and 10 marks internal examination).

**Medium of Instruction:** English

**Examination:**

A) Pattern of examination: Semester wise.

B) Standard of passing : 20 Marks out of 50 marks for each papers. (But for passing a student should obtain minimum 16 marks out of 40 in the theory and oral examination and overall total marks for theory, oral and internal should be minimum 20 ).

**C)Pattern of question papers: For MT 331 to MT 337 and MT 341 to MT 347.**

Q1. Attempt any 05 out of 07 questions each of 02 marks. [10Marks]

Q2. Attempt any 02 out of 03 questions each of 05 marks. [10 Marks].

Q.3. Attempt any 02 out of 03 questions each of 05 marks. [10 Marks].

Q.4. Attempt any 01 out of 02 questions each of 10 marks. [10 Marks].

**D)** External Students: Not allowed.

**E)** Verification / Reevaluation: Allowed for Theory papers only.

**F)** 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	OldCourse
MT 331 : Metric Spaces	MT 341: Metric Spaces	MT 341: Complex Analysis	MT 342: Complex Analysis
MT 332: Real Analysis-I	MT 331 : Set Theory and Logic	MT 342: Real Analysis-II	MT 332: Real Analysis
MT 333 : Problem Course on MT 331 and MT 332	MT 343: Problem Course on MT 341 and MT 342	MT 343: Problem Course on MT 341 and MT 342	MT 333 : Problem Course on MT 331 and MT 332
MT 334 : Group Theory	MT 334 : Group Theory	MT 344: Ring Theory	MT 344: Ring Theory
MT 335 : Ordinary Differential Equations	MT 335 : Ordinary Differential Equations	MT 345: Partial Differential Equations	MT 345: Partial Differential Equations
MT 336 : Problem Course on MT 334 and MT 334	MT 336 : Problem Course on MT 334 and MT 334	MT 346: Problem Course on MT 344 and MT 345	MT 346: Problem Course on MT 344 and MT 345
MT 337 A. Operations Research	MT 337 A. Operations Research	MT 347 A : Optimization Techniques	MT 347 A Optimization Techniques
MT 337 B. Dynamical System	MT 347 D : Dynamics	MT 347 B : Differential Geometry	MT 337 D: Differential Geometry
MT 337 C. C- Programming I	MT 337 C. C- Programming I	MT 347 C: C- Programming II	MT 347 C C- Programming II
MT 337 D: Lattice Theory	MT 337 B: Lattice Theory	MT 347D. Graph theory	MT 337 E : Combinatorics
MT 337 E. Financial Mathematics	MT 347 B : Improper Integrals and Laplace Transforms	MT 347 E: Lebesgue Integration	MT 347 E: Lebesgue Integration
MT 337 F. Number Theory	MT 337 F: Number Theory	MT 347F : Computational Geometry	MT 347 F: Computational Geometry
MT 338: Practical based on papers selected from 337 A to 337 F	MT 338: Practical based on papers selected from 337 A to 337 F	MT 348 : Practical based on papers selected from 347 A to 347 F	MT 348 : Practical based on papers selected from 347 A to 347 F

**Details of Syllabus:**  
**Semester III**

**MT 331: Metric Spaces**

- 1. Introductory Concepts** [14 Lectures]  
Definition and examples of metric spaces, open spheres and closed spheres, neighborhoods, open sets, equivalent Metrics, interior points, closed sets, limit points and isolated points, closure of a set, boundary points, distance between sets and diameter of a set, subspace of a metric space, product metric spaces.
- 2. Completeness** [8 Lectures]  
Convergent sequences, Cauchy sequences, complete spaces, dense sets and nowhere dense sets (only definition)
- 3. Continuous Functions:** [6 Lectures]  
Definition and characterizations, extension theorem, uniform continuity, homeomorphism
- 4. Compactness** [14 Lectures]  
Compact spaces, sequential compactness, equivalence of compactness and sequential compactness, compactness and finite intersection property, continuous functions and compact spaces.
- 5. Connectedness** [6 Lectures]  
Separated sets, disconnected and connected sets.

**Text Book:**

Metric Spaces (second Edition), Pawan K. Jain,  
Khalil Ahmad, Narosa Publishing House. Sections: 2.1 to 2.13, 3.1 to 3.5,  
4.1 to 4.4, 5.1 to 5.6, 6.1, 6.2.

**Reference Books:**

1. Topology of Metric Spaces, S. Kumaresan, Narosa Publishing House
2. First Course in Metric Spaces, B. K. Tyagi, Cambridge University Press
3. Metric Spaces, Satish Shirali, H. Vasudeva, Springer
4. Principles of Mathematical Analysis, W. Rudin

## MT 332: Real Analysis -I

### 1. Sets and functions: [12 Lectures]

Operations on sets, Functions, Real-valued functions, Equivalence countability, Real numbers, Cantor set, Least upper bounds

### 2. Sequences of Real Numbers: [18 Lectures]

Definition of sequence and subsequence, Limit of a sequence, Convergent sequences, Monotone sequences, Divergent sequences, Limit superior, Limit inferior, Cauchy sequences.

### 3. Series of Real numbers: [18 Lectures]

Convergent and divergent series, series with non-negative terms, alternating series, Conditional and Absolute convergence, Rearrangement of series, Tests of absolute convergence, series whose terms form a non-increasing sequence, The class  $l^2$ .

#### Text book:

R. R. Goldberg, Methods of real analysis, Oxford & I. B. H. Publications, 1970.  
Ch. 1, Art 1.1 to 1.7; Ch. 2, Art 2.1 to 2.10; Ch. 3, Art 3.1 to 3.7 and 3.10

#### Reference Books:

1. Ajit Kumar and S.Kumaresan, A Basic Course in Real Analysis, CRC Press, Second Indian Reprint 2015.
2. D. Somasundaram, B. Choudhary - A first course in Mathematical Analysis, Narosa Publishing House, 1997.
3. Robert, G. Bartle, Donald Sherbert - Introduction to real analysis, Third edition, John Wiley and Sons.
4. Shantinarayan and Mittal - A course of Mathematical Analysis, Revised edition, S. Chand and Co.(2002).
5. S.C. Malik and Savita Arora - Mathematical Analysis , New Age International Publications, third Edition,(2008).

## MT 334: Group Theory

- 1. Groups:** [8 lectures]  
Binary Operations, Isomorphic Binary Structures, Groups.
- 2. Subgroups:** [8 lectures]  
Subgroups, Cyclic Groups.
- 3. Permutations:** [16 lectures]  
Cosets, Direct Product: Groups of Permutations, Orbits, Cycles, Alternating Groups, Cosets and the Theorem of Lagrange, Direct Products.
- 4. Homomorphisms and Factor Groups:** [16 lectures]  
Homomorphisms, Factor Groups, Factor Group Computations and Simple Groups.

### Text book:

John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson.  
[Articles: Section 2 to Section 6, Section 8 to Section 10, Section 11(only Direct Product), Section 13, Section 14, Section 15]

### Reference Books:

1. M. Artin, Algebra, Prentice Hall of India, New Delhi, 1994.
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra, Second Ed., Foundation Books, New Delhi, 1995.
3. I.N. Herstein, Topics in Algebra, John Wiley and Sons.
4. N.S. Gopalakrishnan, University Algebra, Second Edition, New Age International, New Delhi, 1986.
5. Joseph. A. Gallian, Contemporary Abstract Algebra,(4th Edition), Narosa Publishing House.
6. D.A.R. Wallace, Groups, Rings and Fields, Springer Verlag, London, 1998.
7. I.N. Herstein, Abstract Algebra.

## MT 335: Ordinary Differential Equations

**1. Linear Differential Equations with constant coefficients:** [12 lectures]

The auxiliary equations. Distinct roots, repeated roots, Complex roots, particular solution. The operator  $1/f(D)$  and its evaluation for the functions  $x^m$ ,  $e^{ax}$ ,  $e^{ax}v$  &  $xv$  and the operator  $1/(D^2 + a^2)$  acting on  $\sin ax$  and  $\cos ax$  with proofs.

**2. Non-Homogeneous Differential Equations:** [14 lectures]

Method of undetermined coefficients, Method of variation of parameters, Method of reduction of order, The use of a known solution to find another.

**3. Power series solutions:** [12 lectures]

Introduction and review of power series, Linear equations and power series, Convergence of power series, Ordinary points and regular singular points.

**4. System of First-Order Equations:** [10 lectures]

Introductory remarks, linear systems, homogeneous linear systems with constant Coefficients, Distinct roots, repeated roots, Complex roots.

**Text Books:**

Elementary Differential Equations, Rainville and Bedient, Macmillan Publication .

**Reference Books:**

1. Ordinary and Partial Differential Equation, by M.D.Raisinghania, S.Chand and Company LTD, 2009
2. Differential Equations by George F. Simmons, Steven G. Krantz, Tata McGraw-Hill.
3. W.R. Derrick and S.I. Grossman, A First Course in Differential Equations with applications. CBS Publishers and distributors, Delhi-110 032. Third Edition.
4. Shanti Narayan, Integral Calculus, S. Chand and Company.
5. Daniel Murray, Introductory Course in Differential Equations, Orient Longman

## MT 337 A: Operations Research

**1. Modeling with Linear Programming:** [8 lectures]

Two variable LP Model, Graphical LP solution, Selected LP Applications, Graphical Sensitivity analysis.

**2. The Simplex Method:** [16 lectures]

LP Model in equation form, Transition from graphical to algebraic solutions, the simplex method, Artificial starting solutions.

**3. Duality:** [6 lectures]

Definition of the dual problem, Primal dual relationship.

**4. Transportation Model:** [12 Lectures]

Definition of the Transportation model. The Transportation algorithm.

**5. The Assignment Model:** [06 Lectures]

The Hungarian method, Simplex explanation of the Hungarian method.

**Text Book:**

Hamdy A. Taha, Operation Research (Eighth Edition, 2009), Prentice Hall of India Pvt. Ltd, New Delhi.

**Ch.2:** 2.1,2.2,2.3(2.3.4, 2.3.5, 2.3.6). **Ch.3:** 3.1, 3.2, 3.3, 3.4, 3.5, 3.6 (3.6.1).

**Ch.4:** 4.1, 4.2. **Ch.5:** 5.1,5.3 (5.3.1, 5.3.2, 5.3.3), 5.4(5.4.1, 5.4.2).

**Reference Books:**

1. Frederick S. Hillier, Gerald J. Lieberman, Introduction to Operation Research (Eighth Edition) Tata McGraw Hill.

2. J K Sharma, Operations Research (Theory and Applications, second edition, 2006), Macmillan India Ltd.

3. Hira and Gupta, Operation Research.

## MT 337 B: DYNAMICAL SYSTEMS

### 1. Planar Linear Systems

[12 Lectures]

System of first order differential equations, Autonomous system, equilibrium points, Conversion of second order differential equation into a system of differential equations. Preliminaries from Linear Algebra Review of Linear dependence and basis in  $\mathbb{R}^2$ , Writing planar system in matrix form, Eigenvalues and eigenvectors Examples, Solving a linear system, Linearity Principle and examples.

### 2. Phase Portraits for Planar Systems

[12 Lectures]

Cases of real distinct eigenvalues Concept of Saddle, Source and Sink types of equilibrium points. Complex eigenvalues. Examples to show center, spiral sink and spiral source Repeated Eigenvalues and changing coordinates Examples by diagonalising the matrix.

### 3. Classification of Planar System and Higher Dimensional Linear Algebra

[12 Lectures]

Review of Linear Algebra, eigenvalues and eigenvectors, properties of determinants, Complex eigenvalues, repeated eigenvalues, Review of Basis and Subspaces, Generosity

### 4. The exponential of a matrix

[12 Lectures]

Solving a system of first order differential equations by using exponential of a matrix.

#### **Textbook:**

Differential Equations, Dynamical Systems and Introduction to Chaos by Morris Hirsch, S. Smale and Devaney, Academic Press, 2004 Elsevier. (Indian Edition)  
Section 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 3.1, 3.2, 3.3, 3.4, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 6.4

**Reference Book:** Differential Equations, Dynamical System and Linear Algebra by Morris Hirsch and Stephen Smale, Academic Press, 1974, Elsevier



# MT 337 C: C Programming-I

**1. Introductory Concepts:** [2 Lectures]

Introduction to computer. Computer Characteristics. Types of Programming Languages. Introduction to C.

**2. C Fundamentals:** [4 Lectures]

The character set. Identifier and keywords. Data types. Constants. Variables and arrays. Declarations. Expressions. Statements. Symbolic constants.

**3. Operators and Expressions:** [6 Lectures]

Arithmetic operators. Unary operators. Relational and Logical operators. Assignment operators. Conditional Operator. Library functions.

**4. Data Input and Outputs:** [8 Lectures]

Preliminaries. Single character input-getchar() function. Single character output-putchar() function. Writing output data-printf function. Formatted input-output. Get and put functions.

**5. Preparing and Running a Program:** [2 Lectures]

Planning and writing a C Program. Compiling and Executing the Program.

**6. Control Statements:** [8 Lectures]

Preliminaries. The while statement. The do-while statement. The for statement. Nested loops. The if-else statement. The switch statement. The break statement. The continue statement. The comma operator.

**7. Functions:** [8 Lectures]

A brief overview. Defining a function. Accessing a function. Passing arguments to a function. Specifying argument data types. Function prototypes ,Recursion.

**8. Arrays:** [10 Lectures]

Defining an array. Processing an array. Passing arrays to a function. Multidimensional arrays. Arrays and strings.

**Text Book:**

Programming with C. By Byron S. Gottfried. Schaum's Outline series.  
Chapters:1,2,3,4,5,6,7,9.

**Reference Book:** The C Programming Language. By Brian W. Kernighan, Dennis M. Ritchie.

## MT 337 D: Lattice Theory

### 1. Ordered Sets

[12 lectures]

- a. Ordered sets.
- b. Examples from social science and computer science.
- c. Diagrams : the art of drawing ordered sets.
- d. Constructing and de-constructing ordered sets.
- e. Down-sets and up-sets.
- f. Maps between ordered sets.

### 2. Lattices and Complete Lattices

[18 lectures]

- a. Lattice as ordered sets.
- b. Lattices as algebraic structures.
- c. sublattices, products and homomorphisms.
- d. Ideals and Filters.
- e. Complete lattices and Intersection-structures.
- f. Chain conditions and completeness.
- g. Join-irreducible elements.

### 3. Modular, distributive and Boolean Lattices

[18 lectures]

- a. Lattices satisfying additional identities.
- b. The characterization Theorems of Modular and Distributive lattices.
- c. Boolean lattices and Boolean algebras.
- d. Boolean terms and disjunctive normal form.

#### **Test-book:**

B.V. Davey and H.A. Priestley : Introduction to Lattices and Order, Cambridge University Press, Second edition, 2002. (**Chapters 1,2 and 4**).

#### **Reference Book :**

S. Greitzer, General Lattice Theory, Academic Press.

## **MT 337 (E): Financial Mathematics**

- 1. Mathematical models in economics** [06 Lectures]  
Introduction, a model of the market, market equilibrium and excise tax.
- 2. The elements of finance and the cobweb model:** [10 Lectures]  
Interest and capital growth, income generation, the interval of compounding, stability of market equilibrium, the general linear case and economic interpretation.
- 3. Introduction to optimization:** [8 Lectures]  
Profit maximization, critical points, optimization in an interval and infinite intervals.
- 4. The derivative in economics:** [12 Lectures]  
Elasticity of demand, profit maximization again, competition versus monopoly, the efficient small firm, startup and breakeven points.
- 5. Linear equations :** [4 Lectures]  
Making money with matrices, a two-industry 'economy', arbitrage portfolios and state prices, IS-LM analysis.
- 6. The input-output model:** [8 Lectures]  
An economy with many industries and the technology matrix.

### **Text Book**

Martin Anthony and Norman Biggs, Mathematics for Economics and Finance Methods and Modelling, Cambridge University Press, Reprint 2012.

### **Reference Book**

Edward T. Dowling , Mathematical Economics, Second Edition, Schaum's Outline Series, McGraw Hill International Edition.

## MT 337 F: Number Theory

### 1. Divisibility :

[8 Lectures]

Divisibility in integers, Division Algorithm, GCD, LCM, Fundamental theorem of Arithmetic, Infinitude of primes, Mersene Numbers and Fermat Numbers.

### 2. Congruences

[12 Lectures]

Properties of Congruences, Residue classes, complete and reduced residue system, their properties, Fermat's theorem. Euler's theorem, Wilson's theorem,  $x^2 \equiv -1 \pmod{p}$  has a solution if and only if  $p = 2$  or  $p \equiv 1 \pmod{4}$ , where  $p$  is a prime. Linear Congruences of degree 1, Chinese remainder theorem.

### 3. Greatest integer function:

[10 Lectures]

Arithmetic functions Euler's function, the number of divisors  $d(n)$ , sum of divisors  $\sigma(n)$ ,  $\omega(n)$  and  $\Omega(n)$ . Multiplicative functions, Möbius function, Möbius inversion formula.

### 4. Quadratic Reciprocity:

[10 Lectures]

Quadratic residues, Legendre's symbol. Its properties, Law of quadratic reciprocity.

### 5. Diophantine Equations :

[8 Lectures]

Diophantine Equations  $ax + by = c$  and 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.  
(§1.1- §1.3, §2.1- §2.3, §3.1- §3.3, §4.1 -§4.3, §5.1 and §5.3.)

### Reference Book:

1. David M. Burton, Elementary Number Theory (Second Ed.), Universal Book Stall, New Delhi, 1991.

## **Semester IV**

### **MT 341: Complex Analysis**

#### **1. Complex Numbers**

**[6 Lectures]**

Sums and products, Basic algebraic properties, Further properties, Vectors and Moduli, Complex Conjugates, Exponential Form, Products and powers in exponential form, Arguments of products and quotients, Roots of complex numbers, Examples, Regions in the complex plane.

#### **2. Analytic functions**

**[12 Lectures]**

Functions of Complex Variables, Limits, Theorems on limits, Limits involving the point at infinity, Continuity, Derivatives, Differentiation formulas, Cauchy-Riemann Equations, Sufficient Conditions for differentiability, Polar coordinates, Analytic functions, Harmonic functions.

#### **3. Elementary Functions**

**[7 Lectures]**

The Exponential functions, The Logarithmic function, Branches and derivatives of logarithms, Some identities involving logarithms, Complex exponents, Trigonometric functions, Hyperbolic functions.

#### **4. Integrals**

**[12 Lectures]**

Derivatives of functions, Definite integrals of functions, Contours, Contour integral, Examples, Upper bounds for Moduli of contour integrals, Anti-derivatives, Examples, Cauchy-Goursat's Theorem (without proof), Simply and multiply Connected domains. Cauchy integral formula, Derivatives of analytic functions. Liouville's Theorem and Fundamental Theorem of Algebra.

#### **5. Series**

**[5 Lectures]**

Convergence of sequences and series, Taylor's series, Laurent series (without proof), examples.

#### **6. Residues and Poles**

**[6 Lectures]**

Isolated singular points, Residues, Cauchy residue theorem, residue at infinity, types of isolated singular points, residues at poles, zeros of analytic functions, zeros and poles.

#### **Text Book:**

J.W. Brown and R.V. Churchill, Complex Variables and Applications, International Student Edition, 2009. (Eighth Edition).

Chapter 1 : §1 to §11. Chapter 2: §12, §15 to §26. Chapter 3 : §29 to §35. Chapter 4 : §37 to §46 and §48 to §53. Chapter 5: §55 to §60 and §62. Chapter 6: §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).

## MT 342: Real Analysis-II

**1. Riemann Integral:** [16 Lectures]  
Sets of measure zero, Definition and existence of Riemann integral, properties of Riemann integral, Fundamental theorem of integral calculus, mean value theorems of integral calculus.

**2. Improper Integrals:** [16 Lectures]  
Definition of improper integral of first kind, comparison test, test, absolute and conditional convergence, integral test for convergence of series, definition of improper integral of second kind, Cauchy principal value.

**3. Sequences and series of functions:** [16 Lectures]  
Point wise and uniform convergence of sequences of functions, consequences of uniform convergence, convergence and uniform convergence of series of functions, integration and differentiation of series of functions.

### Text Books:

1. R. R. Goldberg, Methods of Real Analysis, Oxford and I. B. H. Publication Co., 1970 Ch. 7, Art. 7.1 to 7.4 and 7.8 Ch. 9, Art 9.1 to 9.5
2. First course in mathematical analysis, D somsundaram, B Chuadhari, Narosa Publishing house 2009. Ch. 8, Art 8.5

### Reference Books:

1. Ajit Kumar and S.Kumaresan, A Basic Course in Real Analysis, CRC Press, Second Indian Reprint 2015.
2. Robert, G. Bartle, Donald Sherbert - Introduction to real analysis, Third edition, John Wiley and Sons.
3. Shantinarayan and Mittal - A course of Mathematical Analysis, Revised edition, S. Chand and Co.(2002).
4. S.C. Malik and Savita Arora - Mathematical Analysis , New Age International Publications,Third Edition,(2008).

## MT 344: Ring Theory

### 1. Rings and Fields:

[ 16 Lectures]

Rings and Fields, Integral Domains, The Fields of Quotients of an Integral Domain, Rings of Polynomials, Factorization of Polynomials over a Field.

### 2. Ideals and Factor Rings:

[ 16 Lectures]

Homomorphisms and Factor Rings, Prime and Maximal Ideals.

### 3. Factorization:

[ 16 Lectures]

Unique Factorization Domains , Euclidean Domain Euclidean Domains, Gaussian Integers and Multiplicative Norms

### Text Book:

John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson.

Articles: Section 18 to Section 23, Section 26, Section 27, Section 45, Section 46, Section 47.

### Reference Books:

1. Joseph, A. Gallian, Contemporary Abstract Algebra,(4th Edition), Narosa Publishing House.

2. I.N. Herstein. Abstract Algebra, (3rd Edition), Prentice Hall of India, 1996.

3. N.S. Gopalkrishnan, University of Algebra, Wiley Eastern 1986.

4. C. Musili, Rings and Modules, Narosa Publishing House, 1992.

## MT 345: Partial Differential Equations

### 1. Ordinary Differential Equations in More Than Two Variables [22 Lectures]

- (a) Surface and Curves in Three Dimensions
- (b) Simultaneous Differential Equations of the First Order and the First Degree in Three Variables.
- (c) Methods of solution of  $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$
- (d) Orthogonal Trajectories of a System of curves on a Surface.
- (e) Pfaffian Differential Forms and Equations.
- (f) Solution of Pfaffian Differential Equations in Three Variables

### 2. First Order Partial Differential Equations: [26 lectures]

- (a) Genesis of First Order Partial Differential Equations.
- (b) Classification of Integrals.
- (c) Linear Equations of the First Order.
- (d) Pfaffian Differential Equations.
- (e) Compatible Systems.
- (f) Charpit's Method.
- (g) Jacobi's Method.
- (h) Integral Surfaces through a given curve.
- (i) Quasi-Linear Equations.

#### Text Books:

1. Ian Sneddon, Element of Partial Differential Equations, McGraw-Hill Book Company, McGraw-Hill Book Company. Chapter 1: §1 to §6.
2. T. Amaranath, An Elementary Course in Partial Differential Equations, Narosa Publishing, House 2nd Edition, 2003 (Reprint, 2006). Chapter 1: §1 to §10.

#### Reference Books:

1. Frank Ayres Jr., Differential Equations, McGraw-Hill Book Company, SI Edition (International Edition, 1972)
2. Ravi P. Agarwal and Donal O'Regan, Ordinary and Partial Differential Equations, Springer, First Edition (2009).
3. W.E. Williams, Partial Differential Equations, Clarendon Press, Oxford,(1980).
4. K. Sankara Rao, Introduction to Partial Differential Equations, Third Edition, PHI.



## MT 347 A: Optimization Techniques

### 1. Network Models [12 Lectures]

CPM and PERT, Network representation, Critical Path Computations, Construction of the time schedule, Linear programming formulation of CPM, PERT calculations.

### 2. Decision Analysis and Games [12 Lectures]

Decision under uncertainty, Game theory, Some basic terminologies, Optimal solution of two person zero sum game, Solution of mixed strategy games, graphical solution of games, linear programming solution of games.

### 3. Replacement and Maintenance Models [8 Lectures]

Introduction, Types of failure, Replacement of items whose efficiency deteriorates with time.

### 4. Sequencing Problems [6 Lectures]

Introduction, Notation, terminology and assumptions, processing  $n$  jobs through two machines, processing  $n$  jobs through three machines.

### 5. Classical Optimization Theory [10 Lectures]

Unconstrained problems, Necessary and sufficient conditions, Newton Raphson method, Constrained problems, Equality constraints (Lagrangian Method Only).

#### Text Book:

1. Hamdy A. Taha, Operation Research (Eighth Edition, 2009), Prentice Hall of India Pvt. Ltd, New Delhi. Ch.6: 6.5 (6.5.1 to 6.5.5).

Ch.13: 13.3, 13.4(13.4.1,13.4.2,13.4.3). 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. 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.

### MT 347 B: Differential Geometry

1. Curves in the plane and in space. [4 Lectures]
2. How much does a curve? [8 Lectures]
3. Global Properties of curves. [8 Lectures]
4. Surfaces in three dimensions. [8 Lectures]
5. The first fundamental form. [10 Lectures]
6. Curvature of surfaces. [10 Lectures]

**Text Book :** Andrew Pressley : Elementary Differential Geometry, Springer International Edition, Indian Reprint 2004. Chapters : 1 to 6.

**Reference Book :** John A. Thorpe : Differential Geometry, Springer International Edition, Indian Reprint 2004

## MT 347 C: C programming II

### 1. Program Structures: [4 Lectures]

Storage classes. Automatic variables. External variables, Static variables.

### 2. Pointers: [12 Lectures]

Fundamentals. Pointer declarations. Passing pointer to a function. Pointer and one dimensional arrays. Dynamic memory allocation. Operations on pointers. Pointers and multidimensional arrays. Array of pointers. Pointer to function. Passing functions to other functions. More about pointer declarations.

### 3. Structures and Unions: [12 Lectures]

Defining a structure. Processing a structure. Userdefined data types (typedef ). Structures and pointers. Passing structure to a function. Self-referential structures, Unions.

### 4. Data Files: [10 Lectures]

Opening and closing a data file. Creating a data file. Processing a data file. Unformatted data files. 5. Low-Level Programming: Bitwise operators. Register variables. Enumerations. Macros. Command line arguments. The C processor.

**Text Book:** Programming with C. By Byron S. Gottfried. Schaum's Outline series. Chapters:8,10,11,12,13,14.

**Reference Book:** The C Programming Language. By Brian W. Kernighan, Dennis M. Ritchie.

## **MT 347 D: Graph Theory**

### **1. An Introduction to Graphs**

**[18 Lectures]**

The definition of a Graph, Graphs and Models, More Definitions, Vertex Degree, Sub graphs, Paths and Cycles, The Matrix Representation of Graphs, Fusion

### **2. Trees and Connectivity**

**[14 Lectures]**

Definition and Simple Properties, Bridges, Spanning Trees, Connector Problems, Shortest Path Problems, Cut Vertices and Connectivity.

### **3. Euler Tours and Hamiltonian Cycles**

**[8 Lectures]**

Euler Tours, The Chinese Postman Problem, Hamiltonian Graphs, The Travelling Salesman Problem.

### **4. Directed Graphs**

**[8 Lectures]**

Definitions, In degree and Out degree, Tournaments, Traffic Flow.

### **Text Book**

A First Look at Graph Theory, John Clark and Derek Allan Holton, Allied Publishers Ltd.(1991), Chapter No. 1,2,3 and 7.

### **Reference Books**

1. Introduction to Graph Theory, R. J. Wilson, Pearson(2003)
2. Graph Theory, Hararay, Narosa Publishers, New Delhi(1989)
3. Graph Theory, Narsing Deo, Prentice Hall of India Pvt. Ltd.(1987)
4. Basic Graph Theory, K. R. Parthasarathy, TataMcGraw Hill Publisher Co. Ltd.

## MT 347 E: Lebesgue Integration

### 1. Measurable Sets [12 Lectures]

- (i) Length of open sets and closed sets.
- (ii) Inner and outer measure.
- (iii) Measurable sets.
- (iv) Properties of measurable sets.

### 2. Measurable Functions [12 Lectures]

### 3. The Lebesgue integrals [16 Lectures]

- (i) Definition and example of the Lebesgue integrals for bounded functions.
- (ii) Properties of Lebesgue integrals for bounded measurable functions.
- (iii) The Lebesgue integral for unbounded functions.
- (iv) Some fundamental theorems.

### 4. Fourier Series [8 Lectures]

- (i) Definition and examples of Fourier Series.
- (ii) Formulation of convergence problems.

#### Text-Book:

Richard R. Goldberg, Methods of Real Analysis, Oxford and IBH Publishing Co. Pvt. Ltd. (1970).

(Chapter No. 11, 11.1 to 11.8, 12.1, 12.2. Theorem No. 11.1B and 11.1C, 11.8D Statements only).

#### Reference Books:

1. Tom Apostol, Advanced Calculus, 2nd Edition, Prentice Hall of India, (1994).
2. D. Somasundaram and B. Choudhari, A first course in Mathematical Analysis, Narosa Publishing House, (1997).
3. R.G. Bartle and D.R. Scherbert, Introduction to real analysis 2nd Edition, John Wiley, (1992).
4. Inder K. Rana, Measure and Integratio

# MT 347 F: Computational Geometry

## 1. Two dimensional Transformations

[12 Lectures]

Introduction, Representation of Points, Transformations and Matrices, Transformation of Points, Transformation of Straight Lines, Midpoint Transformation, Transformation of Parallel Lines, Transformation of Intersecting Lines, Rotation, Reflection, Scaling, Combined Transformations, Transformation of the Unit Square, Solid Body Transformation, Translations and Homogeneous Coordinates, Rotation About an Arbitrary Point, Reflection Through an Arbitrary Line, Projection - A Geometric Interpretation of Homogeneous Coordinates, Overall Scaling, Points at Infinity.

## 2. Three Dimensional Transformations:

[12 Lectures]

Three Dimensional Scaling and Shearing, Three Dimensional Rotation. Three Dimensional Reflection. Three Dimensional Translation. Multiple Transformations, Rotations about an Axis Parallel to a coordinate axis, Rotation about an Arbitrary Axis in Space, Reflection Through an Arbitrary Plane. Affine and Perspective Geometry, Orthographic Projections, Axonometric Projections, Oblique Projections, Perspective Transformations. Techniques for generating perspective views, Vanishing points.

## 3. Plane Curves

[12 Lectures]

Curve representation, non-parametric curves, parametric curves, parametric representation of a circle, parametric representation of an Ellipse, parametric representation of a parabola, parametric representation of a Hyperbola.

## 4. Space Curves Beizer curves:

[12 Lectures]

Introduction, definition, properties (without proofs), curve fitting (up to  $n = 3$ ), equation of the curve in matrix form (up to  $n = 3$ ).

### Text-Book:

D.F. Rogers, J. Alan Adams, Mathematical Elements of Computer Graphics, Second Edition, McGraw-Hill Publishing Company.

( §2.2 to 2.20, 3.1 to 3.15, 3.17, 4.1 to 4.8, 5.8)

## **Modalities For Conducting The Practical and The Practical Examination:**

**Special Instruction:** Before starting each practical necessary introduction, basic definitions, intuitive inspiring ideas and prerequisites must be discussed.

- 1) There will be one 3 hour practical session for each batch of 12 students per week
- 2) A question bank consisting at least 60 questions in all for each semester, distributed in two sections: 30 questions each of optional Paper I and optional Paper II will be the course work for this paper. A question bank will be prepared by the individual subject teacher based on pattern of questions provided by university. The question bank of each year should be preserved by the subject teachers, which can be reviewed by the L.I.C. members visiting college.
- 3) University will conduct the Practical Examination each semester twice a year. The practical examination will consist of written examination of 32 marks and oral examination of 08 marks.
- 4) The practical exam will be of the duration of 3 hours.

### **5) The pattern of question paper for MT 338 and MT348 (Mathematics Practical)**

Q1.A) Attempt any 01 out of 02 questions each of 08marks.(Based on optional Paper I) [08 Marks]

B) Attempt any 02 out of 03 questions each of 04 marks.(Based on optional Paper I) [08Marks]

Q2.A) Attempt any 01 out of 02 questions each of 08 marks.(Based on optional PaperII)[08Marks]

B) Attempt any 02 out of 03 questions each of 04 marks.(Based on optional PaperII)[08Marks]

*N.B.* For C-Programming a separate slip containing programmes for 16 marks.

- 6) Each student will maintain a journal to be provided by the college.
- 7) The internal 10 marks will be given on the basis of journal prepared by student and the cumulative performance of student at practicals.
- 8) It is recommended that concept may be illustrated using computer software and graphing calculators wherever possible.
- 9) Trips/Study tours may be arranged at places having important mathematical institutes or historical places.



Faculty of Science

Revised Syllabus

For

B. Sc.  
(Physics)

From Academic Year 2013-2014

Structure of Syllabus



# UNIVERSITY OF PUNE

## Proposed Structure of B.Sc. (Physics) Syllabus

### 1) Preamble:

The systematic and planned curricula from first year to the third year shall motivate and encourage the students for pursuing higher studies in Physics and for becoming an entrepreneur.

### Objectives:

- To provide in depth knowledge of scientific and technological aspects of Physics
- To familiarize with current and recent scientific and technological developments
- To enrich knowledge through problem solving, hand on activities, study visits, projects etc.
- To train students in skills related to research, education, industry, and market.
- To create foundation for research and development in Electronics
- To develop analytical abilities towards real world problems
- To help students build-up a progressive and successful career in Physics

### 2) Eligibility:

- 1 **First Year B.Sc.:** Higher Secondary School Certificate (10+2) Science stream or its equivalent Examination as per the University of Pune eligibility norms.
- 2 **Second Year B.Sc.:** Keeping terms of First Year of B. Sc. with Physics as one of the subjects. Other students if they fulfil the conditions approved by the equivalence committee of Faculty of Science of the University of Pune are also eligible.
- 3 **Third Year B. Sc.:** Student shall pass all First Year B. Sc. courses and satisfactorily keeping terms of Second Year of B. Sc. with Physics 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.

### F.Y. B. Sc.

(From Academic Year 2013-2014)

**(To be implemented from Academic Year 2013-14)**

Paper	Title
Paper I	Section I (For Term 1): Mechanics
	Section II (For Term 2): Heat and Thermodynamics
Paper II	Section I (For Term 1): Physics Principles and Applications
	Section II (For Term 2): Electromagnetics
Paper III	(For Term1 and Term 2): Practical

For each theory course: 36 Lectures per term/2 Credits per term

For practical course: 20 practicals/4Credits

**S. Y. B. Sc.**  
(Semester Pattern)  
(From Academic Year 2014-2015)

Semester I

Paper	Title
Paper I (PHY211)	Mathematical Methods in Physics I
Paper II (PHY 212)	Electronics I /Instrumentation

Semester II

Paper	Title
Paper I (PHY221)	Oscillations, Waves and Sound
Paper II (PHY 222)	Optics

Practical Course (Annual)

Paper III (PHY 223) (Annual)	Practical
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**T. Y. B. Sc. (Physics)**  
(Semester Pattern)

(From Academic Year 2015-2016)

<b>Theory Courses (Semester)</b>	
<b>Semester III</b>	<b>Semester IV</b>
PH331: Mathematical Methods in Physics II	PH341: Solid State Physics
PH332: Classical Electrodynamics	PH342: Quantum Mechanics
PH333: Classical Mechanics	PH343: Thermodynamics and Statistical Physics
PH334: Atomic and Molecular Physics	PH344: Nuclear Physics
PH335: Computational Physics	PH345: Electronics II /Advanced Electronics

PH336: Elective I (Select any One)	PH346: Elective II (Select any One)
A: Astronomy and Astrophysics	F: Renewable Energy Sources
B: Elements of Materials Science	G: Physics of Nano materials
C: Motion Picture Physics	H: Microcontrollers
D: Biophysics	I: Electro Acoustics and Entertainment Electronics
E: Medical Electronics	J: Lasers
	K: Methods of Experimental Physics
<b>Practical Courses (Annual)</b>	
PH347: Laboratory Course I	
Phy348: Laboratory Course II	
PH349: Laboratory Course III (Project)	

**Examination:**

A) Pattern of Examination:

**i) F. Y. B. Sc.**

- (a) There shall be university examination at the end of the academic year for 80 marks for each theory paper.
- (b) 20 marks for each paper are allotted to the comprehensive internal assessment of the student by the respective teacher, teaching the course. The teacher shall evaluate the performance of the student for 10 marks in each term; on the basis of written tests. Ordinarily written tests shall consist of (i) multiple choice questions, (ii) True/False, (iii) basic definitions, (iv) tricky computational problems involving minimal calculations. Student is asked to answer 20 questions in 40 minutes. Each question will be of ½ marks. In the same classroom setup, different set of equivalent sets of question papers may be experimented. It will be preferred to have two such tests in each term, per course (one at the middle of the term and one at the end of the term) and average (or best of the two tests) be considered as internal marks out of 10 for that term. Internal Test shall cover the entire syllabus. If teacher prefers to have one test only, it shall be at the end of the term covering the entire syllabus).
- (c) Practical examination be conducted by respective colleges at the end of the academic year 80 marks be assigned to practicals and 20 marks for internal examination, journal attendance (Journal 10 marks, Oral 10 marks).

**ii) S. Y. B. Sc. and T. Y. B. Sc.**

- (a) There shall be university examination at the end of semester for 40 marks for each theory paper.
- (b) 10 marks for each paper are allotted to the comprehensive internal assessment of the student by the respective teacher, teaching the course. Pattern of internal assessment shall be on the lines of F.Y.B. Sc.
- (c) University Practical examination be conducted at the end of the academic year 80 marks be assigned to practicals and 20 marks for internal examination, journal attendance (Journal 10 marks, Oral 10 marks).

For practical examination:

- (1) At least one examiner should be external
- (2) Certified journals be compulsory
- (3) There shall be two experts for all subjects.
- (4) (a) At T. Y. B. Sc. level, it is preferred to have project work in lieu of one of the practical course.  
(b) Blue print for Model Question Paper: Each Board of Studies shall frame at least 5 sets of model theory papers and 10 sets of model question set for internal assessment.

II) Pattern of the Question paper:

For theory paper (University examination) shall be as follows.

**F. Y. B. Sc. (80 Marks) (Time Allotted: 3 hrs)**

- Q1. 16 marks for 8 sub-questions, each sub-question for two marks. Sub-questions shall be answerable in two to four lines and shall be based on complete syllabus.
- Q2. and Q3. Student shall attempt four out of six questions. Each short answer type question shall carry four marks and be answerable in 6 to 8 lines.
- Q4. Student shall attempt 2 out of 4 long answer type questions. Each question will be for 8 marks and be answerable in 12 to 16 lines.
- Q5. Long easy type question for 16 marks. Student shall attempt one out of two questions.

OR

- Q5. Shall be on the pattern of question 4.  
(Question paper of a particular course should contain minimum of 30% weightage to problems)

**S. Y. B. Sc. and T. Y. B. Sc. (Theory) University Question Paper Pattern:**  
(40 marks, Time allotted: 2 hrs)

- Q1. 10 sub-question each for 1 mark. Sub-questions be answerable within 2 to 4 lines and shall be based on complete syllabus. All sub-questions are compulsory.
- Q2 and Q3: (10 Marks for each questions) Three sub questions. Students have to attempt any two questions.
- Q4. Long Essay type question for 8 marks and one question of two marks.

B) Standard of Passing: 40 % marks

C) ATKT Rules

- (i) Students shall clear 8 heads of passing (out of 12 such heads) while going from F. Y. B. Sc. to S.Y.B.Sc. However he must pass in all F. Y. B. Sc. subjects while going to T. Y. B. Sc.

- (ii) Student shall clear 12 heads of passing (out of 20 such heads) while going from S. Y. B. Sc. to T. Y. B. Sc. (Practical course of S. Y. B. Sc. will be equivalent to 2 heads of passing)
- D) Award of Class: As per University norms.
- E) External Students: Not applicable
- F) Setting of question paper/Pattern of Question paper: As mentioned above
- 6) Structure of the Course:
- a) Compulsory paper: a) At F.Y.B.Sc. and S.Y.B.Sc. all papers are compulsory and at T.Y.B.Sc. 8 papers are compulsory and one paper is optional.
  - b) Optional papers: At T.Y.B.Sc. one paper per semester is optional.
  - c) Question papers and papers etc.: As mentioned above
  - d) Medium of Instructions: English
- 7) Equivalence of previous syllabus along with propose syllabus: The papers are similar so no equivalence is required at B. Sc. level.
- 8) University terms: 6 terms
- 9) Subject-wise detailed syllabus: Attached with this format.
- 10) Recommended books: Given in the syllabus at the end of each course.
- 11) Qualification of teachers: As per UGC regulations.

**F. Y. B. Sc.**  
**Term -I**

**Physics Paper I: Section I: Mechanics**

**Lectures: 36**

**Credits: 2**

**Learning Outcomes:**

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

1. Demonstrate an understanding of Newton's laws and applying them in calculations of the motion of simple systems.
2. Use the free body diagrams to analyse the forces on the object.
3. Understand the concepts of energy, work, power, the concepts of conservation of energy and be able to perform calculations using them.
4. Understand the concepts of elasticity and be able to perform calculations using them.
5. Understand the concepts of surface tension and viscosity and be able to perform calculations using them.
6. Use of Bernoulli's theorem in real life problems.
7. Demonstrate quantitative problem solving skills in all the topics covered.

**Syllabus:**

**1. Newton's laws of motion**

**(6 Lectures)**

- 1.1 Newton's First and Second Law and their explanation
- 1.2 Working with Newton's First and Second Law
- 1.3 Newton's Third Law of motion and its explanation
- 1.4 Various types of forces in nature (explanation) and concept of field
- 1.5 Frame of reference (Inertial, Non-inertial)
- 1.6 Pseudo Forces (e.g. Centrifugal Force)

**2. Work and Energy**

**(8 Lectures)**

- 2.1 Kinetic Energy
- 2.2 Work and Work-Energy Theorem
- 2.3 Calculation of Work done with
  - i) Constant Force
  - ii) Variable ForceIllustration
- 2.4 Conservative and Non-conservative Forces
- 2.5 Potential energy and conservation of Mechanical energy
- 2.6 Change in potential energy in rigid body motion  
Mass-energy equivalence

**3. Elasticity**

**(8 Lectures)**

- 3.1 Hook's law and coefficient of elasticity
- 3.2 Young's modulus, Bulk modulus and Modulus of rigidity
- 3.3 Work done during longitudinal strain, volume strain, and shearing strain
- 3.4 Poisson's ratio
- 3.5 Relation between three elastic moduli ( $Y$ ,  $\eta$ ,  $K$ )
- 3.6 Determination of  $Y$  of rectangular thin bar loaded at the centre
- 3.7 Torsional oscillations  
Torsional rigidity of a wire, to determine  $\eta$  by torsional oscillations

**4. Surface Tension**

**(5 Lectures)**

- 4.1 Surface Tension, Angle of Contact, Capillary Rise Method
- 4.2 Rise of liquid in a conical capillary tube
- 4.3 Energy required to raise a liquid in capillary tube

- 4.4 Factors affecting surface tension
- 4.5 Jeager's Method for Determination of surface tension
- 4.6 Applications of Surface Tension

## **5. Viscosity and Fluid Mechanics**

**(9 Lectures)**

- 5.1 Concept of Viscous Forces and Viscosity
- 5.2 Pressure in a fluid and buoyancy
- 5.3 Pascal's law
- 5.4 Atmospheric Pressure and Barometer
- 5.5 Pressure difference and Buoyant Force in accelerating fluids
- 5.6 Steady and Turbulent Flow, Reynolds's number
- 5.8 Equation of continuity
- 5.9 Bernoulli's Principle
- 5.10 Application of Bernoulli's equation
  - i) Speed of Efflux
  - ii) Ventury meter
  - iii) Aspirator Pump
  - iv) Change of plane of motion of a spinning ball.

### **Reference Books:**

1. University Physics: Sears and Zeemansky, XIth edition, Pearson education
2. Concepts of Physics: H.C. Varma, Bharati Bhavan Publishers
3. Problems in Physics: P.K. Srivastava, Wiley Eastern Ltd.
4. Applied Fluid Mechanics: Mott Robert, Pearson Benjamin Cummir, VI Edition, Pearson Education/Prentice Hall International, New Delhi
5. Properties of Matter: D. S. Mathur, Shamlal Chritable Trust New Delhi
6. Mechanics: D.S Mathur, S Chand and Company New Delhi-5.

**F. Y. B. Sc.**  
**Term –II**

**Physics Paper I: Section II: Heat and Thermodynamics**

**Lectures: 36**

**Credits: 2**

**Learning Outcomes:**

After successfully completing this course, the student will be able to do the following:

1. Describe the properties of and relationships between the thermodynamic properties of a pure substance.
2. Describe the ideal gas equation and its limitations.
3. Describe the real gas equation.
4. Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process.
5. Analyse the heat engines and calculate thermal efficiency.
6. Analyze the refrigerators, heat pumps and calculate coefficient of performance.
7. Understand property 'entropy' and derive some thermo dynamical relations using entropy concept.
8. Understand the types of thermometers and their usage.

**Syllabus**

**1. Equation of state (8 lectures)**

- 1.1 Equations of state
- 1.2 Andrew's experiment
- 1.3 Amagat's experiment
- 1.4 Van der Waals' equation of state
- 1.5 Critical constants
- 1.6 Reduced equation of state
- 1.7 Joule-Thomson porous plug experiment

**2. Concepts of Thermodynamics (8 lectures)**

- 2.1 Thermodynamic state of a system and Zero<sup>th</sup> law of Thermodynamics
- 2.2 Thermodynamic Equilibrium
- 2.3 Adiabatic and isothermal changes
- 2.4 Work done during isothermal changes
- 2.5 Adiabatic relations for perfect gas
- 2.6 Work done during adiabatic change
- 2.7 Indicator Diagram
- 2.8 First law of Thermodynamics
- 2.9 Reversible and Irreversible processes

**3. Applied Thermodynamics (8 lectures)**

- 3.1 Conversion of Heat into Work and its converse
- 3.2 Carnot's Cycle and Carnot's Heat Engine and its efficiency
- 3.3 Second law of Thermodynamics
- 3.4 Concept of Entropy
- 3.5 Temperature-Entropy Diagram
- 3.6 T-dS Equation
- 3.7 Clausius-Clapeyron Latent heat equations

**4. Heat Transfer Mechanisms (8 lectures)**

- 4.1 Heat Engines
  - i. Otto cycle and its efficiency
  - ii. Diesel cycle and its efficiency



#### 4.2 Refrigerators:

- i. General Principle and Coefficient of performance of refrigerator
- ii. The Carnot Refrigerator
- iii. Simple structure of vapour compression refrigerator

#### 4.3 Air conditioning: principle and its applications

### 5. Thermometry

(4 lectures)

#### 5.1 Temperature Scales: Centigrade, Fahrenheit and Kelvin scale

#### 5.2 Principle, construction and working of following thermometers

- i. Liquid and Gas Thermometers
- ii. Resistive Type Thermometer
- iii. Thermocouple as thermometer
- iv. Pyre heliometer

### Reference Books:

1. Physics: 4th Edition, Volume I, Resnick/Halliday/Krane JOHN WILEY & SONS (SEA) PTE LTD
2. Concept of Physics: H.C. Verma, Bharati Bhavan Publishers
3. Heat and Thermodynamics: Brijlal, N. Subrahmanyam, S. Chand & Company Ltd, New Delhi
4. Heat and Thermodynamics: Mark. W. Zemansky, Richard H. Dittman, Seventh Edition, McGraw-Hill International Editions
5. Thermodynamics and Statistical Physics: J.K. Sharma, K.K. Sarkar, Himalaya Publishing House
6. Thermal Physics (Heat & Thermodynamics): A.B. Gupta, H.P. Roy Books and Allied (P) Ltd, Calcutta.

## F. Y. B. Sc.

### Term I

#### Physics Paper II: Section I: Physics Principles and Applications

Lectures: 36

Credits: 2

#### Learning Outcomes:

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

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

#### Syllabus:

#### 1. Physics of Atoms (12 Lectures)

1. The concept of atom (Atomic Models: Thompson and Rutherford)
2. Atomic Spectra
3. Bohr Theory
4. Hydrogen atom Spectra
5. Frank Hertz experiment
6. The LASER  
Absorption, Spontaneous Emission, and Stimulated Emission, Population Inversion and Laser Action, Applications of Lasers

#### 2. Physics of Molecules (10 Lectures)

1. Bonding Mechanisms: A Survey
  - i. Ionic Bonds
  - ii. Covalent Bonds
  - iii. Van der Waals Bonds
  - iv. The Hydrogen Bond
  - v. Metallic Bond
2. Variation of potential energy with inter-atomic distance
3. Concept of Rotational and vibrational energy levels of diatomic molecule

#### 3. Electromagnetic Waves (14 Lectures)

1. Historical Perspective of Electromagnetic Waves
2. Production of electromagnetic waves : Hertz experiment
3. Electromagnetic spectrum
4. Planck hypothesis of photons (Concept only)
5. Sources of electromagnetic waves : Radio waves, Microwaves, Infrared, Visible light, Ultraviolet, X-rays, Gamma rays
6. Applications
  - i. microwave oven
  - ii. RADAR
  - iii. Pyro electric thermometer
  - iv. X-ray radiography and CT Scan
  - v. Solar cell

## 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 (11<sup>th</sup> Ed. Pearson Education)
4. Nanotechnology : Principles and Practices: S. K. Kulkarni, Capital Publishing Company.

**F. Y. B. Sc.  
Term II**

**Physics Paper II: Section II: Electromagnetics**

**Lectures: 36**

**Credits: 2**

**Learning Outcomes:**

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

1. Demonstrate an understanding of the electric force, field and potential, and related concepts, for stationary charges.
2. Calculate electrostatic field and potential of simple charge distributions using Coulomb's law and Gauss's law.
3. Demonstrate an understanding of the dielectric and effect on dielectric due to electric field.
4. Demonstrate an understanding of the magnetic field for steady currents using Biot-Savart and Ampere's laws.
5. Demonstrate an understanding of magnetization of materials.
6. Demonstrate quantitative problem solving skills in all the topics covered.

**Syllabus**

**1. Electrostatics**

**(9 Lectures)**

1. Revision of Coulomb's law
2. Superposition principle
3. Electric field due to an electric dipole, line and disc
4. Revision of Gauss's law
5. Coulomb's law from Gauss's law
6. Gauss's law applications in Cylindrical, planar and spherical symmetry

**2. Dielectrics**

**(9 Lectures)**

1. Electric Dipole
2. Electric dipole and dipole moment
3. Electric potential and intensity at any point due to dipole
4. Torque on a dipole placed in an electric field
5. Polar and non-polar molecules
6. Electric polarization of dielectric material
7. Gauss' law in dielectric
8. Electric vectors and relation between them

**3. Magneto statics**

**(9 Lectures)**

1. Revision of Biot-Savart's law with examples
2. Amperes' law, e.g. Solenoid and Toroid
3. Gauss law for magnetism

**4. Magnetic properties of materials**

**(9 Lectures)**

1. Magnetic materials and Bohr magneton
2. Magnetization (M), magnetic intensity (H), magnetic induction (B), magnetic susceptibility and permeability
3. Relation between B, M and H
4. Hysteresis

**References:**

1. Fundamentals of Physics: 8<sup>th</sup> Edition, Halliday Resnik and Walker
2. Electromagnetics: B. B. Laud

**F. Y. B. Sc.**  
**Term I and II**

**Physics paper III: Practical**

**Total Practicals: 20**

**Credits: 4**

**Learning Outcomes:**

After successfully completing this laboratory course, the students will be able to do the following:

1. Acquire technical and manipulative skills in using laboratory equipment, tools, and materials.
2. Demonstrate an ability to collect data through observation and/or experimentation and interpreting data.
3. Demonstrate an understanding of laboratory procedures including safety, and scientific methods.
4. Demonstrate a deeper understanding of abstract concepts and theories gained by experiencing and visualizing them as authentic phenomena.
5. Acquire the complementary skills of collaborative learning and teamwork in laboratory settings.

**Syllabus:**

**1. Mechanics**

1. Range and Least Count of Instruments, Measurements using various instruments and error analysis (Vernier caliper, screw gauge, travelling microscope, spectrometer etc.)
2. Determination MI of disc using ring
3. MI of Flywheel
4. Determination of coefficient of viscosity by Poiseuille's method
5. Determination of  $Y$  and  $n$  by flat spiral spring
6. Determination of  $Y$  by bending
7. Surface Tension by Jeager's method.

**2. Heat and Thermodynamics**

1. Interpretation of isothermal and adiabatic curves on PV diagrams (Theoretical). Theoretical study of Carnot's cycle by drawing graphs of isothermal and adiabatic curves.
2. Temperature coefficient of resistance
3. Study of thermocouple and determination of inversion temperature
4. Thermal conductivity by Lee's method
5. Specific heat of graphite

**3. Light**

1. Study of spectrometer and determination of angle of prism
2. Spectrometer calibration. Determination of refractive indices of different colours and plotting the graph of refractive index vs wavelength.
3. Study of total internal reflection using LASER
4. Study of polarization of light by reflection
5. Determination of wavelength of LASER light by plane diffraction grating or cylindrical obstacle.

**4. Electricity and magnetism**

1. Charging and discharging of a capacitor

2. Study of LR circuit
3. Study of LCR series circuit
4. Study of Kirchhoff's laws
5. Diode characteristics
6. Study of millimetres (all AC, DC ranges, Least Count)
7. Determination of frequency of AC mains

Students have to perform minimum three experiments from each section and total sixteen experiments. Students can perform any two experiments from Computer Aided experiments in place of any two experiments in above four sections.

### **Additional Activities**

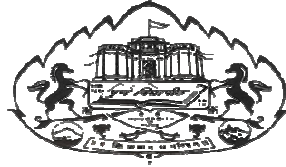
1. Demonstrations (Any four demonstrations equivalent to two experiments)
  1. Magnet –magnet interaction
  2. Collision by using balls
  3. Study of Signal generator using CRO (Sine, square wave signal, measurement of AC voltage, frequency)
  4. Demonstration of action potential
  5. Measurement of sound pressure level
2. Computer aided demonstrations (Using computer simulations or animations) (Any two demonstrations equivalent to two experiments)
  1. Coulomb's law
  2. Vectors : visualization of vectors
  3. Bohr's model
  4. Carnot engine, diesel engine
  5. Graphs and their slopes, and Kinematics graphs (using computer simulations)
3. Mini projects/Hand on activities (Any one equivalent to two experiments)
  1. Students should collect the information of at least five Physicists with their work.
  2. Students should carry out mini projects
4. Study tour (Equivalent to two experiments)  
Students participated in study tour must submit a study tour report.

Students have to perform at least two additional activities out of four activities in addition to sixteen experiments mentioned above. Total Laboratory work with additional activities should be equivalent to twenty experiments.

**UNIVERSITY OF PUNE**

**FOR**

**S.Y.B. Sc. (Physics)**



**FROM ACADEMIC YEAR**

**2014-2015**

### Equivalence of Courses in 2013 pattern with 2008 pattern

#### Semester I

Paper	2008 Pattern (Old Course)	2013 Pattern (New Course)
Paper I (PHY211)	Mathematical Methods in Physics I	Mathematical Methods in Physics I
Paper II (PHY 212)	Electronics I	Electronics I
Paper II (PHY 212)	Instrumentation	Instrumentation

#### Semester II

Paper	2008 Pattern (Old Course)	2013 Pattern (New Course)
Paper I (PHY221)	Oscillations, Waves and Sound	Oscillations, Waves and Sound
Paper II (PHY 222)	Optics	Optics



**S.Y.B. Sc. (Physics)**

**Semester I (Paper I)**

**PH211: MATHEMATICAL MEHODS IN PHYSICS**

**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 singular points of differential equation.

**1. Complex Numbers (12)**

- 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 mathematical and Argand diagram
- 1.5 De-Moivre's Theorem
- 1.6 Powers, roots 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 (12)**

- 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 Implicit and explicit functions
- 2.9 Conditions for maxima and minima (without proof)
- 2.10 Problems.

**3. Vector Algebra (06)**

- 3.1 Introduction to scalars and vectors:
- 3.2 dot product and cross product of two vectors and its physical significance
- 3.3 Scalar triple product and its geometrical interpretation.
- 3.4 Vector triple product and its proof.
- 3.5 Problems.

**4. Vector Analysis (12)**

- 4.1 Introduction
- 4.2 Scalar and vector fields
- 4.3 Differentiation of vectors with respect to scalar.
- 4.4 Vector differential operator and Laplacian operator
- 4.5 Gradient of scalar field and its physical significance.

4.6 Divergence of scalar field and its physical significance

4.7 Curl of vector field

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

4.9 Problems.

## 5. Differential Equation

(06)

5.1 Frequently occurring partial differential equations (Cartesian coordinates)

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

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

5.4 Problems.

Additional Activity:

Four tutorials containing 10 unsolved problems each from suggested references.

### 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, Academic Press.

**S.Y.B. Sc. (Physics)**

**Semester I (Paper II)**

**PH212: ELECTRONICS**

**Learning outcomes:** On successful completion of this course the students will be able to

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

**1. NETWORK THEOREMS (06)**

- 1.1 Kirchhoff's laws (revision)
- 1.2 Voltage and Current divider circuits
- 1.3 Thevenin's theorem
- 1.4 Norton's theorem
- 1.5 Super-position theorem
- 1.6 Maximum power transfer theorem (All theorems 1.3 to 1.6 with proof)
- 1.7 Problems.

**2. STUDY OF TRANSISTOR (14)**

**2.1) BIJUNCTION TRANSISTOR**

1. Revision of bipolar junction transistor, types, symbols and basic action
2. Configurations (Common Base, Common Emitter & Common Collector)
3. Current gain factors ( $\alpha$  &  $\beta$ ) and their relations.
4. Input, output and transfer characteristics of CE, CB & CC configurations.
5. Biasing methods: Base bias, Emitter feedback and voltage divider
6. DC load lines (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, Parameters of: Uni-Junction Transistor(UJT)
2. Use of UJT as a relaxation oscillator

**3. OPERATIONAL AMPLIFIERS (10)**

- 3.1 Introduction
- 3.2 Ideal and practical Characteristics
- 3.3 Operational amplifier: IC 741- Block diagram and Pin diagram
- 3.4 Concept of virtual ground
- 3.5 Inverting and non-inverting operational amplifiers with concept of gain.

- 3.6 Operational amplifier as an adder and subtracter.
- 3.7 Problems.

#### **4. OSCILLATORS**

**(04)**

- 4.1 Concept of positive and negative feedback
- 4.2 Barkhausen criteria for an oscillator
- 4.3 Construction, working and applications of Phase shift oscillator using IC-741
- 4.4 Problems.

#### **5. POWER SUPPLY**

**(06)**

- 5.1 Concept and working of rectifier half wave, full wave and bridge rectifier
- 5.2 Ripple voltage
- 5.3 RC filter circuit
- 5.4 Unregulated and regulated power supply
- 5.5 Concept of load and line regulation
- 5.6 Zener as regulator
- 5.7 Problems.

#### **6. NUMBER SYSTEM AND LOGIC GATES**

**(08)**

- 6.1 Number systems: Binary, Binary coded decimal (BCD), Octal, Hexadecimal
- 6.2 Addition and subtraction of binary numbers and binary fractions using one's and two's complement.
- 6.3 Basic logic gates (OR, AND, NOT)
- 6.4 Derived gates: NOR, NAND, EXOR, EXNOR with symbols and truth tables
- 6.5 Boolean Algebra
- 6.6 De Morgan's theorems and its verification
- 6.7 Problems.

#### **Reference Books:**

1. Electronics Principles, Malvino, 7<sup>th</sup> Edition TaTa Mc-Graw Hills.
2. Principles of Electronics, V. K. Mehta, S. Chand Publication New Delhi.
3. Op Amp and Linear integrated circuits, Ramakant Gaikwad, Prentice Hall of India Pub.
4. Integrated Circuits, Botkar, Khanna Publications, New Delhi
5. Digital Principles and Applications, Malvino and Leech Tata Mc-Graw Hills Pub

**S.Y.B. Sc. (Physics)**

**Semester I (Paper II)**

**PH212: INSTRUMENTATION**

**(For the students who have offered Electronic Science at F. Y. B. Sc.)**

**Learning outcomes:** After successful completion of this course the students will be able to

- Understand the functions of different instruments.
- Use different instruments for measurement of parameters.
- Design experiments using sensors.

**1. Fundamentals of measurement (08)**

- 1.1 Aims of measurement [Ref 1, Pages: 1-2]
- 1.2 Functional elements of typical measurement system (block diagram and its explanation) [Ref 1, Pages: 6-8]
- 1.3 Standard measurements and types of calibration methods [Ref 1, Pages: 19-27]
- 1.4 Static characteristics (accuracy, precision, sensitivity, linearity, repeatability, reproducibility, drift, hysteresis, resolution) [Ref 1, Pages: 29-33]
- 1.5 Dynamic characteristics: concepts, first and second order systems, examples of first-order resistance thermometer and thermal element, examples of second order: U-tube manometer and seismic motion [Ref 1, Pages: 81-106]
- 1.6 Errors in measurement
- 1.7 Problems.

**2. Transducers (12)**

- 2.1 Measurement of displacement: variable resistance, inductance and capacitance methods. Variable capacitance transducers [Ref 1, Pages: 815-825] and Piezoelectric transducers [Ref 1, Pages: 826-829]
- 2.2 Measurement of force: Load cell, column type devices, cantilever beam
- 2.3 Measurement of temperature:
  - I) Scales of temperature (Kelvin, Celsius, Fahrenheit etc.)
  - II) Methods of temperature measurement:
    - a) Non-electrical method – liquid filled thermometer, bimetallic thermometer.
    - b) Electrical method – Platinum resistance thermometer
    - c) Thermistor – PTC and NTC with characteristics
    - d) Radiation method – Type of pyrometers, selective radiation pyrometer (solar radiation) [Ref 1, Pages: 739-758, 788-793]
- 2.4 Problems.

**3. Measurement of pressure, flow and magnetic field (10)**

- 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 (12)**

- 4.1 OP-AMP and its characteristics (ideal and practical), basic modes of operation
- 4.2 OP-AMP circuit used in instrumentation – inverter, adder, subtractor, multiplier, divider, integrator, differentiator, active rectifier, comparator, logarithmic converters, current to voltage and voltage to current converters, buffer amplifier,
- 4.3 Instrumentation amplifier (three OP-AMP configuration) [Ref 1, Pages: 873-903]
- 4.4 Filters [Ref 1, Pages: 913-918]
- 4.5 Problems.

**5. Display, Recorders and Activators (06)**

- 5.1 Type of recorders, graphic recorders (chart and X-T recorders),
- 5.2 Oscillographic recorders [Ref 1, Pages: 1034-1040]
- 5.3 Problems.

**Ref Book:**

- 1. A course in Electrical and Electronic Instrumentation [19<sup>th</sup> edition, 2012], A. K. Sawhney (Dhanpat Rai & Co. Pvt. Ltd., New Delhi)

**Additional Reading:**

- 1. Instrumentation devices and systems :- Rangan, Sarma, Mani [Tata Mc Graw Hill]
- 2. Instrumentation Measurement and Analysis – Nakra, Choudhari [Tata Mc Graw Hill]
- 3. Electronics Instrumentation – H.S.Kalsi [Tata Mc Graw Hill]
- 4. Sensor and Transducers – Patranabis [PHI ]
- 5. Fundamental of Industrial Instrumentation- Alok Barua [Wiley India]

## FOR S.Y.B. Sc. (Physics)

### Semester II (Paper I)

#### PH221: OSCILLATIONS, WAVES AND SOUND

##### Learning outcomes:

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

- Understand the physics and mathematics of oscillations.
- Solve the equations of motion for simple harmonic, damped, and forced oscillators.
- Formulate these equations and understand their physical content in a variety of applications,
- Describe oscillatory motion with graphs and equations, and use these descriptions to solve problems of oscillatory motion.
- Explain oscillation in terms of energy exchange, giving various examples.
- Solve problems relating to undamped, damped and force oscillators and superposition of oscillations.
- Understand the mathematical description of travelling and standing waves.
- Recognise the one-dimensional classical wave equation and solutions to it.
- Calculate the phase velocity of a travelling wave.
- Explain the Doppler effect, and predict in qualitative terms the frequency change that will occur for a stationary and a moving observer.
- Define the decibel scale qualitatively, and give examples of sounds at various levels.
- Explain in qualitative terms how frequency, amplitude, and wave shape affect the pitch, intensity, and quality of tones produced by musical instruments

#### 1. Undamped Free Oscillations (09)

- 1.1 Different types of equilibria (stable, unstable, and neutral equilibrium)
- 1.2 Potential well and periodic oscillations, Approximation of a general potential well  $V(x)$  to a parabola for small oscillations
- 1.3 Definition of linear and angular S.H.M.
- 1.4 Differential equation of S.H.M. and its solution (exponential form)
- 1.5 Composition of two perpendicular linear S.H.Ms. for frequencies 1:1 and 1:2 (analytical method)
- 1.6 Lissajous's figures and its uses, Applications (mechanical, electrical and optical)
- 1.7 Problems.

#### 2. Damped Oscillations (09)

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

### **3. Forced Oscillations** **(10)**

- 3.1 Forced oscillation with one degree of freedom
- 3.2 Differential equation of forced oscillation and its solution (transient and steady state) Amplitude of forced oscillation
- 3.3 Resonance and its examples: mechanical (Barton's pendulum), optical (sodium vapour lamp),
- 3.4 Velocity and Amplitude resonance
- 3.5 Sharpness of resonance
- 3.6 Energy of forced oscillations
- 3.7 Power dissipation
- 3.8 Quality factor and Bandwidth
- 3.9 Application of forced oscillations
- 3.10 Equation of coupled oscillations,
- 3.11 Problems.

### **4. Wave Motion** **(08)**

- 4.1 Differential equations of wave motion in continuous media
- 4.2 Equations for longitudinal waves and its solution (one dimension only)
- 4.3 Equation for transverse waves and its solution (one dimension only)
- 4.4 Energy density and intensity of a wave
- 4.5 Discussion of seismic waves
- 4.6 Problems.

### **5. Doppler Effect** **(06)**

- 5.1 Explanation of Doppler effect in sound
- 5.2 Expression for apparent frequency in different cases.
- 5.3 Asymmetric nature of Doppler effect in sound
- 5.4 Doppler effect in light, symmetric nature of Doppler effect in light.
- 5.5 Applications: Red shift, Violet shift, Radar,
- 5.6 Problems.

### **6. Sound** **(06)**

- 6.1 Definition of sound intensity, loudness, pitch, quality and timber
- 6.2 Acoustic intensity level measurement
- 6.3 Acoustic pressure and its measurement
- 6.4 Reverberation time and Reverberation of a hall
- 6.5 Sabine's formula (without derivation)
- 6.6 Stroboscope
- 6.7 Problems

#### **Reference Books:**

1. Waves and Oscillations, Stephenson
2. The physics of waves and oscillations, N. K. Bajaj, Tata McGraw- Hill, Publishing co. Ltd.
3. Fundamentals of vibration and waves, SPPuri, Tata McGraw-Hill Publishing co. Ltd.
4. A text book of sound, Subramanyam and Brijlal, Vikas Prakashan
5. Sound, Mee, Heinmann, Edition - London
6. Waves and Oscillations, R.N. Chaudhari, New age international (p) ltd.



## S.Y.B. Sc. (PHYSICS)

### SEMESTER II (PAPER II)

#### PH222: OPTICS

#### Learning Outcomes

This course will enable you to:

- acquire the basic concepts of wave optics
- describe how light can constructively and destructively interfere
- explain why a light beam spreads out after passing through an aperture
- summarize the polarization characteristics of electromagnetic waves
- appreciate the operation of many modern optical devices that utilize wave optics
- Understand optical phenomena such as polarisation, birefringence, interference and diffraction in terms of the wave model.
- analyse simple examples of interference and diffraction phenomena.
- be familiar with a range of equipment used in modern optics.

#### 1. Geometrical Optics: (10)

- 1.1 Introduction
- 1.2 Lenses: thin and thick
- 1.3 Sign convention
- 1.4 Thin lenses: lens equation
- 1.5 Lens maker equation
- 1.6 Magnification of thin lens
- 1.7 Deviation by thin lens
- 1.8 Power of thin lens
- 1.9 Equivalent focal length of two thin lenses
- 1.10 Cardinal points
- 1.11 Problems.

#### 2. Lens Aberrations (10)

- Introduction
- Types of aberration: Monochromatic and chromatic
- Types of monochromatic aberrations and their reductions
- Types of chromatic aberrations
- Achromatism : lenses in contact and separated by finite distance
- Problems.

#### 3. Optical Instruments (10)

- 3.1 Introduction
- 3.2 Simple Microscope
- 3.3 Compound Microscope
- 3.4 Ramsdens eye piece
- 3.5 Huygens eye piece

3.6 Problems.

**4. Interference and Diffraction (12)**

4.1 Revision to Interference

4.2 Phase change on reflection (Stokes Treatment)

4.3 Interference by parallel sided thin films

4.3.1 Interference due to reflected light

4.3.2 Interference due to refracted light

4.4 Interference due to Wedge Shaped thin film

4.5 Types Diffraction : Fresnel's diffraction and Fraunhofer's diffraction

4.6 Fraunhofer's diffractions at a double slit

4.7 Plane diffraction grating

4.8 Newton's Rings

4.9 Rayleigh's criterion for resolution

4.10 Problems.

**5. Polarization (06)**

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 Problems.

**Reference Books:**

1. Optics, fourth edition, Pearson education, E. Hetch, A. R. Genesan
2. A Text book of Optics, N.Subhramanyam, Brijlal, M. N. Avadhanulu, S. Chand publication.
3. Physical Optics by A.K.Ghatak, McMillan, New Delhi
4. Fundamental of Optics, F.A.Jenkins, H.E.White, McGraw-Hill international Edition.
5. Principles of optics, D.S. Mathur, Gopal Press, Kanpur

## **S. Y. B. Sc. (PHYSICS)**

### **PAPER III (SEMESTER I and II)**

#### **PH223: PRACTICAL COURSE**

#### **Learning Outcomes**

- 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 to an experiment.
- Set up experimental equipment to implement an experimental approach.
- Analyse data, plot appropriate graphs and reach conclusions from your data analysis.
- Work in a group to plan, implement and report on a project/experiment.
- Keep a well-maintained and instructive laboratory logbook.

#### **Section I:**

##### **1) Oscillations, Waves and Sound (Any 4 experiments)**

1. Logarithmic decrement (in air and water)
2. Study of coupled oscillators comprising two simple pendulum (Mechanical) and determination of coupling coefficient.
3. Study of musical scales using a signal generator and musical instruments.
4. Determination of frequency of AC mains using sonometer.
5. Measurement of coefficient of absorption of sound for different materials (cork, thermocol, mica, paper etc.)
6. Velocity of sound by phase shift method.
7. Determination of speed of sound by Quincke's method interferometer.
8. Directional characteristics of Microphone.

##### **2) Optics (Any 4 experiments)**

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

#### **Section II:**

##### **1) Electronics/Instrumentation (Any 6 experiments)**

1. Circuit Theorems. (Thevenin's, Norton's and Maximum power transfer theorem)
2. Transistor characteristics (CE configuration):

3. Transistor amplifier (single stage)
4. Study of rectifiers (half wave and full wave) with different filters.
5. I-V characteristics of UJT
6. UJT as a Relaxation Oscillator.
6. Zener as a regulator, line and load regulation.
7. Study of Phase shift oscillator (using IC 741)
8. OPAMP as inverting and non inverting amplifier
9. OPAMP as an audio mixer.
10. Study of logic gates (using IC) and verification of De Morgan's theorem.
11. Use of CRO (AC/DC voltage measurement, frequency measurement).
12. To measure displacement (linear and angular) using potentiometer/variable inductor/variable capacitor.
13. To measure force using load cell.
14. To measure pressure using elastic diaphragm (in variable Capacitor/Bourden Tube)
15. To measure magnetic field using Hall probe for a system of ring magnets.

## **2) Computer (2 experiments)**

1. Plotting various trigonometric functions using spreadsheet/any graphic softwares:  $\sin x$ ,  $\cos x$ ,  $\tan x$ ,  $e^x$ ,  $e^{-x}$ ,  $\log x$ ,  $\ln x$ ,  $x^n$  and
2. equations for the following figures: circle, ellipse, parabola, hyperbola.
3. Inverse, determinant of matrix, solution of linear equations.

## **Additional Activities (Any Two)**

1. Demonstrations- Any 4 demonstrations equivalent to 2 experiments
2. Study tour with report equivalent to 2 experiments
3. Mini project equivalent to 2 experiments
4. Computer aided demonstrations (Using computer simulations or animations)(Any demonstrations equivalent to 2 experiments)

Students have to perform at least two additional activities in addition to sixteen experiments mentioned above. Total laboratory work with additional activities should be equivalent to twenty experiments.

# SavitribaiPhule Pune University

## Proposed structure of T. Y. B. Sc. (Physics) revised syllabus

### To be implemented from 2014-2015

Sem III	Sem IV
PH-331: Mathematical Methods in Physics II	PH-341 Classical Electrodynamics
PH 332: Solid State Physics	PH-342: Quantum Mechanics
PH-333: Classical Mechanics	PH-343: Thermodynamics and Statistical Physics
PH-334: Atomic and Molecular Physics	PH-344: Nuclear Physics
PH-335: Computational Physics	PH-345: Electronics/Advanced Electronics
PH-336 Elective I : (Select any One)	PH-346 Elective II : (Select any One)
A: Astronomy and Astrophysics	G: Medical Electronics
B: Elements of Materials Science	H: Physics of Nanomaterials
C: Motion Picture Physics	I: Microcontrollers
D: Biophysics	J: Electro Acoustics and Entertainment Electronics
E: Renewable Energy Sources	K: Lasers
F: Applied Optics	L: Radiation Physics
PH-347: Laboratory Course I	
PH-348: Laboratory Course II	
PH-349: Laboratory Course III (Project)	

# Semester III



**PH331 : Mathematical Methods in Physics- II**

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**1. Curvilinear co-ordinates (14L)**

Introduction to Cartesian, Spherical polar and Cylindrical co-ordinate systems, transformation equations, General Curvilinear co-ordinate system: Co-ordinate surface, co-ordinate lines, length, surfaces and volume elements in curvilinear co-ordinate system, metric coefficient.

Orthogonal Curvilinear co-ordinate system, Expressions for gradient, divergence, Laplacian and Curl, special case for gradient, divergence, Laplacian, and curl in Cartesian, spherical polar and cylindrical co-ordinate system.

(Chapter 2 Ref. 1 / Chapter 1 Ref. 5)

**2. The Special Theory of Relativity (14 L)**

Introduction, Newtonian relativity Galilean transformation equation, Michelson-Morley experiment, Postulates of special relativity, Lorentz transformations, Kinematic effects of Lorentz transformation, Length contraction, Proper time, Transformation of velocities, Variation of mass with velocity, Mass-energy relation. Four vectors.

(Chapter 13 Ref. 2)

**3. Differential equations (10 L)**

Frequently occurring partial differential equations, degree, order, linearity and homogeneity (revision), Method of separation of variables, Singular points, Fuch's theorem (Statement only), Frobenius method for power series solution of Legendre, Hermite and Bessel differential equation. Problems

(Chapter 8 Ref. 1)

**4. Special functions (10 L)**

Generating function for Legendre, Hermite Polynomials, Recurrence relations, their differential equations and orthogonality properties. Bessel function of first kind and their properties. Problems

**Reference books:**

1. Mathematical methods for physicists, Arfken and Weber, Academic press Newyork.
  2. Mathematical physics, Rajput, Pragatiprakashan
  3. Mathematical methods in the physical sciences – Marry L. Boas, John Willy and sons publication
  4. Introduction to special relativity, Robert Resnick, willyeastrn Ltd.
  5. Mathematical physics, B. D. Gupta
  6. Mathematical physics, H. K. Dass
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**T. Y. B. Sc. Physics**  
**PH332: Solid State Physics**

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**1. The Crystalline State (11 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 with proof.

Problems

**2. X ray Diffraction and Other Characterization Techniques (13 L)**

Introduction, Crystal as a grating, Bragg's law and Bragg's Diffraction condition indirect and reciprocal lattice Ewald's construction, Experimental methods of X-ray diffraction: Laue method, Rotating Crystal method, Powder (Debye Scherer) method, Analysis of cubic structure by powder method, Characterization Techniques: Thermal gravimetric analysis (TGA), UV-visible spectroscopy, Electron microscopy (SEM), Problems

**3. Free Electron and Band Theory of Metals (13 L)**

Free Electron model, Energy levels and Density of orbital in 1D and 3D, Bloch theorem (statement only), Nearly free electron model, Fermi energy, Fermi level, Hall Effect, Origin of energy gap, Energy bands in Solids, Effective mass of electron (with derivation), Distinction between metal, semiconductor and insulator

Problems

**4. Magnetism (11 L)**

Diamagnetism, Langevin theory of Diamagnetism, Application of diamagnetic material: (Superconductor) Occurrence of Superconductivity, Critical magnetic field and Meissner effect, Paramagnetism, Langevin theory of Para magnetism, ferromagnetism, ferromagnetic domains, Hysteresis, Curie temperature. Ferromagnetism, Ferrites and its applications, antiferromagnetism, Neel temperature, Problems

**Reference Books :**

- 1 Solid State Physics-S.O.Pillai, 3<sup>rd</sup> Edition, New Age International (P) Ltd, Publisher, (1999).
- 2 Solid State Physics – Kakani and Hemrajani, S. Chand Publication.
- 3 Solid State Physics By Saxena, Gupta and Saxena, PragatiPrakation.
- 4 Introduction to Solid State Physics- Charles Kittel, John Wiley and Sons, 7<sup>th</sup> 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 Problems in Solid State Physics-S.O. Pillai, New Age International (P) Ltd.
- 8 Solid State Physics-Palanyswamy.
- 9 Solid State Physics- David, Snoke, Pearson Publication.



**T. Y. B. Sc. Physics**  
**PH 333 Classical Mechanics**

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**1. Mechanics of system of particles (10 L)**

- 1 Introduction –newton’s laws
- 2 Applications of Newton’s laws of motionProjectile motion in various medium, Rocket motion, Motion of a charged particle in constant electric, magnetic and electromagnetic field.
- 3 System of particles, Centre of mass, Conservation of linear momentum, angular momentum, energy of system of particles (statements only) Problems Ref 1 Ch. 3, Ref 2 Ch 1

**2. Motion in Central Force Field (10 L)**

- 1 Central force, equivalent one body problem
- 2 Motion in central force field
- 3 General features of motion, equation of orbit
- 4 Deduction of Kepler’s laws of planetary motion
- 5 Orbits of artificial satellite Problems Ref1Ch. 5,Ref2Ch4

**3. Scattering of particles (10 L)**

Elastic and inelastic scattering, Elastic scattering - Laboratory and centre of mass system.  
Scattering, Relation between scattering angles in laboratory and centre of mass system.  
Differential cross-section, impact Parameter, total cross-section.

**4. Langrangian and Hamiltonian formulation (10 L)**

- 1 Limitations of Newtonian formulation
- 2 Types of constraints, degrees of freedom, generalized coordinates, configuration space
- 3 D’ Alembert’s principle of virtual work
- 4 Langrangian equation from D’ Alembert’s principle, cyclic coordinates
- 5 Phase space, Hamiltonian’s equations

Problems Ref 1 Ch. 8, Ref 3

**5. Canonical Transformation and Poisson’s Bracket (08 L)**

-Generating function,condition for Canonical transformation and problems , Defination , Identities  
, Poisson’s Bracket , Jacobi identity

**Reference Books**

1. Introduction to Classical Mechanics, R. G. Takawale, P. S. Puranik, Tata McGraw Hill publishing Company Ltd.
2. Classical Mechanics, N. C. Rana, P. S. Joag, Tata McGraw Hill Publishing company Ltd.
3. Principles of mechanics, J. L. Synge, B. A. Griffith, TataMcGraw Hill Publishing company Ltd.
4. Classical Mechanics, Herbert Goldstein, Narosa Publishing House
5. Classical Mechanics by J.C. Upadhyaya, Himalaya publishing Houses.
6. Problem solution of classical mechanics by P.V.Panat

## T. Y. B. Sc. Physics

### PH334 Atomic and Molecular Physics

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- 1. Atomic structure (6 L)**
- 1 Rutherford model of atom
  - 2 Electron orbits
  - 3 Bohr atom
  - 4 Energy levels and spectra (1 to 4 Revision)
- Vector atom model (Concepts of space and quantization and electron spin)
- 5 Atomic excitation and atomic spectra, Problems Ref 1 ch4
- 2. One and two valence electron systems (7 L)**
- 1 Pauli Exclusion principle and electron configuration, quantum states, Spectral notations of quantum states.
  - 2 Spin-Orbit Interaction (Single valence electron atom), Energy levels of Na atom, selection rules, spectra of sodium atom, sodium Doublet.
- 3. Two valence electron systems (7 L)**
- 3 Spectral terms of two electron atoms, terms for equivalent electrons, LS and JJ coupling schemes.
  - 4 Singlet-Triplet separation for interaction energy of LS coupling. Lande's Interval rule, spectra of Helium atom, Problems Ref 1 ch7 Ref. 2 ch8 and ch12
- 4. Zeeman Effect (4 L)**
- 1 Early discoveries and developments
  - 2 Experimental arrangement
  - 3 Normal and anomalous Zeeman Effect Problems
  - 4 Stark effect (Qualitative discussion) Ref 2 ch10
- 5. X ray spectroscopy (6 L)**
- 1 Nature of Xrays
  - 2 Discrete and continuous Xray spectra, Duane and Hunt's Rule
  - 3 Xray emission spectra
  - 4 Mosley's law and its applications
  - 5 Auger effect , Problems Ref 2 ch16
- 6. Molecular spectroscopy (10 L)**
- 1 Rotational energy levels
  - 2 Vibrational energy levels
  - 3 Rotational and Vibrational spectra
  - 4 Electronic spectra of molecules Problems Ref 1 ch8
- 7. Raman spectroscopy (8 L)**
- 1 Classical theory of Raman Effect. Molecular polarizability
  - 2 Quantum theory of Raman Effect
  - 3 Experimental set up for Raman Effect
  - 4 Applications of Raman spectroscopy Ref 3 ch4

#### Reference Books

1. Concepts of Modern Physics 4<sup>th</sup> edition Arthur Baiser (McGraw Hill International edition)
2. Introduction to Atomic spectra White.H.E (McGraw Hill International edition)
3. Fundamentals of Molecular spectroscopy , C.N.Banwell and E.M McCash (McGraw Hill International edition)
4. Modern Physics, J.B.Rajam

**T. Y. B. Sc. Physics**  
**PH335: Computational Physics**

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- 1. Concepts of programming:** (6 L)  
Definition and Properties of algorithms,  
Algorithm development,  
Flow charts- symbols and simple flowcharts.  
Flow charts and Algorithms for Kinematic equations, Free fall, Equation of state, Factorial of a number.  
Types of programming language: Lower, middle and higher level languages.
- 2. C Programming** (14 L)  
Structure of C program, Character set, key words, Constants and variables, Variable names, Data types and their declarations, Symbolic Constants.  
Input/output functions: scanf (), printf (), getchar (), putchar (), getch (), gets (), puts ().  
Operators and Expressions: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Conditional Operator.  
Formatted input/output  
Control statements: If, if else, while, do while for loop, nested control structures (nested if, nested loops), break, continue, switch- case statement, goto statement.  
Use of Library functions: e.g. mathematical, trigonometric, graphics.
- 3. Arrays and Pointers in C** (4 L)  
Arrays: 1-D, 2-D and String  
Examples: Arranging numbers in descending and ascending order, Sum of matrices, multiplication of matrices.  
Concept of Pointers
- 4. User Defined Function in C** (8 L)  
User defined functions: Definitions and declaration of function, function prototype, passing arguments (Call by value, Call by reference).  
Storage Classes: Auto, External, Static, Register variables.
- 5. Graphics in C:** (4L)  
Some simple graphic commands- Line, Circle, Arc, Ellipse, Bar.
- 3. Computational Physics:** [12 L]  
1. Errors in Computation: Inherent errors in storing numbers due to finite bit representation to use in  
Computer, Truncation error, round off errors (Explain with the help of examples)  
2. Iterative methods: Discussion of algorithm and flowcharts and writing C programs for finding single root of equation using bi-section method, Newton Raphson method.  
4. Discussion of algorithm and flowcharts and writing C program for trapezoidal rule and Simpson's 1/3rd rule (derivation of formula is not expected).

**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.

Following programs may be discussed thoroughly in theory lectures:

1. Sum of digits of an integer
2. To find factorial of a number
3. Verifying Boyle's law and Charles' law using equation of state.
4. Checking and printing of prime numbers
5. Solving kinematic equations and free fall equation: obtaining position vs. time data.
6. Obtaining rms velocity of gas using temperature and mass of the gas.
7. To find  $\sin(x)$ ,  $\cos(x)$  using series method
8. Sorting of (1) Numerical data (2) Character type data- ascending, descending.
9. Use of pointers – sorting (any one method of sorting)
10. Matrix operations – addition, subtraction, multiplication
11. Graphics- line, circle, arc, bar, ellipse.
12. Root of equation-Bisection method, Newton Raphson method
13. Numerical integration- Trapezoidal, Simpson's 1/3rd rule.

**T. Y. B. Sc. Physics**  
**PH-336 Elective I (A): Astronomy and Astrophysics**

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**1. Fundamentals of Astronomy: (8 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, Kepler's laws, EM Spectrum: radiation from heated objects', Wien's law, radiation curves, Doppler effect.

**2. Astronomical Instruments: (10 L)**

Optical telescopes, mounts, light gathering power, magnification, resolution. Spectroscopes, CCD camera, photometer, filters Radio telescopes, interferometry UV, IR, X-ray and Gamma ray telescopes. Orbiting space based telescopes: HST, Chandra.

**Star and Star Systems (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 HR diagram: Significance Sun: Solar Cycle, Activity, Butterfly diagram, Photospheric phenomenon Stars as distance estimators

**Galaxies, Dark Matter and Dark Energy (6 L)**

Galaxies, types, their formation, Quasars Hubble's tuning fork diagram Open and Globular clusters Dark Matter / Energy (evidence for both) Cosmology: (6 L) Theories: BBT, Steady State, Oscillating Universe Theory Hubble's law with equation, its significance Concept of space time, fate of our universe Multiverse (only introduction)

**Observational Astronomy: (8 L)**

Co-ordinate system, Celestial hemisphere, Concept of time, Magnitudes: apparent and absolute, constellations. Star dial, Observation of Sun, Eclipses, Moon, planets, meteor showers, transits, occultation's.

**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.VanNostrand 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, BadyanathBasu.

**List of experiments:**

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. To determine the temperature of an artificial star.
6. To observe the Fraunhofer lines in sunlight and determine the elements present.
7. To obtain the Solar image on the screen and trace our the existing sunspots.
8. To locate and observe the various stars, constellation, planets.

**T. Y. B. Sc. Physics**  
**PH-336 Elective I (B) Elements of Materials Science**

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- 1. Defects in Solids** (7L+1P)
- 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** (6L+1P)
- 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. Molecular Phases** (7L+1P)
- 1 Introduction
  - 2 Polymers, Polymerization
  - 3 Molecular weight of polymers
  - 4 Linear polymers addition and condensation
  - 5 Cross linked polymer vulcanization of rubber
- 4. Ceramic Materials** (09L)
- 1 Ceramic Phases, Classification of ceramic materials
  - 2 Ceramic crystals (AX)
  - 3 Mechanical behavior of ceramics
  5. Electromagnetic behavior of ceramics – a) Electric properties dielectrics, semiconductors, piezoelectric b) Magnetic Properties Magnetic Ceramics, hard and soft ferrites
- 5. Phase Diagrams** (9L+2P)
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
- 6. Introduction to smart materials** (5L)
- Definition of smart materials, types and structure of smart materials, Properties of smart materials, Applications of smart materials.

**Reference books**

1. Elements of materials science and Engineering I.H. Vanvlach (4<sup>th</sup> Edition)
2. Materials science and Engineering - V. Raghvan

**List of experiments**

1. To determine the dipole moment of a given liquid
2. To determine magnetic susceptibility of FeCl<sub>3</sub>
3. To determine the specific heat of graphite
4. Determination of the yield point and the breaking point of an elastic material

**T. Y. B. Sc. Physics**  
**PH-336 Elective I (C) Motion Picture Physics**

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- 1. Introduction:** (6 L)  
S. L. R. camera, T. L. R. camera, focal plane shutter, composition of films and paper (B/W) and colour reversal film, shutter speed and Aperture
- 2. Camera lenses:** (5 L)  
Aberrations in lens, angle of view, perspective and its types, camera formats, normal, wide angle, telephoto, zoom, filters
- 3. Processing of photographic materials:** (8 L)  
Different stages involved in processing B/W printing and colour printing, chemicals used in B/W processing. Colour processes- E-6, C-41, EP-2, RA-4. Factors affecting in developing process (B/W) Master print dupe negative, release print, rush print
- 4. Printing Techniques:** (4 L)  
B/W enlarger, its construction and working, contact printing and projection printing, printing methods (color).
- 5. Lighting and special effects:** (10 L)  
Light sources and their characteristics Laboratory special effects: Matte printing, Traveling mattes, slow motion, fast motion, freeze action, reverse action, blow up, and flip over.
- 6. Motion picture techniques:** (8 L)  
Essential parts of movie camera, camera lenses and types, lenses for wide screens, shutter, intermittent, motor drive, view drive, view finders and their types, magazine, camera accessories, camera movements, shots, sound recording on film, optical recording.
- 7. Projection mechanism:** (7 L)  
The projector and its essential parts, intermittent mechanism, drive mechanism, spool boxes, light sources, projection lens, projection screen and their formats.

**Reference Books :**

1. Basic photography – M.J.Lagford, Focal press (London).
2. Advanced photography - M.J.Lagford, Focal press (London).
3. Professional photography - M.J.Lagford, Focal press (London).
4. Basic Motion picture technology – L. Bernard Happe, Focal press (London). List of Experiments:

**Demonstrations**

1. Study of S.L.R camera
2. Study of different camera lenses
3. Study of B/W enlarger
4. Study of color enlarger

**A. Experiments to be performed :**

1. Observe the effect of shutter speed.
2. Contact printing from B/W negative.
3. Projection printing from B/W negative.
4. Shooting and outdoor Scene (B/W or Color).
5. Processing an exposed B/W negative film.
6. Printing from processed color negative film.
7. Shooting a still life (B/W or Color).
8. Shooting and arranging a group photograph.
9. Observe the effect of aperture on depth of film.
10. Portrait Lighting (B/W Film).

**T. Y. B. Sc. Physics**  
**PH-336 Elective I (D) Biophysics**

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**1. Introduction of Biophysics**

- 1.1 Definition and History of Biophysics [Physical properties applied to biology- Surface tension, Viscosity, adsorption, diffusion, osmosis, dialysis and colloids ] (3L)
- 1.2 Cell: Animal and plant cell, types of cell and composition, Functional aspects of cell membrane, cytoplasm, nucleus, mitochondria, chloroplast (Bioenergetics of mitochondria and chloroplast) (4L)
- 1.3 Protein structure (Primary, Secondary, Tertiary and Quaternary structure): Amino-acids structure ( Specify types), Bond length, Bond angles, peptides, and Bond-Rigid planer peptides. Cis and trans configuration, torsion angle, Ramchandran plot. Photosynthesis process:- electron transport, Gibbs's free energy, Redox couple. [Redox potential , Oxidation and reduction, Examples of redox potential in biological system. ] (6L)
- 1.4 Genetic code- symmetry, DNA structure (2L)

**2. Biopotentials**

- 2.1 Bioelectric signals: structure of neuron, resting potential, action Potential, Nernst equation (2L)
- 2.2 Biopotntial amplifier: input impedance, frequency characteristics, gain, CMRR, Calibration, Noise, Temperature sensitive stability. (2L)
- 2.3 Compaind action potentials of the human body ECG, EEG, ERG, EOG (in brief) (4L)
- 2.4 Transducers: Definition, types- resistive, capacitive and inductive transducers, LVDT, photo diode (2L)
- 2.5 Bioelectrodes\_ - Half cell potential, polarizable and non-polarizable electrodes, metal and glass electrodes, types and electric characteristics (3L)

**3. Bioinstruments**

Basic principle, Construction and working of colorimeters, spectrophotometer, ECG machine, PH meter, Centrifuge measurement. (10L)

Electro microscope: SEM, TEM. (2L)

**4. Radiation Biophysics**

- 4.1 Definition, Units of Radioactivity and radiation doses, X-Ray Crystallography as a method for a structure determination of biomolecules NMR. (3L)
- 4.2 Nuclear detector (G M Counter), radioimmunoassays (in brief) (3L)

**5. New Fields**

- 5.1 Biostatistics and Biometry, Definition and concept in brief
- 5.2 Mathematical modeling and Computational biology (Concept only) ( 2 L)

**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 VatsalaPiramal, Dominant Publisher and Distributors, New Delhi-110002
5. Textbook of Biophysics - by R.N. Roy
6. Photosynthesis - by Hall and Rao.

**List of Experiment**

1. Recording and analysis of ECG signals
2. Verification of Beers and Lambert's Law
3. Absorption spectrum of Blood/Chlorophyll.
4. PH Value of Ammino acids.
5. Study of DNA melting
6. Bimolecular model building using standard kits.



**T. Y. B. Sc. Physics**  
**PH-336 Elective I (E) Renewable Energy Sources**

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**1. An Introduction to Energy Sources: (10L)**

Conventional and non-conventional sources of energy, Structure and characteristics of sun, Solar Constant, Electromagnetic energy spectrum, Solar radiations outside earth atmosphere, Solar radiation at the earth surface, 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)**

Liquid flat plate collector, construction and working, Energy balance equation (without thermal analysis), Concentrating collectors, Advantage and disadvantage,

Solar distillation, Solar drying, Solar cooker(box type), Solar water heating systems.

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)**

Introduction, Photovoltaic principle, Power output and conversion efficiency,

Limitation to photovoltaic efficiency, Basic photovoltaic system for power

Generation, Advantages and disadvantages, Types of solar cells, Application of solar photovoltaic systems.

Ref. 3 -15.1, 15.3, 15.4, 15.5, 15.7, 15.8, 15.10.

**4. Energy from Biomass: (12L)**

Introduction, Bio-mass conversion technologies, Bio-gas generation

Factors affecting bio-digestion (list of factors), Working of biogas plant,

Advantages and disadvantage of floating and fixed dome type plant, Bio-gas

from plant wastes, Methods for obtaining energy from biomass, Thermal gasification of biomass, Working of downdraft gasifier, Advantages and disadvantages of biological conversion of solar energy

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, 7.25.

Ref 2: 10.3 (page no 374 to 380)

**5. Wind Energy (06L)**

Introduction, Classification and description of wind machines,

Wind data

Ref -2 (10.2 pages from 353-366)

**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.

**List of Experiments:**

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. Thermal efficiency of liquid – flat plate collector.

5. Study of box type solar cooker.

6. Determination of instantaneous thermal efficiency of parabolic collector.

7. Efficiency and fill factor of solar cells.

**T. Y. B. Sc. Physics**  
**PH-336 Elective I (F) Applied Optics**

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1. Fermat Principles and its applications: Laws of reflection and refraction from Fermat's principle  
Ray paths in inhomogeneous medium, The ray equation and its solution (6L)
2. The matrix method in Paraxial optics: The matrix method, Unit planes, Nodal planes, a system of two thin lenses. (6L)
3. Multiple beam interferometry : Multiple reflection from plane parallel film, The Fabry-Perot Etalon, The Fabry-Perot interferometer, Resolving power, Interference filters. (6L)
4. Diffraction : Two slit Fraunhofer diffraction pattern, N-Slit Fraunhofer diffraction pattern, Fresnel half period zones, the zone plate, Fresnel diffraction, Gaussian beam propagation. (6L)
5. Polarization :Malus law, Double refraction, Quarter wave plate, half wave plate, Optical activity, Wollstone prism, Rochon Prism. (6L)
6. Holography : Importance of coherence, Principle of holography and characteristics, Recording and reconstruction, classification of hologram and application, non-destructive testing. (6L)
7. Fibre optics: Total internal reflection, the optical fibre, the coherent bundle, Numerical aperture, Attenuation in optical fibres, single mode and multimode fibres, Pulse dispersion in optical fibres. (6L)
8. Detection of optical radiation: Human eye, bolometer, pyro-electric, photoconductive detector, photo voltaic detector and photoemissive detector, p-i-n photodiode, APD photodiode. (6L)

References :

- (1) GhatakAjoy, Optics 3<sup>rd</sup> Edition, The McGraw Hill companies.
- (2) M. Born and E. Wolf, Principles of Optics, Cambridge University Press
- (3) F. A. Jenkins, H. E. White, Fundamentals of Optics, Mc Graw Hill

List of Experiments:

- (1) Michelson Interferometer
- (2) Fibre optics communication
- (3) Farbry Perot Etalon
- (4) Polarization of light by reflection

# Semester IV

## T. Y. B. Sc. Physics

### PH-341: Classical Electrodynamics

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#### 1. Electrostatics:

(16 L)

- 1.1. Coulomb's law, Gauss law, Electric field, Electrostatic Potential
- 1.2. Potential energy of system of charges.
- 1.3. Statement of Poisson's equation, Boundary Value problems in electrostatics-solution of Laplace equation in Cartesian system,
- 1.4. Method of image charges: Point charge near an infinite grounded conducting plane, Point charge near grounded conducting sphere.
- 1.5. Polarization  $\mathbf{P}$ , Electric displacement  $\mathbf{D}$ , Electric susceptibility and dielectric constant, bound volume and surface charge densities.
- 1.6. Electric field at an exterior and interior point of dielectric.

#### 2. Magnetostatics:

(16 L)

- 2.1. Concepts of magnetic induction, magnetic flux and magnetic field
- 2.2. Magnetic induction due to straight current carrying conductor, Energy density in magnetic field, magnetization of matter. Relationship between  $\mathbf{B}$ ,  $\mathbf{H}$  and  $\mathbf{M}$ .
- 2.3 Biot-Savart's law, Ampere's law for force between two current carrying loops, Ampere's circuital law,
- 2.4 Equation of continuity, Magnetic vector potential  $\mathbf{A}$ .
- 2.5. Magnetic susceptibility and permeability, Hysteresis loss, B-H curve.

#### 3. Electrodynamics:

(16 L)

- 3.1. Concept of electromagnetic induction, Faraday's law of induction, Lenz's law, displacement current, generalization of Ampere's law
- 3.2. Maxwell's equations (Differential and Integral form) and their physical significance
- 3.3. Polarization, reflection & refraction of electromagnetic waves through media
- 3.4. Wave equation and plane waves in free space.
- 3.5. Poynting theorem & Poynting vector, Polarizations of plane wave.
- 3.6. Microscopic form of ohm's law ( $\mathbf{J} = \sigma \mathbf{E}$ )

#### Reference Books:

- 1) Introduction to Electrodynamics - By D. J. Griffith
- 2) Classical Electrodynamics - By J. D. Jackson.
- 3) Introduction to Electrodynamics - By A. Z. Capri, Panat P. V.
- 4) Electricity and magnetism - By Reitz and Milford
5. Electrodynamics - By Gupta, Kumar, Singh (Pragati Prakashan)
6. Electromagnetic field and waves - By Paul-Lorrain and Dale R Corson
7. Electricity and magnetism - By Murugesan (S. Chand)

**T. Y. B. Sc. Physics**  
**PH-342: Quantum Mechanics**

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**. Origin of Quantum Mechanics: (10 L)**

1. Historical Background
  - a) Review of Black body radiation,
  - b) Review of photoelectric effects.
2. Matter waves
  - De Broglie hypothesis. Davisson and Germer experiment.
3. Wave particle duality
4. Wave function of a particle having definite momentum.
5. Concept of wave packet, phase velocity, group velocity and relation between them
6. Heisenberg's uncertainty principle with thought experiment.
  - Electron diffraction experiment, different forms of uncertainty.

**2. The Schrodinger equation: (15 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. Definition of an operator in Quantum mechanics.
  - Eigen function and Eigen values.
7. Expectation value – Ehrenfest's theorem

**3. Applications of Schrodinger Steady state equation: (12 L)**

1. Free particle.
2. Particle in infinitely deep potential well (one - dimension).
3. Particle in three dimension rigid box.
4. Step potential.
5. Potential barrier. (Qualitative discussion). Barrier penetration and tunneling effect.
6. Harmonic oscillator (one-dimension), correspondence principle.

**4. Spherically symmetric potentials: (06 L)**

1. Schrodinger's equation in spherical polar co-ordinate system.
2. Rigid rotator (free axis).
3. Hydrogen atom: Qualitative discussion on the radial and angular parts of the bound state energy, energy state functions, Quantum numbers  $n, l, m_l, m_s$  – Degeneracy.

**5. Operators in Quantum Mechanics: (05 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 brackets using position, momentum and angular momentum operator.
6. Raising and lowering angular momentum operator.
7. Concept of parity, parity operator and its Eigen values.

**Reference Books:**

1. Quantum Mechanics of Atoms, Molecules, Solids, Nuclei and particles. - By R. Eisberg and R. Resnik Published by Wiley.
2. Quantum Mechanics. - B. H. Brandson and C. J. Joachain: Pearson Education
3. Concepts of Modern physics. - By A. Beiser Published by Mc. Grawthill. Chapter 2,3,5,6.
4. Introduction to Quantum Mechanics. - By D. Griffiths Published by Prentice Hall.
5. Quantum Mechanics. - By Ghatak and Lokanathan Published by Mc. Millan.
6. Quantum Mechanics. - By L. I. Schiff.
7. Quantum Mechanics. - By Powell and Crasemann, Addison-Wesley Pub. Co.
8. Quantum Mechanics an accessible introduction
  - Robert Scherrer Pearson - Addison Wesley

**T. Y. B. Sc. Physics**  
**PH-343: Thermodynamics and Statistical Physics**

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- 1. Kinetic Theory of Gases:** (8L)  
Assumptions of Kinetic theory of gases, Mean free path, Transport phenomenon, Viscosity, Thermal conductivity and diffusion, Problems
- 2. Maxwell Relations and Application:** (10 L)  
Thermodynamical functions: Internal Energy, Enthalpy, Helmholtz function, Gibb's function, Derivation of Maxwell Relations, First and Second TdS Equations, Specific heat and latent heat equations, Joule Thomson effect (Throttling Process)
- 3. Elementary Concepts of Statistics:** (10L)  
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,
- 4. Statistical Distribution of System of Particles:** (8L)  
Specification of state of system, Statistical ensembles, Basic Postulates, Probability calculations, Behaviors of density of states, Thermal, Mechanical and general interactions
- 5. Statistical Ensembles:** (6L)  
Micro canonical Ensemble (Isolated System), Canonical ensembles, simple application of canonical ensemble, Molecules in Ideal gas, Calculation of mean values in canonical ensemble.
- 6. Quantum Statistics:** (6L)  
Quantum distribution function, Maxwell-Boltzmann's statistics, Bose-Einstein Statistics, Fermi-Dirac Statistics, Comparison of the distributions.
- References:**
1. Statistical and Thermal physics  
- By Lokanathan, R.S. Gambhir,
  2. Fundamentals of statistical and thermal physics  
- By F.Reif
  3. Perspectives of modern physics  
- By A. Beiser
  4. Fundamental of Statistical Mechanics  
- By B.B. Laud
  5. A primer of Statistical Mechanics  
- By R.B. Singh
  6. Statistical Mechanics  
- By Gupta, Kumar

**T. Y. B. Sc. Physics**  
**PH 344 Nuclear Physics**

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**1. Basic Properties of Nucleus (07 L)**

Composition, charge, size, density of nucleus, Nuclear Angular momentum, Nuclear magnetic dipole moment, Electric quadrupole moment, parity and symmetry, Mass defect and Binding energy, packing fraction, classification of nuclei, stability of nuclei (N Vs Z Curve) and problems.  
Ref 1, ch (1), Ref 2, ch (4)

Problems Ref 4, ch (26)

**2. Radioactivity (10 L)**

Radioactivity disintegration (concept of natural and artificial radioactivity, Properties of  $\alpha$ ,  $\beta$ ,  $\gamma$  rays, laws of radioactive decay, half-life, mean life, specific activity and its units, successive disintegration and equilibria and radioisotopes).

Application of radioactivity (Agricultural, Medical, Industrial, Archaeological).

Problems

Ref 1 ch (8), Ref 2 – ch (15)

Problems Ref 4 ch (27, 29)

**3. Nuclear forces (08 L)**

Meson theory of nuclear forces, Properties of nuclear forces, properties of deuteron system, Elementary particles, Quarks model for elementary particles.

Ref 1 ch (2, 3), Ref 2 ch (10), Ref 3 ch (3)

Problems Ref 4 ch (26)

**4. Particle Accelerator and Detectors (07 L)**

Introduction to particle Accelerators, Linear (electron/proton Linac) Cyclic (Cyclotron)

Classification of Nuclear Detector

Gas filled Detectors (G. M. counter)

Solid state detectors (NaI(Tl) scintillation counter)

Problems Ref 1 ch (7, 12)

**5. Nuclear Reactions (08 L)**

Introduction to Nuclear reactions, compound nucleus, Q value equation, Exothermic and Endothermic reaction, Threshold energy, Conservation laws, nuclear cross-section.

Problems

Ref 1 ch (13), Ref 2 ch (12) Problems Ref 4 ch (30)

**6. Nuclear Energy (08 L)**

Nuclear fission, chain reaction and critical mass, nuclear reactor and its basic components, homogeneous and heterogeneous reactors, power reactor, fast breeders, nuclear fusion, stellar energy.

Problems. Ref 2 ch (14), Problems Ref 4 ch (31)

**Reference Books**

- 1 Introduction to Nuclear Physics H.A. Enge (Addison Wesley co.)
- 2 The Atomic Nucleus R.D. Evans (Tata McGraw Hill co.)
- 3 Concepts of Nuclear Physics – B.L. Cohen (Tata McGraw Hill co.)
- 4 Schaum's Outline Series Modern Physics R. Gaur (McGraw Hill co.)
- 5 Introduction to Nuclear Physics, S. B. Patel

**Additional References**

- 1 Atomic and Nuclear Physics Shatendra Sharma (Pearson Education, 1<sup>st</sup> Edition)
- 2 Nuclear Physics Kaplan (Narosa Publishing House)
- 3 Introduction to Nuclear Physics Y.R. Waghmare (Oxford IBH.)

**T. Y. B. Sc. Physics**  
**PH345:Electronics**

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- 1. Special Purpose Diodes (4L)**  
LED and Photodiode, Varactor (working and characteristics), Optocoupler. Problems Ref. 1 Article 5.8
- 2. Transistor amplifier (8L)**  
Classification of amplifier, class A, B (working, gain and efficiency calculation) class C and AB (working only), class B push pull amplifier, cross over distortion, differential amplifier (transistorized). Problems  
Ref. 1 Article 11.3, 11.4, 11.5, 11.6, 12.5, 17.1
- 3 Field Effect Transistor (8L)**  
Introduction, classification, principle, working and IV characteristics of JFET, MOSFET (DE MOSFET and E only MOSFET), Application of JFET :- as Variable resistor, electronic switch and analogue multiplexer. Problems  
Ref. 1 Article 13.1 to 13.9, 14.1 to 14.5
- 4 Operational Amplifier (4L)**  
Applications of OPAMP integrator, Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier. Problems  
Ref. 1 Article 20.4, 20.5, 22.1 to 22.3, 22.5, 22.10
- 5. Timer (IC555) (4L)**  
Block diagram, Astable, monostable and bistable multivibrator (working and design) Problems Ref. 1 Article 23.7, 23.8
- 6. Regulated Power Supply (4L)**  
Block diagram of 3 pin IC regulator, study of IC 78XX, 79XX, dual power supply (using 3 pin IC) Block diagram of IC 723 circuits and design of basic low voltage (2 to 7 volt) and high voltage (7 to 28 volt) regulator.  
Problems  
Ref. 1 Article 24.4, for IC 723 refer data book.
- 7. Combinational Circuits (6L)**  
Introduction to SOP and POS techniques, reduction of Boolean expression using Kmap methods ( up to 4 variables), design of half adder , full adder , half subtractor , full subtractor, binary to gray and gray to binary code convertor. Introduction to multiplexer (4:1) and demultiplexer (1:4)  
Ref. 2 Article 5.1 to 5.8.1, 6.1, and 6.2
- 8. Sequential Logic Circuits , (10L)**  
**Flipflops**  
RS flip flop using NAND/NOR clocked RS, D, JK, and T flip flops, preset and clear inputs.  
**Counters**  
4-bit ripple counter, 4-bit parallel counter.  
**Registers**  
Buffer registers (SISO, SIPO, PISO, PIPO) use of register as a memory.  
Ref. 2 Article 7.1 to 7.9, 8.1, 8.2, 8.4, for IC 7490 Refer Data book
- References**
- 1 Electronic Principles (6<sup>th</sup> edition), Malvino (Tata McGraw Hill, New Delhi)
  - 2 Modern Digital Electronics (3<sup>rd</sup> Edition), R.P.Jain, (Tata McGraw Hill, New Delhi)
  - 3 Basic Electronics by R. S. Sedha, S. Chand publication



**T. Y. B. Sc. Physics**  
**PH345:Advanced Electronics**

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**(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: (16 L)**

**Metal resistance versus Temperature devices:**

Metal resistance versus Temperature devices, resistance versus temperature approximation, resistance temperature detectors.

**Thermistors:**

Semiconductor resistance versus Temperature, Thermistor characteristics.

**Thermocouples:**

Thermoelectric effects, Thermocouple characteristics, Thermocouple sensors.

**Other Thermal Sensors:**

Bimetal strip, Gas thermometers, Vapour pressure thermometers, Liquid expansion thermometers, solid state temperature sensors.

**Motion sensors:**

Types of motions, Accelerometers' principles, Types of accelerometers, applications

**Optical sensors:**

**Photo detectors:**

Photo detector characteristics, photoconductive detectors, photo voltaic detectors, photo diode detectors, photo emissive detectors.

**Pyrometry:** Thermal radiation, broadband pyrometers, narrowband pyrometers.

**Optical sources:** Conventional light sources, Laser principles

**Applications:** Label inspection, Turbidity, Ranging.

**2. Signal Conditioning using OP-AMP: (12 L)**

**Principles of Analog Signal Conditioning:**

Signal level and bias changes, linearization, conversions, filtering and impedance matching, concept of loading.

Passive circuits: Divider circuits, bridge circuits, RC filters, Operational Amplifier, characteristics and Specification of OP-AMP Circuits in Instrumentation, Voltage Follower, Inverting and Non-Inverting Amplifier, Instrumentation Amplifier, I to V Converter and V to I converter, Integrator( Low Pass Filter), Differentiator( High Pass Filter) 1st and 2nd order

**3. Digital signal conditioning (10 L)**

Review of digital fundamentals, digital information, Fractional Binary System, Boolean algebra, Digital Electronics, Combinational Circuits, Multiplexer, De- Multiplexer, Encoder, Decoder  
Converters: DAC, ADC, Data Acquisition System

**Characteristics of digital data**

Digitized values, sampled data systems, linearization

**4. Introduction to Process Control: (10 L)**

**Control systems:** Process control principles, servo mechanism, discrete state Control of systems

**Process control block diagram**

Identification of elements, block diagram

**Control system evaluation:** Stability, steady state regulation, Transient regulation, Evaluation criteria

**Numerical Problems On Above Lectures**

**Reference Books:**

1. Process Control Instrumentation Technology by C.D. Johnson Pearson Education 8th edition (Economic Edition).
2. Computer Based Industrial Control by Krishna Kant (Eastern Economic Edition)
3. Instrument of Device System by Rangan, Mani, Sharma
4. Instrument measurement and analysis by B. C. Nakra, K. K. Chaudhari

**T. Y. B. Sc. Physics**  
**PH346 Elective II(G) : Medical Electronics**

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**1. Introduction:** (10 L)

- 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,
  - 1.9 Introduction to man instrument system,
- Problems

**Reference: 1**

**2. Bio potential Electrodes and sensors:** (12 L)

- 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 Radiation sensor
  - 2.9 Temperature sensor
- Problems

**Reference: 2**

**3. Amplifiers and Signal Processing:** (09 L)

- 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

**Reference:- 2**

**4. Clinical Laboratory Instrumentation:** (07 L)

- 4.1 Spectrophotometry,
  - 4.2 Spectrophotometer type instruments
  - 4.3 Calorimetry and calorimeter,
  - 4.4 Clinical flame photometer
- Problems

**Reference: 1**

**5. Measurements of Pressure and Volume Flow of Blood: (10 L)**

- 5.1 Direct measurements of blood pressure,
  - 5.2 Indirect measurements of BP.
  - 5.3 Heart sounds, Phonocardiography,
  - 5.4 Ultrasonic blood flow meter
  - 5.5 Laser Doppler blood flow meter
- Problems

**Reference: 1**

Reference Books:

1. Handbook of Biomedical Instrumentation, R.S. Khandpur

2. Medical Instrumentation application design, John G Webster, Houghon Mifflin Co.
3. Introduction to Biomedical Electronics, Joseph DfuBovy, Mc Graw Hill.
4. Clinical Biophysics, P. Narayanan
5. Introduction to Bio0medical equipment technology, fourth edition, by Joseph J. Carr and John M. Brown

**Practicals**

1. Measurement of BP using Mercury sphygmomanometer and digital BP meter
  2. Recording of ECG and its analysis
  3. Absorbance using calorimeter/ Absorption spectra using Spectrophotometer
  4. Pulse oxymetry
  5. Use of biosensor
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**T. Y. B. Sc. Physics**  
**PH346 Elective II (H):Physics of Nanomaterials**

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**Course Objectives:**

The main objectives of course are to introduce the basic physics behind size and effect of nano materials and to understand the working principle of equipments used in nanostructures. In this course, students will gain knowledge of introduction to nanomaterials and their properties and growth techniques. It also discusses tools like UV, XRD, SEM and TEM to characterize the nanomaterials and applications of nanomaterials.

- 1. Introduction to nanomaterials: (10 L)**  
Introduction to nano-sized materials and structures  
Brief history of nanomaterials and challenges in nanotechnology  
Significance of nano-size and properties, classification of nanostructured materials
- 2. Methods of synthesis of nanomaterials: (12 L)**  
Bottom-up and Top-down approaches  
Physical methods: High energy ball milling, Physical vapour deposition, Ionized cluster beam deposition, sputter deposition, Ultrasonic spray pyrolysis etc.  
Chemical methods: colloidal method, co-precipitation and sol-gel method  
Hybrid method: Electrochemical and chemical vapour deposition.
- 3. Characterization techniques: (11 L)**  
UV- visible spectroscopy  
X-ray diffraction  
Scanning electron microscopy  
Transmission electron microscopy
- 4. Properties of nanomaterials: (05 L)**  
Mechanical, Electrical, Thermal, Optical, solubility, melting point and Magnetic properties
- 5. Special nanomaterials: (06 L)**  
Carbon nanotubes, quantum dots, Nanocrystalline ZnO and TiO<sub>2</sub>.
- 6. Applications: (04 L)**  
Nanoelectronics, Medical, Biological, Automobiles, Space, Defense, Sports, Cosmetics, Cloth industry etc.

**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.

**List of experiments:**

1. Synthesis of metallic nanoparticles by wet chemical method.
2. Study of optical absorption of nanoparticles.
3. Determination of nanoparticles size from X-ray diffraction spectra.
4. Synthesis of silver nanoparticles from silver nitrate by reduction using surfactant.

**T. Y. B. Sc. Physics**  
**PH346 Elective II (I): Microcontrollers**

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- 1. ARCHITECTURE OF 8051: [10]**  
Comparison of Microprocessor and Microcontroller, 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 and Data Pointer, PSW register, Memory Organization of 8051, Internal RAM, Stack and Stack Pointer, Special function registers, Internal ROM, I/O Ports, Oscillator and Clock
- 2. 8051 ASSEMBLY LANGUAGE PROGRAMMING: [10]**  
Introduction to 8051 Assembly programming, Assembling and running an 8051 program, 8051 data types and directives, Intel hex file, Jump, loop, and call instructions, 8051 I/O programming, Addressing modes,
- 3. ARITHMETIC & LOGIC INSTRUCTIONS AND PROGRAMS: [10]**  
Arithmetic instructions, Signed number concepts and arithmetic operations, Logic and compare instructions, Rotate instruction, BCD, ASCII, and other application programs.
- 4. TIMER AND INTERRUPTS PROGRAMMING IN ASSEMBLY: [6]**  
Timers. Programming 8051 timers, counter programming, Programming timers 0 and 1 in 8051, 8051 interrupts, Interrupt priority in the 8051
- 5. SERIAL COMMUNICATION: [4]**  
Basics of Serial programming , RS 232 Standards, 8051 connection to RS 232, 8051 Serial Communication Programming,
- 6. INTERFACING TECHNIQUES [8]**  
LCD and Keyboard interfacing, ADC, DAC, and sensor interfacing (LM35)

**Reference Books:**

1. 8051 Microcontroller by Kenneth J. Ayala.
2. 8051 Microcontroller and Embedded Systems using Assembly and C by Mazidi, Mazidi and D MacKinlay, 2006 Pearson Education Low Price Edition.
3. Microprocessor and Microcontroller by R. Theagarajan, Sci Tech Publication, Chennai
4. Programming customizing the 8051 Microcontroller by Myke Predko, Tata McGraw Hill

## List of Experiments

1. Use of Keil/Pinnacle software.
2. Addition of two 16 bit numbers
3. Multiplication of two 8 bit numbers.
4. Write a program to find largest/smallest number in given block
5. Write a program to toggle bits of port 1 with delay which depends on value of number in R0
6. Memory block transfer from one location to another.
7. Find two's complement of given number.
8. LCD Interfacing
9. Keyboard Interfacing
10. ADC Interfacing
11. Temperature Sensor Using LM 35

## **PH-346 Elective II –(J): Electro Acoustics and Entertainment Electronics**

### **1. Speech and Hearing: (03 L)**

Human voice and speech mechanism. Human hearing mechanism, theories of hearing

### **2. Electro Acoustic Transducers: (25 L)**

1. Microphones: Design and operational features of carbon, moving coil and condenser microphones. Expressions for sensitivity, calibration, directivity. Problems.

2. Loudspeakers: Direct radiator dynamic type, expression for efficiency, radiated output power, effect of voice coil parameters. Horn loudspeaker cutoff frequency, output of horn. Loudspeaker cabinets – types, bass reflex cabinets. Problems.

3. Sound reinforcement system for auditoria: Power handling capacities, testing and evaluating amplifier specifications for auditoria. High-Fidelity (Hi-fi) acoustic evaluation of an auditorium/studio articulation test, sound level distribution, measurement of reverberation time. Acoustic delay units.

### **3. Sound recording and reproduction: (18 L)**

1. Basic requirements of a system for good quality sound recording and reproduction, volume compressors, expanders, equalizers, graphic equalizers, monophonic, stereophonic sound reproducing system, surround sound. Noise reduction. Dolby A ,B system

2. Magnetic tape sound recording and reproduction basic principles, digital audio tape recording (DAT), basic principles of compact disc audio systems, motion picture sound recording and reproduction system, motion picture sound recording and reproduction variable area and variable density

### **4. Ultra Sonics principles and applications (2L)**

#### **Reference Books:**

1. Fundamentals of Acoustics: Kinsler and Fray et al, 4th edition, John Wiley and sons
2. Music, physics and Engineering H.F. Olson Dover publication 1960
3. Basic Acoustics D.E. Hall, Oxford University Press.
4. Acoustics Sourcebook Sybil Parker (Ed) McGraw Hill
5. Handbook for sound engineers G.M. Balov (Ed) New audio cyclopedia
6. Consumer Electronics by S.P. Bali ( Pearson Publication)
7. Electroacoustics by Mendel and Kleiner (CRC Press)

#### **List of experiments:**

1. Non linear distortion of an amplifier.
2. Study of properties of porous acoustic materials.
3. Calibration of microphone by closed chamber method.
4. Study of a tape recorder.
5. Study of graphic equalizer.
6. Study of mufflers of noise reduction.
7. Use of distortion factor meter.
8. Acoustical evaluation of a Hall/Studio.
9. Ultrasonic Interferometer (modified).

**T. Y. B. Sc. PHYSICS**  
**PH346 Elective II ( K): Lasers**

**1. Introduction to Lasers: (08 L)**

Ordinary light and Lasers, Brief history of Lasers, Interaction of radiation with matter, Energy levels, Population density, Boltzmann distribution, Transition Lifetimes, Allowed and Forbidden Transitions, Stimulated Absorption, Spontaneous Emission and Stimulated Emission, Einstein's Coefficients, Einstein's relations.

**2. Laser Action: (06 L)**

Condition for large stimulated emission, Population inversion Condition for light amplification, Gain coefficient Active medium, Metastable states Pumping schemes: three level and four level

**3. Laser Oscillator: (07 L)**

Optical feedback, round trip gain, threshold gain, critical population inversion, Optical resonator, condition for steady state oscillations, cavity resonance frequencies.

**4. Laser Output: (03L)**

Lineshape broadening:

- Lifetime broadening
- Collision broadening
- Doppler broadening

**5. Characteristics of Laser: (04 L)**

Directionality,  
Monochromaticity  
Coherence  
Brightness

**6. Types of Lasers: (12 L)**

Solid State Lasers – Ruby Laser, Diode Laser  
Gas Lasers – HeNe Laser, CO<sub>2</sub> Laser  
Liquid Lasers: Tunable dye laser

**7. Applications of Lasers: (08 L)**

Industrial – welding, cutting, drilling  
Nuclear Science – laser isotope separation, laser fusion,  
Defense - range finder  
Medical - eye surgery  
Optical - holography, supermarket scanners, compact discs

**Reference Books:**

1. An introduction to Lasers – theory and applications, M.N. Avadhanulu, S.Chand and Co. New Delhi
2. Experiments with HeNe Laser by Sirohi
3. Optical fibre and Laser – Principle and applications, Anuradha De, New Age International Publishers, Second edition

**List of Experiments:**

1. Determination of wavelength of HeNe Laser by transmission grating and reflection grating.
2. Beam divergence of a Diode Laser.
3. Determination of the diameter of a thin wire using a laser.
4. Measurement of wavelength of Laser beam using Michelson Interferometer.
5. To study the interference of light using optical fibres
6. Measurement of the focal length of a given convex lens using a laser.

**T. Y. B. Sc. PHYSICS**  
**PH346 Elective II ( L): Radiation Physics**

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**[1] Low Energy Radiation: 8 Lectures.**  
Introduction to Microwave and Radio waves covering spectrum, power levels and detection methods. Laboratory sources of infrared, visible and ultra- violet radiation with details of energy spectrum. Detectors for microwaves, Infrared and Ultra violet radiation. Interactions of ultra violet and microwave radiation with matter

**[2] Energetic Radiation : 8 Lectures.**  
Introduction to Cosmic radiation .Types of particles and their energies in cosmic rays. Basic laboratory sources of electrons and ions up to 50 keV. Focusing of electron and ion beams with magnetic and electrostatics lenses. Methods for measurement of electron and ion beam current and flux. Different types of neutron sources based on radioactive sources.

**[3] X-Ray Radiography: 8 Lectures.**  
Principle and methods of generation of characteristics X-Rays. Interaction of X-Rays with matter, attenuation coefficient..Methods for recording X-Ray radiograph using photographic plate. Modern digital methods for recording X-ray radiograph. Medical applications of X-rays.

**[4] Radiation Detectors and Dosimetry: 8 Lectures.**  
Working principle of ionization chamber and Scintillator detector, Units for radiation exposure, absorbed dose, Relative biological effective dose and dose equivalent. Fricke Dosimeter. Personal dosimeters, Film badge dosimeters, thermoluminescent dosimeter. Calibration of dosimeters. Measurement of dose delivered by an electron accelerator and high strength Cobalt -60 source.

**[5] Radiation Protection: 8 Lectures.**  
Interaction of MeV energy electrons ,ions and gamma-rays with matter. Materials for radiation 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 and MeV energy electron accelerator.

**[6] Radioactive Isotopes and Applications. 8 Lectures.**  
Naturally occurring radioactive isotopes. Production of radioactive nuclides in nuclear reactors and by charged particle beams from accelerators. Measurement of radioactivity and lifetime of radioactive sources. Radioactive pharmaceuticals and labeled compounds. Radioactive nuclei used in diagnostic applications. Applications of gamma-rays in sterilization of medical instruments , medication items and preservation of food.

**Reference and Text Books:**

- (1) Nuclear and Radiation Physics in Medicine.  
Tony Key . World Scientific. 2014
- (2) Radiation Protection and Health Science.  
Marilyn E. Noz . World Scientific. 2007.
- (3) Introduction to radiation Protection .  
Gruppen C. Springer. 2008.



(4) Introduction to Radiological Physics and radiation dosimetry.

Frank H. Attix. Wiley. 1986.

(5) Radiation Physics for Medical Physicists.

Podgorsak Ervin B. Springer. 2005.

(6) Techniques for Nuclear and Particle Physics experiments.

Leo. W.R. Springer. 2005.

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**List of Experiments:**

1) Study of Inverse square law for radiation emitted by radioactive sources using radiation survey meter.

2) Location of a hidden radioactive source by survey meter and measurement of radiation level in air around that source.

3) Measurement of linear absorption coefficient for a brick or a stone using gamma ray source and radiation survey meter.

4) Study of X-ray radiograph of a fracture bone and structurally damaged piece of a material. Estimation of size of the crack using standard procedure.

5) Estimation of attenuation coefficient for gamma rays in at least four different soil samples using radiation survey meter.

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**GROUP I**

**GENERAL PHYSICS (ANY EIGHT)**

1. Viscosity of liquid by Rotating cylinder method
2. Moment of Inertia by Bifilar suspension
3. Young's modulus by Newton's rings
4. Young's modulus by Koenig method
5. Determination of wavelength of light by Michelson's interferometer
6. Surface tension liquid by Fergusson method
7. Surface tension of mercury by Quincke's method
8. Hall Effect
9. Energy gap of a semiconductor
10. Study of XRD spectra of any matter
11. Resistivity by Four probe method
12. Platinum resistance thermometer
13. Kater's pendulum
14. Study of forced oscillations by electromagnetically driven simple pendulum
15.  $\gamma$  by vibration of wooden scale
16. Study of damped oscillations of physical pendulum and finding log decrement.

**GROUP II**

**ATOMIC AND MOLECULAR PHYSICS AND OPTICS (ANY TWO)**

1. Determination of Rydberg's constant
2. Zeeman Effect
3. Lloyd's mirror
4. Determination of Resolving Power of grating
5. Determination of wavelength by Constant deviation spectrometer
6. Determination of refractive index of liquid using hollow prism.

**STATISTICAL PHYSICS AND THERMODYNAMICS (ANY TWO)**

1. Verification of Stefan's law by torch bulb filament
2. Thermal conductivity by Forbes Method.
3. Thermal conductivity of rubber tubing
4. Determination of pressure coefficient of air by constant volume thermometer.

**NUCLEAR AND QUANTUM MECHANICS (ANY TWO)**

1. Characteristics of G.M. tube
2. Inverse square law ( $\gamma$ -rays)
3.  $e/m$  by Thomson method
4. Determination of Planck's constant

**ELECTROMAGNETISM (ANY TWO)**

1. Self Inductance by Anderson's bridge
2. Core losses in transformers
3. Electromagnetic pendulum
4. Inductance by Maxwell's bridge

**Additional Activities (Any Two)**

- a. Demonstrations- Any 4 demonstrations equivalent to 2 experiments
- b. Study tour with report equivalent to 2 experiments
- c. Mini project equivalent to 2 experiments
- d. Computer aided demonstrations (Using computer simulations or animations) (Any 2 demonstrations equivalent to 2 experiments)

*Students have to perform at least two additional activities in addition to sixteen experiments mentioned above. Total laboratory work with additional activities*

should be equivalent to twenty experiments.

**T. Y. B. Sc. Physics**  
**PH348: Laboratory Course II**

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**GROUP I**

**ELECTRONICS (ESSENTIAL) (ANY TWO)**

**(For the students not offering advance electronics in theory courses)**

1. Characteristics of JFET
2. Design and built astablemultivibrator using IC 555/IC 741
3. IC 723 as regulated power supply
4. Integrator and differentiator using IC 741

**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. Study of LVDT
5. Schimdt trigger

**ACOUSTICS and Lasers (ANY TWO)**

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 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.

**NOTE: Four practicals** will be from **optional course I and II** (two each).

**GROUP II**

**COMPUTER INTERFACED PHYSICS EXPERIMENTS/INSTRUMENTATION (ANYTWO)**

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. Temperature controller using AD590
7. Study of IC 7490 as mod 2, mod 5, mod 7 and mod 10 counter

**C-PROGRAMMING (ANY FOUR)**

1. Factorial of a number by simple and recursive method.
2. To find out the first 100 prime numbers
3. Matrix multiplication
4. Graphics (line, circle, arc, ellipse, bar, draw poly)
5. Position time data using kinematic equations
6. Finding pressure using Vander Waals' equation of state

**COMPUTATIONAL PHYSICS (NUMERICAL BASED) (ANY TWO)**

1. Roots of an algebraic equation (Bisection)
2. Roots of polynomial (Newton Raphson)
4. Trapezoidal and Simpson's 1/3 rule

**Additional Activities (Any Two)**

- a. Demonstrations- Any 4 demonstrations equivalent to 2 experiments
- b. Study tour with report equivalent to 2 experiments

c. Mini project equivalent to 2 experiments

d. Computer aided demonstrations (Using computer simulations or animations) (Any 2 demonstrations equivalent to 2 experiments)

e. Use of plagiarism software to find plagiarism in research work.

*Students have to perform at least two additional activities in addition to sixteen experiments mentioned above. Total laboratory work with additional activities should be equivalent to twenty experiments.*

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**T. Y. B. Sc. Physics**  
**PH348 Laboratory Course III**  
**Project**

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It is expected that

1. The student does work equivalent to about twenty laboratory experiments through out both 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 least for thirty 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.

Time schedule for project work:

- (1) Allotment of Internal guide by 30<sup>th</sup> July
- (2) Submission of synopsis by 14<sup>th</sup> August
- (3) Project work revision – every week
- (4) First draft by 15<sup>th</sup> February
- (5) Final report submission by 5<sup>th</sup> March.

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. 500/- each. It is also recommended that a teacher will look after 4 projects at one time.

**University of Pune**  
**Three Year B. Sc. Degree Course in**  
**Zoology**

**Principal Dr. D. K. Mhaske**  
Chairman,  
Board of Studies in Zoology  
University of Pune, Pune 411 007.

## **1) Title of the Course : B. Sc. Zoology**

### **F. Y. B. Sc. Zoology**

**(To be implemented from Academic Year 2013-14)**

## **2) Preamble:**

The well organized curricula including basic as well as advanced concepts in the Zoology from first year to the third year shall inspire the students for pursuing higher studies in Zoology and for becoming an entrepreneur and also enable students to get employed in the Biological research Institutes, Industries, Educational Institutes and in the various concerning departments of State and Central Government based on subject Zoology.

## **3) Introduction:**

At **first year of under-graduation** the topics related to the fundamentals of zoology, including exposure to diversity in animal groups and industries based on the zoological areas are covered. The practical course is aimed to equipped the students with skills required for animal identification, morphological, anatomical, technical description, classification and also applications of zoology in the various industries.

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.

At **third year under-graduation:** Theory and practical courses in each semester shall deal with the further detailed studies of the various disciplines of the zoology subject and other branches of zoology such as Genetics, Animal Physiology, Molecular biology, Biochemistry, Microtechnique, Nonchordate and Chordate, Developmental Biology, Histology. Cell Biology, Biodiversity, Public health and hygiene, Pathology, Entomology, Biotechnology, etc. The students will also learn about use of various technical skills in the biological sciences to be helpful during research in the zoology subject.

## **Objectives:**

- To provide thorough knowledge about various animal sciences from primitive to highly evolved animal groups
- To make the students aware of applications of Zoology subject in various industries

- To highlight the potential of various branches to become an entrepreneur
- To equipped the students with skills related to laboratory as well as field based studies
- To make the students aware about conservation and sustainable use of biodiversity
- To inculcates interest and foundation for further studies in Zoology
- To address the socio-economical challenges related to animal sciences
- To facilitate students for taking up and shaping a successful career in Zoology

#### **4) Eligibility:**

- 1 **First Year B.Sc. :** A student who has passed the Higher Secondary School Certificate (10+2) Science stream with Biology or its equivalent examination as per the University of Pune eligibility norms.
- 2 **Second Year B.Sc. :** Keeping terms of First Year of B. Sc. with zoology as one of the subjects. Other students if they fulfill the conditions approved by the equivalence committee of Faculty of Science of the University of Pune are also eligible.
- 3 **Third Year B.Sc.:** Student shall pass all First Year B. Sc. courses and satisfactorily keeping terms of Second Year of B. Sc. with zoology 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.

#### **5 A) Examination Pattern:**

##### **First Year B. Sc. Zoology**

Pattern of Examination: Annual

Theory courses      Zoology Theory Paper I : Annual

                                 Zoology Theory Paper II : Annual

Practical Course      Annual



Paper/ Course No.	Title	Total Number of lectures/practicals per Term	Standard of passing		
			Internal marks out of <b>20</b>	External marks out of <b>80</b>	Total marks out of <b>100</b>
Theory Paper I ZY-101 (First term)	Animal Systematics and Diversity -I	Three lectures/Week (Total 36 lectures per term)	08	32	40 *
Theory Paper I ZY-101 (Second term)	Animal Systematics and Diversity -II	Three lectures/Week (Total 36 lectures per term)			
Theory Paper II ZY-102 (First term)	Fundamentals of Cell Biology	Three lectures/Week (Total 36 lectures per term)	08	32	40 *
Theory Paper II ZY-102 (Second term)	Genetics	Three lectures/Week (Total 36 lectures per term)			
<b>Practical Paper III ZY-103 (First &amp; Second Term)</b>	Practical	9 Practicals of 4 lectures in each term (18 practicals / year)	08	32	40 *

\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory (100 + 100 ) = 200 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers given on the basis of internal assessment tests

**Theory examination** will be of three hours duration for each theory course. There shall be 5 questions each carrying equal marks. The pattern of question papers shall be:

Question 1	8 sub-questions, each of 2 marks; answerable in 2 -3 lines and based on entire syllabus
Question 2 and 3	4 out of 6 - short answer type questions; answerable in 8 – 10 lines
Question 4	2 out of 4 – Descriptive answer type questions, answerable in 15 – 20 lines
Question 5	1 out of 2 – Descriptive answer type questions, answerable in 35 – 40 lines

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks in each term. The written test shall comprise objective type questions – Multiple Type Questions, True / False, Definitions, Answer in one or two line questions. There shall be 20 questions.

Practical: Regular assessment of each practical for 20 marks each: Marks for journal: 10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02

**Practical Examination:** Practical examination shall be conducted by the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination.

### Second Year B. Sc. Zoology

Pattern of examination: Semester

Theory courses ZY- 211 and ZY- 212: Semester

ZY-211 and ZY-212: Semester

Practical Course: Annual

Paper/ Course No.	Title	Total Number of lectures/practicals Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
ZY- 211	Animal Systematics and Diversity -III	Four lectures/Week (Total 48 per semester )	04	16	20 *
ZY- 212	Applied Zoology I	Four lectures/Week (Total 48 per Semester )	04	16	20 *
ZY-211	Animal Systematics and Diversity -IV	Four lectures/Week (Total 48 per Semester )	04	16	20 *
ZY-212	Applied Zoology II	Four lectures/Week (Total 48 per Semester )	04	16	20 *
ZY-223 (Semester- I and II)	Paper III Practical course	12 Practicals of 4 lectures in each Semester (24 practicals / year)	08	32	40**

\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\*Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester (50 + 50 ) = 100 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers given on the basis of internal assessment tests.
4. Internal marks for Practical Course should be a regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02

**Theory examination** will be of two hours duration for each theory course. There shall be 4 questions each carrying equal marks as follows: The pattern of question papers shall be:

Question 1	10 sub-questions, each of 1 marks based on entire syllabus	10 marks
Question 2 and 3	2 out of 3 sub-questions, each of 5 marks; short answer type questions; answerable in 10-15 lines	5 marks each
Question 4	1 out of 2 sub-questions, each of 10 marks; long answer type questions (20-25lines)	10 marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question. There shall be 20 questions. Practicals: Regular assessment as described earlier (regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02)

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination. One of the examiners will be external.

## Third Year B. Sc. Zoology

Pattern of examination: Semester

Theory courses:

(Sem III: ZY-331 to ZY-336) : Semester

(Sem IV: ZY- 341 to ZY-346) : Semester

Practical Course:(ZY-347-349) : Annual

<b>Theory Papers</b>					
Paper/Course No.	Title	Total Number of lectures Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
<b>SEM III</b>					
ZY-331	Animal Systematics and Diversity V	48	4	16	20*
ZY-332	Mammalian Histology	48	4	16	20*
ZY-333	Biological Chemistry	48	4	16	20*
ZY-334	Environmental Biology and Toxicology	48	4	16	20*
ZY-335	Parasitology	48	4	16	20*
ZY-336	General Pathology or Cell Biology	48	4	16	20*
<b>SEM IV</b>					
ZY-341	Biological Techniques	48	4	16	20*
ZY-342	Mammalian Physiology and Endocrinology	48	4	16	20*
ZY-343	Genetics and Molecular Biology	48	4	16	20*
ZY-344	Organic Evolution	48	4	16	20*
ZY- 345	General Embryology	48	4	16	20*
ZY-346	Public Health and Hygiene or Medical Entomology	48	4	16	20*

Practical Papers					
BO 347 (Semester III & IV)	Practical Paper I	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **
BO 348 (Semester III & IV)	Practical Paper II	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **
BO 349 (Semester III & IV)	Project Practical Paper III	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **

\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\*Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester ( $50 \times 6$ ) = 300 marks
2. Total marks per year 600 (Theory) + 300 marks (practicals) = 900 marks
3. Internal marks for theory papers be given on the basis of internal assessment tests.
4. Practicals: Regular assessment as described earlier (regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02)

**Theory examination** will be of two hours duration for each theory course. There shall be 4 questions each carrying marks as per the table. The pattern of question papers shall be:

Question 1	10 sub-questions, each of 1 marks based on entire syllabus	10 marks
Question 2 and 3	2 out of 3 sub-questions, each of 5 marks; short answer type questions; answerable in 10 – 15 lines	5 marks each
Question 4	2 out of 3 sub-questions, each of 10 marks; long answer type questions (20 – 25 lines)	10 marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question. There shall be 20 questions.

Practicals: Regular assessment as described earlier (regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02)

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination. One of the examiners will be external.

### **5 B) Standard of Passing:**

- i. In order to pass in the first year theory 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 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 16 marks out of 40 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.)

### **5 C) ATKT Rules:**

While going from F.Y.B.Sc. to S.Y.B.Sc. at least 8 courses (out of total 12) should be passed; however all F.Y.B.Sc. courses should be passed 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 passed (Practical Course at S.Y.B.Sc. will be equivalent to 2 courses).

### **5 D) 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

### **5 E) External Students:**

There shall be no external students.

### **5 F) Setting of question papers:**

**F. Y. B. Sc.:** For theory papers I and II annual question papers shall be set by the University of Pune and assessment done at the respective colleges. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Paper III, papers shall be set by the University of Pune and assessment done at the respective colleges.

**S. Y. B. Sc. and T. Y. B. Sc.:** For theory papers for each semester and also for the annual practical examination, question papers shall be set by the University of 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. For Practical Papers, papers shall be set by the University of Pune and assessment done by the internal examiner and external examiner appointed by University of Pune.

### **5 G) Verification and Revaluation Rules:**

As per University Statues and Rules for verification and revaluation of marks in stipulated time after declaration of the semester examination result.

## **6) Course Structure:**

**Duration:** The duration of B.Sc. Zoology Degree Program shall be three years.

#### **a) Compulsory Papers:**

F. Y. B. Sc.: 2 Theory + 1 Practical (Annual)

S. Y. B. Sc.: 2 Theory per semester + 1 Practical (Annual)

T. Y. B. Sc.: 6 Theory per semester + 3 Practical (Annual)

#### **b) Question Papers :**

##### **F. Y. B. Sc. Theory paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

##### **S. Y. / T. Y. - B. Sc. Theory paper:**

University Examination – 40 marks (at the end of each term)

Internal Examination – 10 marks

##### **F. Y. / S. Y. / T. Y. - B. Sc. Practical Paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

c) **Medium of Instruction:** The medium of instruction for the course shall be **English**.

### 7) **Equivalence of Previous Syllabus:**

<b>Old Course (2008 Pattern)</b>	<b>New Course (2013 Pattern)</b>
Paper I: Nonchordates and Chordates	Animal Systematics and Diversity –I and II
Paper II: Genetics and Parasitology	Fundamentals of Cell Biology and Genetics
Paper III: Practical course	Paper III: Practical course

**8) University Terms:** Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

**9) Qualification of Teachers:** M.Sc. Zoology or equivalent master degree in science with class/grades and NET/SET/Ph.D. as per prevailing University/Government /UGC rules.



**UNIVERSITY OF PUNE**  
**BOARD OF STUDIES IN ZOOLOGY**  
**Proposed Revised Syllabus for F. Y. B. Sc. (Zoology)**  
**To be implemented from June, 2013**  
**F. Y. B. Sc. (Zoology) New Syllabus**

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**1. Zoology: Paper- I**

**Term- I: Animal Systematics and Diversity –I**

**2. Zoology Theory Paper II**

**Term I: Fundamentals of Cell Biology**

**3. Zoology: Paper- I**

**Term- II: Animal Systematics and Diversity – II**

**4. Zoology: Paper- II**

**Term- II: Genetics**

**5. F. Y. B. Sc. Zoology Practical Paper - III based on Theory Paper I  
and Paper II**

UNIVERSITY OF PUNE  
BOARD OF STUDIES IN ZOOLOGY  
COURSE STRUCTURE OF UNDERGRADUATE CLASSES  
(To be implemented from June 2013)

**Class: F.Y. B. Sc.**

Paper	Course No.	Term I	Term II
I	ZY 101	Animal Systematics and Diversity -I	Animal Systematics and Diversity –II
II	ZY 102	Fundamentals of Cell Biology	Genetics
III	ZY 103	Practical course	

**Class: S.Y. B. Sc.**

Paper	Course No.	Semester I	Course No.	Semester II
I	ZY.211	Animal Systematics and Diversity -III	ZY. 221	Animal Systematics and Diversity –IV
II	ZY.212	Applied Zoology I	ZY.222	Applied Zoology II
III	ZY.223	Practical course		

**Class: T.Y. B. Sc.**

Paper	Course	Semester III	Course	Semester IV
I	ZY.331	Animal Systematics and Diversity V	ZY.341	Biological Techniques
II	ZY.332	Mammalian Histology	ZY.342	Mammalian Physiology and Endocrinology
III	ZY.333	Biological Chemistry	ZY.343	Genetics and Molecular Biology
IV	ZY.334	Environmental Biology and Toxicology	ZY.344	Organic Evolution
V	ZY.335	Parasitology	ZY.345	General Embryology
VI	ZY.336	General Pathology or Cell Biology	ZY.346	Public Health and Hygiene or Medical Entomology
VII	ZY.347	Practicals corresponding to ZY 331, ZY 332, ZY 341 & ZY 342		
VIII	ZY.348	Practicals corresponding to ZY 333, ZY 334, ZY 343 & ZY 344		
IX	ZY.349	Practicals corresponding to ZY 335, ZY 336, ZY 345 & ZY 346		

**Prin. (Dr) D. K. Mhaske**  
Chairman, B.O.S. in Zoology  
University of Pune

## **University of Pune**

Draft of Syllabus to be implemented from June 2013

### **F. Y. B. Sc. Zoology**

Paper 1- ZY-101:	First term:	Animal Systematics and Diversity - I
	Second term:	Animal Systematics and Diversity - II
Paper II- ZY-102:	First term:	Fundamentals of Cell Biology
	Second term:	Genetics
Paper III ZY-103:		Practical course

## PAPER I: FIRST TERM

### ZY-101: ANIMAL SYSTEMATICS AND DIVERSITY -I

- 1. Principles of classification:** **4**
  - 1.1 Systematics-Linnaean hierarchy (Phylum, Class, Order, Family, Genus and Species)
  - 1.2 Binomial nomenclature
  - 1.3 Five kingdom classification system
- 2. Salient features and classification upto classes of the following:** (any two examples from each class) **8**
  - 2.1 Protozoa
  - 2.2 Porifera
  - 2.3 Coelenterata
  - 2.4 Platyhelminthes
  - 2.5 Aschehelminthes
  - 2.6 Annelida
- 3. Study of *Paramoecium* :** **8**
  - 3.1 Systematic position, Habit and habitat
  - 3.2 Structure, nutrition, excretion and reproduction (binary fission and conjugation)
- 4. Study of Earthworm :** **16**
  - 4.1 Systematic position, Habit and habitat
  - 4.2 External characters
  - 4.3 Digestive system
  - 4.4 Circulatory system
  - 4.5 Excretory system
  - 4.6 Reproductive system
  - 4.7 Nervous system and sense organs
  - 4.8 Economic importance

**PAPER –I: SECOND TERM**

**ZY-101: ANIMAL SYSTEMATICS AND DIVERSITY – II**

**1. Salient features and classification upto order with one example of the following:**

**6**

1.1 Hemichordata

1.2 Urochordata

1.3 Cephalochordata

**2. Salient features of following classes with two examples of each**

**4**

2.1 Pisces- Cartilaginous and Bony fishes

2.2 Amphibia- Apoda, Urodela and Anura

**3. Study of Frog:**

**20**

3.1 Systematic position, Habit and habitat

3.2 External characters and sexual dimorphism

3.3 Digestive system, food, feeding and physiology of digestion

3.4 Circulatory system (lymphatic system not expected)

3.5 Central Nervous system

3.6 Sense organs

3.7 Reproductive systems (male & female)

**4. General topics:**

**6**

4.1 Migration in fishes

4.2 Neoteny in amphibia

4.3 Parental care in amphibia

**PAPER II-FIRST TERM**

**ZY 102: FUNDAMENTALS OF CELL BIOLOGY**

<b>1. Introduction to cell biology:</b>	<b>4</b>
1.1 Definition and scope	
1.2 Stains: Principle and composition of vital stains, cytoplasmic stains and nuclear stains with two examples of each	
<b>2. Structure of prokaryotic (<i>E.coli</i>) and eukaryotic (Plant and Animal) cell</b>	<b>3</b>
<b>3. Structure and function of cell membrane:</b>	<b>6</b>
3.1 Chemical composition	
3.2 Fluid mosaic model	
3.3 Functions of plasma membrane	
<b>4. Composition of Cytoplasm</b>	<b>1</b>
<b>5. Study of following cell organelles with respect to structure and functions in brief:</b>	<b>10</b>
5.1 Endoplasmic reticulum	
5.2 Golgi complex	
5.3 Lysosomes, peroxisomes and glyoxysomes	
5.4 Ribosomes	
5.5 Mitochondria	
<b>6. Nucleus:</b>	<b>5</b>
6.1 Shape, size, number and position	
6.2 Ultrastructure of nuclear envelope and pore complex	
6.3 Functions	
<b>7. Cell division and their significance:</b>	<b>7</b>
7.1 Cell cycle in brief	
7.2 Mitosis	
7.3 Meiosis	

## PAPER II-SECOND TERM

### ZY 102: GENETICS

<b>1. Introduction to genetics:</b>	<b>4</b>
1.1 Mendelian inheritance: laws of heredity and their practical application	
1.2 Test cross and Back cross	
<b>2. Gene Interaction:</b>	<b>5</b>
2.1 Concept of gene interaction, co-dominance and incomplete dominance	
2.2 Complementary factors (9:7)	
2.3 Supplementary Factors (9: 3:4)	
2.4 Inhibitory factors (13:3)	
2.5 Duplicate dominant factors (15:1)	
<b>3. Lethal genes in <i>Mus musculus</i></b>	<b>1</b>
<b>4. Multiple Alleles:</b>	<b>4</b>
4.1 Concept, characteristics and importance of multiples alleles, ABO & Rh-blood group system and it's medicolegal importance.	
4.2 Concept of polygenic inheritance with reference to skin color in man	
<b>5. Chromosomes:</b>	<b>5</b>
5.1 Introduction to morphology and composition	
5.2 Classification based on the centromeric position	
5.3 Types of chromosome (autosomes and sex chromosome)	
5.2 Chromosomal aberrations: structural changes	
<b>6. Sex-determination:</b>	<b>5</b>
6.1 Introduction	
6.2 Chromosomal theory of sex determination (XX-XY, ZZ-ZW, XX-XO and Haploid-Diploid method)	
6.3 Parthenogenesis and Gynandromorphism	
<b>7. Human genetics:</b>	<b>4</b>
7.1 Study of human karyotype	
7.2 Syndromes:	
a) Autosomal-Down's (Mongolism), Patau's, Edward's and Cri-du-chat	

b) Sex chromosomal abnormalities in man: Klinefelter's and Turner's syndrome	
7.3 Inborn errors of metabolism: albinism, phenylketonuria and alkaptonuria	
<b>8. Sex linked inheritance in human:</b>	<b>3</b>
8.1 Colorblindness, haemophilia and hypertrichosis	
<b>9. Cytoplasmic inheritance:</b>	<b>1</b>
9.1 Kappa particles in <i>Paramecium</i>	
<b>10. Application of genetics:</b>	<b>4</b>
10.1 Genetic counseling.	
10.2 Concept of genetic Engineering	
10.3 Eugenics	



### ZY-103 PRACTICAL COURSE

- Practical 1. To study the classification with reasons of the following (D)  
Phylum Protozoa- *Amoeba*, *Euglena* and *Volvox*  
Phylum Porifera- *Sycon*, *Hyalonema* and *Euspogia*
- Practical 2. To study the classification with reasons of the following (D)  
Phylum Coelenterata- *Hydra*, *Physalia* and any one coral  
Phylum Platyhelminthes- Tapeworm, Planeria and Liverfluke
- Practical 3. To study the classification with reasons of the following (D)  
Phylum Aschelminthes- *Ascaris*  
Phylum Annelida- *Tubifex*, Leech and *Neries*
- Practical 4. Culturing of *Paramoecium* (E)
- Practical 5. Study of live *Paramoecium* (E)
- Practical 6. Study of external characters, binary fission & conjugation  
in *Paramoecium* (D)
- Practical 7. Study of external characters and digestive system of Earthworm (E)
- Practical 8. Study of reproductive (male and female) system of Earthworm (E)
- Practical 9. Study of nervous system of Earthworm (E)
- Practical 10. Earthworm mounting- septal nephridia, setae and spermatheca (E)
- Practical 11. Study of prokaryotic and eukaryotic cell with the help of suitable  
material (D)
- Practical 12. Study of temporary preparation of different mitotic stages  
from onion root tip cells (E)
- Practical 13. To study the classification with reasons of the following (D)  
Hemichordata- *Balanoglossus*  
Urochordata- *Doliolum/ Salpa*  
Cephalochordata- *Amphioxus*
- Practical 14. To study the classification with reasons of the following (D)  
Cartilaginous fishes- any two  
Bony fishes- any two  
Amphibia- any three

- Practical 15. Study of external characters, sexual dimorphism and digestive system of Frog with the help of model/ charts (D)
- Practical 16. Study of brain of Frog with the help of model/ chart (D)
- Practical 17. Study of monohybrid ratio and dihybrid ratio by providing hypothetical data and deducing applicability of Mendelian laws (three examples of each ratio) (E)
- Practical 18. Preparation of culture media and maintenance of *Drosophila* culture (E)
- Practical 19. Study of *Drosophila*: External characters and sexual dimorphism (D)
- Practical 20. Study of *Drosophila* mutants (any two eye and any two wing mutant) (D)
- Practical 21. Study of genetic traits in human beings (tongue rolling, widow's peak, ear lobes, color blindness and PTC tasters/ nontasters) (E)
- Practical 22. Study of normal human karyotype from metaphase chromosomal spread picture (E)
- Practical 23. Study of blood groups in human (ABO and Rh) (E)
- Practical 24. Study of any 3- cell organelles from electron micrographs (D)
- Practical 25. Compulsory visit to vermiculture unit/biodiversity spot/ZSI/large water body (E)

Note: Minimum 18 practical are to be performed by the students.

## REFERENCE BOOKS FOR F. Y. B. SC. ZOOLOGY

1. The Frog-its reproduction and development -By Robert Rugh,Tata McGraw Hill Edition,New Delhi
2. Biology of Animals By Ganguly,BB.,Sinha,A.K.,Adhikari,S.,New Central Book Agency,Kolkata
3. Arthropod Phylogeny By Gupta,A.P.,Van Nostrand Co.,New York
4. Introduction to Amphibia By Bhamrah,MS.,Juneja,K.,Amol Publication,Delhi
5. Life of Vertebrates By Young,JZ., III Edition,Clarendon Press,London
6. General Zoology By Goodnight and others IBH Publishing Co.
7. Life of Invertebrates By Prasad,ASN,Vikas Publishing House,New Delhi
8. Textbook of Vertebrate Zoology By Prasad,SN.,Kashyap,V.,New Age India Publishers,New Delhi
9. Modern Textbook of Zoology,Vertebrates By Kotpal,RL.,Rastogi and Co. Meerut
10. Phylum Protozoa to Echinodermata (series) By Kotpal,RL.,Rastogi and Co. Meerut
11. Animal Diversity By Kershaw,DR., Redwood Burn Ltd.,Trowbridge
12. Textbook of Zoology By Parkar J. and Haswell,W.,ELBS Edition
13. Textbook of Zoology By Vidyarthi, Agrasia Publishers, Agra
14. Chordate zoology By Jordan EL.,and Verma PS.,S.Chand and Co.,New Delhi
15. Functional Organization of chordates (part I and II) By Nigam HC. And Sobti,R., S.Chand and Co.,New Delhi
16. Invertebrate zoology By Barnes,Saunders College Publishing Co.,Philadelphia,USA,1987
17. Genetics By Verma,PS. And Agrawal, VK., S.Chand and Co.,New Delhi
18. Principle of Genetics By Sinnott,Dunn and Dobzhansky, Tata McGraw Hill Edition,New Delhi
19. Genetics By Gupta, PK., Rastogi Publication, Meerut
20. Genetics By Sarin,C., Tata McGraw Hill,New Delhi
21. Principles of Genetics By Gardner,EJ.,Simmons,MJ. And Snustad,DP. John Wiley and Sons
22. Cytology and Genetics By Dyanasagar VR., Tata McGraw Hill Pub. Co.Ltd.,New Delhi

23. Cell and Molecular Biology By De Robertis,EDP. And De Robertis EME,Molt  
Saunders Inc.
24. Cell Biology By Powar,CB,Himalaya Publication House
25. Cell and Molecular Biology By Dupraw I, Academic Press, New York
26. Cell Biology By avers,CJ.,Addison Wesley Pub. Co. New York and London
27. Cell and Molecular Biology By Carp,G.,John Waley, USA
28. Cell Biology By David,E.,Sadava Johnes and Bartlett Publication,London
29. Cell Structure and Function By Lowey,AG. and Siekevitz,JR.,Menninger and  
Gallew,JAN.,Saunder College Publication,Philadelphia

**UNIVERSITY OF PUNE**  
**BOARD OF STUDIES IN ZOOLOGY**  
**Revised Syllabus for S. Y. B. Sc. (Zoology) To be**  
**implemented from June, 2014**  
**S.Y. B. Sc. (Zoology) New Syllabus**

**Semester-I**

Paper I- ZY-211: Animal Systematics and Diversity – III

Paper II- ZY-212: Applied Zoology – I

**Semester-II**

Paper I- ZY-221: Animal Systematics and Diversity – IV

Paper II- ZY-222: Applied Zoology – II

**Semester-I and II (Annual Examination)**

**Paper III- ZY-223: Practical course (Corresponding to Theory papers)**

UNIVERSITY OF PUNE  
BOARD OF STUDIES IN ZOOLOGY  
COURSE STRUCTURE OF UNDERGRADUATE CLASSES

**Class: F.Y. B. Sc. (To be implemented from June 2013)**

Paper	Course No.	Term I	Term II
I	ZY 101	Animal Systematics and Diversity -I	Animal Systematics and Diversity –II
II	ZY 102	Fundamentals of Cell Biology	Genetics
III	ZY 103	Practical course	

**Class: S.Y. B. Sc. (To be implemented from June 2014)**

Paper	Course No.	Semester I	Course No.	Semester II
I	ZY.211	Animal Systematics and Diversity -III	ZY. 221	Animal Systematics and Diversity –IV
II	ZY.212	Applied Zoology I	ZY.222	Applied Zoology II
III	ZY.223	Practical course		

**Class: T.Y. B. Sc. (To be implemented from June 2015)**

Paper	Course	Semester III	Course	Semester IV
I	ZY.331	Animal Systematics and Diversity V	ZY.341	Biological Techniques
II	ZY.332	Mammalian Histology	ZY.342	Mammalian Physiology and Endocrinology
III	ZY.333	Biological Chemistry	ZY.343	Genetics and Molecular Biology
IV	ZY.334	Environmental Biology and Toxicology	ZY.344	Organic Evolution
V	ZY.335	Parasitology	ZY.345	General Embryology
VI	ZY.336	General Pathology or Cell Biology	ZY.346	Public Health and Hygiene or Medical Entomology
VII	ZY.347	Practicals corresponding to ZY 331, ZY 332, ZY 341 & ZY 342		
VIII	ZY.348	Practicals corresponding to ZY 333, ZY 334, ZY 343 & ZY 344		
IX	ZY.349	Practicals corresponding to ZY 335, ZY 336, ZY 345 & ZY 346		

**Prin. (Dr) D. K. Mhaske**  
Chairman, B.O.S. in Zoology  
University of Pune

## University of Pune

Draft of Syllabus to be implemented from June 2014

### S. Y. B. Sc. Zoology

#### Semester-I

Paper I- ZY-211: Animal Systematics and Diversity – III

Paper II- ZY-212: Applied Zoology – I

#### Semester-II

Paper I- ZY-221: Animal Systematics and Diversity – IV

Paper II- ZY-222: Applied Zoology – II

#### Semester-I and II (Annual Examination)

Paper III- ZY-223: Practical course (Corresponding to Theory papers)

#### Equivalence of Previous Syllabus:

Semester	Old Course (2009 Pattern)	New Course (2014 Pattern)
Semester-I	Paper I: General Zoology and Biological Techniques-I	Paper I: Animal Systematics and Diversity –III
Semester-I	Paper II: Applied Zoology-I	Paper II: Applied Zoology-I
Semester-II	Paper I: General Zoology and Biological Techniques-II	Paper I: Animal Systematics and Diversity –IV
Semester-II	Paper II: Applied Zoology-II	Paper II: Applied Zoology-II
Annual Examination	Paper III: Practical course	Paper III: Practical course

## **PAPER I: FIRST SEMESTER**

### **ZY-211: ANIMAL SYSTEMATICS AND DIVERSITY -III**

- 1. Salient features and classification upto classes of the following: (any two examples from each class) : 15**
  - 1.1** Arthropoda :- Crustacea, Arachnida, Insecta, Myriapoda, Onychophora.
  - 1.2** Mollusca:- Aplacophora, Gastropoda, Pelecypoda, Scaphopoda, Cephalopoda.
  - 1.3** Echinodermata:- Asteroidea, Ophuroidea, Holothuria, Echinoidea, Crinoidea.
- 2. Study of following with reference to: 15**
  - 2.1** Arthropoda:- Mouthparts in Insects, Metamorphosis in Insects, Mimicry in Insects,  
Economic importance of Insects, Larval forms in Crustacea
  - 2.2** Mollusca:- Economic importance of mollusc, Shell and foot modification in mollusc,  
Torsion and Detorsion in mollusc, Larval forms in molluscs
  - 2.3** Echinodermata:- Origin of Echinodermata, Types of Pedicellariae, Larval forms in Echinodermata,
- 3. Study of Starfish : 18**
  - 4.1** Systematic position, Habit and habitat
  - 4.2** External characters
  - 4.3** Digestive system
  - 4.4** Water vascular system
  - 4.5** Reproductive system
  - 4.6** Autotomy and regeneration



## PAPER –I: SECOND SEMESTER

### ZY-221: ANIMAL SYSTEMATICS AND DIVERSITY – IV

1. **Salient features of following classes and its subclasses with two examples of each:** **12**
  - 1.1 Reptilia
  - 1.2 Aves
  - 1.3 Mammalia
2. **General topics:** **16**
  - 2.1 Poisonous and non-poisonous snakes (Two examples each)
  - 2.2 Desert adaptations in reptiles in brief.
  - 2.3 Beak and feet modifications in birds
  - 2.4 Migration in birds
  - 2.5 Aerial adaptations in birds
  - 2.6 Egg laying mammals
  - 2.7 Aquatic mammals
3. **Study of *Scoliodon* :** **20**
  - 3.1 Systematic position, Habit and habitat
  - 3.2 External characters
  - 3.3 Digestive system, food, feeding and physiology of digestion
  - 3.4 Respiratory system
  - 3.5 Blood vascular system
  - 3.6 Nervous system and sense organs
  - 3.7 Male urinogenital system and female reproductive system

**PAPER II: FIRST SEMESTER**  
**ZY-212: APPLIED ZOOLOGY – I**

- 1. Fisheries :**
- 1.1** An introduction to fisheries and its types (in brief) : Freshwater fisheries, Marine fisheries, Brackish water fisheries. **2**
- 1.2** Different types of ponds used in fishery : Nursery pond, Rearing pond Stock pond **2**
- 1.3** Habit, habitat and culture methods of following freshwater forms : **10**
- a) Rohu (*Labeo rohita*)
  - b) Catla (*Catla catla*)
  - c) Mrigal (*Cirrhinus mrigala*)
  - d) Giant prawn (*Macrobrachium rosenbergi*)
- 1.4** Harvesting methods of following marine forms : **4**
- a) Harpadon
  - b) Mackerel
  - c) Lobster
  - d) Pearl oyster
- 1.5** Crafts and gears in Indian Fishery : **2**
- a) Crafts – Catamaran, Machwa, Dinghy, Dug out canoe, Built –up boat
  - Gears – Gill net, Dol net, Purse net, Rampani net, Cast net
- 1.6** Fishery byproducts : **2**
- a) Fish meal
  - b) Fish flour
  - c) Liver oil
  - d) Ising glass
  - e) Fish glue
  - f) Fish manure
  - g) Fish fin soup
- 1.7** Fish preservation technique : **2**
- a) Chilling
  - b) Freezing
  - c) Salting
  - d) Drying
  - e) Canning

## **2. Agricultural Pests and their control :**

- 2.1** An introduction to Pest, types of pests (agricultural, household, stored grain, structural, veterinary, forestry and nursery) **2**
- 2.2** Major insect pests of agricultural importance ( Marks of identification, life cycle, nature of damage and control measures) **9**
- a) Jowar stem borer
  - b) Red cotton bug
  - c) Brinjal fruit borer
  - d) Mango stem borer
  - e) Pulse beetle
  - f) Rice weevil
- 2.3** Non insect pest : Rats and Bandicoots, Crabs, Snails, Slugs, Birds and Squirrels **2**
- 2.4** Pest control practices in brief : Cultural control, Physical control, Mechanical control, Chemical control, Biological control, Pheromonal control and Concept of IPM in brief **6**
- 2.5** Plant protection appliances : Rotary duster, Knapsack sprayer, Cynogas Pump. **3**
- 2.6** Hazards of pesticides on human and antidotes. **2**

## PAPER II: SECOND SEMESTER

### ZY-222: APPLIED ZOOLOGY – II

#### 1. Apiculture :

- 1.1 An introduction to Apiculture, Study of habit, habitat and nesting behavior of *Apis dorsata*, *Apis indica*, *Apis florea* and *Apis mellifera*. 3
- 1.2 Life cycle, Colony organization and division of labour, Polymorphism 3
- 1.3 Bee behaviour and bee communication. 3
- 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 3
- 1.5 Bee keeping and seasonal management. 2
- 1.6 Bee products (collection methods, composition and uses: a) Honey b) Wax c) Bee Venom d) Propolis e) Royal jelly f) Pollen grains 4
- 1.7 Diseases and enemies of Bees:
- a) Bee diseases – Protozoan, Bacterial, Viral, Fungal – with two examples.
- b) Bee pests – Wax moth (Greater and Lesser), Wax beetle.
- c) Bee Enemies – Bee eater, King crow, Wasp, Lizard, Bear, Man. 5
- 1.8 Bee pollination 1

#### 2. Sericulture :

- 2.1 An introduction to sericulture, Study of different types of silk moths, their distribution and varieties of silk produced by Mulberry, Tassar, Eri and Muga silk worms in India. 4
- 2.2 External morphology and life cycle of *Bombyx mori*. 3
- 2.3 Cultivation of mulberry (moriculture): a) Varieties for cultivation, b) Rainfed and irrigated mulberry cultivation – Fertilize schedule, Pruning methods and leaf yield. 4
- 2.4 Harvesting of mulberry: a) Leaf plucking b) Branch cutting c) Whole shoot cutting. 2
- 2.5 Silk worm rearing: a) Types of rearing b) Rearing house c) Rearing techniques d) Important diseases and pests. 7
- 2.6 Post harvest processing of cocoons:
- a) Harvesting and Preparation of cocoons for marketing

- b) Stiffling, Sorting, Storage, Deflossing and Riddling**
- c) Cocoon cooking, Reeling Equipment and Rereeling,  
Washing and Polishing.**

### PAPER III: FIRST AND SECOND SEMESTER

#### ZY-223: PRACTICAL COURSE

- Practical 1. Study and classification with reasons of the following animals  
Phylum Arthropoda:- Scorpion, Crab, Cockroach, Head louse, Centipede,  
Peripatus (D)
- Practical 2. Study and classification with reasons of the following animals  
Phylum Mollusca:- Chiton, Snail, Bivalve, Dentalium, Octopus, (D)
- Practical 3. Study and classification with reasons of the following animals  
Phylum Echinodermata:- Star fish, Brittle star, Holothuria, Sea Urchin,  
Echinus (D)
- Practical 4. Study of permanent slides of mouthparts of the following insects : (D)  
Cockroach, Mosquito, Plant bug/Bed bug, Butterfly, Honey Bee and Housefly
- Practical 5. A) Study of Shell:- Chiton, Pila, Sepia, Pecten, Dentalium,  
B) Study of Foot:- Chiton, Patella, Aplysia, Sepia, Octopus, Dentalium (D)
- Practical 6. To Study the external characters and digestive system of *starfish*. (E)
- Practical 7. A) Study of water vascular system of *starfish*. (E)  
B) Temporary preparation of gonads from *starfish*. (E)
- Practical 8. A) Study of permanent slides of T. S. of arm and types of pedicellariae  
of *starfish*. (D)  
B) Larval forms in Echinodermata. (D)
- Practical 9. Identification, Classification and study of habit, habitat and economic  
importance of the following:  
a) Rohu, Catla, Mrigal, Pomphret. (D)  
b) Prawn, Crab, Oyster. (D)
- Practical 10. Study and maintenance of Aquarium. (E)
- Practical 11. Study of any three types of crafts and gears in fishing. (D)
- Practical 12. Study of insect pests with respect to marks of identification, nature of  
damage and economic importance (Examples related to theory course) (D)
- Practical 13. Study of pest control appliances (Sprayer/Duster) (D)
- Practical 14. Study and classification with reasons of the following animals (D)  
Class Reptilia – Cobra, Garden lizard, Turtle, Rat snake, Draco

- Practical 15. Study and classification with reasons of the following animals (D)  
 Class Aves – Sparrow, Crow, Parrot, Woodpecker  
 Class Mammals – Rabbit, Mongoose, Kangaroo
- Practical 16. Identification of Poisonous and non- poisonous snakes with the help of identification key with two examples of each (D)
- Practical 17. Study of modifications of beaks and feet in birds (Museum specimen) (D)  
 a) Beaks: tearing and piercing, fruit eating, mud probing, fish catching, wood chiseling and flower probing.  
 b) Feet: perching, raptorial, climbing, swimming, running.
- Practical 18. Study of external characters and digestive system of *Scoliodon*. (E)
- Practical 19. Study of brain of *Scoliodon* (E)
- Practical 20. a) Temporary preparation of placoid scales from *Scoliodon* (E)  
 b) Study of cranial nerves, eye ball muscles of *Scoliodon* (D)  
 c) Study of Membranous labyrinth of *Scoliodon* (D)
- Practical 21. a) Study of life cycle of Honey bee (D)  
 b) Study of mouth parts, thoracic appendages (legs and wings) and sting apparatus of Honey bee (E)
- Practical 22. Study of various bee keeping equipments (D)
- Practical 23. Study of: a) bee products, b) bee pests, d) bee enemies (D)
- Practical 24. a) Study of life cycle of *Bombyx mori*. (D)  
 b) Study of any five equipments in Sericulture. (D)
- Practical 25. Compulsory submission of field visit report along with at least five Photographs/ sketches of insect pest/fishes/any animal corresponding to theory courses
- Practical 26. Compulsory study tour/visit to sea coast/fishery institute/sericulture farm/apiculture institute / agricultural farm.

## Practical Skeleton Paper

**Class – S.Y.B.Sc.**

**Subject – Zoology**

**Time – 10.00 am onwards**

**Max. Marks – 80**

- Q.1 – Dissect Starfish/*Scoliodon* so as to expose its.....system. (16)
- Q.2 – Make a stained temporary preparation of .....  
from Honey bee/Starfish/*Scoliodon* (10)
- Q.3 – Identification (Non-chordates and Chordates) (21)
- a) Identify and classify giving reasons (Arthropoda)
  - b) Identify and classify giving reasons (Mollusca/Echinodermata)
  - c) Identify and classify giving reasons (Cyclostomata/Reptiles)
  - d) Identify and classify giving reasons (Aves/Mammals)
  - e) Identify and describe the types of mouthparts of insect
  - f) Identify and describe (Shell/Foot of mollusca/Poisonous/Non poisonous snake)
  - g) Identify and comment on its modifications (Beak/feet modifications in birds)
- Q.4 – Identification (Applied Zoology) (18)
- a) Identify and give its economic importance (Any fish)
  - b) Identify and describe (Any gear/craft)
  - c) Identify and give its application (Plant protection appliance)
  - d) Identify and describe (One stage of life cycle of honeybee/silkworm)
  - e) Identify and describe (Sericulture equipment)
  - f) Identify and describe (Bee keeping equipment/Bee product)
- Q.5 – a) Tour report and Certified Journal (05)  
b) Viva- voce (05)
- Q.6- Submission of **field visit** report along with five photographs/sketches  
of insect pest/fishes/any animal (05)



## REFERENCES:

### ZY-211 Animal Systematics and Diversity - III

1. Text Books of Zoology. Vol.11, Invertebrates, 1982, A. J. Marshall And W. D. Williams, ELBS And Macmillan, Hongkong.
2. Life of Invertebrates, 1980, S. N. Prasad, Vikas Publishing Co. Sahldabad.
3. The Invertebrates, Echinodermata Vol- IV 1992, L.H. Hyman, International books and periodicals supply services Dehli.
4. Invertebrate Zoology, 1982, R. D. Barnes, Saunders College, Philadelphia.
5. 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 Dehli.
6. Invertebrates Zoology, E.L. Jordon and P.S. Verma; S. Chand and Co. Ltd., New Dehli. 14<sup>th</sup> fully Revised Edition- 2007.
7. Invertebrate Zoology, 1991, Paul, A. Meglitch and Fedricks R. Schram, Oxford University Press, New York.
8. IGCSE Biology, D. G. Mackean, Published by John Murray, London. UK, 2002.
9. Invertebrate Zoology, Edited by D. T. Anderson, Oxford University Press, New York.- Indian Edition by- A.P. Offset, Dehli, 2006.
10. Diversity of Organisms. Edited by Caroline M., Pond Biology- Form and Function. Published by Hodder and Stoughton, The Open University, London.
11. An Introduction to Mollusca. H. S. Bhamrah, Kavita Juneja. Anmol Publications Pvt. Ltd. New Dehli- 110002 (India).
12. An Introduction of Echinodermata. . H. S. Bhamrah, Kavita Juneja. Anmol Publications Pvt. Ltd. New Dehli- 110002 (India).
13. Modern Text Book Of Zoology. Invertebrates. 6<sup>th</sup> Edition, 1992, R. L. Kotpal, Rastogi Publication, Merut.

### ZY- 212 Applied Zoology Part- I

#### Fisheries & Agricultural pests and their Control

1. Fishes . Mary Chandy. N.B.T. India, 2005.
2. Economic Zoology, Shukla Upadhyay, Rastogi Publication, Meerut, India, 1998.
3. Fisheries Developments, K.K. Trivedi, Oxford and IBH Pub. Co.
4. Marine Fishes in India, 1990, D.V.Bal & K. Virabhdra, tata McGraw Hill Publication.
5. Fishery Management, 1990, S.C.Agarwal, Avinash Publication House, New Dehli.

6. Entomology & Pest Management. Pedigo L.P. Prentice Hall, India 1996.
7. General & Applied Entomology, Nayar K.K. & T.N. Ananthkrishnan & B.V.Davis, Tata McGraw Hill Publication, New Dehli.
8. Insects. M.S. Mani, NBT, India, 2006.
9. Agricultural Pests: Biology & Control Measures, B.M.Deoray and T.B.Nikam, Nirali Publication, Pune, 1990.
10. Insects & Mites of Crops in India. M.R.G.K. Nair – by ICAR, New Dehli.
11. The Science of Entomology. W.S.Romosor and J.G. Stoffolano, McGraw Hill Publication, 1988.
12. Agricultural Insect Pests of India and their Control, Dennis S.Hill, Cambridge University Press.
13. Applied Entomology. Vol. I & II. K.P. Srivastava. Kalyani Publication, Ludhiyana, New Dehli.
14. Principles of Insect Pest Management. G.S. Dhaliwal and Ramesh Arora, Kalyani Publications, Ludhiyana.
15. Pest Management and Pesticides: Indian Scenario. Editor- B. Vasantaraj David, Namrutha Publications, Madras (Chennai).
16. Concepts of Insect Control. Ghosh M.R. Wiley Eastern Ltd. New Dehli.

### **ZY- 221 Animal Systematics and Diversity - IV**

1. A Text Book of Zoology, Vertebrates, Vol-II, Jeffery Parker and W.A. Haswel, Edited by Marshall and Williams, CBS Publication, New Dehli.
2. Chordate Zoology, 1982, P.S Dhami and J.K.Dhami, R.Chand and Co., New Dehli.
3. A Text Book of Zoology, 1984, R.D. Vidyarthi, R. Chand and Co., Dehli.
4. Modern Text Book of Zoology, Vertibrates. R. L. Kotpal, 3<sup>rd</sup> edn. Rastogi Publications, Meerut.
5. Chordate Zoology, E.L. Jordon. S. Chand & Co., New Dehli.
6. Organic Evolution. R.S. Lull. Light & Life Publishers.
7. Organic Evolution, 1991, T.S. Gopalkrishna. Itta Sambashivarab Publ. House, Dehli.
8. Human Physiology, Vol.I & II, 1980, Edn. Dr. C.C. Chatterjee, Medical applied agency, Calcutta.
9. Biology, Campbell and Reece. 7<sup>th</sup> Edn. Pearson Education in South Asia, Dehli.

## **ZY-222 Applied Zoology Part-II**

### **Apiculture and Sericulture**

1. Destructive and useful Insects, their habit and Control, 1973. C.L. Metcalf and W. p. Flint, Tata McGraw Hill Publications, New Dehli.
2. A Text Book Of Entomology, 1974. V.K. Mathur and K.D. Upadhayay, Goel Printing Press, Barani.
3. Imm's Text Book of Entomology, Vol I & II, Richard and Owen.
4. Biology of Insects, 1992. S.C. Saxena. Oxford and IBH Publishing Co., New Dehli. Bombay, Calcutta.
5. Bee and Bee Keeping, 1978, Roger A. Morse, Conell University Press, London.
6. The Behaviour & Social Life of Honey Bees, C.R. Ribbandas, Dover Publication inc. New York.
7. Principal of Sericulture, 1994. Hisao Arguo, Oxford & Co.
8. An Introduction of Sericulture, 1995. G.Ganga, J. Sulochana, Oxford & IBH Publication Co. Bambay.
9. FAQ Manual of Sericulture. Vol I Mulberry Cultivation, Vol II Silkworm Rearing. Central Silk Board, Bangalore.

### **ZY- 223 Practical Courses**

1. Invertebrates Practical Zoology. V. Banerjee. Bharati Bhavan, Patana, 1997
2. Practical Zoology. Invertebrate / Vertebrate. S. S. Lal, Rastogi Publications. Meerut, India, Uttar Pradesh, 1998.
3. Experimental Physiology. V. V. Kulshreshtha. Vikas Publishing House Pvt. Ltd, New Delhi.
4. Practical Course in Biological Chemistry. Bhide, Diwan and Athavle, Narendra Prakashan.
5. A Manual of Practical Zoology, Vol I Non-Chordata, 1994. P.K.G Nair and K. P Aehar. Himalaya Publishing House, Bombay, Delhi, Nagpur.
6. A Manual of Practical Zoology, Vol II Non-Chordata, 1994. P.K.G Nair and K. P Aehar. Himalaya Publishing House, Bombay, Delhi, Nagpur.
7. A Manual of Practical Zoology, Invertebrate, 1975. P. Verma, S. Chand and Co., New Delhi..

8. Practical Invertebrate Zoology, 1972. V. S. Shrivastava. Central Book Depot, Allahabad.
9. A Manual of Practical Vertebrate Zoology and Physiology, 1990. V. B. Rastogi, Kedarnath, Ramnath, Meerut, Delhi.
10. Practical Bee keeping, Herbert Mace. Ward Lock Limited, London.
11. Handbook of Practical Sericulture, 1987. S. R. Uttal and M.N. Narsimhana, Central Silk Board, Bangalore.

**SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE**

**Three Year B. Sc. Degree Course in**

***Zoology***

**Principal Dr. D. K. Mhaske**

***Chairman,***

***Board of Studies in Zoology,***

***Savitribai Phule Pune University, Pune. 411 007***

**1) Title of the Course: B. Sc. Zoology**

**F. Y. B. Sc. Zoology**

**(To be implemented from Academic Year 2013-14)**

**2) Preamble:**

The well organized curricula including basic as well as advanced concepts in Zoology from first year to third year shall inspire the students for pursuing higher studies in Zoology and for becoming an entrepreneur and also enable students to get employed in the Biological research Institutes, Industries, Educational Institutes and in the various concerning departments of State and Central Government based on subject Zoology.

**3) Introduction:**

At **first year of under-graduation** the topics related to the fundamentals of zoology, including exposure to diversity in animal groups and industries based on the zoological areas are covered. The practical course is aimed at to equip the students with skills required for animal identification, morphological, anatomical, technical description, classification and also applications of zoology in the various industries.

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 the content of first year shall be introduced.

At **third year under-graduation**: Theory and practical courses in each semester shall deal with the further detailed studies of the various disciplines of the Zoology subject and other branches of Zoology such as Genetics, Animal Physiology, Molecular Biology, Biochemistry, Microtechnique, Non-chordate and Chordate, Developmental Biology, Histology, Cell Biology, Biodiversity, Public health and hygiene, Pathology, Entomology, Biotechnology, etc. The students will also learn about use of various technical skills in the biological sciences to be helpful during research in the Zoology subject.

**Objectives:**

- To provide thorough knowledge about various animal sciences from primitive to highly evolved animal groups.
- To make the students aware of applications of Zoology subject in various industries.
- To highlight the potential of various branches of Zoology to become an entrepreneur.

- To equip the students with skills related to laboratory as well as field based studies.
- To make the students aware about conservation and sustainable use of biodiversity.
- To inculcate interest and foundation for further studies in Zoology.
- To address the socio-economical challenges related to animal sciences.
- To facilitate students for taking up and shaping a successful career in Zoology.

#### 4) Eligibility:

1. **First Year B.Sc.:** A student who has passed the Higher Secondary School Certificate (10+2) Science stream with Biology or its equivalent examination as per the Savitribai Phule Pune University, Pune eligibility norms.
2. **Second Year B.Sc.:** Keeping terms of First Year of B. Sc. with zoology as one of the subjects. Other students if they fulfill the conditions approved by the equivalence committee by Faculty of Science of the Savitribai Phule Pune University, Pune are also eligible.
3. **Third Year B.Sc.:** Student shall pass all First Year B. Sc. courses and satisfactorily keeping terms of Second Year of B. Sc. with zoology as one of the subjects.

**Note:** Admissions will be given as per the selection procedure / policies adopted by the respective college, in accordance with terms and conditions laid down by the Savitribai Phule University of Pune. Reservation and relaxation will be as per the Government rules.

#### 5 A) Examination Pattern:

##### First Year B. Sc. Zoology

Pattern of Examination : Annual

Theory courses	Zoology Theory Paper I : Annual
	Zoology Theory Paper II : Annual
Practical Course	Annual

Paper/ Course No.	Title	Total Number of lectures/practicals per Term	Standard of passing		
			Internal marks out of <b>20</b>	External marks out of <b>80</b>	Total marks out of <b>100</b>
Theory Paper I ZY-101 (First term)	Animal Systematics and Diversity -I	Three lectures/Week (Total 36 lectures per term)	8	32	40*
Theory Paper I ZY-101 (Second term)	Animal Systematics and Diversity -II	Three lectures/Week (Total 36 lectures per term)			
Theory Paper II ZY-102 (First term)	Fundamentals of Cell Biology	Three lectures/Week (Total 36 lectures per term)	8	32	40*
Theory Paper II ZY-102 (Second term)	Genetics	Three lectures/Week (Total 36 lectures per term)			
Practical Paper III ZY-103 (First & Second Term)	Practical	9 Practicals of 4 lectures in each term (18 practicals / year)	8	32	40*

\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

**Notes:**

1. Total marks: Theory (100 + 100 ) = 200 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers be given on the basis of internal assessment, tests etc.

**Theory examination** will be of three hours duration for each theory course. There shall be 5 questions each carrying equal marks. The pattern of question papers shall be:

Question 1	8 sub-questions, each of 2 marks; answerable in 2 -3 lines and based On entire syllabus
Question 2 and 3	4 out of 6 - short answer type questions; answerable in 8 – 10 lines
Question 4	2 out of 4 – Descriptive answer type questions, answerable in 15 – 20 lines
Question 5	1 out of 2 – Descriptive answer type questions, answerable in 35 – 40 lines





- \* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50
- \*\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

**Notes:**

1. Total marks: Theory for each semester (50 + 50 ) = 100 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers be given on the basis of internal assessment tests.
4. Internal marks for Practical Course should be a regular assessment of each practical for 20 marks each : Marks for journal : 10, Marks for attendance : 05, Marks for experimental skills : 05.

**Theory examination** will be of two hours duration for each theory course. There shall be 4 questions each carrying equal marks as follows: The pattern of question papers shall be:

Question 1	10 sub-questions, each of 1 marks based on entire syllabus	10 marks
Question 2 and 3	2 out of 3 sub-questions, each of 5 marks; short answer type questions; answerable in 10-15 lines	10 marks each
Question 4	1 out of 2 sub-questions, each of 10 marks; long answer type questions (20-25lines)	10 marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple choice Questions, True / False, Definitions and Answer in Two or three lines. There shall be 20 questions.

Practicals: Regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks for experimental skills: 05

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory for appearing in practical examination. There shall be two expert and two examiners per batch for the practical examination. One of the examiners will be external.

### Third Year B. Sc. Zoology

(To be implemented from academic year 2015-2016)

Pattern of examination: Semester

Theory courses: (Sem III: ZY-331 to ZY-336) : Semester

(Sem IV: ZY- 341 to ZY-346) : Semester

Practical Course:(ZY-347-349) : Annual

<b>Theory Papers</b>					
Paper/Course No.	Title	Total Number of lectures Per Semester	Standard of passing		
			Internal marks out of <b>10</b> (Theory) out of <b>20</b> (Practical)	External marks out of <b>40</b> (Theory) out of <b>80</b> (Practical)	Total passing marks out of <b>50</b> (Theory) out of <b>100</b> (Practical)
<b>SEM III</b>					
ZY-331	Animal Systematics and Diversity V	48	4	16	20*
ZY-332	Mammalian Histology	48	4	16	20*
ZY-333	Biological Chemistry	48	4	16	20*
ZY-334	Environmental Biology and Toxicology	48	4	16	20*
ZY-335	Parasitology	48	4	16	20*
ZY-336	General Pathology or Cell Biology	48	4	16	20*
<b>SEM IV</b>					
ZY-341	Biological Techniques	48	4	16	20*
ZY-342	Mammalian Physiology and Endocrinology	48	4	16	20*
ZY-343	Genetics and Molecular Biology	48	4	16	20*
ZY-344	Organic Evolution	48	4	16	20*
ZY-345	General Embryology	48	4	16	20*
ZY-346	Public Health and Hygiene or Medical Entomology	48	4	16	20*

Practical Papers					
ZY- 347 (Semester III & IV)	Practical Paper I	Practicals related to ZY-331, ZY-332, ZY-341, ZY-342. 12 Practical of 4 lectures in each Semester (24 Practical / year)	8	32	40**
ZY- 348 (Semester III & IV)	Practical Paper II	Practicals related to ZY-333, ZY-334, ZY-343, ZY-344. 12 Practical of 4 lectures in each Semester (24 Practical / year)	8	32	40**
ZY- 349 (Semester III & IV)	Practical Paper III	Practicals related to ZY-335, ZY-336, ZY-345, ZY-346. 12 Practical of 4 lectures in each Semester (24 Practical / year)	8	32	40**

\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

**Notes:**

1. Total marks: Theory for each semester ( $50 \times 6$ ) = 300 marks
2. Total marks per year 600 (Theory) + 300 marks (practicals) = 900 marks
3. Internal marks for theory papers be given on the basis of internal assessment tests.
4. Practicals: Regular assessment of each practical for 20 marks each: Marks for journal: 10, Marks for attendance: 05, Marks for experimental skills: 05.

**Theory examination** will be of two hours duration for each theory course. There shall be 4 questions each carrying 10 marks. The pattern of question papers shall be:

Question 1	10 sub-questions, each of 1 marks based on entire syllabus	10 marks
Question 2 and 3	2 out of 3 sub-questions, each of 5 marks; short answer type questions; answerable in 10 – 15 lines	10 marks each
Question 4	1 out of 2 sub-questions, each of 10 marks; long answer type questions (20 – 25 lines)	10 marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple choice questions, True / False, Definitions, Answer in Two or three line questions. There shall be 20 questions.

Practicals: Regular assessment of each practical for 20 marks each: Marks for journal: 10, Marks for attendance: 05, Marks for experimental skills: 05.

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination. One of the examiners will be external.

**5 B) Standard of Passing:**

- i) In order to pass in the first year theory 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 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 16 marks out of 40 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.)

**5 C) ATKT Rules:**

While going from F.Y.B.Sc. to S.Y.B.Sc. at least 8 courses (out of total 12) should be passed; however all F.Y.B.Sc. courses should be passed 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 passed (Practical Course at S.Y.B.Sc. is equivalent to 2 courses).

**5 D) 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 69%	First Class
3	Aggregate 55% and more but less than 59%	Higher Second Class
4	Aggregate 50% and more but less than 54%	Second Class
5	Aggregate 40% and more but less than 49%	Pass Class
6	Below 40%	Fail

**5 E) External Students:**

There shall be no external students.

**5 F) Setting of question papers:**

**F. Y. B. Sc.:** For theory papers I and II annual question papers shall be set by the University of Pune and assessment shall be done at the respective colleges. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Paper III, papers shall be set by the University of Pune and assessment done at the respective colleges.

**S. Y. B. Sc. and T. Y. B. Sc.:** For theory papers for each semester and also for the annual practical examination, question papers shall be set by the University of Pune. Centralized assessment for theory papers shall be done as per the University instructions. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Papers, papers shall be set by the University of Pune and assessment shall be done by the internal examiner and external examiner appointed by University of Pune.

**5 G) Verification and Revaluation Rules:**

As per University Statues and Rules for verification and revaluation of marks in stipulated time after declaration of the semester examination result.

**6 Course Structure:**

**Duration:** The duration of B.Sc. Zoology Degree Program shall be three years.

**a) Compulsory Papers:**

F. Y. B. Sc.: 2 Theory + 1 Practical (Annual)

S. Y. B. Sc.: 2 Theory per semester + 1 Practical (Annual)

T. Y. B. Sc.: 6 Theory per semester + 3 Practical (Annual)

**b) Question Papers :**

**F. Y. B. Sc. Theory paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

**S. Y. / T. Y. - B. Sc. Theory paper:**

University Examination – 40 marks (at the end of each term)

Internal Examination – 10 marks

**F. Y. / S. Y. / T. Y. - B. Sc. Practical Paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

**Medium of Instruction:** The medium of instruction for the course shall be **English**.

## 7 Equivalence of Previous Syllabus:

### F.Y.B.Sc. :-

Old Course (2008 Pattern)	New Course (2013 Pattern)
Paper I: Nonchordates and Chordates	Animal Systematics and Diversity –I and II
Paper II: Genetics and Parasitology	Fundamentals of Cell Biology and Genetics
Paper III: Practical course	Paper III: Practical course

### S.Y.B.Sc. :-

Semester	Old Course (2009 Pattern)	New Course (2014 Pattern)
Semester-I	Paper I: General Zoology and Biological Techniques-I	Paper I: Animal Systematics and Diversity –III
Semester-I	Paper II: Applied Zoology-I	Paper II: Applied Zoology-I
Semester-II	Paper I: General Zoology and Biological Techniques-II	Paper I: Animal Systematics and Diversity –IV
Semester-II	Paper II: Applied Zoology-II	Paper II: Applied Zoology-II
Annual Examination	Paper III: Practical course	Paper III: Practical course

### T.Y.B.Sc. :-

#### Semester- III

	Papers in Old Course (2010 Pattern)		Equivalent papers in new Course (2015 Pattern)
ZY-331	General Zoology	ZY-331	Animal Systematics and Diversity V
ZY-332	Mammalian Histology	ZY-332	Mammalian Histology
ZY-333	Biological Chemistry	ZY-333	Biological Chemistry
ZY-334	Environmental Biology and Toxicology	ZY-334	Environmental Biology and Toxicology
ZY-335	Any one of the following a. Basic Entomology b. General Pathology	ZY-335	Parasitology
ZY-336	Cell Biology	ZY-336	Any one of the following a. General Pathology b. Cell Biology

#### Semester-IV

	<b>Papers in Old Course (2010 Pattern)</b>		<b>Equivalent papers in new Course (2015 Pattern)</b>
ZY-341	Biotechnology	ZY-341	Biological Techniques
ZY-342	Mammalian Physiology and Endocrinology	ZY-342	Mammalian Physiology and Endocrinology
ZY-343	Molecular Biology	ZY-343	Genetics and Molecular Biology
ZY-344	Organic Evolution	ZY-344	Organic Evolution
ZY-345	Any one of the following a. Biodiversity b. Public Health and Hygiene	ZY-345	General Embryology
ZY-346	Genetics and Developmental Biology	ZY-346	Any one of the following a. Public Health and Hygiene b. Medical Entomology
ZY-347	Practical I ZY-331, ZY-332, ZY-341, ZY-342	ZY-347	Practical I ZY-331, ZY-332, ZY-341, ZY-342
ZY-348	Practical II ZY-333, ZY-334, ZY-343, ZY-344	ZY-348	Practical II ZY-333, ZY-334, ZY-343, ZY-344
ZY-349	Practical III ZY-335, ZY-336, ZY-345, ZY-346	ZY-349	Practical III ZY-335, ZY-336, ZY-345, ZY-346

**8 University Terms:** Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

**9 Qualification of Teachers:** M.Sc. Zoology or equivalent master degree in science with class/grades and NET/SET/Ph.D. as per prevailing rules and regulations laid down by University/Government /UGC.



**SAVITRIBAI PHULE PUNE UNIVERSITY**

**BOARD OF STUDIES IN ZOOLOGY**

**Revised Syllabus for T. Y. B. Sc. (Zoology) to be implemented from June, 2015**

**Semester-III:-**

- ZY-331: Animal Systematics and Diversity V
- ZY-332: Mammalian Histology
- ZY-333: Biological Chemistry
- ZY-334: Environmental Biology and Toxicology
- ZY-335: Parasitology
- ZY-336: General Pathology or Cell Biology

**Semester-IV:-**

- ZY-341: Biological Techniques
- ZY-342: Mammalian Physiology and Endocrinology
- ZY-343: Genetics and Molecular Biology
- ZY-344: Organic Evolution
- ZY-345: General Embryology
- ZY-346: Public Health and Hygiene or Medical Entomology
- ZY-347: Practical I- ZY-331, ZY-332, ZY-341, ZY-342
- ZY-348: Practical II- ZY-333, ZY-334, ZY-343, ZY-344
- ZY-349: Practical III- ZY-335, ZY-336, ZY-345, ZY-346

**SAVITRIBAI PHULE PUNE UNIVERSITY**  
**BOARD OF STUDIES IN ZOOLOGY**  
**COURSE STRUCTURE OF UNDERGRADUATE CLASSES**  
**(To be implemented from June 2015)**

**Class: F.Y. B. Sc.**

Paper	Course No.	Term I	Term II
I	ZY 101	Animal Systematics and Diversity -I	Animal Systematics and Diversity –II
II	ZY 102	Fundamentals of Cell Biology	Genetics
III	ZY 103	Practical course	

**Class: S.Y. B. Sc.**

Paper	Course No.	Semester I	Course No.	Semester II
I	ZY.211	Animal Systematics and Diversity -III	ZY. 221	Animal Systematics and Diversity –IV
II	ZY.212	Applied Zoology I	ZY.222	Applied Zoology II
III	ZY.223	Practical course		

**Class: T.Y. B. Sc.**

Paper	Course	Semester III	Course	Semester IV
I	ZY.331	Animal Systematics and Diversity V	ZY.341	Biological Techniques
II	ZY.332	Mammalian Histology	ZY.342	Mammalian Physiology and Endocrinology
III	ZY.333	Biological Chemistry	ZY.343	Genetics and Molecular Biology
IV	ZY.334	Environmental Biology and Toxicology	ZY.344	Organic Evolution
V	ZY.335	Parasitology	ZY.345	General Embryology
VI	ZY.336	General Pathology or Cell Biology	ZY.346	Public Health and Hygiene or Medical Entomology
VII	ZY.347	Practicals corresponding to ZY 331, ZY 332, ZY 341 & ZY 342		
VIII	ZY.348	Practicals corresponding to ZY 333, ZY 334, ZY 343 & ZY 344		
IX	ZY.349	Practicals corresponding to ZY 335, ZY 336, ZY 345 & ZY 346		

**Prin. (Dr) D. K. Mhaske**  
Chairman, B.O.S. in Zoology  
Savitribai Phule Pune University, Pune

**T. Y. B. Sc. Zoology**  
**ZY- 331 (Paper I)**  
**Animal Systematics and Diversity- V**

**Total lectures: 48**

- |          |  |           |
|----------|--|-----------|
| <b>1</b> | <b>Study of <i>Pila globosa</i> with reference to the following:</b>   | <b>12</b> |
|          | 1.1 Systematic position, habit, habitat and external characters  |           |
|          | 1.2 Body wall & pallial complex  |           |
|          | 1.3 Functional anatomy: digestive, respiratory, circulatory, excretory, reproductive, nervous system & sense organs                                |           |
| <b>2</b> | <b>Study of the following groups with reference to:</b>  | <b>08</b> |
|          | 2.1 Protozoa : locomotion & nutrition  |           |
|          | 2.2 Porifera : skeleton and canal system   |           |
|          | 2.3 Coelenterata : polymorphism and corals   |           |
|          | 2.4 Hemichordata : affinities  |           |
| <b>3</b> | <b>Study of <i>Calotes versicolor</i> with reference to the following :</b>  | <b>14</b> |
|          | 3.1 Systematic position, habit, habitat and External characters  |           |
|          | 3.2 Functional Anatomy - Digestive, Circulatory, Excretory, Reproductive, Nervous system and Sense organs  |           |
| <b>4</b> | <b>Comparative study of following topics in vertebrates</b>  | <b>08</b> |
|          | 4.1 <b>Integument:</b> Skin of <i>Scoliodon</i> , Frog, <i>Calotes</i> , Pigeon & Rat  |           |
|          | 4.2 <b>Heart:</b> Structure of heart of <i>Scoliodon</i> , Frog, <i>Calotes</i> , Pigeon & Rat   |           |
|          | 4.3 <b>Kidney:</b> Evolution of Archinephros, Pronephros, Mesonephros, Metanephros   |           |
|          | 4.4 <b>Brain:</b> Morphological variation in the different regions of the brain of <i>Scoliodon</i> , Frog, <i>Calotes</i> , Pigeon and Rat/Rabbit |           |
| <b>5</b> | <b>Study of following groups with reference to</b>   | <b>06</b> |
|          | 5.1 Pisces : Dipnoi, Accessory respiratory organs , Electric organs  |           |
|          | 5.2 Reptilia : Temporal vacuities, General characters of Rhyncocephalia  |           |
|          | 5.3 Mammalia : Dentition in mammals  |           |

### Reference Books

1. Living Invertebrates, 1987: Pearse, Buchsbaum, Blackwell Scientific Publication, California.
2. A Text book of Zoology Invertebrates, Vol. I 1992, 7<sup>th</sup> Edn. Parker and Haswell edited by Marshall William, C B S publishers and distributors, New Delhi.
3. Invertebrate Zoology, 1992; S. N. Prasad, Vikas Publishing House, New Delhi.
4. Life of Invertebrates, 1992; S.N. Prasad, Vikas Publishing House, New Delhi.
5. Invertebrate Zoology, 1992 4<sup>th</sup> Edn., reprint, P.S. Dhami and J. K. Dhami, R. Chand and Co., New Delhi.
6. Modern text book of Zoology, Invertebrates 10<sup>th</sup> Edn., 2009, R.L. Kotpal, Rastogi publ., Meerut.
7. Invertebrates Structure and Function, 2<sup>nd</sup> Edn.1979, EJW Barrington, John Wiley and Sons Inc.
8. Invertebrates Zoology, 1994, 6<sup>th</sup> Edition, Ruppert, E. Edward, R. D. Barnes; Saunders college Publishing, USA.
9. Invertebrate Zoology, 1991, P.A. Meglitsch and F. R. Schram, Oxford University Press; New York.
10. Invertebrate: A New synthesis, 1988, R.S.K. Barnes, P. Calow and P.J.W., Olive Blackwell Scientific, U.K.
11. An Introduction to Protochordata, 1990, H. S. Bhamrah and KavitaJuneja, Anmol publication, New Delhi.
12. The invertebrates: Protozoa through Ctenophora Vol.I, 1959, Hyman, Libbie Henrietta, McGraw-Hill Book Co., Inc. New York.
13. A text book of Zoology, Vol.II, 1990, T. J. Parker and W. A. Haswell, Low price Publication, Delhi.
14. Modern Text Book of Zoology, 1992, R. L. Kotpal, Rastogi Publication, Meerut.
15. Chordate Zoology, 1982, P. S. Dhami and J. K. Dhami, R. Chand and Co., New Delhi.
16. The life of Vertebrates, 3<sup>rd</sup> edn.1993, J. Z. Young, Oxford University Press, USA.
17. The Phylum Chordata: Biology of Vertebrates and their Kin, 1987, H. H. Newman, Distributor Satish book enterprise, Agra.
18. A text book of Zoology, 1984, R. D. Vidyarthi, S. Chand and Co., New Delhi.
19. Comparative Anatomy of the Vertebrates, G. C. Kent, R. K Carr, 9<sup>th</sup>Edn., 2001, McGraw Hill, Boston, USA

20. Practical Zoology Invertebrates, 11<sup>th</sup> revised Edn., 2014, S. S. Lal, Rastogi publ., Meerut.
21. Vertebrate Practical Zoology, 11<sup>th</sup> revised Edition, 2014, S. S. Lal, Rastogi publ., Meerut.
22. Practical Zoology, 2004, Vijay Laxmi Sharma, Paragon International Publishers.
23. The anatomy of Garden Lizard, 1974, S.Y. Paranjape, Pune University Publication, Pune.
24. Chordate Zoology, 2009 reprint, E. L. Jorden, S. Chand and Co., New Delhi.
25. Text book of Zoology, Vertebrates, Vol. II, T.J. Parker and W.A. Haswell, edited by Marshall and Williams, CBS Publications, New Delhi.

**ZY- 332 (Paper II)**  
**Mammalian Histology**

**Total lectures: 48**

<b>1</b>	<b>Introduction</b>	<b>1</b>
	1.1 Definition and scope	
<b>2</b>	<b>Tissues:</b>	<b>6</b>
	2.1 Definitions and review of tissues (location, structure and functions): epithelial, connective, nervous and muscular	
<b>3</b>	<b>Histological study of following organs</b>	
	3.1 Skin (V.S.)	3
	3.2 Tooth (V.S.)	2
	3.3 Tongue (C.S.) with reference to mucosa papillae and taste buds	2
	3.4 Alimentary canal: Basic histological organization with reference to: Oesophagus (T.S.), stomach (T.S.), duodenum (T.S.) Ileum (T.S.) and rectum (T.S.)	8
	3.5 Glands associated with digestive system:	6
	Salivary glands – parotid (C.S.), submandibular (C.S.) sublingual (C.S.), liver (C.S.) and pancreas (C.S.) including both exocrine and endocrine components	
	3.6 Respiratory organs: Trachea (T.S.) and lung (C.S.)	2
	3.7 Blood vessels: Artery (T.S.), vein (T.S.) and capillaries (T.S.)	2
	3.8 Kidney (L.S.), Structure of nephron and juxtaglomerular complex	4
	3.9 Reproductive organs:	6
	a) Testis (T.S.) with reference to Seminiferous Tubules and cells of Leydig	
	b) Ovary (C.S.) - primary, secondary and matured (Graffian) follicle, corpus luteum and corpus albicans	
<b>4</b>	<b>Histology of endocrine glands :</b>	<b>6</b>
	4.1 Pituitary gland	
	4.2 Thyroid gland	
	4.3 Adrenal gland	

### **Reference Books**

1. Inderbir Singh's Textbook of Human Histology (With Colour Atlas and Practical Guide), 2014, 7<sup>th</sup> Edn., Neelam Vasudeva and Sabita Mishra, Jaypee Brothers Medical Publishers, New Delhi, India.
2. Bailey's Text book of Histology, 1971, 16th edn. Wilfred M. Copenhaver, Richard P. Bung & Mary Bartell Bunge, The William & Wilkins Company, Baltimore.
3. Histology, 1987, 9th Edn., Arthur W. Ham, David H. Cormack, J. B. Lippincott Co. Philadelphia.
4. Essential Histology, 2001, 2<sup>nd</sup> Edition, David H. Cormack, Lippincott Williams & Wilkins, Philadelphia.
5. A text book of Histology, 2014, 5<sup>th</sup> edn. Krishna Garg, Indira Bahl & Mohini Kaul CBS publication & Distributors, Delhi.
6. Histology, 1977, 4<sup>th</sup> Edn., R. O. Greep and L. Weiss, McGraw Hill Int. Book Co., New York.
7. Histology of Mammals, 1983, M. V. Athawale and A. N. Latey, Narendra Prakashan, Pune.
8. Hand book of Basic Microtechnique, 1964, 3rd Edn., Peter Gray, McGrawHill Book Co. New York.
9. Hand Book of Histopathological & Histochemical Techniques, 1983, 3<sup>rd</sup> Edition reprint, Butterworth & Co. (Publishers) Ltd, UK.
10. Hand Book of Histological and Histochemical Techniques, 1991, 1st Edn. S. K. David, CBS publisher & Distributors, Delhi.

## ZY-333 (Paper III)

### Biological chemistry

Total lectures: 48

- 1. Basic Biochemistry:** 10
  - 1.1 Bonds –Types: Ionic, covalent, noncovalent bonds (hydrogen, hydrophobic, electrostatic, Van der Waal forces) and their functions in bio molecules
  - 1.2 Structure of water molecule (liquid, ice and colloid)
  - 1.3 Physico-chemical properties of water
  - 1.4 Concept of acid and base, pH, Sorenson's scale, derivation of Henderson Hasselbalch equation and its applications
  - 1.5 Concept of Buffer-types of buffer, buffering capacity and buffers in biological system (Phosphate, bicarbonate)
- 2. Carbohydrates:** 10
  - 2.1 Definition and classification of carbohydrates
  - 2.2 Isomerism in carbohydrates- Structural and stereoisomerism
  - 2.3 Stereo chemical properties-enantiomers, anomers, epimerism, mutarotation, racemisation, biological significance and clinical significance-hypoglycemia and hyperglycemia
- 3. Proteins:** 08
  - 3.1 Essential and non essential amino acids
  - 3.2 Structure and classification of amino acids, Peptide bond, types of proteins, protein structures (primary, secondary, tertiary and quaternary structures with suitable example), bonds responsible for protein structures and Biological significance of proteins
- 4. Enzymes:** 12
  - 4.1. Classification and properties of enzymes
  - 4.2 Regulatory and non regulatory enzymes
  - 4.3 Enzyme kinetics, MM equation and its importance and LB plot
  - 4.4 Reversible and irreversible enzyme inhibition
  - 4.5 Factors influencing enzyme activity (pH, temperature, substrate concentration, enzyme concentration)
  - 4.6. Introduction of isoenzymes, allosteric enzymes, immobilized enzymes and ribozymes
  - 4.7. Clinical significance of enzymes- PKU and AKU



## 5. Lipids:

08

- 5.1 Introduction, classification and chemistry
- 5.2 Clinical significance (obesity, atherosclerosis, myocardial infarction)
- 5.3 Biological significance of lipids

### Reference books

1. Principles of Biochemistry, 1993, 2<sup>nd</sup> Edn, Lehninger A. L. Nelson D.L. & Cox M.M. CBH Publisher and distributors, Delhi.
2. Biochemistry, 1995 5<sup>th</sup> Edn. Zubay G. Wm, C.Brown Communications USA
3. Harpers Biochemistry ,1996 , 26<sup>th</sup> Edn., Murray R.k.,Granner D.K. ,Mayes P.A. &Rodwell V.W. Prentice Hall international USA.
4. Outline of biochemistry, 1995 5<sup>th</sup> Edn, Conn E.E., Stumph P.K. Bruening G &Doi R.H.John Wiley & Sons, USA
5. Principals of Biochemistry, 1993, 1<sup>st</sup> Edn., Pattabhiraman T.N.,Gajanan Book publisher s and distributors Bangalore.
6. Clinical Biochemistry, 1994, B. P. Godkar, Bhalini Publishing house, Mumbai.
7. Biochemistry, 1995 5<sup>th</sup> Edn, Stryer Sanfrancisco, W. H. Freeman & Co.
8. Biochemistry, 1990, 8<sup>th</sup> Edn., D.Voet & J. Voet, JohnWilley, New York

## ZY-334 (Paper IV)

### Environmental Biology and Toxicology

Total lectures: 48

- |  |           |
|--|-----------|
| <b>1 Environmental Biology</b>   | <b>2</b>  |
| Introduction- Definition, basic concepts and scope   |           |
| <b>2 The Ecosystem</b>   | <b>8</b>  |
| 2.1 Definition, abiotic and biotic components and their interrelationship  |           |
| 2.2 Energy flow in ecosystem and flow models   |           |
| 2.3 Major Ecosystems: (a) natural ecosystem: e.g. fresh water, forest (b) artificial ecosystem: e.g. cropland                            |           |
| 2.4 Food chain in ecosystem and food web   |           |
| 2.5 Ecological pyramids  |           |
| <b>3 Environmental Pollution:</b>  | <b>12</b> |
| 3.1 Definition and types of pollution  |           |
| 3.2 Pollutants, types of pollutants (metallic, gaseous, acids, alkalis, biocides)  |           |
| 3.3 Air pollution: Definition, sources of air pollution and their effects  |           |
| 3.4 Air pollution and its relevance with the following   |           |
| 3.4.1 Acid rain  |           |
| 3.4.2 Greenhouse effect  |           |
| 3.4.3 Ozone layer depletion  |           |
| 3.5 Water pollution: definition, sources of water pollution and their effects on ecosystem. Community waste with reference to following: |           |
| I. Sewage  |           |
| II. Industrial wastes  |           |
| III. Agricultural wastes   |           |
| 3.6 Land / Soil pollution: definition, sources of land / soil pollution and their effects  |           |
| 3.7 Noise pollution: definition, sources of noise pollution and their effects and control measures                                       |           |
| <b>4 Environment and Development</b>   | <b>5</b>  |
| 4.1 Bioindicators and environmental monitoring   |           |
| 4.2 Environmental challenges in India: land degradation, population explosion, urbanization and industrialization                        |           |

<b>5</b>	<b>Natural Resources and Conservation:</b>	<b>5</b>
5.1	Renewable and non-renewable resources	
5.2	Soil conservation	
5.3	Forest conservation	
5.4	Energy sources: conventional and non-conventional	
<b>6</b>	<b>Wildlife Management:</b>	<b>5</b>
6.1	Definition, causes of wildlife depletion	
6.2	Importance of wildlife management in India	
6.3	Endangered species, vulnerable species, rare species and threatened species	
6.4	Wild life conservation	
<b>7</b>	<b>Toxicants and Toxicity:</b>	<b>7</b>
7.1	Definition of toxicology, scope and branches	
7.2	Types of toxicants	
7.3	Factors influencing toxicity (pH, temperature, reproductive status, age, physiological state)	
7.4	Dose, LD <sub>50</sub> , LC <sub>50</sub>	
<b>8</b>	<b>Toxicants of Public Health and Hazards:</b>	<b>4</b>
	Pesticides, heavy metals, fertilizers, food additives and radioactive substances	

### Reference Books

1. Ecology and environment, 2014, 12th revised Edition, P. D. Sharma, Rastogi Publ. Meerat.
2. Environmental Biology, 1996, P. S. Verma and V. K. Agrawal, S. Chand and Co. New Delhi.
3. Ecology, 2007, 1<sup>st</sup> Edn. Mohan P. Arora, Himalaya Publ. House, Delhi.
4. Fundamentals of ecology, 2009, 3<sup>rd</sup> Edn., M. C. Dash, Tata Mcgraw Hill, New Delhi.
5. Elements of ecology, 1967, George L. Clarke, John Wiley and Sons, New York.
6. Ecology of Natural resources, 1985, Francois Ramade, W. J. Duffin, John Wiley and Sons, New York.
7. Concepts of Ecology, 1996, E.J. Kormondy, Prentice Hall of India. New Delhi
8. Modern concept of Ecology, 1995, 8<sup>th</sup> Edn. H. D. Kumar, Vikas Publishing House, New Delhi

9. Fundamentals of Ecology, 2006, 5<sup>th</sup> Edn., E. P. Odum, Oxford & IBM Publi.Co. New Delhi.
10. Environmental problems and Solution, 1998, 2<sup>nd</sup>Edn. D. K. Asthana, Meera Asthana, S. Chand Publi., New Delhi.
11. Toxicology, 2011, 3<sup>rd</sup> revised Edn., P.D. Sharma, Rastogi Publi. Meerut.
12. Pollution and Health hazards in India, 1987, R. Kumar,. Ashish Publi. House, New Delhi.
13. Toxicology – Principles and Methods, 2010, 2<sup>nd</sup> Edn., M. A. Subramanian,, M J P Publishers, Chennai.
14. Selective Toxicity, 1973, A. Albert, Chapman and Hall, London.
15. Environmental Toxicology, 2003, M. Satake, Y. Mido, Discovery Publi. House, New Delhi.
16. Introduction to General Toxicology, 1976, E. J. Ariens; A. M. Simonis; J. Offermeier, Academic Press, London.

## ZY-335 (Paper V)

### Parasitology

**Total lectures: 48**

- |          |   |    |
|----------|---|----|
| <b>1</b> | <b>Introduction:</b> Scope and branches of Parasitology   | 3  |
|          | Definition: host, parasite, vector, commensalisms, mutualism and parasitism   |    |
| <b>2</b> | <b>Types of parasites:</b> ectoparasites, endoparasites and their subtypes  | 3  |
| <b>3</b> | <b>Types of hosts:</b> intermediate and definitive, paratenic, reservoir  | 3  |
| <b>4</b> | <b>Host-Parasite relationship:</b> Host specificity- definition, structural specificity, physiological specificity and ecological specificity   | 3  |
| <b>5</b> | <b>Study of the following parasites</b> with reference to habit, habitat, Life cycle, Mode of Infection, pathogenicity and control measures - <i>Plasmodium vivax</i> , <i>Entamoeba histolytica</i> , <i>Ascaris lumbricoides</i> and <i>Taenia solium</i> | 16 |
| <b>6</b> | <b>Study of the following parasites</b> with reference to morphology, life cycle, pathogenicity and control measures: Head louse, Tick, Mite ( <i>Sarcoptes scabiei</i> )   | 6  |
| <b>7</b> | <b>Parasitological significance of Zoonosis:</b> Bird flu, Rabies and Toxoplasmosis   | 4  |
| <b>8</b> | <b>Control measures of arthropod vectors of human diseases:</b> Malaria ( <i>Anopheles stephensi</i> , <i>A. culicifacies</i> ), Dengue, Haemorrhagic fever ( <i>Aedes aegypti</i> , <i>A. albopictus</i> ), Filariasis ( <i>Culex pipiens fatigans</i> )   | 6  |
| <b>9</b> | <b>Epidemic diseases:</b> Typhoid, Cholera, Small pox; their occurrence and eradication programmes  | 4  |

### Reference Books

1. Comparative Protozoology: Ecology, Parasitology, Life history, 1988, Anderson, O.R. Springer Verlag, Berlin.
2. Parasites and parasitism, Cameron, 1958, T. W. M. Methuen, London
3. An Introduction to Parasitology, 1961, Chandler, A.C. & C. P. Read, Wiley, New York
4. Parasitology and Helminthology in relation to Clinical Medicine, 1980, Edn.12 Chatterjee, K.D., Chatterjee Medical publishers, Calcutta.
5. The biology of animal parasites, 1964, Cheng T.C., Saunders, Philadelphia.
6. Symbiosis, 1970, Cheng T.C., Pegasus, New York.
7. Parasitology -The biology of animal parasites, 1971, Noble E.R. & G. A. Noble, Lea and Febiger, Philadelphia U.S.A.

8. Fundamentals of Ecology, 1971, Edn.3, Odum E.P., Saunders, Philadelphia U.S.A.
9. Entomology.Edn.10 Vols.1&2 McGraw Hill, New York.
10. Animal Parasitism, 1972, C.P. Read, Prentice Hall, Englewood Cliffs, N.J., U.S.A.
11. Parasites: Lice, Ticks& Fleas (Free Kindle), 2014, C.D. Shelton

**ZY-336 (Paper VI)**

**a) General Pathology**

**Total lectures: 48**

<b>1 Introduction:</b>	<b>4</b>
1.1 Definition, scope and basic branches	
1.2 Applied pathology- biopsy and surgery	
1.3 Autopsy- post mortem changes	
<b>2 Clinical pathology</b>	<b>4</b>
2.1 Definition and scope	
2.2 Gastric analysis	
2.3 Urine examination	
2.4 Importance of CSF examination	
2.5 Liver function test	
2.6 Renal function test	
<b>3 Diseases:</b>	<b>4</b>
3.1 Definition and causes	
3.2 Infectious diseases: aetiology and infectious agents	
<b>4 Retrogressive changes:</b>	<b>4</b>
Definition, cloudy (changes) swelling, degeneration, fatty degeneration, mucoid degeneration and amyloid degeneration	
<b>5 Necrosis:</b>	<b>3</b>
5.1 Definition and causes	
5.2 Nuclear and cytoplasmic changes	
5.3 Types of necrosis	
<b>6 Gangrene:</b>	<b>3</b>
6.1 Definition and causes	
6.2 Types: dry, moist and gas gangrene	
<b>7 Circulatory disturbances:</b>	<b>8</b>
7.1 Hyperemia: active and passive (causes and effects)	
7.2 Ischaemia: causes and effects	
7.3 Hemorrhage: causes, effects and hemorrhagic effects	

7.4	Thrombosis: thrombus formation, its causes and effects	
7.5	Embolism: Definition, sources, types and effects	
<b>8</b>	<b>Inflammation:</b>	<b>5</b>
8.1	Definition and causes, cardinals of inflammation (signs), vascular phenomenon and cellular response	
8.2	Acute and chronic inflammation	
<b>9</b>	<b>Repair:</b>	<b>4</b>
9.1	Process of Repair	
9.2	Types: by regeneration, by connective tissue proliferation	
9.3	Healing: primary and secondary	
<b>10</b>	<b>Neoplasia:</b>	<b>4</b>
10.1	Definition, causes and types of tumours-benign and malignant	
10.2	Leukemia: acute and chronic.	
<b>11</b>	<b>Disorders of pigmentations:</b>	<b>2</b>
	Brief idea about normal process of pigmentation, melanosis and jaundice	
<b>12</b>	<b>Disorders of mineral metabolism:</b>	<b>3</b>
	Mechanism of calcification, pathological calcification (dystrophic and metastatic) causes and its effects. Gout aetiology and pathogenesis	



### **Reference Books**

1. A text book of Pathology, 2009, 15<sup>th</sup> Rev Edn., Dey N. C. and Dey T. K. Sinha Debashish, New central book agency, Kolkota
2. General pathology and pathology of systems, 2008, 6<sup>th</sup> Edn., Bhende Y. M. and Deodhar S.G.; Popular Prakashan Ltd, India.
3. Robins Basic Pathology, 2012, 9<sup>th</sup> Edn., Vinay Kumar, Abul K. Abbas, Jon C. Aster, Saunders, Philadelphia.
4. Textbook of Pathology, 2014, 7th Edition, Harsh Mohan, Jaypee Brothers Medical Publishers (P) Ltd
5. Essentials in Hematology & Clinical Pathology, 2012, 1st Edition, Ramadas Nayak, Sharada Rai, Astha Gupta,
6. Concise Book On Medical Laboratory Technology, 2005 reprint, 1<sup>st</sup> Edn., C. R. Maiti, New Central Book Agency (p) Ltd, Kolkata, India

## ZY- 336 (Paper VI)

### b) Cell Biology

**Total lectures: 48**

<b>1</b>	<b>Introduction to Cell biology:</b>	<b>3</b>
1.1	Definition and scope	
1.2	Prokaryotic and eukaryotic cell: size, shape and structure	
<b>2</b>	<b>Plasma membrane:</b>	<b>6</b>
2.1	Unit membrane concept	
2.2	Models: Lipid membrane, Protein-Lipid (Danielli-Davson) and Fluid Mosaic	
2.3	Membrane receptors	
2.4	Membrane transport: Passive and Active	
2.5	Exocytosis and Endocytosis (Phagocytosis and Pinocytosis)	
<b>3</b>	<b>Endoplasmic reticulum:</b>	<b>5</b>
3.1	Occurrence and ultrastructure	
3.2	Type: smooth and rough	
3.3	Functions	
<b>4</b>	<b>Golgi complex:</b>	<b>3</b>
4.1	Origin, occurrence and morphology	
4.2	Ultrastructure and functions	
<b>5</b>	<b>Lysosomes:</b>	<b>3</b>
5.1	Origin, occurrence and morphology	
5.2	Ultrastructure, polymorphism and functions	
<b>6</b>	<b>Mitochondria:</b>	<b>4</b>
6.1	Origin, occurrence and morphology	
6.2	Ultrastructure and functions (explanation of the cycles not expected)	
<b>7</b>	<b>Nucleus:</b>	<b>6</b>
7.1	Shape, Size, number and position	
7.2	Ultrastructure of nuclear membrane and pore complex	
7.3	Nucleolus: general organization, chemical composition and functions	
7.4	Nuclear sap/ nuclear matrix	
7.5	Nucleocytoplasmic interactions	

<b>8</b>	<b>Cytoskeleton:</b>	<b>3</b>
8.1	Microfilaments: location, ultrastructure, biochemical composition and functions	
8.2	Intermediate Filament: location, ultrastructure, biochemical composition and functions	
8.3	Microtubules: location, ultrastructure, biochemical composition and functions	
<b>9</b>	<b>Cell cycle and cell division:</b>	<b>6</b>
	Various phases of cell cycle, mitosis, meiosis & role of centriole in the cell division	
<b>10</b>	<b>Cellular ageing and cell death:</b>	<b>4</b>
10.1	Concept of ageing theories:	
10.1.1	Intracellular changes: free radicals	
10.1.2	Extra cellular changes	
10.2	Cell death:	
10.2.1	Apoptosis: definition and significance	
10.2.2	Necrosis: definition and examples	
<b>11</b>	<b>Cancer cell:</b>	<b>5</b>
11.1	Characteristics	
11.2	Theories/ hypothesis regarding causes of cancer	
11.2.1	Extrinsic causes: physical, chemical and biological agents (viruses).	
11.2.2	Intrinsic causes: somatic mutations, oncogenes and ageing related phenomenon	

### Reference Books

1. Cell and molecular biology, 2010, 8<sup>th</sup> Edn., De Robertis EDP and De Robertis EMF Jr., Lippincott Williams & Wilkins, Philadelphia
2. Molecular Cell biology, 2013, 1<sup>st</sup> Edn., C. B. Powar, Himalaya Publi. House.
3. Cell and molecular biology, 1968, Dupraw E. J., Academic Press, New York.
4. Molecular Cell biology, 1986, Avers C.J. Addison Wesley Pub. Co., New York & London.
5. Cell and Molecular biology, 2013, 7<sup>th</sup> Edn., Gerald Karp, John Wiley and Sons, USA.
6. Cell biology, 1993, David E. Sadava, Johnes and Bartlett Publi., London.
7. Cell Structure and Function, 1991, 3<sup>rd</sup> Edn, A.G. Loewy & Siekevitz, Saunder college Publi., Philadelphia
8. Becker's World of the Cell, 2012, 8th Edition, Jeff Hardin, Gregory Paul Bertoni, Lewis J. Kleinsmith, Benjamin Cummings, UK
9. The Cell: A molecular approach, 2013, 6<sup>th</sup> Edn., Geoffrey M. Cooper, Robert E. Hausman, Sinauer Associates, USA
10. Molecular Biology of the Cell, 2007, 5<sup>th</sup> Edn., Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Taylor & Francis, UK

**ZY- 341(Paper I)**  
**Biological Techniques**

**Total lectures: 48**

- 1 Introduction to biological techniques** 10
  - 1.1 **Solution/strengths of chemicals:** percentage, normality, molarity, molality, osmolarity, osmolality, ppm, ppb
  - 1.2 Separation techniques: principle and applications, techniques related to isolation, purification and characterization of bio molecules
    - 1.2.1 Chromatography (paper, ion-exchange), gel filtration
    - 1.2.2 Electrophoresis-(agarose, polyacrylamide)
    - 1.2.3 Ultracentrifugation
    - 1.2.4 Colorimetry and spectroscopy
- 2 Haematological Techniques:** 08
  - 2.1 Blood cell count –Total count of RBCs, WBCs and Differential count of WBCs and their significance. Examination of bone marrow. Hb%, bleeding time, clotting time and their significance
  - 2.2 Microscopy: simple, compound, phase contrast, electron - their principle & working
  - 2.3 Micrometry
  - 2.4 Camera Lucida
- 3 Micro technique:** 10
  - 3.1 Procurement of tissues and precautions to be taken to avoid tissue damage during procurement
  - 3.2 Fixatives: Classification of fixatives and importance of fixation of tissues
  - 3.3 Methods of fixation
  - 3.4 Dehydration, clearing, impregnation and block making:
    - 3.4.1. Clearing and alcoholising agents
    - 3.4.2. Clearing and dealcoholisation
    - 3.4.3. **Impregnation and Embedding:** Types of embedding media, methods of embedding and block making. Comments on hardening of paraffin
- 4 Microtomes and Knives:** 08
  - 4.1 Types of microtomes
  - 4.2 Types of microtome knives

4.3	Section cutting: Microtomy- steps and precautions, common faults in section cutting- reasons & remedies. Mounting and spreading of ribbons	
<b>5</b>	<b>Stains and Staining</b>	<b>06</b>
5.1	Classification of stains	
5.2	Methods and types of staining	
5.3	General procedure for staining of sections	
5.4	Vital Stains	
5.5	Mounting and labeling of sections: Classification of mounting media, refractive indices of mounting media	
<b>6</b>	<b>Histochemical staining:</b>	<b>06</b>
6.1	Demonstration of Carbohydrates (PAS technique)	
6.2	Demonstration of Nucleic acid (Feulgen Reaction)	

## References

1. Introduction of Medical Laboratory Technique, 1998, 7<sup>th</sup> Edn., Baker F. J., Silverton R. E., Pallister C. J., Butterworth-Heinemann, UK
2. Hematology: Basic Principles and Practice, 2008, 5<sup>th</sup> Edn., Ronald Hoffman , Bruce Furie, Philip McGlave, Churchill Livingstone Elsevier, USA
3. Histological and Histochemical Methods, Theory and Practice, 2008, 4<sup>th</sup> Edn., John A. Kiernan, Scion Publishing Ltd, UK
4. Basic Separation Techniques in Biochemistry, 1998, Okotore R. O., New Age International, New Delhi.
5. Cytological techniques: The Principles Underlying Routine Methods, 1963, Baker J.R, Methuen & Co, London
6. Davenport H. A.: Histological and Histochemical techniques.
7. Handbook of basic Microtechnique, 1958, 2<sup>nd</sup> Edn., Gray P., McGraw-Hill, USA
8. The microscope and how to use it, 1970, George Stehli, Dover Publications Inc., New York.
9. Histopathological technique and Practical Histochemistry, 1976, 4<sup>th</sup> Edn, Lillie R.D McGraw-Hill, USA
10. Staining methods (Histological and Histochemical), 1960, Mc Manus J. F. A. And Mowry R.W., Paul B. Hoeber, Inc.; Harper & Brothers, NY
11. Notes on Microscopical Techniques for Zoologist, 1964, Pantin C. F.A.: Cambridge University Press
12. Elementary Microtechnique, 1973, 4<sup>th</sup> Edn., Peacock H.A., Edward Arnold Publ. Ltd., UK
13. Histochemistry, 1968, Pearse A.G.E., Vol. I & II., W.B. Saunders Company (WBS) of Philadelphia
14. Microscope and microscopic life, 1979, 2<sup>nd</sup> Edn., Peter Healey, Hamlyn, UK
15. Biological Instrumentation and methodology, 2008, 2<sup>nd</sup> Revised Edition, P.K. Bajpai, S. Chand and Co. Ltd., New Delhi.

## ZY- 342 (Paper II)

### Mammalian Physiology & Endocrinology

**Total lectures: 48**

- |          |   |          |
|----------|---|----------|
| <b>1</b> | <b>Introduction: Definition and scope</b>   | <b>1</b> |
| <b>2</b> | <b>Nutrition:</b>   | <b>6</b> |
| 2.1      | Concept of nutrition and energy requirements  |          |
| 2.2      | Physiology of digestion: digestive enzymes and their actions- salivary, gastric and intestinal digestion. Role of liver and pancreas in digestion |          |
| <b>3</b> | <b>Circulation :</b>  | <b>6</b> |
| 3.1      | Cardiac Cycle- systole, diastole and pacemakers   |          |
| 3.2      | Cardiac output and blood pressure   |          |
| 3.3      | Definitions and significance of electrocardiogram, colour doppler, angioplasty, angiography, angina pectoris, and coronary bypass                 |          |
| <b>4</b> | <b>Respiration:</b>   | <b>5</b> |
| 4.1      | Definition and types- Pulmonary and tissue respiration  |          |
| 4.2      | Mechanism of transport of gases   |          |
|          | (a) Transport of Oxygen- Oxyhaemoglobin formation   |          |
|          | (b) Transport of Carbon-dioxide   |          |
|          | (c) Respiratory Quotient and BMR  |          |
| <b>5</b> | <b>Excretion:</b>   | <b>5</b> |
| 5.1      | Physiology of Urine formation- ultrafiltration, reabsorption, tubular secretion   |          |
| 5.2      | Counter-Current Multiplier theory for urine concentration   |          |
| 5.3      | Role of ADH, and Renin angiotensin system   |          |
| 5.4      | Definitions and clinical significance of- renal failure, renal calculi, dialysis  |          |
| <b>6</b> | <b>Muscles:</b>   | <b>5</b> |
| 6.1      | Ultrastructure of striated muscle   |          |
| 6.2      | Sliding filament theory of muscle contraction – physical and chemical changes   |          |
| 6.3      | Response of muscles to stimulation- simple muscle twitch, muscle fatigue and rigor mortis   |          |
| <b>7</b> | <b>Nervous Excitation:</b>  | <b>5</b> |
| 7.1      | Origin and conduction of nerve impulse, saltatory conduction  |          |



- 7.2 Synapse- ultrastructure and transmission of nerve impulse
- 7.3 Definitions/concepts: impulse, stimulation, conduction, response, EEG, epilepsy
- 8 Reproduction:** 8
- 8.1 Reproductive cycles with hormonal control- estrous and menstrual
- 8.2 Hormonal control of pregnancy
- 8.3 Hormonal control of parturition and lactation
- 8.4 Hormonal control of male reproduction
- 9 Endocrinology:** 7
- 9.1 Introduction
- 9.2 Mechanism of hormone action
- 9.3 Endocrine disorders: gigantism, acromegaly, dwarfism, diabetes insipidus, goiter, cretinism, myxedema, rickets, Addison Disease, Cushing's syndrome

### Reference Books

1. Textbook of Medical Physiology, Guyton A.C. & Hall J.E., 2006, 11<sup>th</sup> Edition, Hercourt Asia Pvt. Ltd. / W.B. Saunders Company
2. Principles of Anatomy & Physiology, 2006, 11<sup>th</sup> Edition, Tortora G.J. & Grabowski S., John Wiley & sons, Inc.
3. Human physiology, Vol. I & II, 1980, 12th Edn. Dr. C. C. Chatterjee, Medical applied agency, Kolkata
4. Text book of Animal Physiology, 2008, 2<sup>nd</sup> Edn. Nagabhushanam, S. V. S. Rana, S. Kalavathy, Oxford University Press, India.
5. Animal Physiology: Adaptation and Environment, 1997, Schmidt-Nielsen, Knut, Cambridge University Press,
6. General and Comparative Physiology, 1983, 3<sup>rd</sup> Edn., Hoar W. S., Prentice Hall, UK.
7. Medical Physiology, 2006, Asis Das, Books and Allied Pvt. Ltd., Kolkata
8. Endocrinology, 2005, Lohar P. S., M J P Publishers, Chennai
9. Vander, Sherman, Luciano's Human Physiology: The Mechanisms of Body Function, 2003, 9<sup>th</sup> Edn., Eric P. Widmaier, Hershel Raff , Kevin T. Strang , Mc Graw Hill

## ZY -343 (Paper III)

### Genetics and Molecular Biology

Total lectures: 48

1. Linkage, crossing over and molecular basis of recombination 5
2. **Gene Mutation** 6
  - 2.1 Definition
  - 2.2 Types of mutations: spontaneous, induced, somatic, gametic, forward, reverse. Types of point mutation- deletion, insertion, substitution, transversion, transition
  - 2.3 Mutagenic agents.
    - a) UV radiation and ionising radiation
    - b) Base analogs, alkylating and intercalating agents
3. **Population Genetics** 5
  - 3.1 Basic Concepts in population genetics: Mendelian population, gene pool, gene frequency, chance mating (Panmictic mating)
  - 3.2 Hardy Weinberg law and its equilibrium
4. **Molecular Biology**
  - 4.1. DNA as genetic material- evidences (Griffith's, Avery et al and Hershey and Chase experiment), RNA as genetic material-TMV 4
  - 4.2. Chromatin-Heterochromatin, Euchromatin, histones, nucleosome arrangement, packaging of DNA 3
5. **Central Dogma of Molecular Biology**
  - 5.1. **DNA Replication**-Semiconservative (Messelson and Stahl experiment) Mechanism in prokaryotes and eukaryotes 5
  - 5.2. **Transcription**- Transcriptional unit, RNA polymerase, transcription in prokaryotes and eukaryotes, post transcriptional modification (splicing- mRNA, modifications at 3' and 5' end) 5
  - 5.3. **Translation**-Genetic code, properties of genetic code, ribosome structure [prokaryotes and eukaryotes], protein synthesis–initiation, elongation, termination and concept of post translational modification (glycosylation) 5
6. **Concept of operon** - regulation of gene action, Lac operon, Trp operon 5
7. **Recombinant DNA Technology**- 5

Introduction, restriction enzymes, cloning vector, PCR (polymerase chain reaction), DNA finger printing

### Reference Books

1. Principles of Genetics, 1997, P. D. Snustad, M. L. Simmons J. B. Jenkins, John Wiley & Sons, USA
2. Genetics, 2014, 9<sup>th</sup> Edn., Verma P. S. and Agarwal V. K., S. Chand and Co., New Delhi
3. Genetics, 2014, 4<sup>th</sup> rev Edn., 3<sup>rd</sup> reprint, Gupta P. K., Rastogi Publications, Meerut
4. Genetics, 2004, 1<sup>st</sup> Edn. Sarin, C., Tata McGraw Hill, New Delhi.
5. Principles of Genetics, 2006, 8<sup>th</sup> Edn., Gardner E. J., Simmons M. J. and Snustad D. P., Wiley India Pvt Ltd
6. Genetics, 1997, 3<sup>rd</sup> Edn., D. L. Hartl, Jones and Bartlett Publishers, USA
7. Genetics, 1985, 3<sup>rd</sup> revised Edn., Strickberger M. W., Macmillan USA
8. Molecular Biology of the Cell, 2007, 5<sup>th</sup> Edn., Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Taylor & Francis, UK
9. Gene V & VI, 1994, Lewin Boxford University Press ,Oxford
10. Molecular Biology of the gene, 1993, Watson J. Hopkins, Roberts, Steitz and Weiner, Benjamin Cummings.
11. Text book of Molecular biology, 1994, K. ShivramaSastry, G. Padmanabhan & C. Subramanyan, Mc. Millan India.
12. Cell and molecular biology, 2010, 8<sup>th</sup> Edn., De Robertis EDP and De Robertis EMF Jr., Lippincott Williams & Wilkins, Philadelphia

## ZY-344 (Paper IV)

### Organic Evolution

Total lectures: 48

<b>1</b>	<b>Introduction.</b>	4
1.1	Origin of life	
1.2	Origin of eukaryotic cell (Origin of mitochondria , plastids & symbionts)	
<b>2</b>	<b>Evidences in favour of organic evolution:</b>	8
	Evidences from: anatomy, embryology, geographical distribution, palaeontology, physiology, biochemistry, genetics and molecular biology	
<b>3</b>	<b>Theories of organic evolution</b>	8
3.1	Lamarckism	
3.2	Darwinism and Neo Darwinism	
3.3	Mutation Theory	
3.4	Modern Synthetic theory	
<b>4</b>	<b>Isolation:</b>	6
4.1	Isolating mechanism	
4.2	Classification of isolating mechanism: Pre-zygotic and post-zygotic	
<b>5</b>	<b>Speciation:</b>	4
5.1	Types of speciation(Allopatric & Sympatric )	
5.2	Mechanism of speciation	
5.3	Patterns of speciation	
5.4	Factors influencing speciation	
<b>6</b>	<b>Geological Time Scale</b>	4
<b>7</b>	<b>Animal Distribution:</b>	2
7.1	Methods of distribution	
7.2	Classification of animal distribution	
7.3	Patterns of animal distribution	
7.4	Factors affecting distribution	
<b>8</b>	<b>Antiquity of Man:</b>	7
	Evolution of anthropoids including man (Kenya-pithecus to <i>Homo sapiens</i> )	
<b>9</b>	<b>Zoogeographical Realms: With reference to fauna</b>	5

### **Reference Books**

1. Organic Evolution, Richard Swann Lull, Light & Life Publishers.
2. Introductions to Evolution, Paul Amos Moody, Kalyani Publishers, New Delhi.
3. Organic Evolution, 1991 T.S. Gopalkrishanan, Itta Sambashivarab Publ. House
4. Evolution, 1996 P. K. Gupta, Rastogi Publ., Meerut
5. Evolutionary Biology, 1990, Mohan P. Arora, Himalaya Publi. House, Delhi.
6. Evolution, 1968, E. O. Dodson, Reinhold Publ. Crop., New York.
7. The major features of evolution, 1953, Simpson G. G. Columbia, New York.
8. The origin of species, 1959, Charles Darwin, New American Library, New York.

**ZY-345 (Paper V)**  
**General Embryology**

**Total lectures: 48**

- |          |   |          |
|----------|---|----------|
| <b>1</b> | <b>Introduction:</b>  | <b>4</b> |
|          | 1.1 Definition and scope  |          |
|          | 1.2 Theories of preformation, pangenesis, epigenesis, axial gradient and germ plasm   |          |
| <b>2</b> | <b>Concepts in Developmental Biology:</b>   | <b>2</b> |
|          | Growth, differentiation, dedifferentiation, cell determination, cell communication, morphogenesis, induction and regeneration   |          |
| <b>3</b> | <b>Gametogenesis:</b>   | <b>8</b> |
|          | 3.1 General aspects and origin of germ cells  |          |
|          | 3.2 Sperm: general structure, mention variations with reference to Insect, Amphioxus, Frog, Bird and Human  |          |
|          | 3.3 Ultra structure of typical sperm. (entire, T.S. through head, middle piece and tail)  |          |
|          | 3.4 Spermatogenesis: phases & spermiogenesis (nuclear and cytoplasmic changes)  |          |
|          | 3.5 Oogenesis phases: growth phase- pre-vitellogenesis, vitellogenesis and post-vitellogenesis  |          |
|          | 3.6 Oocyte maturation: role of MPF ( maturation promotion factor )  |          |
|          | 3.7 Ovum: general structure   |          |
|          | 3.8 Egg membranes: primary, secondary and tertiary  |          |
|          | 3.9 Types of eggs   |          |
| <b>4</b> | <b>Fertilization:</b>   | <b>7</b> |
|          | 4.1 Concept and types   |          |
|          | 4.2 Attraction of gametes: sperm activation, chemotaxis (fertilizin and antifertilizin as enzymes and gamones as hormones)  |          |
|          | 4.3 Sperm penetration: acrosome reaction, capacitation & decapacitation   |          |
|          | 4.4 Activation of ovum: fertilization cone, polyspermy prevention: fast block (fertilization potential) & slow block (cortical reaction) & perivitelline space fertilization membrane |          |
|          | 4.5 Amphimixis  |          |
|          | 4.6 Significance of fertilization   |          |

<b>5</b>	<b>Cleavage</b>	<b>5</b>
5.1	Mechanism	
5.2	Planes and symmetry	
5.3	Patterns / Types	
5.4	Significance	
<b>6</b>	<b>Blastula: Definition and types</b>	<b>3</b>
<b>7</b>	<b>Gastrulation:</b>	<b>6</b>
7.1	Concept	
7.2	Basic cell movements in gastrulation: epiboly, emboly, convergence, invagination, ingression & involution (with reference to frog )	
7.3	Organizer: primary, secondary, tertiary	
7.4	Organogenesis: cell differentiation, tissue differentiation & organ formation up to rudimentary stage	
<b>8</b>	<b>Chick Embryology:</b>	<b>11</b>
8.1	Structure of Hen's egg	
8.2	Fertilization and cleavage	
8.3	Gastrulation:	
8.3.1	Formation of primitive endoderm	
8.3.2	Primitive streak development	
8.3.3	Head process and regression of Primitive streak	
8.4	Development of nervous system up to 48 hours	
8.5	Development of heart and blood vessels up to 48 hours	
8.6	Development of digestive system up to 48 hours	
<b>9</b>	<b>Extra embryonic membranes</b>	<b>2</b>

### Reference Books

1. An Introduction to Embryology 2012, 5<sup>th</sup>Edn., Balinsky B. L., Fabian B. C. Brooks Cole Pub. Co., USA.
2. Developmental Biology: Patterns, principle and problems, 1982, Saunders J. W., Prentice Hall Coll Div.
3. Developmental Biology 1992 3<sup>rd</sup> den Browder L. W., Erickson C.A. & Jeffery W. R., Saunders college pub., London.
4. Developmental Biology, 2013, 10<sup>th</sup>Edn. Gilbert S. F., Sinauer Associates Inc.

## ZY- 346 (Paper VI)

### a) Public Health and Hygiene

**Total lectures: 48**

<b>1</b>	<b>Introduction and scope of public health</b>	<b>1</b>
<b>2</b>	<b>Health:</b>	<b>4</b>
	2.1 Definition, factors affecting health (inborn, environmental)	
	2.2 Personal and community health.	
	2.3 Effects of alcohol, tobacco and drugs	
	2.4 WHO and its programmes	
<b>3</b>	<b>Food:</b>	<b>6</b>
	3.1 Sources: Plants and Animals	
	3.2 Necessity: deficiency diseases	
	3.3 Beverages and condiments	
	3.4 Food preservation methods	
<b>4</b>	<b>Air and ventilation:</b>	<b>3</b>
	4.1 Composition of air	
	4.2 Purification of air	
	4.3 Ventilation system: natural and artificial	
<b>5</b>	<b>Water and water supplies:</b>	<b>5</b>
	5.1 Sources and properties of water, quality of water for human consumption	
	5.2 Process of purification of water- small scale and large scale	
	5.3 Slow sand or biological filtration of water and rapid sand or mechanical filtration of water	
<b>6</b>	<b>Soil:</b>	<b>3</b>
	Composition, properties and diseases spread by soil	
<b>7</b>	<b>Sanitation:</b>	<b>5</b>
	7.1 Definition and concept	
	7.2 Disposal of human and animal waste, refuse, sewage	
<b>8</b>	<b>Diseases:</b>	<b>10</b>
	8.1 Communicable diseases: causative organisms, signs and symptoms, modes of transmission, prevention and control measures of: influenza, chicken pox, measles, tuberculosis, leprosy, swine flu and encephalitis	



8.2	Non Communicable diseases: rheumatic heart disease, coronary heart disease and diabetes	
<b>9</b>	<b>Demographic Biostatistics:</b>	<b>4</b>
9.1	Introduction	
9.2	Purpose of data sampling	
9.3	Methods of sampling	
<b>10</b>	<b>Epidemiology</b>	<b>3</b>
10.1	Introduction	
10.2	Epidemiologic methods	
10.3	Causes of epidemiology	
<b>11</b>	<b>Social and Industrial hygiene:</b>	<b>2</b>
11.1	Accident, emergencies in home and industries	
11.2	Occupational disease (details of diseases not expected)	
11.3	Provisions for disabled and mental hygiene	
11.4	Bio-safety for disabled and mental hygiene	
<b>12</b>	<b>Radiation risk</b>	<b>2</b>

### Reference Books

1. A text book of preventive and social medicine 2011, 21<sup>st</sup> Edn., Park. K., Banarsidas Bhanot Publishers, Jabalpur, India
2. Preventive and social medicine in India, 2013, 4<sup>th</sup> Edn., B. K. Mahajan, M. C. Gupta, Jaypee Brothers Medical Publishers, New Delhi, India
3. Medical Zoology and Medical Technology. R.C. Sobti, Shobanlal and Co., Jalandhar
4. Review in community medicine, 2006, 2<sup>nd</sup> Edn., V. V. R. Seshu Babu, Paras Medical Books Pvt. Ltd., Hyderabad.

## ZY-346 (Paper VI)

### b) Medical Entomology

**Total lectures: 48**

<b>1</b>	<b>Fundamentals of Agricultural, Forest, Medical and Veterinary Entomology</b>	<b>02</b>
<b>2</b>	<b>Introduction to medical entomology</b>	<b>06</b>
	2.1 Morphology and anatomy of insects	
<b>3</b>	<b>Veterinary entomology- Insects as disease spreading agents in general</b>	<b>06</b>
<b>4</b>	<b>Insects as social groups-</b>	<b>06</b>
	4.1 Definition, intraspecific and interspecific relationships among insects	
	4.2 Social organization in wasps and termites	
	4.3 Significance of social organizations	
<b>5</b>	<b>House hold insects in relation to human-</b>	<b>12</b>
	5.1 Cockroach	
	5.2 House cricket	
	5.3 Silver fish	
	5.4 Carpet beetles	
	5.5 Furniture beetles	
	5.6 Ants	
<b>6</b>	<b>Study of following insects as causing agents of human diseases- their classification up to family, appearance, habit, brief life history, distribution, diseases caused and control measures-</b>	<b>16</b>
	6.1 Mosquito	
	6.2 Flea	
	6.3 House fly	
	6.4 Bed bug	
	6.5 Louse	
	6.6 Tick	
	6.7 Mite	
	6.8 Blister beetle	

### **Reference Books**

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. Handbook of medical entomology, Riley W. A., Johannsen O. A., Comstock Pub., New York.
4. Medical and Veterinary Entomology, 1995, 2<sup>nd</sup>Edn., Kettle D. S., CABI, UK
5. Medical Entomology for Students, 2012, 5<sup>th</sup>Edn., Mike Service, Cambridge University Press, UK
6. Essentials of Parasitology, 2008, 8<sup>th</sup> Edn., Schmidt G. D., McGraw Hill.
7. Parasitology: Biology of animal parasites, 1982, 3<sup>rd</sup> Edition, Noble E. A. and Noble G. A., Lippincott Williams and Wilkins
8. A text book of preventive and social medicine 2011, 21<sup>st</sup> Edn., Park. K. Banarsidas Bhanot Publishers, Jabalpur, India.

**ZY-347 (Practical I)**

**ZY -331 Paper I Animal Systematics and Diversity V**

**Practicals:**

- 1 Study of external characters and digestive system of *Pila* E
- 2 A. Study of Nervous system of *Pila* E  
B. Temporary mounting of radula, osphradium and statocyst of *Pila* E
- 3 Study of external characters and digestive system of *Calotes* D
- 4 Study of arterial and venous system of *Calotes* D
- 5 Study of nervous system of *Calotes* D
- 6 A. study of male and female urinogenital systems of *Calotes* D  
B. Temporary mounting of scales, pecten and hyoid apparatus of *Calotes* D
- 7 Study of Spicules in sponges D
- 8 Study of *Balanoglossus*-external characters, T. S. through proboscis, collar and trunk D
- 9 Comparative study of D  
A. Scales in fishes: Placoid, Cycloid, and Ctenoid  
B. Heart: *Scoliodon*, Frog, *Calotes*, Pigeon and Rat  
C. Brain: *Scoliodon*, Frog, *Calotes*, Pigeon and Rat
- 10 Study of accessory respiratory organs in fishes: *Anabas*, *Labeo*, *Clarias* D
- 11 **Compulsory study tour to visit costal locality** / Bio-diversity area / Hilly area / ponds/  
lakes / tanks / zoo / museum / science center- prepare tour report and submit at the time of  
examination

**ZY-332 Mammalian Histology**

**Practicals:**

- 1 Study of the different types of tissues with the help of permanent slides D
- 2 Temporary mounting of tissues: E  
a) medullated nerve fiber b) striated muscle fiber
- 3 Study of permanent histological slides of skin, tooth, tongue, stomach, duodenum, ileum,  
liver, pancreas and any one salivary gland D
- 4 Study of permanent histological slides of trachea, lung, kidney, testis, ovary, thyroid and  
adrenal D
- 5 Study of human blood smear to observe different cells E

## ZY- 341 Biological Techniques

### Practicals:

- |   |   |   |
|---|---|---|
| 1 | a) Principle & use of camera lucida   | E |
|   | b) Study of micrometer  | E |
| 2 | Tissue collection & fixation. Block making  | E |
| 3 | Sectioning, staining & mounting. Submission of any three permanent slides from three different organs | E |
| 4 | Total count of W.B.Cs.  |   |
| 5 | Principle and applications of colorimeter and spectrophotometer.                                      | E |
| 6 | Separation of amino acid mixture by ascending paper chromatography.                                   | E |

## ZY-342 Mammalian Physiology & Endocrinology

### Practicals:

- |   |   |   |
|---|---|---|
| 1 | a) Estimation of haemoglobin  | E |
|   | b) Preparation of haemin crystals   | E |
| 2 | To study the effects of various osmolarities on erythrocytes                        | E |
| 3 | To estimate the blood glucose level   | E |
| 4 | Estimation of bleeding and clotting time  | E |
| 5 | Study of any five disorders caused by endocrine glands with the help of photographs | E |

**Minimum 24 practicals be performed during the year**

## ZY-348 (Practical Course II)

### ZY- 333 - Biological Chemistry

#### Practicals

- 1 Study of principle and working of pH meter and measuring pH of three samples D
- 2 To study the effect of pH, temperature and inhibition on salivary amylase E
- 3 Detection of carbohydrates (monosaccharides, disaccharides and polysaccharides) with the help of suitable tests E
- 4 Isolation of casein by adjusting isoelectric point E
- 5 Study of preparation of standard acid and alkali and its standardisation E

### ZY- 334- Environmental Biology and Toxicology

#### Practicals:

- 1 **Study** of fresh water plankton (field collection, preservation and gross identification) E
- 2 **A visit to water body to study physiochemical properties of water.** (Temperature, pH, turbidity, hardness, acidity and alkalinity) using analysis kit E
- 3 Study of physiochemical properties of soil sample (using analysis kit) E
- 4 Estimation of dissolved oxygen in water by winkler's method E
- 5 Estimation of dissolved CO<sub>2</sub> in water E
- 6 Hypothetical problem to determine LC<sub>50</sub> and LD<sub>50</sub> E

### ZY-343- Genetics and Molecular Biology

- 1 Study of Hardy- Weinberg law with suitable recording of genetic traits E
- 2 Temporary preparation of polytene chromosome from suitable material E
- 3 Estimation of DNA by Diphenylamine method E
- 4 Detection of DNA and RNA by Methylgreen Pyronin E
- 5 Preparation of DNA paper model E

## ZY 344-Organic Evolution

### Practicals:

1. Study of morphological similarities and differences between man and ape D
2. Study of types of fossils with the help of specimens/ charts/ photos D
3. Study of animal adaptations in: Turtle, Draco, Exocoetus, Bat and Parrot D
4. Study of evidences of evolution- embryological, palaeontological, connecting links, morphology and comparative anatomy D
5. Study of successive stages of evolution of man: a) Australopithecus b) *Homo erectus* c) *Homo neanderthalis* d) Cro-magnon man e) *Homo sapiens* 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.) E

## ZY- 349 (Practical Course III)

### ZY-335: Parasitology

#### Practicals:

- 1 Study of Life cycle of *Plasmodium vivax* and *Entamoeba histolytica* (whole mounts of life stages) D
- 2 Study of Life Cycle –*Ascaris lumbricoides* and *Taenia solium* (whole mounts of life stages) D
- 3 Study of morphology and pathogenicity of Head louse, Tick, Mite and blister beetle D
- 4 Study of vectors—mosquito, rat flea, house fly and bed bug D
- 5 To study rectal parasites of cockroach E

### ZY-336 a) General Pathology

#### Practicals:

- 1 Study of pathogenic agents and pathological conditions with the help of suitable microscopic slides D
  - a) *Mycobacterium tuberculae*
  - b) *Mycobacterium leprae*
  - c) *Vibrio cholerae*
  - d) *Anthrax bacilli*
  - e) *Pneumococci* sp.
  - f) *Trypanosoma* sp.
- 2 Study of pathological conditions with the help of suitable microscopic slides D
  - a) Normal and diseased cell (Lung)
  - b) Fatty degeneration (Liver)
  - c) Cloudy degeneration/Swelling (Kidney)
  - d) Dying cell –necrosis (Liver)
  - e) Lung lobar pneumonia
  - f) Ovarian cyst
  - g) Thyroid goitre
- 3 Study of following pathological slides or specimens D
  - a) Carcinoma in situ eg. Human cervix



- b) Malignant cell
  - c) Organized thrombus
  - d) Ovary fibroid tumour/carcinoma
  - e) Carcinoma of colon-cauliflower growth
  - f) Carcinoma of stomach
  - g) Liver cirrhosis
  - h) Breast fibrocystic disease
4. To detect the normal and abnormal constituents of urine E
  5. Study of Gastric juice analysis by Toffler's reagent (alcoholic solution of dimethylamino-azobenzol methyl orange indicator). E
  6. Visit to medical college/hospital/pathological laboratory

**OR**

**ZY-336: b) Paper VI- Cell biology**

**Practicals:**

- 1 Study of detection of mitochondria by Janus Green B E
- 2 Study of permanent slides of mitosis & meiosis D
- 3 Study of temporary preparation of different mitotic stages from onion root tip cells E
- 4 To study the effect of Colchicine on mitosis E
- 5 Study of temporary preparation of different meiotic stages from grasshopper testis / Tradescantia/ Onion floral bud E

**ZY-345 General Embryology**

**Practicals:**

- 1 Study of sperm smear (any one animal), types of eggs (insect, amphioxus, frog and hen) D
- 2 To study the types of blastulae and gastrulae (amphioxus, frog and hen) D
- 3 Study of whole mount slides of chick embryology – 24h, 33hr and 48 hr D
- 4 To study the sections of chick embryo--24hr, 33hr and 48 hr D
- 5 Ex-ovo culture of chick embryo E
- 6 Temporary preparation of chick embryo E

### ZY-346 – a) Public Health and Hygiene

#### Practicals:

- 1 To detect adulterants in the food samples by appropriate tests E
- 2 To study the food preservation methods E
- 3 Study of housefly, cockroach, ants and rats with reference to public health and hygiene D
- 4 A compulsory visit to water purification / sewage treatment /effluent treatment plant D
- 5 Testing potability of water for human consumption by MPN method E
- 6 Any suitable example of measurement of dispersion E  
(Mean deviation or Standard deviation)

OR

### ZY-346 -b) Medical Entomology

#### Practicals:

- 1 Study of interrelationships of insects and man (Any three) D
- 2 Study of household insects in relation to human health D
- 3 Study of social insects- honey bee and termites D
- 4 Temporary preparation of mouth parts of harmful insects—mosquito, bed bug and house fly E
- 5 To study control methods of harmful insects with suitable examples (biological control measures, repellants, fumigation, dusting, netting) D

# **University of Pune**

## **Two Year M.Sc. Degree Course in Zoology**

### **M.Sc. Zoology**

**(Credit and Semester based Syllabus to be implemented from Academic Year 2013-14)**

**1) Title of the Course:**

M.Sc. Zoology

**2) Preamble of the Syllabus:**

Master of Science (M.Sc.) in Zoology is a post graduation course of University of Pune. The credit system to be implemented through this curriculum, would allow students to develop a strong footing in the fundamentals and specialize in the disciplines of his/her liking and abilities.

The students pursuing this course would have to develop in depth understanding various aspects of the subject. The working principles, design guidelines and experimental skills associated with different fields of Zoology such as Genetics and Cell Biology, Biochemistry, Molecular Biology, Biostatistics, Bacterial and Phage technology, Biodiversity, Entomology, Physiology, Developmental Biology, Endocrinology, Biochemical Techniques, Animal tissue culture, etc.

**3) Introduction:****Salient Features of the Credit System:**

1. Master's degree course in Zoology would be of 100 credits, where one credit course of theory will be of one clock hour per week running for 15 weeks and one credit for practical course will consist of 15 hrs. of laboratory exercise including the revision and setting up the practical. Thus, each credit will be equivalent to 15 hours.
2. Student will have to take admission in Zoology and complete 75 credits incorporated in the syllabus structure of Zoology. The remaining 25 credits shall be chosen from the courses offered by the Zoology Department or other Departments of the University/College with credit system structure.
3. Besides Credits related to practical Courses, students may be allowed to take courses with less weightage per semester on the condition they complete the degree in maximum of four years. This provision can be availed which is subject to the availability of concerned courses in a given semester and with a maximum variation of 25 credits (in case of fresh credits) per semester in the concerned department/college.
4. Every student shall complete 100 credits in a minimum of four semesters. All Semesters will have 25 credits each.
5. The student will be declared as failed if he/she does not pass in all credits within a total period of four years. After that such students will have to seek fresh admission as per admission rules prevailing at that time.
6. Academic calendar showing dates of commencement and end of teaching, internal assessment tests and term end examination will be prepared and duly notified before commencement of each semester every year.
7. Project course should not be greater than 10% of the total credits of the degree course. Project course is equivalent to 10 credits.

### **Instructions for the Students:**

The students seeking admission to M.Sc. Zoology course is hereby informed that they are supposed to adhere to the following rules:

1. A minimum of 75 % attendance for lectures / practical is the pre-requisite for grant of term.
2. There shall be tutorial / practical / surprise test / home assignment / referencing of research papers / seminar / industrial visits/Field Visit / training course/viva-voce as a part of internal assessment in each semester. The students are supposed to attend all the tests. The students should note that re-test will not be permitted to the student absent for the test/s unless the case is considered by competent authority.
3. The students opting for dissertation course shall follow the rules framed for the same.
4. The students are supposed to attend all the Industrial Workshops / Laboratory Workshops / Training Programme/ symposia/ seminar/ field visit / study tour organized by the department/ college. The students shall attend these programmes at their own cost.

### **4) Eligibility:**

The candidate should have a B.Sc. degree with Zoology as principal subject or B.Sc. (General) degree with Zoology as one of the subsidiary subjects. Graduates in any life science related subjects such as Biotechnology, Bioinformatics, Life science, Biochemistry, Microbiology, Agriculture, Veterinary sciences, Biology, Botany etc.

Admission: 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.

### **5) Examination**

#### **[A] Pattern of Examination**

Evaluation of Students:

- 1) The In-semester and End-Semester examinations will be of 50 marks each.
- 2) Student has to obtain 40% marks in the combined examination of In-Semester and End-Semester assessment with minimum passing of 30% marks in both assessments separately.
- 3) A student cannot register for third semester if he/she fails to complete the 50% credits of the total expected within two semesters.
- 4) Internal marks remain unchanged and internal assessment cannot be repeated. If student remain absent during internal assessment examination, he/she will have second chance with the permission of the competent authority. But it will not be right of the student. It will be under the discretion of the competent authority and internal departmental assessment committee. In case he/she wants to repeat Internal, he/she can do so only by registering for the said courses.
- 5) There shall be revaluation of answer script of end semester examination, but not of internal assessment papers.

**i. In-semester Examination:** Internal assessment for each course would be continuous and dates for each tutorials/practical tests etc. will be pre-notified in the time table for teaching or placed separately as a part of time table. Department / College Internal Assessment Committee will coordinate this activity.

**a) Theory Courses:** Students should be encouraged to participate in various academic activities. A teacher must select a variety of the procedures for conducting internal assessment suggested as follows.

- a) Multiple choice questions
- b) Combination of objective and subjective questions.
- c) Open book test (concerned teacher will decide the allowed books)
- d) Tutorial
- e) Surprise test specified topics in a given notified period
- f) Oral
- g) Assignments
- h) Review of research paper
- i) Seminar presentation
- j) Journal/Lecture/Library notes

Student has to preserve the documentation of the internal assessment except midterm test answer script. It is the responsibility of the student to preserve the documents.

**b) Practical Courses:** It is a continuous evaluation process. Practical courses will be evaluated on the basis of the following:

1. Performance assessment of each experiment on the basis of attendance, punctuality, journal completion, practical skills, results, oral and analysis.
2. Assessment on practical course be conducted before the end-semester examination.
3. Assessment of each experiment shall be done for each practical weekly.
4. Assessment of the Activity will be based on any one of the following (per practical course).
  - i. Special training programs in recognized research institutes such as NCL, NIO, NIV, ZSI, BNHS, etc.
  - ii. Project on Research Methodology
  - iii. Industrial/Institution Visit report
  - iv. Field visit report/ study tour report

The student strength of practical batch should be 12.

**Project Course:** Project will be evaluated by the examiner/s in consent with the project guide if required.

**ii. End-Semester Examination:** The End-semester examination programme will be scheduled as per the notifications and guidelines issued by the Examination section of University of Pune.

**[B] Standard of Passing**

Student has to obtain 40% marks in the combined examination of In-Semester and End-Semester assessment with minimum passing of 30% passing in both assessments separately.

**[C] ATKT Rules**

A student cannot register for third semester if he/she fails to complete the 50% credits of the total credits expected to be ordinarily completed within two semesters.

**[D] Award of Class**

Grades will be awarded from grade point average (GPA) of the credits.

**GPA Rules:**

1. The formula for GPA will be based on Weighted Average. The final GPA will not be printed unless a student passes courses equivalent to minimum 100 credit hours (Science). Total credit hours indicate the sum of credit hours of the courses which a student has passed.
2. A seven point grade system [guided by the Government of Maharashtra Resolution No. NGO – 1298 / [4619] / UNI 4 dt. December 11, 1999 and University regulations] will be followed. The corresponding grade table is attached herewith.
3. If the GPA is higher than the indicated upper limit in the third decimal digit then the student be awarded higher final grade (e.g. a student getting GPA of 4.492 may be awarded 'A')
4. For Semester I, II, III examinations, only the grade points will be awarded for each subject. Final GPA along with final grade will be awarded only at the end of IV semester. There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. The revaluation result will be adopted if there is a change of at least 10% marks and in the grade of the course.
5. After the declaration of result, for the improvement of Grade, the student can reappear for the examination of 30 credits worth theory courses.
6. Grade improvement programme will be implemented at the end of the academic year. A student can opt for grade improvement programme only after the declaration of final semester examination i.e. at the end of next academic year after passing M.Sc. (Zoology) examination and within two years of completion of M.Sc. (Zoology). A student can appear for grade improvement programme only once.

Grade and Grade Point Average		
Marks	Obtained Grade	Grade Points
100 – 75	'O' Outstanding	06
74 – 65	'A' Very Good	05
64 – 55	'B' Good	04
54 – 50	'C' Average	03
49 – 45	'D' Satisfactory	02
44 – 40	'E' Pass	01
39 and less	'F' Fail	00

Final Grade Points	
Grade Points	Final Grade
5.00 – 6.00	<b>O</b>
4.50 – 4.99	<b>A</b>
3.50 – 4.49	<b>B</b>
2.50 – 3.49	<b>C</b>
1.50 – 2.49	<b>D</b>
0.50 – 1.49	<b>E</b>
0.00 – 0.49	<b>F</b>

Common Formula for Grade Point Average (GPA):

$$\text{GPA} = \frac{\text{Total of Grade Points earned} \times \text{Credit hours for each course}}{\text{Total Credit hours}}$$

B Grade is equivalent to at least 55% of the marks

**[E]External Students:** There shall be no external students.

**[F]Setting of Question Paper / Pattern of Question Paper**

For core (compulsory) theory courses end semester question papers set by the University of Pune and 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.

Theory examination will be of 3 hours duration for each theory course of 4 credits. There shall be 3 questions each carrying marks as shown below. The pattern of question papers shall be:

Question 1 (20 Marks)	10 compulsory sub-questions, each of 2 marks; answerable in 2 -3 lines
Question 2 (20 Marks)	5 out of 7– short answer type questions.
Question 3 (10 Marks)	2 out of 3 – Long answer type questions.



### [G]Verification / Revaluation

There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. The revaluation result will be adopted if there is a change of at least 10% marks and in the grade of the course. There shall be revaluation of answer script of end semester examination, but not of internal assessment papers.

### 6) Structure of Course

Basic structure/pattern (Framework) of the proposed postgraduate syllabus for the two year integrated course leading to M.Sc. (Zoology) in the colleges affiliated to Pune University.

#### M.Sc. Zoology - Course structure & Credits Distribution

##### M.Sc. Zoology –Part –I Semester-I

Course No	Title	Credits	Course No	Title	credits
ZY 101T	Biochemistry-I	3C	ZY 101 P	Practicals in Biochemistry-I	3C
ZY 102T	Cell Biology	3C	ZY 102 P	Practicals in Cell Biology	2C
ZY 103T	Genetics	2C	ZY 103 P	Practicals in Genetics	2C
ZY104T	Biostatistics	2C	ZY104 P	Practicals in Biostatistics	2C
ZY105T	Skills in Scientific communication and writing	2C	ZY105 P	Practicals in Skills in Scientific communication	2C
ZY106T	Fresh Water Zoology	2C	ZY106 P	Practicals in Fresh Water Zoology	2C
		<b>14C</b>			<b>13C</b>

(T = Theory ; P = Practicals)

**Total credits =27**

**Note:- Courses equivalent to atleast 25 credits should be taken by the students.**

##### Semester-II

Course No	Title	credits	Course No	Title	credits
ZY 201T	Biochemistry-II	3C	ZY 201 P	Practical Biochemistry-II	2C
ZY 202 T	Molecular Biology	3C	ZY 202 P	Practical Molecular Biology	3C
ZY 203T	Developmental Biology	2C	ZY 203 P	Practical Developmental Biology	2C
ZY204T	Endocrinology	2C	ZY204 P	Practical Endocrinology	2C
ZY205T	Comp.Animal Physiology	2C	ZY205 P	Practical Comp.Animal Physiology	2C
ZY206T	Biochemical techniques/ Ichthyology	2C	ZY206 P	Practicals in Biochemical techniques/ Ichthyology	2C
		<b>14C</b>			<b>13C</b>

(T = Theory ; P = Practicals)

**Total credits =27**

**Note: - Courses equivalent to atleast 25 credits should be taken by the students.**

**M.Sc. Zoology –Part –II**  
**Semester-III**

Course No	Title	Credit	Course No	Title	credits
ZY 301T	Animal Physiology I (special) or Entomology I (special) or Genetics I (special)	4C	ZY 301 P	Practicals in Animal Physiology I/Entomology I/Genetics I	3C
ZY 302T	Immunology / Environmental biology	2C	ZY 302 P	Practicals in Immunology / Environmental biology	2C
ZY 303T	Genetic toxicology / Aquaculture	2C	ZY 303 P	Practicals in Genetic toxicology / Aquaculture	2C
ZY304T	Insect physiology and biochemistry	2C	ZY304 P	Practicals in Insect physiology and biochemistry	2C
ZY305T	Research methodology	2C	ZY305 P	Practicals in Research methodology	2C
ZY306T	Parasitology	2C	ZY306 P	Practicals in Parasitology	2C
ZY307T	Fundamentals of Systematics	2C	ZY307 P	Practicals in Fundamentals of Systematics	2C
ZY 308T	Insect Ecology	2C	ZY308 P	Research Project	2C
ZY 309 T	Toxicology I	2C	ZY 309 P	Practicals in Toxicology I	2C
		20C			19C

(T = Theory ; P = Practicals)

**Total credits =39**

**Note:- courses equivalent to atleast 25 credits should be taken by the students.**

**Semester-IV**

Course No	Title	Credit	Course No	Title	Credits
ZY 401T	Animal Physiology II (special) or Entomology II (special) or Genetics II (special)	4C	ZY 401 P	Practical Animal Physiology II/ Entomology II/ Genetics II	3C
ZY 402 T	Economic Zoology / Bacteria and phage Genetics	2C	ZY 402 P	Practical Economic Zoology / Bacteria and phage Genetics	2C
ZY 403T	Mammalian reproductive physiology / Biodiversity assessment	2C	ZY 403 P	Practical Mammalian reproductive physiology / Biodiversity assessment	2C
ZY404T	Histology and histochemistry	2C	ZY404 P	Practical Histology and histochemistry	2C
ZY405T	Pollution biology	2C	ZY405 P	Practical Pollution biology	2C
ZY406T	Apiculture	2C	ZY406 P	Practical Apiculture	2C
ZY 407T	Pest control	2C	ZY308 P	Research Project	2C
ZY 408 T	Toxicology II	2C	ZY 408 P	Practicals in Toxicology II	2C
		18C			17C

(T = Theory ; P = Practicals)

**Total credits = 35**

**Note:- courses equivalent to Atleast 25 credits should be taken by the students.**

**a) Question Papers and papers etc.:**

Theory

In-Semester Examination : 50 Marks

End-Semester Examination : 50 Marks

Practical

In-Semester Examination : 50 Marks

End-Semester Examination : 50 Marks

**b) Medium of Instructions:** English.

**7) Equivalence of Previous Syllabus:**

<b>Old Course (2008 Pattern)</b>	<b>New Course (2013 Pattern)</b>
ZY 101 Biochemistry	ZY101T: Biochemistry
ZY 202 b Cell Biology	ZY102T: Cell Biology
ZY 102 a Genetics	ZY103T: Genetics
ZY 103 b Statistical Methods	ZY104T: Biostatistics
ZY 102 b English for Scientists	ZY105T: Skills in scientific communication and writing
ZY 103 a Fresh Water Zoology	ZY106T: Fresh water zoology
ZY 104 a Biochemistry	ZY101P: Practicals in Biochemistry
ZY 205 b Cell biology	ZY102P: Practicals in Cell Biology
ZY 105 b Genetics	ZY103P: Practicals in Genetics
ZY 105 a Statistical Methods	ZY104P: Practicals in Biostatistics
ZY 105 c English for Scientists	ZY105P: Practicals in Skills in scientific communication and writing
ZY 104 b Fresh water Zoology	ZY106P: Practicals in Fresh water zoology

<b>Old Course (2008 Pattern)</b>	<b>New Course (2013 Pattern)</b>
ZY 101 Biochemistry	ZY 201 T Biochemistry-II
ZY 202 a Molecular Biology	ZY 202 T Molecular Biology
ZY 201 a Developmental Biology	ZY 203 T Developmental Biology
ZY 203 b Endocrinology	ZY 204 T Endocrinology
ZY 201 b Comparative Animal Physiology	ZY 205 T Comparative Animal Physiology
ZY 203 a Biochemical Techniques/ Ichthyology	ZY 206 T Biochemical techniques/ Ichthyology
ZY 104 a Biochemistry	ZY 201P Practical Biochemistry-II
ZY 204 b Molecular biology	ZY 202P Practical Molecular Biology
ZY 205 a Devepolmental Biology	ZY 203P Practical Developmental Biology
ZY 205 c Endocrinology	ZY 204P Practical Endocrinology
ZY 204 a Comparative Animal Physiology	ZY 205P Practical Comparative Animal Physiology
ZY 204 c Biochemical techniques/ Ichthyology	ZY 206P Practicals in Biochemical techniques/ Ichthyology

### 8) University Terms:

Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only for duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

### 9) Qualification of Teacher:

- i. M.Sc. (Zoology) degree with NET/SET/ Ph.D qualification.
- ii. Recognition of Pune University as a post graduate teacher, by papers.
- iii. Other criteria as per the guidelines of UGC and University of Pune.

### 10) Detail Syllabus with Recommended Books

**ZY 101 T: BIOCHEMISTRY – I ( 3 Credits = 45 lectures)**

1. Water :Structure and Function, pH and Buffers, Biological Buffer System (3L)
2. Carbohydrates: Classification, basic Chemical Structures, General Reactions and properties, Biological Significance. (6L)
3. Lipids: Classification, structure and function of major lipid subclasses. Formation of micelles, monolayers, bilayer (5L)
4. Vitamins and Coenzymes: Classification, water-soluble and fat-soluble vitamins, coenzyme forms and their significance (6L)
5. Amino acids: Classification, properties and reactions (N / C terminal reactions, ninhydrin reaction) (4L)
6. Proteins: (4L)
  - a. Peptide bond, formation, End group analysis and sequencing, Ramachandran plot
  - b. Protein structure :
    - i. Levels, primary structure and its importance
    - ii. Secondary structure- X ray diffraction, alpha-helix, beta-helix
    - iii. Tertiary structure: Forces stabilizing, unfolding and refolding.
    - iv. Quaternary structure- hemoglobin.
  - c. Biological Roles of Proteins
7. Enzymes: (10L)
  - 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)

**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, Stryer Lubert, 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.

**ZY 101 P: PRACTICALS IN BIOCHEMISTRY I (3 Credits: 45hours)**

1. Preparation of Acid & Alkali solutions and acid-base titration (4H)
2. To prepare Buffers of known pH and molarity and measurement of pH of various samples, Buffering capacity (4H)
3. Estimation of alpha amino nitrogen by formal titration. (4H)
4. To find saponification value of a given fat. (4H)
5. Estimation of Inorganic Phosphate (4H)
6. Estimation of Sugar (Glucose) by Folin Wu method. (4H)
7. Estimation of Amino Acid (Tyrosine) (4H)
8. Isolate proteins by salting out / by adjusting isoelectric point. (4H)
9. Estimation of vitamin. (4H)
10. Isolation of amylase/ invertase, to find specific activity and progress curve (5H)
11. Estimation of protein by Lowry et.al method. (4H)

**REFERENCE BOOK:**

1. An introduction to Practical Biochemistry by David Plummer; Eds. 3, Tata McGraw Hill Publishing Company.
2. Practical Biochemistry by Jayraman.
3. Biochemical Methods by S. Sadasivam and A. Manickam; New Age International Publishers.

**ZY 102 T: CELL BIOLOGY (3 Credits= 45 Lectures)**

1. Introduction to the cell types and shapes (2L)
2. Overview of chemical nature of the cell (2L)  
Carbon as backbone of biologically important molecules  
Macromolecules and their role in form and function of living systems.
3. Plasma membrane : (9L)  
Structure, Location of Intrinsic and extrinsic proteins and channels; Receptors-  
Structure and role in signal transduction; membrane potential and synaptic  
transmission; glycocalyx; cell junction, cell adhesion molecules
4. Endomembrane system: (Endoplasmic reticulum, Golgi complex, Lysosomes;  
Glyoxysomes, peroxisomes: Structure and function), protein trafficking (10L)
5. Mitochondria and chloroplast- Structure, Genetic system, Functions; protein import. (6L)
6. Nucleus: Ultrastructure, Nuclear pore complex, nuclear cytoplasmic interactions,  
Nucleolus, Nuclear lamina and its role in cell division. (Lamin Dissociation) (4L)
7. Cell Cycle: Phases, Check points of cell cycle mechanism of regulation (Cyclin and  
cyclindependent kinases) Regulation of CDK cyclin activity. (7L)
8. Cytoskeleton:types,Chemistry,Organisations,associated proteins and their role (5L)

**REFERENCE BOOKS**

1. Alberts, B., D. Bray, J. Lewis, M. Raff, K. Roberts and J. D. Watson. (1995). Molecular  
Biology of the Cell. Eds. 3, Garland Publi. New York and London.
2. 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.
3. Cell and Molecular Biology By De Robertis, EDP. And De Robertis EME,Molt Saunders Inc

**ZY 102 P: PRACTICALS IN CELL BIOLOGY (2 Credits: 30hr) (1P= 4hr)**

1. Measurements of cell size using light microscope. (1P)
2. Temporary preparation of human epithelial cheek cells (1P)
3. Study of different stages of mitosis in suitable material and mitotic index (1P)
4. Study of meiosis in Grasshopper testes / Onion flower buds / Aloe vera with emphasis on  
all stages of prophase. (1P)
5. Limits of cleanliness (To check for microbial flora) (2P)
6. Cell fractionation- Nuclei, mitochondria observation, nuclear count. (2P)
7. Study of Cyclosis in *Paramecium* (1P)
8. Ultra structure of cell organelles. (1P)
9. Study of different types of Cells. (1P)
10. Study of disaggregation and reaggregation in sponge cells and effect of toxicant or  
cytochalasin / pesticide endosulfan / CuSO<sub>4</sub> or toxicant (1P)
11. Study of metaphase spreads from bone marrow of rat / mouse (1P)



**ZY 103 T: GENETICS (2 Credits= 30 lectures)**

1. Recapitulation of Mendelian principles; Practical applications of genetics in brief. **(3L)**
2. Classical concept of a gene: multiple alleles (blood groups), gene interactions (dominant and recessive epistasis) **(3L)**
3. Linkage and crossing over: Linkage, linkage groups, types of crossing over, recombination maps in diploids for 3 point test cross, (determination of gene order with suitable examples) **(5L)**
4. Inheritance of qualitative and quantitative traits: genetic basis and influence of environment on quantitative inheritance. **(3L)**
5. Principles of Population Genetics: Hardy-Weinberg law and its application for autosomal genes. Calculations of gene frequencies with suitable examples. **(5L)**
6. Organization and regulation of lac and arabinose operons. **(4L)**
7. Somatic cell genetics and its applications. **(3L)**
8. Human genetics: dominant and recessive disorders, physical and physiological traits. **(4L)**

**REFERENCE BOOKS:**

1. Strickberger, M.W., Genetics, Edn.III, MacMillan, 1976.
2. Gardner, E.J., Peter & Simmons, M.J. and Snustad, D.P. Principles of Genetics, John Wiley AND Sons, New York, 2006.
3. William S Klug and Michael R Cummings. Concepts of Genetics. Edn. IX. Prentice Hall Internatl, Inc., New York, 2008.
4. Trends in Genetics. Elsevier Publications, Amsterdam.
5. Lewin, Benjamin. Genes IX. John Wiley and Sons, New York, 2008.
6. Genetics By Verma,PS. And Agrawal, VK., S.Chand and Co.,New Delhi
7. Genetics By Gupta, PK., Rastogi Publication, Meerut
8. Genetics By Sarin,C., Tata McGraw Hill,New Delhi
9. Genetics: Daniel J Fairbanks, W. Ralph Andersen; Brooks / Cole Publ. co. (1999).
10. Genetics-A Molecular Approach: Peter J. Russell;Pearson Inc. publishing as Benjamin Cummings; 2006

**ZY 103 P: PRACTICALS IN GENETICS : (2 credits) (1P: 3 hrs) (10PX3= 30 hrs)**

1. Study of sex linked inheritance in *Drosophila sp.* (1P)
2. Study of monohybrid ratio in *Drosophila sp.* (1P)
3. Study of dihybrid ratio in *Drosophila sp.* (1P)
4. Non-allelic gene interaction in *Drosophila sp.* (1P)
5. Linkage study in *Drosophila sp.* (1P)
6. Determination of gene distances and gene order for a given three point test cross (1P)
7. Polytene chromosomes of *Drosophila or Chironomous*-examination of puff and bands (1P)
8. Estimation of allelic frequencies, heterozygote frequencies in human populations (1P)
9. Human Mendelian traits (blood groups, attached ear lobe, tongue rolling, etc.) family studies. Estimation of gene frequencies & percentage of heterozygotes for the given data. (1P)
10. Pedigree Analysis: Sex-Linked, Autosomal dominant and recessive. (1P)
11. Analysis of quantitative trait in a plant/ animal.: frequency distribution (1P)
12. Analysis of quantitative trait in a plant/ animal.: standard deviation variance (1P)
13. Microbial Genetics: Basic methodology; colony counts, growth curve (2P)
14. Bacterial transformation- antibiotic resistance marker (2P)

**ZY 104 (T) BIostatistics****2 Credits= 30 lecturers**

1. Introduction: (2)
  - 1.1 Applications and Uses of Statistics
  - 1.2 Population & sample, Different types of Sample
  - 1.3 Exercise & Problems.
2. Data Classification: (3)
  - 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.
3. Measures of central tendency: (3)
  - 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)
  - 3.3 Exercise & Problems.
4. Measures of dispersion: (4)
  - 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.
5. Correlation and Regression: (5)
  - 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.
6. Probability and probability distribution: (5)
  - 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 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: (8)

- 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 Exercise & Problems.

### REFERENCES:

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

### **ZY 104 (P) - BIOSTATISTICS: (2 credits) (1P: 3 hrs) (10PX3= 30 hrs)**

1. Construction of frequency distribution and its graphical representation.
2. Measures of Central Tendency.
3. Measures of Dispersion.
4. Correlation and Regression.
5. Computation and application of binomial & Poisson probabilities.
6. Computation and application of normal probabilities.
7. Test for means and proportions.
8. Chi-square test of goodness of fit.
9. Paired and unpaired t- test, F-test.
10. Statistical analysis with Computer software packages.

**ZY 105 T: SKILLS IN SCIENTIFIC COMMUNICATION AND WRITING**

**(2 Credits = 30 lectures)**

1. Language as a communication tool, relationship among reading, writing, hearing and speaking, synonyms and antonyms (2L)
2. Organization of English language: sentence structure, basic grammar, Syntax, paragraphs, paraphrases and précis- recognizing important statements, key words (3L)
3. Common error in written and spoken presentation: tautology, double negative, doubles positive, superfluous words, sequence and tenses. (2L)
4. Oral presentation: How to prepare presentation, power point slides, use of communication and IT, Voice, speed of delivery, obstacles in effective communication (2L)
5. Hypothesis, theory and concept (1L)
6. The Genetic code as a simple language (2L)
7. Outline of a science paper and project preparation, funding (2L)
8. Introduction: Survey of literature, defining the problem and justification (2L)
9. Materials and Methods: contents, importance of measurements, reproducibility etc. (2L)
10. Observations and Results: text and data presentation, tables, graphs, histograms, diagrams, photographic plates, legends & captions (3L)
11. Discussion: What to discuss? Logical sequence and critical analysis of ideas and evidence or data conclusion (2L)
12. Citation: How to find references from journals, books and data bases, styles of citations (2L)
13. Summary , Abstract, acknowledgements and Title designing (3L)
14. Editing & correcting: proof- reading symbols, Jargons and abbreviations (2L)

**REFERENCE BOOKS:**

1. O'Conner, M and Woodford, F.P.(1975). Writing scientific papers in English. Elsevier- Excerpta Medica-North Holland pul., Amsterdam.
2. Trelease, S.F. (1958). How to write Scientific and Technical papers. Williams and Wilkins Co. Baltimore, USA

3. Robert Day (1996). How to write and publish a Scientific Paper. Cambridge University Press
4. McMillan, V (1997). Writing Papers in the Biological Sciences. Edn. 2, W.H. Freeman. New York
5. G. Vijayalakshmi and C. Sivapragasam. (2008) Research Methods –Tip & Techniques, MJP Publishers, Chennai. WWW.mjppublishers.com

**ZY 105 P: PRACTICALS IN SSCW: (2 credits) (1P: 3 hrs) (10PX3= 30 hrs)**

1. English vocabulary, word formation, basic grammar-verb, adverb, adjective, noun, pronoun (1P)
2. Syntax, paraphrasing and précis writing, synonyms, antonyms, abbreviations (1P)
3. Spoken English: pronunciation, diphthong, accent, clarity, speed, punctuation, simplicity and syntax (1P)
4. Common errors in written and spoken presentation- Tautology, double negatives and double positives, sequence and tenses, ambiguity, spellings, jargons. (1P)
5. Outline of a scientific paper; preparation of a project and writing Introduction. (1P)
6. Writing abstracts, conclusion/ summary and acknowledgements, key words (1P)
7. To suggest a title to the given abstract/paper (1P)
8. Assigning legends to given graphs, figures and captions to given tables, Deciphering the given pictorals (1P)
9. Study of proof correction symbols; proof- reading the given text & correcting the proofs (1P)
10. Designing of tables and graphs from the given data, (1P)
11. How to write materials and methods ,observation section of a research paper (1P)
12. Write discussion section for the given discussionless research paper (1P)
13. Citations/ Bibliography: how to find and cite references from journals, books and databases` (1P)
14. Oral presentation: Rhythm, style, control, mock presentation for 10 minutes (1P)
15. Use of animation in scientific communication (1P)

**ZY 106 T: FRESHWATER ZOOLOGY (2 Credits: 30 Lectures)**

1. Types of Aquatic environment. (4L)  
 Lotic Habitat : Major river systems in India / rapid and slow moving rivers.  
 Lentic Habitat: Lakes, Ponds and Swamps, Bogs lakes and succession of lakes.  
 Ephemeral water bodies (Temporary habitat).
2. Physical conditions of water: movement of water, Depth, Viscosity, Density, Buoyancy, (surface film and surface film animals), Temperature and light, Transparency and turbidity. (4L)
3. Chemical conditions of water: Dissolved oxygen and Carbon di-oxide, phosphates, Nitrates. Acidity and alkalinity, Mg-hardness, Ca-hardness, dissolved solids, organic Matter, Importance of chemical conditions to aquatic life. (4L)
4. Physiological and protective adaptations of the following. (2L)  
 Protozoa, Rotifera, Crustaceans, Fishes.
5. Diagnostic features and life cycle of temporary rainwater pool animals: Fairy shrimps and Tadpole shrimps. (3L)
6. Respiratory and Locomotory adaptations in freshwater insects and their larvae. (3L)
7. Amphibia and water: General life cycle of frog. Tadpole as important herbivore of freshwater habitat. (2L)
8. Adaptations in freshwater reptiles: Turtles and Crocodiles. economic importance of reptiles. (3L)
9. Economic importance of freshwater molluscs (snails and bivalves)- as a food & medicine. (2L)
10. Biological changes in freshwater due to sewage pollution (with reference to rivers) and its effect on freshwater animals. (3L)

**REFERENCE BOOKS**

1. Mellanby, H (1975). Animal life in freshwater, 6<sup>th</sup> Edn., Chapman-Hall.
2. Limnology: Welch P.S.(1957), Mc Grall, and Hill Co. New York.
3. Treatise on limnology: Hutchinson, G.E.(1967). John. Willy.Pub.New York.
4. Aquatic pollution: Edward A.(2000) Laws. 3<sup>rd</sup> edition. John wiley and Sons. New York.
5. Life in Lakes and Rivers: T.T.Macan and Worthington E.B.(1951) COLLIN, London.

6. Limnology: by Alexander Home, Charles Goldman.
7. Limnology: Lake and River Ecosystem, Robert G. Wetzel 3<sup>rd</sup> edition.
8. Fundamentals of Limnology: franz Ruttner. 3<sup>rd</sup> Edition. University of Toronto Press, 1963.
9. The Ecology of Running water: Hugh Bernard Noel Hynes.
10. Limnological methods: Paul Smith Welch.
11. Fresh water animals of India (An Ecological Approach) : G.T.Tonapi

**ZY 106 P: PRACTICALS IN FRESH WATER ZOOLOGY: (2 credits) (1P: 3 hrs)**

**(10PX3= 30 hrs)**

1. A qualitative and quantitative analysis of zooplankton from a given sample of water using Sedgwick rafter counting cell. **(1P)**
2. To prepare and maintain a culture of paramecium, Daphnia and Hydra. **(1P)**
3. Study of aquatic and semiaquatic adaptations in amphibians and reptiles. **(1P)**
4. Study of locomotory and respiratory adaptations in aquatic insects and their larvae.(Ranatra, Notonecta, Gerris, Bellostoma, Dytiscus). **(1P)**
5. Estimation of Chlorides in given sample of water. **(1P)**
6. Identification of commercially important freshwater fishes and crustaceans. **(1P)**
7. Study if Bioindicators of pollution by insects, rotifers, algae, diatoms. **(1P)**
8. Determinations of LC50 using fish/insect larvae for known pollutant like Heavy metal/any Pesticide/industrial effluent. **(1P)**
9. Water analysis with regadrs to hardness (Total and Calcium). **(1P)**
10. Visit to freshwater body for the study of aquatic ecosystem. **(1P)**
11. Collection and identification of Benthos. **(1P)**
12. Compulsory Visit to ZSI, Pune and water purification plant and submission of tour report. **(1P)**



**ZY 201 T: BIOCHEMISTRY-II (3 Credits = 45 lectures)**

**A. Bioenergetics I**

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. Glycolysis; Detailed study, energetic and its regulation; PFK, gluconeogenesis (5L)
4. Carbohydrate metabolisms: Glycogen biosynthesis and its regulation. Role of enzymes in synthesis and degradation of glycogen, role of cAMP (4L)
5. Citric acid cycle: Detailed study, energetics, regulation and significance, Role of PDH. (7L)
6. Electron transport chain and oxidative phosphorylation (4L)

**B. Bioenergetics II**

1. Oxidative degradation of amino acids: transamination, oxidative deamination, ureacycle, Ammonia excretion (6L)
2. Purine and pyrimidine degradation, biosynthesis of purine and pyrimidine nucleotides (6L)
3. Lipid metabolism: Introduction, oxidation of even chain saturated fatty acids, oxidation of unsaturated fatty acids, oxidation of odd chain fatty acids, omega ( $\omega$ )-oxidation of fatty acids, Ketogenesis. Transport of Fatty Acids. (7L)

**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.

**ZY 201 P: PRACTICALS IN BIOCHEMISTRY II (3Credits: 45hours)**

1. Units and specific activity of enzymes. (4H)
2. Effect of substrate concentration on enzyme activity (4H)
3. Effect of pH and temperature on enzyme activity. (4H)
4. Effect of inhibitor and activator on enzyme activity. (5H)
5. Colorimetry and spectrophotometry (2H)
6. Estimation of cholesterol (4H)
7. Separation sugars by paper chromatography (5H)
8. Estimation of uric acid in Lizard excreta/ Human blood etc. (4H)
9. To find absorption spectrum of haemoglobin, BSA, Tyrosine (4H)
10. Estimation of Nitrogenous Base (Guanine) (4H)
11. Estimation of free aminoacids by Ninhydrin method. (5H)
12. Estimation of Starch (3H)
13. Separation of amino acids by TLC (4H)

**REFERENCE BOOK:**

1. An introduction to Practical Biochemistry by David Plummer; Eds. 3, Tata McGraw Hill Publishing Company.
2. Practical Biochemistry by Jayraman.
3. Biochemical Methods by S. Sadasivam and A. Manickam; New Age International Publisheres.

## **ZY 202T: MOLECULAR BIOLOGY (3 Credits = 45 lectures)**

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<sub>m</sub>, 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, Cot ½ and, kinetic and sequence complicity,satellite DNA. **Types of RNA and their significance** **(2L)**
4. **DNA Replication:** DNA replication in *E. coli*, Origin of replication, , types of *E. coli* 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 phages. Eukaryotic DNA replication, multiple replicons, eukaryotic DNA polymerases, ARS in yeast, Origin Recognition Complex (ORC), regulation of replication. **(10L)**
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. Transcriptional Unit in prokaryotes and eukaryotes, role and significance of promoter,enhancer, intron, exon, silencer, Transcriptional factors, mechanism of prokaryotic gene transcription, structure of RNA polymerase,post transcriptional processing: Capping,polyadenylation and splicing in eukaryots. Ribonucleoproteins (SnRNPs &ScRNPs) **(10L)**
7. Protein synthesis:Genetic Code ribosome structure, activation of aminoacids,peptide bond formation and translocation of peptides, post-translational modifications, inhibitors of protein synthesis **(7L)**
8. **Mobile DNA elements:** Transposable elements in bacteria, IS elements, composite transposons, replicative, non-replicative transposons, Mu transpositionControlling elements in Tn A and Tn 10 transposition, SINES and LINES. Retroviruses and retrotransposon **(4L)**

### **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 -
4. Pearson Education, Inc. and Dorling Kindersley Publishing, Inc.

5. *Molecular Biology*, 4th Edition (2007), Weaver R., Publisher-McGraw Hill Science.
6. *Molecular Biology of the Cell*, 4th Edition (2004), Bruce Alberts, Dennis Bray, Julian
7. Lewis, Martin Raff, Keith Roberts, and James D. Publisher: Garland Publishing.
8. *Essential Cell Biology*, 2nd Edition (2003) Bruce Albert, Dennis Bray, Karen Hopkin,
9. Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, Publisher: Garland Publishing.
10. *Fundamentals of Molecular Biology*, (2009), Pal J.K. and Saroj Ghaskadbi, Publisher: Oxford University Press.

**ZY 202 P: PRACTICALS IN MOLECULAR BIOLOGY (2 credits) (9 PX5hrs= 45)**

1. Isolation of bacterial DNA and estimation by UV spectrophotometry (2P)
2. Absorption studies of isolated DNA (1P)
3. Isolation of Liver DNA and quantification by Agarose gel electrophoresis (2P)
4. Isolation of RNA and agarose gel electrophoresis. (1P)
5. Demonstration of plasmid DNA in *E. coli*. and its characterization by UV-spectrophotometry (1P)
6. Concept of biological database, gene and protein search by BLASTA and FASTA (1P)
7. Lab Safety Techniques and sterilization. (1P)
8. To analyse protein on native PAGE and SDS-polyacrylamide gel electrophoresis (2P)

**ZY 203 T: DEVELOPMENTAL BIOLOGY (2 Credits = 30 lectures)**

1. Basic concepts of Developmental Biology: Model systems: Fish, Frog, Chick, Mouse and *Drosophila*. (2L)
2. Introduction of gametogenesis, regulation of sperm motility (tail fiber complex and role of dyenin ATPase), role of pH and divalent cation. (2L)
3. Oogenesis: synthesis and storage of maternal transcripts, proteins and cell organelles, rDNA amplification, transcription lampbrush chromosomes, vitellogenesis (3L)
4. Fertilization : Species specific sperm attraction, recognition of egg & sperm, acrosome reaction, signal transduction, molecular strategy to ensure monospermy and species-specificity in fertilization (4L)
5. Types of eggs and cleavage patterns: Concepts in Pattern formation, animal vegetal axis, gradients, origin, and specification of germ layers (2L)
6. Egg activation: regulation of cell cycle and utilization of maternal macromolecules and organelles during early development. (2L)
7. Organizers: Role of Spemann's organizers in frog and Hensen's node in birds (2L)
8. Mesoderm induction in *Xenopus*: Role of signals in dorsal, intermediate and ventral mesoderm induction. (3L)
9. Pattern formation in *Drosophila*.: Bicoid , Nanos and Torso Morphogen gradients and regulation of Hunchback (3L)
10. Neural competence and molecular signaling during neural induction (3L)
11. Concept of growth, differential cell proliferation, shaping of organ primordia and programmed morphogenetic cell death. (2L)
12. Growth and post embryonic development: Apoptosis, aging and senescence Hayflicks experiment (2L)

**REFERENCE BOOKS:**

1. *Developmental Biology*, 8th edition (2006), S.F. Gilbert. Publisher - Sinauer Associates Inc.
2. *Principles of Development*, 3rd edition (2007), Lewis Wolpert, Publisher- Oxford University Press.
3. *An Introduction to Embryology*, 5th edition (2004), B. I. Balinsky. Publisher - Thomas Asia Pvt. Ltd.
4. *Developmental Biology*, (2001), R. M. Twyman, Publisher - Bios Scientific Publishers LTD.

**ZY 203 P: PRACTICALS IN DEVELOPMENTAL BIOLOGY: (2 CREDITS)****(1P: 3 HRS) (10PX3= 30 HRS)**

1. Mounting of chick embryos and preparation of permanent mounts (1P)
2. Filter paper ring method for *in vitro* culturing of chick Embryo & observations. (1P)
3. Gross anatomy and histology of chick embryo upto 72 hrs. Brain, heart, lens, ear development. (1P)
4. Drosophila development on live material: egg structure, egg laying and early development in culture by phase contrast (1P)
5. Study of embryonic and post-embryonic development using frog egg as a model system. (1P)
6. Study of effect of ligature in Drosophila / House fly larva (1P)
7. Study the imaginal disc in Drosophila larva (1P)
8. Chick limb bud staining with neutral red for morphogenetic cell death (2P)
9. Study of grafting of Hensen's node (2P)
10. Regeneration of Hydra/Planaria (1P)

**ZY 204 T: ENDOCRINOLOGY (2Credits=30 Lectures)**

1. Hormones as chemical messenger, structure of hormones (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 (2L)
6. Control of chromatophores: Pituitary, pineal (2L)
7. Hormonal regulation of carbohydrates, protein & lipid metabolism: pancreatic hormones- glucocorticoids (3L)
8. Osmoregulatory hormones: ADH, mineralcorticoids, 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. Hormonal regulation of yolk synthesis, secretion & uptake in oogenesis w.r.t amphibian. (2L)
13. Hormones and reproduction in cephalopod mollusks and echinoderms (2L)
14. Hormones regulation in insect larval development and metamorphosis (2L)

**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

**ZY 204 P: PRACTICALS IN ENDOCRINOLOGY: (2 credits) (1P: 3 hrs)****(10PX3= 30 hrs)**

1. Histology of invertebrate and vertebrate neurosecretory and endocrine structures. (1P)
2. Staging of fish chromatophores and effect of adrenaline *in vivo* and *in vivo*, and Acetylcholine *in vivo*. (1P)
3. Blood sugar regulation in the crab- role of eye stalk. (1P)
4. Study of retrocerebral complex of the cockroach. (1P)
5. Introduction of alloxan diabetes in the mouse/ rat / human. (1P)
6. Gonadectomy in the mouse/ rat. (1P)
7. Pancreatectomy in the mouse/ rat. (1P)
8. Effect of insulin on blood sugar, hepatic and muscle glycogen of the rat/human. (1P)
9. Adrenalectomy and self- selection of fluid by the rat. (1P)
10. Thyroidectomy in the rat. (1P)
11. Estimation of thyroxine from human blood. (1P)
12. Determination of Acetylcholine esterase. (1P)



**ZY 205 T: COMPARATIVE ANIMAL PHYSIOLOGY (2 Credits = 30 lectures)**

1. Digestion: Physiology of digestion. (3L)
2. Respiration: Respiratory Surfaces: comparison of ventilation associated with gills and pulmonary respiration. Blood pigment, role in Oxygen transport. O<sub>2</sub> dissociation curves-physiological and ecological significance, CO<sub>2</sub> (4L)
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<sup>++</sup> in contraction (4L)
4. Osmotic regulation: Concepts of osmole, osmolarity and tonicity, ionic regulation, Hyper-and hypo-osmotic regulators, ureosmotic animals (4L)
5. Excretion: Basic processes in urine formation, renal function in animals specially the mammalian kidney, Renal pressure system, Comparative biochemistry of nitrogen excretion. (4L)
6. Temperature: Biokinetic Zones, tolerance and resistance. Thermobiological terminology. Compensatory patterns in poikilotherms. Critical temp, and zone of thermal neutrality. Mechanism of thermoregulation in homeotherms. (4L)
7. Chemical Communication: Neurosecretion, neurohemal & endocrine organs. chemistry of vertebrate hormones, Mechanism of hormone action (4L)
8. Sense organ: classification & functions (details of photoreception as a model). Reflexes, Principles of neural integration. (3L)

**ZY 205 P: PRACTICALS (2 credits) (10PX3= 30) (Any 10)**

1. Study of nitrogenous waste products of animals from different habitats. (1P)
2. RBCs in different vertebrates and in different physiological conditions. (1P)
3. Body size and oxygen consumption in aquatic animals (crab/fish). (1P)
4. Estimation of sugar in rat/crab/human blood. (1P)
5. Effect of insulin on the blood sugar of rat. (1P)
6. Estimation of lactate content of rat/crab/human blood. (1P)
7. Determination of bleeding time & clotting time of human blood. (1P)
8. Estimation of chloride content of rat/crab/human blood. (1P)
9. Capillary circulation in the foot-web of frog/tail-fin of fish. (1P)
10. Effect of load on muscle contraction in the frog/rat/fowl. (1P)
11. Determination of the heart beat in the crab-effect of temperature & ions. (1P)
12. Effect of eye stalk ablation on chloride & glucose in the haemolymph of the crab. (1P)

**References:**

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

**ZY 206 T: BIOCHEMICAL TECHNIQUES (2 Credits = 30 lectures)**

1. **Chromatography:** Principles and applications of: Adsorption chromatography Partition chromatography, Ion-exchange chromatography, affinity chromatography, Molecular exclusion chromatography, thin layer chromatography, HPLC, RPLC, selection of chromatographic system. (9L)
2. **Electrophoresis:** Moving boundary electrophoresis, zone electrophoresis, different supports used for electrophoresis, electrophoresis under native, dissociating and denaturing conditions, occurrence of artefacts, isoelectric focussing, activation analysis (5L)
3. **Absorption spectroscopy:** Concepts of light & electromagnetic spectrum, IR: identification of functional groups, atomic absorption spectrometry and applications (5L)
4. **Radioactivity:** Properties of radioisotopes, commonly used isotopes, structure & working of G.M, counter, isotopic dilution analysis, use of isotopes in biology, radiation hazards. (3L)
5. **Manometry:** Respiratory quotient determination, Principle of Warburg's apparatus, working and applications. (2L)
6. Methods for protein and DNA sequencing. (3L)
7. **Centrifugation:** Principle, basic theory of ultracentrifuge, molecular weight determination and its applications (3L)

**REFERENCE BOOKS:**

1. Principles and Techniques of Biochemistry and Molecular Biology, 6th edition (2008), Keith Wilson and John Walker, Publisher–Cambridge University Press.
2. Light Microscopy in Biology: A Practical Approach, 2nd edition (1999), Alan J. Lacey, Publisher–Oxford University Press.
3. Electron Microscopy: Principles and Techniques for Biologists, (1992), Lonnie D. Russell, Publisher-Jones & Bartlett

**ZY 206 P: PRACTICALS (2 credits) (10 PX3= 30) (Any 10P)**

1. Estimation of proteins by colorimetric and spectrophotometric methods (1P)
2. To find out the capacity and nature of a given ion-exchanger. Investigate the % retention and %elution of aminoacids on a given ion exchanger (1P)
3. To analyse protein on native PAGE and SDS-polyacrylamide gel electrophoresis (2P)
4. To separate protein by gel filtration G-50 (1P)
5. To locate enzymes on electrophoreogram by active staining (1P)
6. Enzyme purification by salting out and organic solvent precipitation (2P)
7. To study the effect of different solvents for a given dye using thin layer chromatography (1P)
8. Characterization of DNA by density gradient centrifugation (1P)
9. In situ detection of different enzymes (1P)
10. Estimation of respiratory quotient by Warburg's Respirometer (1P)
11. Enzyme isolation and purification by fractionation methods (2P)
12. Immobilization of enzymes (1P)
13. Analysis of sequences by BLAST and FASTA. (1P)

**ZY 206 T: ICHTHYOLOGY (2 Credits= 30 lectures)**

1. Classification and diagnostic characters (up to orders) of extant Cyclostomata, Chondrichthyes and Osteichthyes (9 major orders of fishes) (4L)
2. Phylogeny of fishes (1L)
3. External morphology, body form, appendages, pigmentation, skin and scales. Principles of morphometry, Locomotion (2L)
4. Endoskeleton: Skull, axial and appendicular skeleton (2L)
5. Food and feeding habits, Digestive system and its anatomical modifications (3L)
6. Respiration: Structure and functions of gills; adaptations for air breathing; role of air bladder. Respiratory functions of food (2L)
7. Buoyancy mechanisms: Role of fat and swim bladder (2L)
8. Excretion and Osmoregulation; Glomerular and aglomerular kidneys; Nitrogen(ammonia,urea, TMAO) excretions; water and salt and balance in steno-and euryhayline fishes. Role of skin and gills (3L)
9. Catadromous and anadromous fishes (1L)
10. Reproduction: Structure of gonads, gametogenic cycles; spawning, Parental care (4L)
11. Nervous system and Sense organs: Organization of the central and peripheral nervous systems. Eye, lateral line organs and chemoreceptors (3L)
12. Endocrine organs: Functions of the pituitary, thyroid, inter-renal and chromaffin tissues, ultimaobranchial and corpuscles of Stannius (3L)

**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. Hoar, W.S. & D.J. Randall, (1969). Fish Physiology. Vols.I onwards, Academic Press, New York.
4. 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.
5. Khanna, S.S. (1984). An Introduction to Fishes. Central Book Depot., Allahabad.

6. Lagler, K.E., J.E. Bardach, R.R. Miller & D.R.M. Passino (1977). Ichthyology, Edn.2, Wiley, New York.
7. Talwar, P.K. & A.G. Jhingran (1991). Fish and Fisheries of India and Adjacent Countries, Vols. I & II. Oxford & I.B.H., New York.
8. Wake, M.H. (Ed.) (1979). Hyman's Comparative Vertebrate Anatomy. Edn.3, University of Chicago Press, Chicago

**ZY 206 P: PRACTICALS IN ICHTHYOLOGY: (2 credits) (1P: 3 hrs) (10PX3= 30 hrs)**

1. General external characters, fins and scales (permanent slides & temporary preparations); morphometric measurements (1P)
2. Classification of fishes (12-18 representatives of different orders); use of diagnostic keys (1P)
3. Pharyngeal basket and skull of lamprey; endoskeleton (9 articulated and disarticulated) of carp (1P)
4. Length-weight relationship, condition factors, gonosomatic and hepatosomatic indices of any one species (1P)
5. Adaptations of fishes (adhesive organs, accessory respiratory organs, stomachless fishes, spiral valve, electric organs etc) (1P)
6. Digestive, and reproductive systems of carp/catfish/Tilapia (1P)
7. Cranial nerves (V, VII, IX & X) and eye ball musculature and innervations in Scoliodon and carp/catfish (1P)
8. Histology of digestive, respiratory, excretory, reproductive and endocrine organs (1P)
9. Chromatophores and their responses to external agent (1P)
10. Satiation index (e.g. Gambusia-mosquito larvae system) (1P)
11. Setting up of an aquarium and study of breeding behaviour of gourami Siamese fighter, swordtail/tilapia (1P)
12. Visit to fish farm/fish market. (1P)

**University of Pune**

**Two Year M.Sc. Degree Course in  
Zoology**

**M.Sc. Zoology**

**(Credit and Semester based Syllabus to be implemented from Academic Year 2013-14)**

**1) Title of the Course:**

M.Sc. Zoology

**2) Preamble of the Syllabus:**

Master of Science (M.Sc.) in Zoology is a post graduation course of University of Pune. The credit system to be implemented through this curriculum, would allow students to develop a strong footing in the fundamentals and specialize in the disciplines of his/her liking and abilities.

The students pursuing this course would have to develop in depth understanding various aspects of the subject. The working principles, design guidelines and experimental skills associated with different fields of Zoology such as Genetics and Cell Biology, Biochemistry, Molecular Biology, Biostatistics, Bacterial and Phage technology, Biodiversity, Entomology, Physiology, Developmental Biology, Endocrinology, Biochemical Techniques, Animal tissue culture, etc.

**3) Introduction:****Salient Features of the Credit System:**

1. Master's degree course in Zoology would be of 100 credits, where one credit course of theory will be of one clock hour per week running for 15 weeks and one credit for practical course will consist of 15 hrs. of laboratory exercise including the revision and setting up the practical. Thus, each credit will be equivalent to 15 hours.
2. Student will have to take admission in Zoology and complete 75 credits incorporated in the syllabus structure of Zoology. The remaining 25 credits shall be chosen from the courses offered by the Zoology Department or other Departments of the University/College with credit system structure.
3. Besides Credits related to practical Courses, students may be allowed to take courses with less weightage per semester on the condition they complete the degree in maximum of four years. This provision can be availed which is subject to the availability of concerned courses in a given semester and with a maximum variation of 25 credits (in case of fresh credits) per semester in the concerned department/college.
4. Every student shall complete 100 credits in a minimum of four semesters. All Semesters will have 25 credits each.
5. The student will be declared as failed if he/she does not pass in all credits within a total period of four years. After that such students will have to seek fresh admission as per admission rules prevailing at that time.
6. Academic calendar showing dates of commencement and end of teaching, internal assessment tests and term end examination will be prepared and duly notified before commencement of each semester every year.
7. Project course should not be greater than 10% of the total credits of the degree course. Project course is equivalent to 10 credits.



### **Instructions for the Students:**

The students seeking admission to M.Sc. Zoology course is hereby informed that they are supposed to adhere to the following rules:

1. A minimum of 75 % attendance for lectures / practical is the pre-requisite for grant of term.
2. There shall be tutorial / practical / surprise test / home assignment / referencing of research papers / seminar / industrial visits/Field Visit / training course/viva-voce as a part of internal assessment in each semester. The students are supposed to attend all the tests. The students should note that re-test will not be permitted to the student absent for the test/s unless the case is considered by competent authority.
3. The students opting for dissertation course shall follow the rules framed for the same.
4. The students are supposed to attend all the Industrial Workshops / Laboratory Workshops / Training Programme/ symposia/ seminar/ field visit / study tour organized by the department/ college. The students shall attend these programmes at their own cost.

### **4) Eligibility:**

The candidate should have a B.Sc. degree with Zoology as principal subject or B.Sc. (General) degree with Zoology as one of the subsidiary subjects. Graduates in any life science related subjects such as Biotechnology, Bioinformatics, Life science, Biochemistry, Microbiology, Agriculture, Veterinary sciences, Biology, Botany etc.

Admission: 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.

### **5) Examination**

#### **[A] Pattern of Examination**

Evaluation of Students:

- 1) The In-semester and End-Semester examinations will be of 50 marks each.
- 2) Student has to obtain 40% marks in the combined examination of In-Semester and End-Semester assessment with minimum passing of 30% marks in both assessments separately.
- 3) A student cannot register for third semester if he/she fails to complete the 50% credits of the total expected within two semesters.
- 4) Internal marks remain unchanged and internal assessment cannot be repeated. If student remain absent during internal assessment examination, he/she will have second chance with the permission of the competent authority. But it will not be right of the student. It will be under the discretion of the competent authority and internal departmental assessment committee. In case he/she wants to repeat Internal, he/she can do so only by registering for the said courses.
- 5) There shall be revaluation of answer script of end semester examination, but not of internal assessment papers.

i. **In-semester Examination:** Internal assessment for each course would be continuous and dates for each tutorials/practical tests etc. will be pre-notified in the time table for teaching or placed separately as a part of time table. Department / College Internal Assessment Committee will coordinate this activity.

a) **Theory Courses:** Students should be encouraged to participate in various academic activities. A teacher must select a variety of the procedures for conducting internal assessment suggested as follows.

- a) Multiple choice questions
- b) Combination of objective and subjective questions.
- c) Open book test (concerned teacher will decide the allowed books)
- d) Tutorial
- e) Surprise test specified topics in a given notified period
- f) Oral
- g) Assignments
- h) Review of research paper
- i) Seminar presentation
- j) Journal/Lecture/Library notes

Student has to preserve the documentation of the internal assessment except midterm test answer script. It is the responsibility of the student to preserve the documents.

b) **Practical Courses:** It is a continuous evaluation process. Practical courses will be evaluated on the basis of the following:

1. Performance assessment of each experiment on the basis of attendance, punctuality, journal completion, practical skills, results, oral and analysis.
2. Assessment on practical course be conducted before the end-semester examination.
3. Assessment of each experiment shall be done for each practical weekly.
4. Assessment of the Activity will be based on any one of the following (per practical course).
  - i. Special training programs in recognized research institutes such as NCL, NIO, NIV, ZSI, BNHS, etc.
  - ii. Project on Research Methodology
  - iii. Industrial/Institution Visit report
  - iv. Field visit report/ study tour report

The student strength of practical batch should be 12.

**Project Course:** Project will be evaluated by the examiner/s in consent with the project guide if required.

ii. **End-Semester Examination:** The End-semester examination programme will be scheduled as per the notifications and guidelines issued by the Examination section of University of Pune.

**[B] Standard of Passing**

Student has to obtain 40% marks in the combined examination of In-Semester and End-Semester assessment with minimum passing of 30% passing in both assessments separately.

**[C] ATKT Rules**

A student cannot register for third semester if he/she fails to complete the 50% credits of the total credits expected to be ordinarily completed within two semesters.

**[D] Award of Class**

Grades will be awarded from grade point average (GPA) of the credits.

**GPA Rules:**

1. The formula for GPA will be based on Weighted Average. The final GPA will not be printed unless a student passes courses equivalent to minimum 100 credit hours (Science). Total credit hours indicate the sum of credit hours of the courses which a student has passed.
2. A seven point grade system [guided by the Government of Maharashtra Resolution No. NGO – 1298 / [4619] / UNI 4 dt. December 11, 1999 and University regulations] will be followed. The corresponding grade table is attached herewith.
3. If the GPA is higher than the indicated upper limit in the third decimal digit then the student be awarded higher final grade (e.g. a student getting GPA of 4.492 may be awarded 'A')
4. For Semester I, II, III examinations, only the grade points will be awarded for each subject. Final GPA along with final grade will be awarded only at the end of IV semester. There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. The revaluation result will be adopted if there is a change of at least 10% marks and in the grade of the course.
5. After the declaration of result, for the improvement of Grade, the student can reappear for the examination of 30 credits worth theory courses.
6. Grade improvement programme will be implemented at the end of the academic year. A student can opt for grade improvement programme only after the declaration of final semester examination i.e. at the end of next academic year after passing M.Sc. (Zoology) examination and within two years of completion of M.Sc. (Zoology). A student can appear for grade improvement programme only once.

Grade and Grade Point Average		
Marks	Obtained Grade	Grade Points
100 – 75	'O' Outstanding	06
74 – 65	'A' Very Good	05
64 – 55	'B' Good	04
54 – 50	'C' Average	03
49 – 45	'D' Satisfactory	02
44 – 40	'E' Pass	01
39 and less	'F' Fail	00

Final Grade Points	
Grade Points	Final Grade
5.00 – 6.00	<b>O</b>
4.50 – 4.99	<b>A</b>
3.50 – 4.49	<b>B</b>
2.50 – 3.49	<b>C</b>
1.50 – 2.49	<b>D</b>
0.50 – 1.49	<b>E</b>
0.00 – 0.49	<b>F</b>

Common Formula for Grade Point Average (GPA):

$$\text{GPA} = \frac{\text{Total of Grade Points earned} \times \text{Credit hours for each course}}{\text{Total Credit hours}}$$

B Grade is equivalent to at least 55% of the marks

**[E]External Students:** There shall be no external students.

**[F]Setting of Question Paper / Pattern of Question Paper**

For core (compulsory) theory courses end semester question papers set by the University of Pune and 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.

Theory examination will be of 3 hours duration for each theory course of 4 credits. There shall be 3 questions each carrying marks as shown below. The pattern of question papers shall be:

Question 1 (20 Marks)	10 compulsory sub-questions, each of 2 marks; answerable in 2 -3 lines
Question 2 (20 Marks)	5 out of 7– short answer type questions.
Question 3 (10 Marks)	2 out of 3 – Long answer type questions.

### [G]Verification / Revaluation

There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. The revaluation result will be adopted if there is a change of at least 10% marks and in the grade of the course. There shall be revaluation of answer script of end semester examination, but not of internal assessment papers.

### 6) Structure of Course

Basic structure/pattern (Framework) of the proposed postgraduate syllabus for the two year integrated course leading to M.Sc. (Zoology) in the colleges affiliated to Pune University.

#### M.Sc. Zoology - Course structure & Credits Distribution

#### M.Sc. Zoology –Part –I Semester-I

Course No	Title	Credits	Course No	Title	credits
ZY 101T	Biochemistry-I	3C	ZY 101 P	Practicals in Biochemistry-I	3C
ZY 102T	Cell Biology	3C	ZY 102 P	Practicals in Cell Biology	2C
ZY 103T	Genetics	2C	ZY 103 P	Practicals in Genetics	2C
ZY104T	Biostatistics	2C	ZY104 P	Practicals in Biostatistics	2C
ZY105T	Skills in Scientific communication and writing	2C	ZY105 P	Practicals in Skills in Scientific communication	2C
ZY106T	Fresh Water Zoology	2C	ZY106 P	Practicals in Fresh Water Zoology	2C
		<b>14C</b>			<b>13C</b>

(T = Theory ; P = Practicals)

**Total credits =27**

**Note:- Courses equivalent to atleast 25 credits should be taken by the students.**

#### Semester-II

Course No	Title	credits	Course No	Title	credits
ZY 201T	Biochemistry-II	3C	ZY 201 P	Practical Biochemistry-II	3C
ZY 202 T	Molecular Biology	3C	ZY 202 P	Practical Molecular Biology	3C
ZY 203T	Developmental Biology	2C	ZY 203 P	Practical Developmental Biology	2C
ZY204T	Endocrinology	2C	ZY204 P	Practical Endocrinology	2C
ZY205T	Comp.Animal Physiology	2C	ZY205 P	Practical Comp.Animal Physiology	2C
ZY206T	Biochemical techniques/ Ichthyology	2C	ZY206 P	Practicals in Biochemical techniques/ Ichthyology	2C
		<b>14C</b>			<b>14C</b>

(T = Theory ; P = Practicals)

**Total credits =28**

**Note: - Courses equivalent to atleast 25 credits should be taken by the students.**

## M.Sc. Zoology –Part –II

### Semester-III

Course No	Title	Credit	Course No	Title	credits
ZY 301T	Animal Physiology I (special) or Entomology I (special) or Genetics I (special)	4C	ZY 301 P	Practicals in Animal Physiology I/Entomology I/Genetics I	3C
ZY 302T	Immunology / Environmental biology	2C	ZY 302 P	Practicals in Immunology / Environmental biology	2C
ZY 303T	Genetic toxicology / Aquaculture	2C	ZY 303 P	Practicals in Genetic toxicology / Aquaculture	2C
ZY304T	Insect physiology and biochemistry	2C	ZY304 P	Practicals in Insect physiology and biochemistry	2C
ZY305T	Research methodology	2C	ZY305 P	Practicals in Research methodology	2C
ZY306T	Parasitology	2C	ZY306 P	Practicals in Parasitology	2C
ZY307T	Fundamentals of Systematics	2C	ZY307 P	Practicals in Fundamentals of Systematics	2C
ZY 308T	Insect Ecology	2C	ZY308 P	Research Project	2C
ZY 309 T	Toxicology I	2C	ZY 309 P	Practicals in Toxicology I	2C
		20C			19C

(T = Theory ; P = Practicals)

**Total credits =39**

**Note:-** courses equivalent to atleast 25 credits should be taken by the students.

### Semester-IV

Course No	Title	Credit	Course No	Title	Credits
ZY 401T	Animal Physiology II (special) or Entomology II (special) or Genetics II (special)	4C	ZY 401 P	Practical Animal Physiology II/ Entomology II/ Genetics II	3C
ZY 402 T	Economic Zoology / Bacteria and phage Genetics	2C	ZY 402 P	Practical Economic Zoology / Bacteria and phage Genetics	2C
ZY 403T	Mammalian reproductive physiology / Biodiversity assessment	2C	ZY 403 P	Practical Mammalian reproductive physiology / Biodiversity assessment	2C
ZY404T	Histology and histochemistry	2C	ZY404 P	Practical Histology and histochemistry	2C
ZY405T	Pollution biology	2C	ZY405 P	Practical Pollution biology	2C
ZY406T	Apiculture	2C	ZY406 P	Practical Apiculture	2C
ZY 407T	Pest control	2C	ZY308 P	Research Project	2C
ZY 408 T	Toxicology II	2C	ZY 408 P	Practicals in Toxicology II	2C
		18C			17C

(T = Theory ; P = Practicals)

**Total credits = 35**

**Note:-** courses equivalent to Atleast 25 credits should be taken by the students.

**a) Question Papers and papers etc.:**

Theory

In-Semester Examination : 50 Marks

End-Semester Examination : 50 Marks

Practical

In-Semester Examination : 50 Marks

End-Semester Examination : 50 Marks

**b) Medium of Instructions:** English.

**7) Equivalence of Previous Syllabus:**

<b>Old Course (2008 Pattern)</b>	<b>New Course (2013 Pattern)</b>
ZY 101 Biochemistry	ZY101T: Biochemistry
ZY 202 b Cell Biology	ZY102T: Cell Biology
ZY 102 a Genetics	ZY103T: Genetics
ZY 103 b Statistical Methods	ZY104T: Biostatistics
ZY 102 b English for Scientists	ZY105T: Skills in scientific communication and writing
ZY 103 a Fresh Water Zoology	ZY106T: Fresh water zoology
ZY 104 a Biochemistry	ZY101P: Practicals in Biochemistry
ZY 205 b Cell biology	ZY102P: Practicals in Cell Biology
ZY 105 b Genetics	ZY103P: Practicals in Genetics
ZY 105 a Statistical Methods	ZY104P: Practicals in Biostatistics
ZY 105 c English for Scientists	ZY105P: Practicals in Skills in scientific communication and writing
ZY 104 b Fresh water Zoology	ZY106P: Practicals in Fresh water zoology



<b>Old Course (2008 Pattern)</b>	<b>New Course (2013 Pattern)</b>
ZY 101 Biochemistry	ZY 201 T Biochemistry-II
ZY 202 a Molecular Biology	ZY 202 T Molecular Biology
ZY 201 a Developmental Biology	ZY 203 T Developmental Biology
ZY 203 b Endocrinology	ZY 204 T Endocrinology
ZY 201 b Comparative Animal Physiology	ZY 205 T Comparative Animal Physiology
ZY 203 a Biochemical Techniques/ Ichthyology	ZY 206 T Biochemical techniques/ Ichthyology
ZY 104 a Biochemistry	ZY 201P Practical Biochemistry-II
ZY 204 b Molecular biology	ZY 202P Practical Molecular Biology
ZY 205 a Developmental Biology	ZY 203P Practical Developmental Biology
ZY 205 c Endocrinology	ZY 204P Practical Endocrinology
ZY 204 a Comparative Animal Physiology	ZY 205P Practical Comparative Animal Physiology
ZY 204 c Biochemical techniques/ Ichthyology	ZY 206P Practicals in Biochemical techniques/ Ichthyology

### 8) University Terms:

Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only for duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

### 9) Qualification of Teacher:

- i. M.Sc. (Zoology) degree with NET/SET/ Ph.D qualification.
- ii. Recognition of Pune University as a post graduate teacher, by papers.
- iii. Other criteria as per the guidelines of UGC and University of Pune.

### 10) Detail Syllabus with Recommended Books

## M.Sc. Zoology –Part –II

### Semester-III

Course No	Title	Credit	Course No	Title	credits
ZY 301T	Animal Physiology I (special) or Entomology I (special) or Genetics I (special)	4C	ZY 301 P	Practicals in Animal Physiology I/Entomology I/Genetics I	3C
ZY 302T	Immunology / Environmental biology	2C	ZY 302 P	Practicals in Immunology / Environmental biology	2C
ZY 303T	Genetic toxicology / Aquaculture	2C	ZY 303 P	Practicals in Genetic toxicology / Aquaculture	2C
ZY304T	Insect physiology and biochemistry	2C	ZY304 P	Practicals in Insect physiology and biochemistry	2C
ZY305T	Research methodology	2C	ZY305 P	Practicals in Research methodology	2C
ZY306T	Parasitology	2C	ZY306 P	Practicals in Parasitology	2C
ZY307T	Fundamentals of Systematics	2C	ZY307 P	Practicals in Fundamentals of Systematics	2C
ZY 308T	Insect Ecology	2C	ZY308 P	Research Project	2C
ZY 309 T	Toxicology I	2C	ZY 309 P	Practicals in Toxicology I	2C
		20C			19C

(T = Theory ; P = Practicals)

**Total credits =39**

**Note:- courses equivalent to atleast 25 credits should be taken by the students.**

### Semester-IV

Course No	Title	Credit	Course No	Title	Credits
ZY 401T	Animal Physiology II (special) or Entomology II (special) or Genetics II (special)	4C	ZY 401 P	Practical Animal Physiology II/ Entomology II/ Genetics II	3C
ZY 402 T	Economic Zoology / Bacteria and phage Genetics	2C	ZY 402 P	Practical Economic Zoology / Bacteria and phage Genetics	2C
ZY 403T	Mammalian reproductive physiology / Biodiversity assessment	2C	ZY 403 P	Practical Mammalian reproductive physiology / Biodiversity assessment	2C
ZY404T	Histology and histochemistry	2C	ZY404 P	Practical Histology and histochemistry	2C
ZY405T	Pollution biology	2C	ZY405 P	Practical Pollution biology	2C
ZY406T	Apiculture	2C	ZY406 P	Practical Apiculture	2C
ZY 407T	Pest control	2C	ZY308 P	Research Project	2C
ZY 408 T	Toxicology II	2C	ZY 408 P	Practicals in Toxicology II	2C
		18C			17C

(T = Theory ; P = Practicals)

**Total credits = 35**

**Note:- courses equivalent to Atleast 25 credits should be taken by the students.**

**Equivalence of Previous Syllabus: Sem. III and Sem IV**

<b>Old Course -2008 Pattern Sem III</b>	<b>New Course- 2013 Pattern Sem III</b>
ZY 311 Entomology I	ZY 301 T Entomology I (Special )
ZY 312 Genetics I	ZY 301 T Genetics I (Special )
ZY 313 Physiology I	ZY 301 T Animal Physiology I (Special )
ZY 321 Immunology	ZY 302 T Immunology
ZY 322 Environmental Biology	ZY 302 T Environmental Biology
ZY 323 Fundamentals of Systematics	ZY 307 T Fundamentals of Systematics
ZY 324 Aquaculture	ZY 303 T Aquaculture
ZY 325 Insect Ecology	ZY 308 T Insect Ecology
ZY 331 Parasitology	ZY 306 T Parasitology
ZY332 Insect Physiology and Biochemistry	ZY 304 T Insect Physiology and Biochemistry
ZY333 Modern Concepts in Animal Evolution	ZY 309 T Toxicology I
ZY 334 Genetic Toxicology	ZY 303 T Genetic Toxicology
ZY 335 Insect Behaviour	No equivalence
ZY 341 Research Project	ZY 308 P Research Project
ZY 351 A Practicals for Special Paper I	ZY 301 P Practicals in corresponding Course
ZY 351 B Laboratory exercises in related courses Zy 321-325 and Zy 331-335	ZY 302 - 309 Practicals in Corresponding courses.

<b>Old Course -2008 Pattern Sem IV</b>	<b>New Course- 2013 Pattern Sem IV</b>
ZY 411 Entomology II	ZY 401 T Entomology II
ZY 412 Genetics II	ZY 401 T Genetics II
ZY 413 Physiology II	ZY 401 T Animal Physiology II
ZY 421 Animal tissue Culture	ZY 408 T Toxicology II
ZY 422 Pollution Biology	ZY 405 Pollution Biology
ZY 423 Marine Biology	ZY 402 Economic Zoology
ZY 424 Bacterial and Phage Genetics	ZY 402 T Bacterial and Phage Genetics
ZY 425 Medical Entomology	ZY 407 T Pest Control
ZY 431 Physiology of Mammalian reproduction	ZY 403 T Mammalian Reproductive Physiology
ZY 432 Comparative Invertebrate Histology and Histochemistry	ZY 404 T Histology and Histochemistry
ZY 433 Biodiversity Assessment	ZY 403 T Biodiversity Assessment
ZY 434 Protozoology	No equivalence
ZY 435 Apiculture	ZY 406 T Apiculture
ZY 441 Laboratory Experiments in Special Paper II	ZY 401 P Practicals in corresponding Course
ZY 451 Laboratory Exercises in related courses Zy 421-425 and ZY 431-435	ZY 402 -408 Practicals in Corresponding courses.

**ZY 301 (T) – Animal Physiology I (4 credits)**

Sr.No	Topic	Hours
1	<b>Bioluminescence and Animal electricity</b> 1.1 Bioluminescence: phyletic distribution, structure of luminescent organs, biochemical and molecular mechanism. 1.2 Animal electricity: electro receptors electro organs and their structure and	10
2	<b>Buoyancy:</b> definition, density reduction, gas floats with examples swim bladder with example.	7
3	<b>External and Internal environment:</b> 3.1 External environment: the atmosphere, aquatic & terrestrial environment 3.2 Internal environment: Extracellular and intra cellular environment 3.3 Homeostasis and regulation: tolerance and resistance, acclimatisation and acclimation, regulatory mechanism. 3.4 Biological clock and their regulation: Circadian rhythms lunar and tidal rhythm, circa annual rhythm, photoperiodism.	7
4	<b>Membrane physiology</b> 4.1 Membrane structure, membrane permeation, diffusion mediated transport, dynamics of semi permeable membrane. 4.2 resting membrane potential, diffusion, equilibrium potential, Goldman-Hodkin- Katz potential, conductance, current, capacitance 4.3 Excitable cell membrane: action potential, role of various ion channels, role of $\text{Na}^+$ $\text{K}^+$ pump, properties of action potentials	10
5	<b>Energy metabolism:</b> 5.1 Metabolic rate 5.2 Energy storage: Fat and glycogen 5.3 Effect of $\text{O}_2$ concentration: acclimation to low $\text{O}_2$ level, anaerobic metabolism, lactic acid and glycolysis 5.4 Problem of diving and deep sea hydro thermal vent 5.5 Metabolic rate and body size: mammals, birds, marsupials & monotremes 5.6 Energy cost of locomotion: running, swimming, flying 5.7 Effect of high altitude	15
6	<b>Excretion:</b> 6.1 Nitrogenous waste- ammonia and its excretion, urea, urea cycle, uric acid and its excretion, products of nucleoprotein metabolism, miscellaneous end product of nitrogen metabolism. 6.2 Organ of excretion and urine formation 6.3 Renal regulation and acid –base balance.	6
7	<b>Osmoregulation -</b> Maintaining water and electrolyte balance and its regulation in aquatic invertebrates & vertebrate, moist skinned animals, arthropods, terrestrial, vertebrate and marine air breathing vertebrates	5

References

1. Guyton A.C and Hall J.E, Text book of medical physiology, Hartcort brace and co. Asia Pvt.Ltd., Singapore.
2. Baldwin, E. An introduction to Comp Biochemistry. Cambridge.
3. Hill, R.W. & GA Wyse, . Animal physiology. Harper & Row, NW.
4. Randall, D, W.Burggen & K, French. Eckert Animal Physiology : Mechanism and adaptation, W H Freeman, NY
5. Schmidt-Nielsen, Animal Physiology: Adaptation and Environment. Cambridge.
6. Hoar, W S General and Comparative physiology. Prentice Hall, India, New Delhi.
7. Vernberg, F.J. & Vernberg, WB . Animal and the environment. Holt, Rienhart & Winston, NY.
8. Prosser and Brown. Comparative physiology.

**ZY 301 (P) – Animal Physiology I (3 credits) (1P: 3 hrs) (15PX3= 30 hrs)**

1	Estimation serum uric acid	1p
2	Body size and oxygen consumption in aquatic animals	1p
3	Effect of salinity on oxygen consumption in aquatic animals	1p
4	Absorption spectra of blood pigment	1p
5	Osmotic stress and volume change in earthworm	1p
6	Effect of temperature on water loss in cockroach	1p
7	Carbohydrates in mammalian gut	1p
8	Detection of allantoin in mammalian urine	1p
9	Glomerular filtration rate by creatinine clearance	1p
10	Effect of starvation on liver and muscle glycogen in mouse	2p
11	Induction of heat shock puff in salivary gland chromosomes of Drosophila	1p
12	Estimation of blood Sodium, potassium, Calcium	1p
13	Estimation of blood alkaline & acid phosphatases	1p
14	Normal & abnormal constituents of human urine	1p

## ZY- 301 T Entomology I (Special) 4 Credits

1. Introduction to Entomology: Definition, Origin , Evolution and Inter-relationship of insects with other arthropods. 03L
2. General outline of Classification and Phylogeny of insects: Aptrygote insects (1-4 order), Exopterygote insects (5-20 order) and Endopterygote insects (21-29 order). 20L
3. Integument and it's derivatives. 02L
4. Comparative study of : Head and its appendages; Thorax and its appendages ; Abdomen and it's appendages. 08L
5. Comparative and histological studies of the following systems: Digestive system, Respiratory system, Circulatory system and Excretory system and Reproductive system, Nervous system. 20L
6. Studies of the following systems: The Sense organs, Endocrine glands and Exocrine glands. 05L
7. Light and sound producing organ. 02L

### Reference Books

1. Imms' Text book of Entomology- By O. W. Richards and R. G. Davies, (Methuen &Cc., London, ), Vols. I & II.
2. Principles of Insect Morphology- By R. E. Snodgrass, (Tata, McGraw- Hill, Bombay, .
3. Introduction of Comparative Entomology- By R. M. Fox & J. W. Fox, (Reinhold, New York,).
4. The Insect: Structure & Function- By R.F. Chapman (E. L.B.S., & E.U.P. London, ).
5. General & Applied Entomology- By K.K. Nayar, T.N. Anathakrishnan & B.V.David, (Tata,McGraw-Hill, New Dehli, ).
6. A Text book of Entomology' by H. H. Ross (John Wiley and Sons, Ins. New York,).

**ZY- 301P Entomology I Practical Course (3 Credits)**

1. Method of collection, preservation & presentation of insect. 1P
2. Study of generalized insect including Systematic position, Habit and Habitat, Important morphological features and Dissection of so as to study: Digestive. Nervous and Reproductive system and Retrocerebral complex. 3P
3. Study of head capsule, mouthparts and antenna and their modification. 2P
4. Study of generalized wing and their modification with significance. 1P
5. Study of insect orders; (i) Apterygote insects, (ii) Exopterygote insects and (iii) Endopterygote insects inclusive of Taxonomy and diagnostic features upto family ( atleast one insect from each order). 6P
6. 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. 3P
7. Temporary mounting of Mouth parts, Antenna, Wings and Appendage of the insect pest used in practical number 4. 1P

**Note:- 15 practicals are to be performed by the students.**

**ZY-301T: Genetics I****4 Credits.****1. Model Genetic System: Life cycles and advantages of the following organisms commonly used in genetic studies** 08 L

- 1.1 T4 and T1 phages
- 1.2 *Neurospora*
- 1.3 *E.coli*
- 1.4 *Saccharomyces cerevisea* and *Schizosaccharomyces pombe*
- 1.5 *Caenorhabditis*
- 1.6 *Drosophila*
- 1.7 Zebra fish
- 1.8 Mouse

**2. Advanced Population Genetics:** 13L

- 2.1 Recapitulation of basic concepts and H-W 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 matings, inbreeding, genetic drift

**3. Evolutionary genetics:** 13L

- 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.

**4. Evolutionary Genetics:** 13L

- 4.1 Genetic polymorphism
- 4.2 Selection strategies and effects
- 4.3 Genetics of speciation- classical and modern concepts
- 4.4 Use of molecular information in understanding phylogenetic relationship

**5. Applications of Molecular methodologies in genetic analysis:** 13L

- 5.1 Introduction to gene localization on chromosomes
- 5.2 Chromosomal Probes and Paints
- 5.3 Gene Therapy: Ex vivo and In vivo gene therapy and two examples of gene delivery system
- 5.4 Reverse Genetics

**Reference books**

1. Strickberger, M.W., genetics, Edn III, Mac Millan,
2. Gardner, E.J., Simmons, M.J. and Snustad, D.P. Principles of genetics, John Wiley and Sons, NY,
3. Griffiths, A.J.F., Miller, J.H., Suzuki, D.T., Lewontin, R.C. and Gelbert, W.M. An introduction to Genetics analysis. W.H. Freeman and Co. NY,
4. Trends in genetics, Elsevier Publication, Amsterdam.
5. Genetics: Analysis of Genes and Genomes, D.L. Hartl, E. W Jones, Jones and Bartlett Publ. 2009.
6. Genes X: Benjamin Lewin, Jones and Bartlett Publications 2014.



**ZY 301 P Practicals in Genetics I Credits - 03**

1. Analysis of metric trait and estimation of phenotypic variance. [1P]
2. Partitioning of phenotypic variance in genetic and nongenetic 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 *Drosophila*: [1p]
  - a) Genetic Drift
  - b) Artificial selection- Experimental simulation and modeling.
5. Extraction of Genomic DNA from *Drosophila*. [2P]
6. Microbial genetics: Basic methodology, colony count, growth curve [2P]
7. Microbial genetics: Isolation of Auxotroph (Estimation of frequency) Replica plate technique. [2P]
8. Bacterial transformation and blue white selection. Calculation of transformation efficiency. [1P]
9. Study of conventions of nomenclature of genes and gene products in different model systems. [2P]

**ZY 302 (T) – Immunology (2 credits)**

<b>Sr. No.</b>	<b>Topic</b>	<b>Lectures</b>
<b>1</b>	Immune System: a) Introduction to Immunology b) Concept of immunity (self –nonself, antigen, antibody, immune response, immunological tolerance, autoimmune disease) and active and passive immunization, c) Primary and Secondary lymphoid organ. Tissue, cells and molecules of the human immune system.	<b>3</b>
<b>2</b>	Humoral immunity, and cell mediated immunity, T cell receptors.	<b>2</b>
<b>3</b>	Immediate response to infection:, Inflammation, cell migration, acute phase response interferon's and NK cell.	<b>3</b>
<b>4</b>	Antibody structure, antibody classes, subclasses, structure- function relationship, iso, idio and allo types	<b>4</b>
<b>5</b>	Theories of antibody synthesis, generation of antibody diversity ( molecular basis), Antibody class switching	<b>3</b>
<b>6</b>	Antigen antibody reaction and complement fixation pathways.	<b>2</b>
<b>7</b>	Immunogenetics: HLA and Disease association, immune deficiencies and disorders. Antigen processing and MHC	<b>5</b>
<b>8</b>	Hybridoma principle and application, ELISA, Immunofluorescence, Immunoelectrophoresis, RIA and Monoclonal & Polyclonal Antibody and its application	<b>5</b>
<b>9</b>	Immunological Memory and Vaccination	<b>3</b>

**Reference books**

1. Essential immunology, Ivon Roitt, Blackwell scientific publications, London.
2. Immunology, I.V. Roitt, Butterworth publishers, USA
3. Kuby Immunology: Kindt T.J., Goldsby R.A., Osborne B.A., Kuby J. : Freeman WH Publ.

**ZY 302 (P) – Immunology (2 credits) (1P: 3 hrs) (10PX3= 30 hrs)**

1	Ouchterlony technique of agar gel diffusion	2p
2	Immunoelectrophoresis	2p
3	Haemagglutination inhibition test	2p
4	Histology of Lymphoid organ- Skin, Spleen, Thymus, Ilium, Lymph node, Bone marrow	2p
5	Blood smear preparation to study various blood cells	2p
6	Blood group analysis with reference to cross matching	2p
7	To estimate the antigen concentration using rocket electrophoresis	2p
8	Dot immunobinding assay to detect antibodies in the serum	2p
9	To perform ELISA.	2p

## **ZY302 T Environmental Biology (2 C= 30 Lectures)**

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. (6 L)
2. Environmental Microbiology: Microbes - classification and their applications in the environmental sciences. Cultivation and growth of microorganisms. Microorganisms and their association with man, animals and plants. Microbes as anti-microbial agents. (2L)
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 of India and their conservation issues. Forests and semi-arid habitats of India: their distribution in India, ecological status of forests and arid lands, and their conservation. (4L)
7. Endangered, Endemic and Extinct Species of India: Threatened species categories of IUCN, threatened species of plants and animals in India and their reasons, Red data books. (3L)
9. Wildlife management and conservation. Protected Areas Network in India: Goals of management, Strategies for planning. Factors influencing wildlife management such as habitats, population, behavior, 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. (7L)

### **References:**

1. Fundamentals of Ecology: E. P. Odum
2. Modern concepts in Ecology: H: D. Kumar
3. Microbes, Man and Animals: The Natural History of Microbial Interactions: Linton, A. H. and Burns, R.G. John Wiley and Sons.
4. Elements of Microbiology: Pelczar, M.J. and Chan ECS, McGraw Hill.
5. General Microbiology: Stainer, R.Y .. , Adelberg, EA and Ingraham, J.L. . Macmillan Press.
6. Microbial Methods for Environmental Biotechnology: Grainer, J.M. and Lynch, J.M. . Academic Press.
7. Microbiological Methods for Environmental Scientists and Enginners : Gaudy, A.F. and Guady, E.T. McGraw Hill.

### ZY302 P Environmental Biology (2C)

1.	A visit to aquatic ecosystem and methods for water and plankton collection	2P
2.	Plankton identification and quantification from river / lake water samples.	2P
4.	Vegetation studies by line, quadrates and belt transect methods and their analysis.	2P
5.	Preparation of media for microbial culture, Isolation and culturing of microbes from soil/water samples.	2P
5.	Water analysis for physico-chemical characteristics.	1P
6.	Physico chemical analysis of soil.	1P

### ZY 303 (T) – Genetic Toxicology (2 credits)

Sr.No.	Topic	Lectures
1	Toxicology: Definition and its subdivisions, scope and significance of genetic toxicology	3
2	Mutations at molecular, functional and chromosomal levels. Mechanisms of Mutagenesis End point mutations and its function, carcinogenicity and transformation. Biological significance of mutagenesis	7
3	Mutagenic agents in human environment. Applications of genetic toxicology to human and environmental monitoring	5
4	Methodologies used in detection of mutation, functional, cytogenetic effects. Use of Ames test, mammalian systematics, Drosophila etc.	5
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.	7
6	Genetic toxicology and its role in the study of congenital malformations	3

#### 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. Suttoa, H.E. and Harris, M.I., Academic press
4. Mutation research (section on genetic toxicology testing)
5. Journal of environmental pathology and toxicology, Patnotox Publ. Inc.
6. Genetic Toxicology: Principles and methods, Parry J.M., Parry E.M. (eds) Springer Publ. (2012)
7. Principles of Genetic Toxicology: David Brusick. Springer

**ZY 303 (P) – Genetic Toxicology (2 credits) (1P: 3 hrs) (10PX3= 30 hrs)**

1	Dominant lethal test in <i>Drosophila</i>	2 P
2	Sex linked recessive lethal test in <i>Drosophila</i>	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	2P
7	Study of <i>Drosophila</i> mutants and maintaining <i>Drosophila</i> culture.	2p

**ZY 303 T: AQUACULTURE (2 Credits = 30 lectures)**

I. Aquaculture concept, Culture systems: Freshwater aquaculture systems: Freshwater prawn culture, fish culture in paddy fields, Brackish water culture, Mariculture: Oyster culture, Crab culture, Lobster culture, mussel culture, culture of Eels, Culture of aquatic weeds. (3 L)

**2. Composite fish culture: (5L)**

- 2.1 Definition and various patterns.
- 2.2 Mixed fish farming in India.
- 2.3 Techniques of composite culture.
  - 2.3.1 Culture of buffalo fish ..
  - 2.3.2 Culture of Catfishes.
  - 2.3.3 Culture of miscellaneous fishes.
  - 2.3.4 Cray fish culture.

**3. Preparation and management of fish culture ponds. (3L)**

- 3.1 Nursery ponds.
  - 3.1.1 Predatory and Weed fishes and their control.
  - 3.1.2 Fish toxicants.
  - 3.1.3 Fertilization.
  - 3.1.4 Aquatic insects and their control.
  - 3.1.5 Fish food organisms and their production.
  - 3.1.6 Stocking.
  - 3.1.7 Supplementary feeding.
- 3.2 Rearing ponds
- 3.3 Stocking ponds.
- 3.4 Fish breeding: Natural & Artificial.

**4. Transport of fish seed and Brood fish. (5L)**

- 4.1 Causes of mortality in transport.
- 4.2 Methods for packaging and transport.
  - 4.2.1 Open systems.
  - 4.2.2 Closed systems.
- 4.3 Use of chemicals in live fish transport.
  - 4.3.1 Anesthetic drugs.
  - 4.3.2 Antiseptics & Antibiotics.

**5. Harvesting: Fishing techniques, preservation & processing of fish, (2L)****6. Fish pathology:**

- 6.1 Parasitic infections.
  - 6.1.1 Fungus infections.
  - 6.1.2 Protozoan diseases.

- 6.1.3 Worm diseases.  
6.2 Non parasitic diseases.
- 7. Fresh water prawn culture.** (2L)
- 7.1 Introduction.  
7.2 Breeding characteristics.  
7.3 Juvenile prawn migration.  
7.4 Seasonal & regional distribution of seeds.  
7.5 Identification of juveniles.  
7.6 Controlled breeding.  
7.7 Culture:  
7.7.1 Ponds.  
7.7.2 Monoculture.  
7.7.3 Mixed culture.  
7.7.4 Role of hard water in culture of *Macrobrachium* species.  
7.7.5 Fertilization & feeds. (3L)
- 8. Pearl culture:** Introduction, Pearl producing mollusks, pearl formation, collection of oysters, rearing of oysters, insertion of nucleus, harvesting of pearls, composition & quality of pearl. (4L)
- 9. Technologies in Fisheries development:** Recirculation technology, Geographic Information System (GIS) technology, passive Acoustics in fisheries, Use of Information Communication Technology (ICT) in fishes: production aspects, marketing aspects. (3L)

### **REFERENCE BOOKS**

1. Fish and fisheries of India, V. G. Jingran, Hindustan pub. corp. New Delhi.
2. Textbook of fish culture, Marcel Hute and Heny Kahn, Blackwell Scientific Publication, Australia.
3. Text book of Aquaculture, M. Srinivasulu, Reddy, KRS Sambhasiva Rao, Discovery Publishing House New Delhi.
4. Fisheries & Aquaculture Biotechnology. Yawn Mehta, Campus Books International, Prahalad street, Ansari Road, Durga Ganj, New Delhi.

**ZY 303 P: PRACTICALS IN AQUACULTURE (2 Credits) (1P: 3 hours) (IOPX 3= 30 hours)**

1. Culture of Daphnia & Rotifers as fish food animals. (IP)
2. Histopathological & Biochemical investigations to test freshness of the fish, Prawn tissue. (This is necessary as the fresh fish are good.) (3P)
3. Study of Indian Oysters (Shells & their brief biology) . (IP)
4. Visit to artificial pearl culture. (IP)
5. Methods of processing, storing fish & prawns (ex. Salting & Drying) (2P)
6. To study the habit & habitat of some important culturable freshwater fishes. (IP)
7. Estimation of productivity of water bodies. (IP)
8. Hypophysation of fishes. (IP)

**ZY 304 T Insect Physiology and Biochemistry (02 Credits)**

1. Integument : Structure, Chemistry, sclerotization, functions. 03 L
2. Digestion and absorption of proteins, Carbohydrates and lipids. 03 L
3. Fat body : Structure, physiology, biochemistry, functions. Integration of carbohydrate, fat and acid metabolism 04 L
4. Ventilatory mechanisms and their control 03 L
5. Haemolymph :Physico-chemical characteristics of plasma : types and structure of haemocytes, functions. 03 L
6. Muscle : structure, physiology and biochemistry of flight muscles 03 L
7. Excretion and water balance: Structure and function of malphigian tubules. Water balance and nitrogen excretion. 04 L
8. Microsomal and extramicrosomal enzymes insecticide degradation and detoxification. 03 L
9. Endocrines, neurosecretory hormones, chemistry, function and mechanism of hormone action, moulting and juvenile hormones ; chemistry and physiology, other peptide and steroid hormones 04 L

## Reference books :

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

**ZY 304 P Practicals in Insect Physiology And Biochemistry (02 Credits)**

1. Kymographic study of ventilatory movement in beetle.	01 P
2. Oxygen consumption in dragon fly nymph	01 P
3. Study of heart and haemocytes of cockroach	01 P
4. To determine the trehalase activity in haemolymph of any insect.	01 P
5. Amino acid in haemolymph of any insect by chromatographic technique.	02 P
6. Study of fat body glycogen of cockroach and effect of starvation	01 P
7. Assay of amylase in midgut of cockroach	01 P
8. Effect of temperature on water loss in cockroach	01 P
9. Von Wisselinghs test for presence of chitin in insect cuticle	01 P

**ZY 305 T RESEARCH METHODOLOGY :(2 Credits - 30 h)**

01. Research Methodology: Literature review, Defining the research question, Approaches and Methodology, Documentation and presentation of data, Analysis and interpretation of data, manuscript preparation (3L)



02. Quantitative methods: Biostatistics used for analysis of Biological data (06L)
03. Computer application: bioinformatics, databases and their applications (03L)
04. Tools and techniques: (18L)
- Techniques used Purification and characterization of biomolecules: Centrifugation, Ultrafiltration, Chromatography, electrophoresis, spectrophotometry, GC-MS, IC-MS, NMR, MALDI-TOF, X-ray crystallograpy, Circular Dichroism CD
  - Microscopic techniques including Fluroscence microscopy, Confocal microscopy, Atomic force microscopy and live cell imaging FACS analysis
  - Histology and histochemistry: Fixation and sectioning of tissue, embryos and cells.
  - Immunohistochemistry, immunoflurosecence, histochemical staining for characterization of cell type.
  - Real time PCR, DNA microarray, New generation DNA sequencing, Protein Microarry, protein sequencing, FRET analysis

#### References:

1. O'conner, M. and Woodford, F.P. Writing scientific papers in English. Elsevier – Ecerpta Medica- North Holland Publ., Amsterdam.
2. Trelease, S.F. How to write Scientific and Technical papers. Williams & Willikins Co., Baltimore, USA.
3. Day, R.A. How to write and publish a Scientific Paper. Cambridge University Press.
4. McMillan, V.E., writing Papers in the Biological Sciences, W.H. Freeman, NY
5. Principles and Techniques of Biochemistry and Molecular Biology, Wilson K and Walker J.M., Cambride University Press
6. Biophysical & Biochemical Techniques, Wilson K and Walker J.M.,
7. Laboratory Exercises and techniques in Cellular Biology, Anthony Contanto, Wiley Publ. 2012
8. Histological and Histochemical methods: Theory and Practice, Kiernan J.A. Scion Publ Ltd.
9. Histochemistry, Pearse A.G.E, Garfield.

### **ZY 305 P - RESEARCH METHODOLOGY : (2 Credits)**

- |   |  |    |
|---|--|----|
| 1 | Selecting a title for the paper, writing the abstract and key words    | 1P |
| 2 | Writing the Discussion Conclusions and Results: Citation of references | 1P |
| 3 | Importance of scientific surveys, primary data and secondary data in   | 1P |

	research	
4	. Writing a project proposal to a funding agency.	1P
5	Use of MS Excel in data presentation.	1P
6	Examples of some common statistical tests	2P
7	Purification of a biomolecule	2P
8	Making a ICT enabled scientific presentation	1P
9	Microscopic techniques	1P

**ZY 306 T: PARASITOLOGY      02 credits**

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 behavior, 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 Circum sporozoite 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.  
3.4 Nematoda: chromosome germ line limited DNA & chromatin diminution in *Ascaris*.
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, Indirect haemagglutination test, indirect fluorescent antibody test, Radio immuno assay, ELISA, complement fixation test, Latex agglutination test
5. **Prophylaxis & control:** Biologic, Genetic, Chemical, Physical & Other methods (2L)  
chemical, Physical & Other methods

### **REFERENCE BOOKS:**

1. Comparative protozoology, Ecology, Physiology, Life history, Anderson, O.R. , Springer verlag, Berlin.
2. General Parasitology, Cheng T. C., Academic Press.
3. Modern Parasitology, Cox F.E.G.,Eds.Parasitology in focus, facts & trends, Melhorn h., Eds., Spriger Verlag, Beriin.
4. Medical Parasitology, Piakarsky G. L., Springer Verlag, Berlin.
5. Modern Parasitology, Cellular immunological & immunological aspects, Wyler D. J., Eds., W. H. Freeman, NY

### **ZY 306 P PRACTICALS IN PARASITOLOGY (2 Credits) (10p x3= 30 Hrs.)**

1. Study of life cycle, role as vector & control measures of: (2P)  
Ticks(*Argas*, *Boophilus*)  
Mosquito - anyone from- *Anopheles*/ *Aedes*/ *Culex*

- Any two flies: *Tabanus/ Phlebotomus/ Sarcophaga*.  
Cyclops
2. Ectoparasites & Endoparasites of wild rat, cattle, dog, chick & human including stages in excreta. (2P)
  3. Study of life cycle of parasitic protozoa: *Trypanosoma, Leishmania* (1P)
  4. Study of life cycle of helminth parasites: *Schistosoma, Echinococcus, Ancylostoma, Dracunculus*. (2P)
  5. Culturing of *Entamoeba & Plasmodium* (2P)
  6. Study of Parasites from digestive tract of Cockroach/gut / parasites of hen (1P)

### ZY 307 (T) – Fundamentals of Systematics (2 credits)

Sr.No.	Topic	lectures
1	Fundamental of Systematics: Biological classification, Hierarchy of categories and higher taxa, Taxonomic characters – procedures and keys, Species concepts: varieties, subspecies, sibling species, race etc.	7
2	Kingdoms of Life : General outline of kingdoms including Monera& Protista; Broad outline & Diversity in kingdom Animalia	3
3	Methodologies in systematics : Morphology based taxonomy, Numerical taxonomy, Cyto-taxonomy and chemotaxonomy, Molecular systematics, DNA fingerprinting & Molecular markers for detection/evaluation of polymorphism,RFLP, RAPD etc.	8
4	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 and various taxa	6
5	Taxonomic procedures: taxonomic collection preservation, curation process and identification.	3
6	Molecular phylogenetics and phylogeography.	3

### Reference books:

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.

### ZY 307 (P) – Fundamentals of Systematics (2 credits) (10PX3= 30 hrs)

Sr.No.	Topic
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1	Minor phyla-specimen Study	1p
2	Study of museum specimens and slides( invertebrates,1-2 examples from each phyla)	2p
3	Study of museum specimens( protochordates and chordates,1-2 examples from each phyla)	2p
4	Identification of animals with the help of keys-House fly, Honey bee etc.	1p
5	Identification of animals with the help of keys- Cockroach, Earthworm.	1p
6	Method of collection, Preservation, and Curing of any insect Specimen	2p
7	Visits to Scientific Institute like Zoological Survey of India and Report writing	1p

### **ZY : 308. T:Insect Ecology (2 credits/30h)**

1.	Introduction to Insect ecology: History of ecology & Entomology Ecological associations Insect and humans	(5L)
2.	Insect and Climate: Temperature Photoperiod Rainfall Wind Climate change	(5L)
3.	Insect Herbivores: Feeding strategies of herbivorous insects Plant defences	(5L)
4.	Natural enemies and insect population dynamics: The variety of Natural enemies Impact of enemies on insect populations The Concept of niche & competition among insects	(5L)
5.	Insects in ecosystems Fundamentals of ecosystem ecology Leaf shredding insects, Insect defoliators & cycling of nutrients insect, plant community :structure and successor.	(5L)
6.	Insect conservation: Threats to insects Conservation and restoration Prospects for insect conservation	(5L)

### **ZY-308P- Research Project (2C)**

The project course would involve training to students in literature survey, planning and execution of experimental work, analysis of data and its presentation.

Students would utilize few of the practical's from their course more intensively for this course. Project should start at third semester and will be assessed at end of fourth semester. The experimentation work during the project should be equivalent to minimum 10 practicals in each semester.

1. **Basic Concept of Toxicology:** Introduction of toxicology, history of toxicology, definition of toxicology, definition of poison, definition of toxicity and classification of toxicants. 2 L
2. **Toxic agent and their mode of action:** Introduction, Toxic agent and mode of action of toxic agents. 3L
3. **Xenobiotics:** Introduction, Important of xenobiotics concerned to Human health, Adverse effects of xenobiotics through Biological Magnification and Biotransformation, mechanism of Xenobiotic Translocation, Membrane permeability and mechanism of chemical transfer, absorption of xenobiotics, distribution of xenobiotics, accumulation of xenobiotics, elimination, biotransformation and excretion. 8L
4. **Pesticides and Heavy Metal Toxicity: Pesticides and their toxicological effects:** Classification of Pesticides, Insecticides, Mode of action of Insecticide. 4L
5. **Heavy Metal Toxicity:** Introduction, dispersion, general principal of metal toxicity, sources, toxic metals and their toxicity. Arsenic, Aluminium, Cadmium (Itai-Itai disaster), Chromium Lead, Mercury, Manganese, Zinc and Nickel. 6L
6. **Evaluation of toxicity.** Acute subacute and chronic assays LD<sub>50</sub>, LC<sub>50</sub>, NOEL. 3L
7. Maintenance and general handling of animals for toxicological laboratory. 2L
8. **Ecotoxicology**, clinical toxicology, occupational and nanotoxicology. 2L

#### **Reference Books:**

1. Principles of Toxicology: Environmental and Industrial Applications – Eds. : Phillip L. Williams, Robert C. James, Stephen M. Roberts; JOHNWILEY & SONS, INC.
2. Casarett and Doull's Toxicology The basic science of poisons – Ed: Curtis Klaassen; McGraw-Hill.
3. Fundamental Toxicology – Eds: John Duffs & Howard Worth; RSC Publishing.

**ZY 309 P - Toxicology I (2 credits: 30hr) 3hr = 1P**

1. To determine LC<sub>50</sub> of pesticide using suitable animal model 1P
2. Effect of heavy metal ions on heart beat of Daphnia 1P
3. *In situ* toxicity assessment using avian model 1P
4. *In vitro* toxicity testing using chick embryo 2P
5. Sediment-water toxicity test using chironomids 1P
6. Hydra and zebra fish as a model for various toxicity testing 2P
7. Acute dermal toxicity testing 1P
8. Acute oral testing 1P
9. Skin sensitizing assay. 1P
10. Effect of heavy metal/pesticide on organ system in test organism 1P
11. Carcinogenicity studies 1P
12. Visit to toxicity/ genotoxicity testing facility 1P



**ZY 401 T ANIMAL PHYSIOLOGY II (04 Credits)**

1. Nutrition and digestion (10)
- Nutrition
  - Nutrients and Nutritive types
  - Calorimetry and BMR
  - Digestion
  - Components of digestive system
  - General mechanism of digestion; Autonomous smooth muscle function, intrinsic nerve flexes, extrinsic nerve and gastrointestinal hormones
2. Respiration (11)
- Internal and external respiration ; Anatomy of respiratory system
  - Pulmonary respiration: Partial pressure, inspiration and expiration, Lung volume and capacities
  - Gas exchange across the pulmonary and systemic capillaries
  - Gas transport; O<sub>2</sub> transport, CO<sub>2</sub> transport and abnormalities in the blood gas content
  - Neuronal control of respiration, role of central and peripheral receptors
  - Other functions of respiratory system
3. Blood and blood vessels (9)
- Blood composition and function, Haematopoiesis
  - Blood clotting and it's molecular mechanism
  - 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
  - Blood pressure-Hypertension and Hypotension
4. Cardiac Physiology (10)
- Anatomy of heart
  - Electrical activity of the heart pace makers, spread of cardial coupling, action potential of cardiac cells
  - Electrocardiography
  - Mechanism events of cardiac cycle, Heart sound
  - Neuronal and Hormonal control of heart
  - Cardiovascular response of exercise
5. Neuronal Physiology (8)
- Nerve cells : Structure & Function
  - Excitation and conduction of nerve fiber: Resting membrane potential, Action potential, all or none law, electronic potential, saltatory conduction
  - Ionic basis of excitation and conduction
  - Neurotransmitter types and receptors: Metabolism of neurotransmitters, Neuropeptides
  - Synapse and Neuronal integration
  - impact of drugs and disease on synaptic transmission
6. Muscle Physiology (05)

- a) 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
- b) Pathways of ATP formation during contraction
- c) Skeletal muscle fiber types, contractile machinery of smooth muscle

7. Sensory Physiology (07)

- a) Receptor types, receptor potential and receptor adaptation
- b) Eye-structure and physiology of vision
- c) Ear-Hearing and equilibrium, sound waves and its characters, structure of ear and physiology of hearing and equilibrium
- d) Chemical senses : Taste and smell

References:

1. Guyton A.C and Hall J.E, Text book of medical physiology, Hartcort bracc and co. Asia Pvt.Ltd., Singapore.
2. Baldwin, E. An introduction to Comp biochemistry. Cambridge.
3. Hill, R.W. & GA Wyse, Animal physiology. Harper & Row, NW.
4. Randall, D, W.Burggen & K, French. Eckert Animal Physiology : Mechanism and adaptation , W H Freeman, NY
5. Schmidt-Nielsen,. Animal Physiology: Adaptation and Environment. Cambridge.
6. Hoar, W S General and Comparative physiology. Prentice Hall, India, New Delhi.
7. Vernberg, F.J. & Vernberg, WB . Animal and the environment. Holt, Rienhart & Winston, NY.
8. Prosser and Brown. Comparative physiology.

**ZY 401 P - ANIMAL PHYSIOLOGY II (03 Credits)**

1. Effect of exercise on breathing rate, pulse rate and blood lactate of man
2. Determination of bleeding time and clotting time in man
3. Study of invertebrate (earthworm and crab) heart
4. Ionic effects on perfused heart of frog
5. Effect of vagotomy on frog heart
6. Effect of adrenalin and acetylcholine on perfused heart of frog
7. Capillary circulation in frog and cockroach/Fish.
8. Study of glycerinated muscles fibers
9. LDH isoenzymes isolation and detection using agarose gel electro phoresis in heart / skeletal muscle of rat
10. Phosphagen kinase in mouse and crab muscle phosphagen
11. Effect of load on muscles contraction in frog
12. Cobalt back filling of cockroach ventral nerve cord
13. Detection and measuring of heart beats(Manually) in Drosophila larva/Daphnia.
14. Estimation of Respiratory Quotient by Warburg's Respirometer
15. Mapping of taste areas on human tongue.
16. Study of Types of heart (Myogenic and Neurogenic )
17. Effect of pH, temperature and incubation on human salivary amylase activity.
18. Determination of protein, glucose in Urine.
19. Determination of protein, glucose in Urine from diabetic patient.
20. Qualitative Analysis:
  - 1) Preparation and study of Urine crystals.
  - 2) Estimation of serum urea.

**Any 15 Practicals to be completed by the students**

### **ZY-401T: Entomology II (Special)- 4 Credits**

1. Gametogenesis: Spermatogenesis , Oogenesis, Seminal transfer, Fertilization and oviposition. **08L**
2. Insect early embryonic development: Cleavage and Blastoderm formation, Germ band, Gastrulation, Blastokinesis, differentiation of germ layers, Segmentation, Appendages formation and organogenesis in brief. **21L**
3. The post embryonic development; Eclosion from the egg. The developmental stages: larva, Pupa, Nymph, Emergence from the pupa/cocoon. Metamorphosis and Growth. **20L**
4. Hadorn's experiments with imaginal disc, Regeneration and Aging. **06L**
5. Diapause: Occurrence, Initiation and Preparations for diapauses, Diapause development and Controls. **05L**

#### *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 Mariapods' 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 (Methen, London ).
6. 'Developmental system: Insects' Vol. I, by S. J. Counce and C.H. Waddington (Academic Press, London, ).
7. 'Developmental system: Insects' Vol. II, by S. J. Counce and C.H. Waddington (Academic Press, London, ).

**ZY- 401P- Entomology II Practical Course (3 Credits)**

1. Study of different types of insect Eggs. **1P**
2. Early embryology of insect: egg, cleavage, blastula, germ band, gastrula, embryo- 1 day old, 2 day old and 3 day old in suitable insect. **1P**
3. Study of post embryonic development of insects: Collection and study of types of larvae, pupae, Nymph (Aquatic and Terrestrial). **2P**
4. Histological studies of male reproductive system (Testes, Vasa deference, Ejaculatory duct, Accessory gland and spermatogenesis). **1P**
5. Histological studies of female reproductive system (Ovariole, oviduct, common oviduct, Accessory glands and bursa copulatrix, spermatheca). **1P**
6. Dissection of House fly: The digestive system, Nervous system, Male and Female Reproductive System, Temporary mountings of antenna, haltere, legs and ovipositor. **3P**
7. Dissection of butterfly: The digestive system, Nervous system, Male and Female Reproductive System, Temporary mountings of antenna, scales and ovipositor. **3P**
8. Study of Beneficial Insects: Any 5 insects to be studied inclusive of their Systematics, Habit and Habitat, Diagnostic features, Economics and Ecological significance, Threats and Conservation measures. **1P**
9. Study of Harmful Insects: Any 5 insect Pests, Predators, Parasites and Vectors of diseases to be studied inclusive of their Systematics, Habit and Habitat, Diagnostic features, Nature of damage and control measures. **1P**
10. Morphological and taxonomic study of insect pest of agricultural importance. (any 10). **1P**
- 11 Study of insect pests and veterinary and public health importance. Nonconventional pests. **1P**
- 12 Study of efforts of contact poison on pests:
  - a) Chlorinated hydrocarbons,
  - b) Organophosphates
  - c) Carbamate.
 Calculation of LD<sub>50</sub> and effects on behavior. **1P**
- 13 Study of respiratory poisons (fumigants)- Carbon tetrachloride, ethylene dichloride, Nicotine. **1P**
- 14 Study of insect repellants (any two). **1P**
- 15 Study of insect attractants (any two). **1P**

**Note: 15 practicals are to be performed by the students.**

**ZY401 T Genetics II****4 Credits**

1. Solving problems (Numerical Probability estimation) of Mendelian and non-mendelian genetics. 03 L
  
2. Basic Human Genetics: 18L
  - 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.
  
3. Clinical Genetics: 16L
  - 3.1 Monogenic diseases
    - 2.1.1 Cystic Fibrosis
    - 2.1.2 Tay-Sachs syndrome
    - 2.1.3 Marphan syndrome
  - 3.2 Triplet repeat based disorders
  - 3.3 Inborn metabolic errors-
    - 3.3.1 Disorders of carbohydrate metabolism
    - 3.3.2 Disorders of nucleic acid metabolism
  
    - 3.3.3 Disorders of lipid metabolism
    - 3.3.4 Lysosomal storage disorders
    - 3.3.5 Peroxisomal disorders
  - 3.4 Disorders of Hematopoietic systems-
    - 3.4.1 Over view of blood cell types & haemoglobin
    - 3.4.2 Sickle cell anemia
    - 3.4.3 Thalassemias
    - 3.4.4 Hemophilia's
  - 3.5 Prenatal and pre-implantation diagnosis
    - 3.5.1 Indications for prenatal diagnosis
    - 3.5.2 Indications for chromosomal testing

## 3.5.3 Non- invasive methods

## 3.5.4 Invasive methods

4. Physical mapping methods: 3L  
 4.1 Low resolution mapping- cell hybrids, radiation hybrid mapping, syteny homology.  
 4.2 Restriction maps, clone contig maps, STS map, EST map, DNA sequence map.
5. Immunogenetics: 4L  
 4.1 Genetic basis of antibody diversity.  
 4.2 Regeneration of TCR diversity.  
 4.3 HLA polymorphism and disease association.
5. Oncogenetics: 3L  
 5.1 Concepts of oncogenes and tumor suppressor genes.  
 5.2 Role of oncogenes.  
 5.3 Cytogenetic studies.
6. Behavioural Genetics: 5L  
 6.1 Rothen Buhler's experiment on genetics of Bee behavior (hygienic and unhygienic Trait).  
 6.2 Nature- nurture and behavior-  
 6.2.1. Genetics experiments to investigate animal behavior  
     6.2.1.1 Selection studies.  
     6.2.1.2 Inbred strain studies.  
 6.3 Identifying genes for controlling behavior  
     6.3.1 Induced mutations  
     6.3.2 Quantitative trait loci.  
     6.3.3 Syteny orthology  
 6.4 Twin and adoption study designs.  
 6.5 Environmental influence- shared and non- shared environment.  
 6.6 Genetics of human behavioural defects- Schizophrenia.
7. Neurogenetics: 3L  
 7.1 Circadian rhythms, learning and memory mutants in *Drosophila*.  
 7.2 Psychopathology- Alzheimer's disease
8. *Drosophila* genetics: 6L  
 8.1 History of *Drosophila* genetics.  
 8.2 Genetic basis of Sex determination and dosage compensation in *Drosophila*.  
 8.3 Genetic Regulation of *Drosophila* early embryonic development and pattern formation:  
 Maternal genes and formation of body axis, Segmentation genes, Homeotic gene functions, Regulation of Hox- gene expression;

**REFERENCE BOOKS:**

1. Strickberger, M.W., Genetics, MacMillan,
2. Gardner, E.J., Peter & Simmons, M.J. and Snustad, D.P. Principles of Genetics, John Wiley AND Sons, New York,
3. William S Klug and Michael R Cummings. Concepts of Genetics. Prentice Hall Internatl, Inc., New York,
4. Trends in Genetics. Elsevier Publications, Amsterdam.
5. Lewin, Benjamin. Genes X. John Wiley and Sons, New York,
6. Develpomental Biology, S.F. Gilbert, Sinaur Associates.
7. Genetics: Analysis of Genes and Genomes, D.L. Hartl , E .W Jones, Jones and Barlett Publ. 2009.
8. Genetics By Sarin,C., Tata McGraw Hill,New Delhi
9. Genetics: Daniel J Fairbanks, W. Ralph Andersen; Brooks / Cole Publ. co.
10. Genetics-A Molecular Approach: Peter J. Russell;Pearson Inc. publishing as Bejnamin Cummings;

**ZY 401 P Practical in Genetics II 03 credits.**

1. Methodology for constructing Human Pedigree. [IP]
  2. Analysis and construction of typical pedigrees for autosomal dominant and recessive genes, sex linked dominant and recessive genes. [IP]
  3. Preparation of metaphase chromosomal spreads of one vertebrate. [2P]
  4. Enzyme polymorphism in natural population. [2P]
  5. Visit to a medical genetics laboratory for cytogenetic, biochemical and other studies. [IP]
  6. G banding on mouse metaphase spread [IP]
  7. In-silico design of PCR primers for a gene of interest. [IP]
  8. C banding on mouse metaphase chromosomes. [2P]
  9. Study of courtship behavior in wild type and mutant *Drosophila*. [IP]
  10. Study of maternal effect mutants for genes- Bicoid and Nanos. [IP]
  11. Preparation of metaphase chromosomal spread of 3'd instar larva of *Drosophila* ( from brain Ganglion) [2P]
  12. Measurement of olfaction activity in *Drosophila* larvae and Adult Fly. [1P]
  13. Measurement of locomotor activity in *Drosophila* larvae and Adult Fly. [1P]
  14. Larval mechanosensation assay in *Drosophila*. [1P]
  15. Chromatography of *Drosophila* eye colour pigment. [1p]
  16. To Study effect of mitogen induction on lymphocytes. [2p]
  17. Concept of genetic disorder databases and demonstration of use of OMIM. [IP]
  18. Genetic monitoring ( using immunogenetic marker) in laboratory animals. [2P]  
[ by skin grafting]
  19. Open field Activity test and Elevated plus maze test for anxiety levels in laboratory mice. [IP]
- Any 15 Practicals to be performed by the students.**



**ZY 402 (T) Economic Zoology (2 Credits) 30 Lectures**

- 1) Parasitic protozoans and their role in human welfare, soil protozoans and their role in agriculture. (2L)
- 2) Sponge culture and its importance in industry. (1L)
- 3) Concept of Coral reef and its significance. (1L)
- 4) Helminths as human and animal parasites. (2L)
- 5) Nematodes- parasitic roundworms of animals and plants. (1L)
- 6) Vermiculture industry in India. (1L)
- 7) Household insects, Apiculture, Lac culture, Sericulture, Prawn culture, Insects of commercial value and stored grain pests. (10L)
- 8) Economic importance of amphibian, reptiles and birds (2L)
- 9) Poultry, Piggery, Dairy industry and wool industry. (8L)
- 10) Model animals in pharmaceutical industry. (2L)

**References:**

- 1) Economic Zoology-Shukla and Upadhaya
- 2) Economic Zoology-P.D.Srivastava
- 3) Economic Zoology-Manju Yadav
- 4) Economic Zoology-K.R.Ravindranathan
- 5) Textbook of Economic Zoology- P.R.Venkitaraman

**ZY 402 P / Economic Zoology (2Credits)**

- 1 ) Prawn culture in laboratory aquarium 1P
- 2) Apiculture equipments. 1P
- 3) Poultry breeds, feeding utensils in poultry 2P
- 4) A visit to piggery/poultry/pearl culture centre/ apiculture centre/sericulturecentre. 1P
- 5) Fishing tools, crafts and gear. 1P
- 6) Morphology of Edible, freshwater fishes-Catla,Rohu, Labeo, Mrigala, Notopterus, Mystus sp. , Clarius, Channa, Heteropneustes, Reba,Wallago . 2P
- 7) Collection and identification of locally available/cultured fishes. 2P

REFERENCE BOOKS

A Handbook on Economic Zoology , Dr Jawaid Ahsan And Dr Subhas Prasad Sinha S. Chand Group.

Economic Zoology , G.S Shukla and V. B Upadhyay. Rastoi Publications

Encyclopedia of Economic Zoology, A.A. Khan. Anmol Publications

Economic Zoology by. Manju Yadav, Discovery Publishing House Pvt. Limited.

Economic Zoology by Malhotra ,Prakash, Adhyayan Puhlishers & Distributers

**ZY 402 T Bacterial and Phage Genetics -2Credits**

1. Bacterial Chromosome, Mechanism of gene transfer: Conjugation, transformation and transduction, chromosomal mapping, two-three point crosses, concept of cistron, complementation and complementation groups, mutations: auxotrophs, conditional, suppressors, transposable elements and chromosomal mapping. [14]
2. Bacteriophages: General introduction and properties [01]
3. Bacteriophage lambda: morphology and structure of nucleic acids, lytic cycle and lysogeny [03]
4. T even and odd phages: bacteriophage T2 and T4 morphology, nucleic acid structure and life cycle. Special features compared to lambda [05]
5. Bacteriophage T7: morphology and structure of nucleic acid , salient features [03]
6. RNA phages: Q beta and MS2, replication nd concept of overlapping genes [03]
7. Bacteriophage Mu [01]

Reference books:

1. Microbial Genetics, Frifielder D.
2. Genetics, Strickberger, M.W. millan Pub.
3. Genes of Bacteria and their viruses, Hays [www.,CBS](http://www.CBS Press) Press.

**ZY 402 P Practicals in Bacterial and Phage Genetics 02 Credits.(10Px3hrs.)**

1. Bacterial viable count, determination of growth curve, gram staining [1P]
2. Mutagenesis and auxotroph selection, replica plating [2P]
3. Bactriophage lambda titration, determination of pfu/ml [2P]
4. UV survival curve and phage mutagenesis [2P]
5. Transduction in bacteria [1P]
6. Conjugation and selection with genomic markers [2P]
7. Tetrad analysis in Fungi [1P]

**ZY 403 (T) Mammalian Reproductive Physiology (2 Credits)**

1. Reproductive organ: male and female gonads, duct systems and sex accessories, external sexual dimorphisms (3L)
2. Reproductive patterns: Environmental factors and breeding, continuous and seasonal breeders (3L)
3. Sexual cycles: puberty, oestrous and menstrual cycles. Ovarian event: follicular phase, cycling of non-pregnant uterus and vagina. (5L)
4. Hormonal regulation: hypothalamus –pituitary and gonad axis; other hormones. Hypothalamic GnRH, pituitary gonadotropins, behavioural effects, testicular hormones, testosterone derivatives, inhibin, ovarian hormones: oestrogen, progesterone's feedback relationships (4L)
5. Pregnancy: conception and blastocyst formation , implantation and delayed implantation, placenta: formation, types and functions, hormones in pregnancy (2L)
6. Parturition; birth process and its neuroendocrine control, puerperium (3L)
7. Lactation: mammary glands, milk synthesis, secretion. Hormonal regulation and suckling reflex. (3L)
8. Reproductive dysfunctions: Aging and reproduction. Climacteric, anatomical, endocrine and genetic disorders. (3L)
9. Artificial control of reproduction: increasing reproductive potential, artificial insemination, *in vitro* fertilization and embryo transfer, induced breeding, synchronisation of oestrus and ovulation, chemical and hormonal aspect, limiting reproductive potential, physical, physiological, surgical, chemical methods of contraception in male , female. Infertility: its causes and treatment, hormonal aspects. (4L)

**Reference books**

1. Austin C.R. and short R V., reproduction in mammals Books 1-5, Univ of Cambridge
2. Hogarth PH Biology of Reproduction, Blackie and Son, Glasgow, London.
3. Nalbandov, AV, reproductive Physiology, Lea and Febiger, Philadelphia

**ZY 403(P) – Mammalian reproductive physiology**  
**(2 credits) (1P: 3 hrs) (10PX3= 30 hrs)**

- |  |    |
|--|----|
| 1. Anatomy of male and female reproductive system in rat/mouse         | 1P |
| 2. Histology of male reproductive organs                               | 1P |
| 3. Histology of female reproductive organs                             | 1P |
| 4. Vaginal smear technique in mice.                                    | 1P |
| 5. Ovaryectomy in white rats   | 1P |
| 6. Study of placental type   | 1P |
| 7. Archectomy in white rat   | 1P |
| 8. Study of uterine smooth muscles                                     | 1P |
| 9. Study of contraceptive devices                                      | 1P |
| 10. Visit to artificial insemination centre and family planning clinic | 1P |

**ZY403 T Biodiversity assessment (2Credits = 30 lectures)**

1. Concepts of Biodiversity : Biodiversity as natural ,biological capital of the earth. It's importance at global and local level. Genetic biodiversity, Species biodiversity, Agro biodiversity. ( 3L)
2. Kingdom of life: General outline of all kingdom - Broad outline and diversity of kingdom animalia ( Major phyla with unique characteristics and examples) (2L)
3. Biodiversity distribution: Hot spots of biodiversity of the world. Biogeographical classification of India .India as a megadiversity Nation. (2L)
4. Value of Biodiversity: Consumptive, productive, social ethical aesthetic and option values. ( 2L)
5. Wild life: Wild life in India, Rare and endangered species, wild life values and human culture. (2L)
6. Threats to biodiversity: Loss of Biodiversity and its causes. Patterns of Losses Causes and factors of mass extinction. Listing of threatened biodiversity including vulnerable, rare, and threatened. Endangered and extinct animal species. Red data Book, Blue data book. (5L)
7. Conservation: Objective of, conservation, strategies and conservation. Modern tools and techniques to assess biodiversity in situ vs ex situ conservation. Action plan of conservation. Conservation of rare and endangered species. Conservation through a network of protected areas. Role of N G O s in conservation. Ecodevelopment for biodiversity conservation. Conservation movements in India - Chipko, Devrai , Bishnoi's movements etc. (8L)

8. Conservation and Prevention Acts in India: Forest conservation Act Protection Act 1971,1972 ,1980, Wild life (2L)
9. Case studies: Project Tiger, Project breeding. Vulture culture project. Elephant, Project Rhino, Project Crocodile and Turtle (4 L)

### **REFERENCE BOOKS**

Guide to India's wild life A.N.Jagnnath Rao
Biodiversity .E.O Wilson ,Academic Press 1988
Biodiversity status and prospects by Tandon.
An Introduction to Biodiversity. Prithipalsingh
Biodiversity and biotechnology. Ray
Biodiversity and its significance. Y.A. Abrol
Conservation Biology S.K. Jain
The Preservation of species: The value of Biological Diversity by Norton B.G.

### **ZY403 P Biodiversity assessment 2 Credits**

1. Study of fauna of different zoogeographical regions - with minimum three examples from each region. (1P)
2. Biodiversity studies of fishes, amphibians ,reptiles, aves ,mammals available in the local area. (1P)
3. Study of biodiversity indices with suitable examples (1P)
4. Qualitative analysis of zooplanktons. (1P)
5. Study of community characteristics by quadrat and transect method. (1P)
6. Sampling technique and experimental design in soil/water/forest. (1P)
7. Checklist preparation of fish/ birds/ mammal fauna in local area. (1P)
8. Study of endangered fauna of Maharashtra . (1P)
9. Supportive instruments in Biodiversity assessment. (1P)
10. Visit to wild life sanctuary. (1P)

**ZY 404 (T) Histology and Histochemistry (2 Credits)**

1. Fundamentals of histology: Epithelial, connective, muscular, nervous and other specialized tissues. (5)

2. Tools in histology: Principles, design and functioning of microtomes, automated microtomes, ultra microtome, cryostat, problems and troubleshooting (3)

3 Techniques in histology:

Sample preparation, obtaining tissue samples, handling reagents, fixatives (types of fixatives and effect on tissue ), processing of fixed samples, dehydration( procedure and significance), embedding, block making, staining( staining methods histochemical and immunohistological methods), dyes and dye binding reactive groups, mordants and mordanting, temporary and permanent preparations, whole mount preparation (7)

4. Fundamentals of histochemical techniques: principle and practice, detection of glycogen, neutral and acid mucopolysaccharides, detection of basic proteins, detection of specific and nonspecific lipids, detection of nonspecific esterases, detection of acid /alkaline phosphatase. (15)

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

**ZY 404 (P) – Histology and histochemistry (2 credits) (1P: 3 hrs) (10PX3= 30 hrs)**

1. Enzyme detection: acid phosphatase, alkaline phosphatase, esterases (1P)
2. Nucleic acid staining: methyl green, pyronine, feulgen stain (1P)
3. Study of different types of tissue with help of permanent slides (2P)
4. Effect of fixatives, fixation of tissues (1P)
5. Block preparation and sectioning (2P)
6. Mucopolysaccharide staining, AB pH 1.5, 2.5 (1P)
7. Proteins (basic mellrg) and lipid staining by sudan black (1P)
8. Comparative study of effect of fixative on a given tissue (1P)
9. Effect of fixatives on tissue sections- liver (1P)

### **ZY 405T: Pollution Biology (2 credits = 30 lectures)**

1. Biosphere: Introduction, hydrosphere, lithosphere, atmosphere. (2L)
2. Pollution: Kinds of pollution and pollutants(Air, Water, Agricultural). (3L)
3. Noise pollution: Characteristics of sound, source and effects of noise pollution. (3L)
4. Pesticide pollution: Pesticides and their kinds, possible sources and pathways of pesticide Pollution. Impact of pesticides on living organisms. (3L)
5. Radioactive pollution: Types , sources and effects, radioactivity assessments and control. (2L)
6. Bioassay: Purpose of bioassay, selection and test organisms, pollutant bioassay using fish. (3L)
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, Hazardous Waste in India. (3L)

#### 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 )

### **ZY-405P: Practicals in Pollution Biology (2 Credits) (10P =30hrs.)**

1. Study of bio – indicators of pollution. (1P)
2. Analysis of CO, CO<sub>2</sub> 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. (1P)
5. Analysis of pH and salinity form water /soil sample. (1P)
6. Determination of LC<sub>50</sub>/ LD<sub>50</sub> for insecticide / pollution /molluscicide etc. (1P)
7. Estimation of Biomass by:- (1P)
  - i) Wet weight and ii) Dry weight.
8. Estimation of calcium and magnesium in polluted water. (1P)
9. Soil analysis for calcium carbonate. (1P)
10. Estimation of sulphate in polluted water (1P)

### **ZY- 406 (T) Apiculture, 2 Credits/30 L**

1. **Introduction to Apiculture:** History of Bees and Beekeeping, Systematics, Bee species, Bee morphology, Colony organization, Polymorphism, Caste system, Division of labour, Bee flora, Foraging and Honey flow periods. (7 L)
2. **Bee keeping as an occupation:** Extent of Beekeeping in Maharashtra and India, Limitations on the development of beekeeping, Advantages of extensive beekeeping, Beekeeping equipments and initiation into keeping a colony, the future of beekeeping. (7 L)
3. **The first step in beekeeping:** Purchase of a colony, the Apiary site, how to manage a colony, the manipulation of a colony, taking care of bee diseases and enemies. (7 L)
4. **Beekeeping techniques and Apiary management:** Establishment of a colony,, Routine management, Seasonal management, Migratory beekeeping, Harvesting and marketing of bee products, Bee flora and planned pollination services. (7 L)
5. **Important Institutions pertinent to Apiculture:** National Bee Board, Bee Research and Training Institute, Apiaries. Economics and extension of Bee keeping. (2 L)

### **Reference Books**

1. Bees and Beekeeping  
D. P. Abrol , Kalyani Publisher, New Delhi.



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.

**ZY- 406(P) Apiculture, 2 Credits/10 Practical.**

1. Study of Honey bee species, Castes and Bee morphology. (3P)
2. Study of Beekeeping equipments: Bee box and tools. (2P)
3. Study of Bee products: Honey, Bees wax, Pollens, Royal Jelly, Propolis and Bee venom. (2P)
4. A compulsory visit to an Apiary or Central Bee Research & Training Institute or a Beekeeper to gain a first hand experience in handling bees. (2P)
5. Study of bee flora in the locality and observations on bee foraging Behaviour. (1P)

### **ZY 407 T -Pest Control ( 2 Credits)**

1. Introduction of the pest control, types of pests and their importance, Damage caused by pests. **02L**
2. Brief outline of medical and veterinary entomology with reference to important measures to control the vectors. House hold 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. Biological control measures: Biological agents, Advantages and Drawbacks of Biological control, Biological Control Management. **12L**
4. Autocidal control ,Chemosterilents,Kniplings model,Pheromonal and hormonal control. Concept of Integrated pest management. **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. Doult (Academic Press, New York, 1967).

**ZY 408 T Toxicology II (2 credits : 30hr )**

1. Absorption, distribution, and elimination of toxic agents: transfer of molecules across membranes, absorption from GI tract and lung, and across the skin, deposition/ distribution, biotransformation and excretion 7h
2. Bioactivation & detoxification: metabolism of xenobiotic, enzymology of xenobiotic metabolism, bioactivation & inactivation of xenobiotics (Any two OP and CP compounds) 8h
3. Toxicogenomics: microarray, proteomics, metabolomics 3h
4. Toxicity testing: Regulatory agencies, Regulatory testing methods 6h
5. Lab safety, disposal of bio-medical waste, GLP 3h
6. Legal aspects: CPCSEA guidelines, IAEC, rational use of animals, alternatives for animal models 3h

**Reference books:**

1. Principles of Toxicology : Environmental and Industrial Applications – Ed. : Phillip L. Williams, Robert C. James, Stephen M. Roberts; JOHNWILEY & SONS, INC.
2. Casarett and Doull's Toxicology The basic science of poisons – Ed: Curtis Klaassen; McGraw-Hill
3. Fundamental Toxicology – Eds: John Duffs & Howard Worth; RSC Publishing
4. <http://envfor.nic.in/division/committee-purpose-control-and-supervision-experiments-animals-cpcsea>.

**ZY 408 P Practicals in Toxicology II (2 credits : 30hr ) 3hr = 1P**

1. Estimation of phosphate in water 1P
2. Effect of pollution on the oxygen consumption of suitable animal 1P
3. Qualitative assessment of polluted water sample for presence of lead or mercury pollution. 1P
4. Developmental toxicity testing by using *Drosophila* model 1P
5. Bacterial reverse mutation test in *S. typhimurium* 1P
6. Sperm shape abnormality assay 1P
7. Prenatal developmental toxicity test 1P
8. MTT test for cytotoxicity 1P
9. Monitoring cell death by LDH (Lactate dehydrogenase) 1P
10. Alternatives to animals in toxicity testing 1P
11. Visit to authorized Animal House facility 1P
12. Estimation of Acetyl cholinesterase activity on exposure to OP compounds on test organism. 1P

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**B.B.A. SEM – III**

**Subject: Personality Development**  
**(Course Code –301)**

**Objectives:**

1. To make the students aware about the dimensions and importance of effective personality.
2. To understand personality traits and formation and vital contribution in the world of business .
3. To make the students aware about the various dynamics of personality development.

Sr. No.	Topics	Number of lectures
<b>UNIT 1</b>	<b>Introduction:</b> <ul style="list-style-type: none"> <li>• Meaning and Definition of Personality.</li> <li>• Factors affecting Personality Development: Biological, Home Environment and Parents, School Environment and Teachers, Peer Group, Sibling Relationships and Mass Media, Cultural Factors, Spiritual Factors, Public Relations.</li> </ul>	5
<b>UNIT 2</b>	<b>Personality Traits.</b> <ul style="list-style-type: none"> <li>• <b>Meaning and Definition:</b> Personality Traits.</li> <li>• <b>Developing Positive Personality Traits:</b>  <b>Attitude:</b>Factors that determine Attitude, Benefits of Positive Attitude and Consequences of negative attitude, steps to build positive attitude.</li> <li>• <b>Personality habits:</b> Meaning and concept of habits.</li> <li>• <b>Developing effective Habits:</b>Behaviour and Character.  <b>Being Proactive/Creative and Innovative</b>  <b>Beginning with the end in mind</b>            Putting first things first with determination, discipline, clarity and concentration.            Thinking Big and Winning Through: Action, Active, Facing Challenges, striving for</li> </ul>	10

	<p>success.  Apologizing, Appreciating, Accepting feedback.  Aiming high, enthusiasm, team building, setting goals, zeal and passion building.  (Practical Examples of the above)</p>	
<b>UNIT 3</b>	<p><b>Pillars of personality development:</b></p> <ul style="list-style-type: none"> <li>• <b>Introspection:</b> Meaning and importance, Views about Introspection, Self Introspection Skills.</li> <li>• <b>Self Assessment:</b> Meaning, importance, types and self assessment for students.</li> <li>• <b>Self Appraisal:</b> Meaning, importance, tips for self appraisal.</li> <li>• <b>Self Development:</b> Meaning, process of self development, Self Development Techniques, Use of self Development, Individual Development Plan.</li> <li>• <b>Self Introduction:</b> Meaning, tips for effective self introduction, Self Acceptance, Awareness, Self Knowledge, belief, confidence, criticism and self examination.</li> <li>• <b>Defining Success:</b> Real or Imaginative, obstacles to success, factors and qualities that make person successful.</li> <li>• <b>Concept of Failure:</b> Reasons for failure.</li> <li>• <b>Personal SWOT analysis &amp; STAR analysis.</b></li> </ul> <p>(One or two caselets on the above topic)</p>	15
<b>Unit 4</b>	<p><b>Self Esteem:</b></p> <ul style="list-style-type: none"> <li>• <b>Self Concept:</b> Meaning, definition and development</li> <li>• <b>Self Esteem:</b> concept, significance of Self esteem, types (positive, negative), characteristics of people of high and low Self esteem, steps for enhancing positive Self esteem.</li> <li>• <b>Sigmund Freud ID, EGO and SUPER EGO Concepts.</b></li> <li>• <b>Ego Management, What ego mismanagement can do.</b></li> <li>• <b>Managing Egoistic insults</b></li> </ul> <p>(One or two case lets on the above topic)</p>	8

<b>Unit 5</b>	<b>Personality Formation Structure:</b> <ul style="list-style-type: none"> <li>• Mind mapping.</li> <li>• Competency mapping.</li> <li>• Developing interpersonal and group skills.</li> <li>• Building positive relationships.</li> <li>• Strategies of gaining power and influence.</li> <li>• Enhancing personality through effective communication.</li> <li>• Intentional Communication.</li> <li>• Intentional Listening.</li> <li>• <b>Effective Speech:</b> Writing and delivering and successful negotiation.</li> <li>• Understanding body language, projecting positive body language.</li> <li>• Manners and etiquettes.</li> <li>• Proper dressing for varied occasions. (One or two case lets on the above topic)</li> </ul>	10
<b>Total</b>		<b>48</b>

**Recommended Books:**

1. Seven Habits Of Highly Effective People – Stephen Covey
2. You Can Win – Shiv Khera
3. Three Basic Managerial Skills For All – Hall Of India Pvt Ltd New Delhi
4. Hurlock Elizabeth B Personality Development Tata Mcgraw Hill New Delhi
5. Understanding Psychology: By Robert S Feldman. ( Tata Mcgraw Hill Publishing)
6. Personality Development and Career management: By R.M.Onkar (S Chand Publications)
7. Social Psychology: By Robert S Feldman. ( Tata Mcgraw Hill Publishing)
8. Mcgrath Eh Basics Management Skills For All Printish Hall Of India Pvt Ltd New Delhi
9. Wehtlel David A and Kin S Kemerron – Developing Managerial Skills – Pearson Education New Delhi.
10. Essentials of Business Communication - Rajendra Pal and J. S. Korlhalli - Sultan Chand & Sons, New Delhi.
11. Business Communication (Principles, Methods and Techniques) Nirmal Singh - Deep & Deep Publications Pvt. Ltd., New Delhi
12. Effective Business Communication – H.Murphy.

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**B.B.A. SEM – III**

**Subject: Business Ethics  
(Course Code –302)**

**Objectives:**

1. To impart knowledge of Business Ethics to the students.
2. To promote Ethical Practices in the Business.
3. To develop Ethical and Value Based thought process among the future manager's entrepreneurs.

<b>Sr. No</b>	<b>Topics</b>	<b>Number of lectures</b>
<b>Unit 1.</b>	<b>Introduction to Ethics :</b> <ul style="list-style-type: none"><li>• Meaning and Nature of Ethics.</li><li>• Moral and Ethics.</li><li>• Importance of Ethics.</li><li>• Types of Ethics.</li><li>• Causes of Unethical behavior.</li></ul>	08
<b>Unit 2.</b>	<b>Area of Business Ethics :</b> <ul style="list-style-type: none"><li>• Meaning , Nature and Importance of Business Ethics.</li><li>• Types of Business Ethics.</li><li>• Factors influencing business ethics.</li><li>• Corporate Ethics – ethical behavior &amp; audit of ethical behavior.</li><li>• Individual ethics, Professional Ethics.</li><li>• Gandhian Philosophy of ethical behaviour.</li><li>• Social Audit.</li></ul>	10
<b>Unit 3</b>	<b>Business Ethics in Global Economy :</b> <ul style="list-style-type: none"><li>• Concept of Globalization.</li><li>• Global Business Network.</li><li>• Relationship among Business, Business Ethics and Business Development.</li><li>• Developing Business ethics in Global Economy.</li><li>• Marketing ethics in foreign trade.</li><li>• Role of Business Ethics in a developing civilized society.</li></ul>	13



<b>Unit 4</b>	<b>Moral Issues in Business :</b> <ul style="list-style-type: none"> <li>• Concept of Corporate Social Responsibility.</li> <li>• Relationship between C.S.R. and Business Ethics.</li> <li>• Justice &amp; Economic system ethics relating to environment protection.</li> <li>• Business Ethics and Environment Protection.</li> <li>• Business Ethics and Consumer Protection.</li> <li>• Business Ethics and Social Justice.</li> <li>• Arguments for and against Corporate Social Responsibility.</li> </ul>	10
<b>Unit 5.</b>	<b>Functional Ethics:</b> <ul style="list-style-type: none"> <li>• Meaning of Functional Ethics.</li> <li>• Types of Ethics according to Functions of Business, (Marketing, HRM, Purchase, Selling &amp; Distribution).</li> <li>• Patents ,Copy-rights, Intellectual Property Rights, Trade Marks and Business Ethics.</li> <li>• Ethical Challenges for managers in the 21<sup>st</sup> Century</li> </ul>	07
	<b>Total</b>	<b>48</b>

**Recommended Books:**

1. Business Ethics - GautamPherwani
2. Business Ethics - RituPamraj
3. Business Ethics - Prof. Agalgatti
4. Business Ethics - Manuel G Velasquez
5. Business Ethics - O.C.Ferrell, John Paul Fraedrich,Lindaferrell

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**BBA SEM – III**

**Subject: Human Resource Management and Organizational Behavior**  
**(Course Code - 303)**

**Objectives:**

1. To introduce to the students the functional department of human resource management and acquaint them with planning, its different functions in an organization.
2. To introduce the human resource processes that are concerned with planning, motivating and developing suitable employees for the benefit of the organization.

Sr. No.	Topics	No. of Lectures
<b>UNIT 1</b>	<p><b>Introduction to Human Resource Management:</b></p> <ul style="list-style-type: none"> <li>• Definition and concept of human resource / personnel management.</li> <li>• History of Human Resource Management.</li> <li>• Importance of human resource management.</li> <li>• Functions of human resource management.</li> <li>• Organization of HRM-               <ul style="list-style-type: none"> <li>➤ Personnel department in Line organization.</li> <li>➤ Personnel department in Functional Organization.</li> <li>➤ Personnel department in Line and staff Organization.</li> </ul> </li> <li>• Role of personnel manager               <ul style="list-style-type: none"> <li>➤ Administrative Role</li> <li>➤ Operational Role</li> <li>➤ Strategic Role</li> </ul> </li> <li>• Challenges before human resource management.</li> </ul>	08
<b>UNIT 2</b>	<p><b>Human Resources Planning:</b></p> <ul style="list-style-type: none"> <li>• Definition and objectives of Human Resource planning.</li> <li>• Process of Human Resource planning.</li> <li>• Factors influencing estimation of Human Resources.</li> <li>• Concept of Recruitment-Recruitment policy-Sources of Recruitment- Methods of Recruitment, Traditional Vs Modern Recruiting methods.</li> <li>• Concept of Selection , importance of selection and procedure, Standards for Selection Test.</li> <li>• Distinguish between Recruitment and Selection.</li> <li>• Case study on Human Resource Planning.</li> </ul>	09

<b>UNIT 3</b>	<b>Training and Development:</b> <ul style="list-style-type: none"> <li>• Meaning and Definition <ul style="list-style-type: none"> <li>➤ Needs-Objectives-</li> <li>➤ Importance of Training-</li> <li>➤ Training Methods</li> <li>➤ Evaluation of Training Programme</li> <li>➤ Methods of Evaluation.</li> </ul> </li> <li>• Concept of Management Development <ul style="list-style-type: none"> <li>➤ Management Development Process and methods.</li> <li>➤ Evaluation of Management Development Programme.</li> </ul> </li> <li>• Distinguish between training and Development.</li> <li>• Case Study on Training Development.</li> </ul>	09
<b>UNIT 4</b>	<b>Performance Appraisal &amp; Wage and Salary Administration:</b> <b>Part A : Performance Appraisal</b> <ul style="list-style-type: none"> <li>➤ Concept and objectives of performance Appraisal.</li> <li>➤ Process of Performance Appraisal.</li> <li>➤ Performance Appraisal Methods.</li> <li>➤ 360 degree Feedback System.</li> <li>➤ Factors effecting for a sound Performance Appraisal policy.</li> <li>➤ Problems with Performance Appraisal.</li> <li>➤ Challenges in Performance Management.</li> <li>➤ Case study on Performance Appraisal.</li> </ul> <b>Part B : Wage and Salary Administration</b> <ul style="list-style-type: none"> <li>➤ Methods of Wage Payments.</li> <li>➤ Employee Remuneration Factors.</li> <li>➤ Determining the level of remuneration.</li> <li>➤ Profit sharing-Fringe Benefits and Employee services-Wages &amp; Salary Administration.</li> <li>➤ Case study on Wage and Salary Administration.</li> </ul>	14
<b>UNIT 5</b>	<b>Introduction to Organizational Behaviour:</b> <ul style="list-style-type: none"> <li>• Meaning- Definition- Scope- Disciplines Contributing to Organizational Behaviour.</li> <li>• Emerging aspects of Organization Behaviour.</li> <li>• Challenges and Opportunities for Organization Behaviour.</li> <li>• Organization Behaviour across cultures.</li> <li>• Models and Approaches of Organizational Behaviour.</li> <li>• Organization Changes and Development.</li> <li>• Nature of Change – Levels of Change, Types of Change, Resistance to Change.</li> <li>• Cases of Organizational Behaviour.</li> </ul>	8
<b>TOTAL</b>		48

**Recommended Books:**

1. P. C. Pardeshi - Human Resource Management.
2. C. B. Mamoria - Personnel Management
3. K. Ashwathappa - Organisational Behaviour
4. K. Ashwathappa - Human Resource Management.
5. V.S. P. Rao- Human Resource Management. Texts and cases
6. L.M. Prasad- Human Resource Management

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**B.B.A. SEM – III**

**Subject: Management Accounting**  
**(Course Code - 304)**

**Objectives:**

1. To impart basic knowledge of Management Accounting.
2. To know the implications of various financial ratios in decision making.
3. To study the significance of working capital in business.
4. To understand the concept of budgetary control and its application in business.
5. To develop the calculating ability of various techniques of management accounting.

Sr. No.	Topics	No. of Lectures
<b>UNIT 1</b>	<b>Introduction:</b> <ul style="list-style-type: none"> <li>• <b>Management Accounting</b> – Definition, Objectives, Scope, Functions, Advantages, Limitations, Distinction between, Financial Accounting and Management Accounting, Distinction between Cost Accounting and Management Accounting.</li> <li>• Strategic Management Accounting.</li> </ul>	10
<b>UNIT 2</b>	<b>Analysis and Interpretation of Financial Statement:</b> <ul style="list-style-type: none"> <li>• Methods of Analysis, Comparative Statements, Common Size Statement, Trend Percentage or Trend Ratio (Horizontal Analysis), Ratios, Fund Flow Statement</li> <li>• <b>Ratio Analysis:</b> Meaning of Ratio, Necessity and Advantages of Ratio Analysis, Interpretation of Ratios.</li> <li>• <b>Types of Ratio:</b> <ol style="list-style-type: none"> <li>i) Liquidity Ratios</li> <li>ii) Leverage Ratios</li> <li>iii) Activity Ratios</li> <li>iv) Profitability Ratios</li> </ol> <p style="text-align: center;"><i>(Problems on following ratios only :-</i> Gross Profit , Net Profit , Operating Expenses , Current Ratio, Quick Ratio, Stock Turnover</p> </li> </ul>	12

	Ratio, Debtors Turnover Ratio, Debt Equity Ratio, Return on Investment Ratio, Interest Coverage Ratio.)	
<b>UNIT 3</b>	<b>Fund Flow Statement and Cash Flow Statement:</b> <ul style="list-style-type: none"> <li>Meaning of Fund Flow Statement, Working Capital, Causes of changes in working Capital, Proforma of Sources and Application of Funds, Proforma of Adjusted Profit and Loss Account , Proforma of Cash Flow Statement.</li> </ul>	8
<b>UNIT 4</b>	<b>Working Capital:</b> <ul style="list-style-type: none"> <li>Meaning, Objective and Importance, Factors determining requirement of Working Capital, Sources of Working Capital, Problems on computation of Working Capital.</li> </ul>	10
<b>UNIT 5</b>	<b>Budget and Budgetary Control</b> <ul style="list-style-type: none"> <li>Meaning , Definition, Nature of Budget and Budgetary Control, Types of Budget - as per time and Function, Objective of Budget and Budgetary Control, Limitations of Budget and Budgetary Control, Steps in Budgetary Control.</li> </ul>	8
	<b>TOTAL</b>	<b>48</b>

**(Problem Area: Ratio Analysis, Working Capital and Cash Budget.)**

**Recommended Books:**

1. R. N. Anthony, G. A. Walsh:: Management Accounting
2. M. Y. Khan,. K. P. Jain:: Management Accounting I. M. Pandey::Management Accounting (Vikas)
3. J. Betty: Management Accounting
4. Sr. K. Paul: Management Accounting
5. Dr. Jawaharlal:: Management Accounting
6. Man Mohan Goyal: Management Accounting
7. S. N. Maheshwari:: Principles of Management Accounting
8. R. K. Sharma and Shashi K. Gupta: Management Accounting
9. Richard M. Lynch and Robert Williamson: Accounting for Management Planning and Control
10. Horngren: Introduction to Management Accounting (Pearson)

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**B.B.A. SEM – III**

**Subject: Business Economics (Macro)**

**(Course Code - 305)**

**Objectives:**

1. To study the behavior of working of the economy as a whole.
2. To develop an analytical framework to understand the inter-linkages among the crucial macroeconomic variables.
3. To apply economic reasoning to problems of business and public policy.

Sr. No	Topics	Number of lectures
<b>Unit 1</b>	<b>Introduction:</b> <ul style="list-style-type: none"> <li>• Definition and Nature of Macroeconomics.</li> <li>• Scope, Importance and Limitations.</li> </ul>	6
<b>Unit 2</b>	<b>National Income Accounting:</b> <ul style="list-style-type: none"> <li>• National Income Aggregates (GDP, GNP etc. at market price and factor cost).</li> <li>• Approaches to measuring national income.</li> <li>• Nominal and real measures of national income.</li> </ul>	8
<b>Unit 3</b>	<b>Theory of Income and Employment:</b> <ul style="list-style-type: none"> <li>• Say's Law of Markets.</li> <li>• Consumption Function.</li> <li>• Saving Function.</li> <li>• Investment Function.</li> <li>• Aggregate Expenditure Function.</li> <li>• Keynes' Theory of Income and Employment.</li> <li>• Concept of underemployment equilibrium.</li> </ul>	12
<b>Unit 4</b>	<b>Business Cycle, Inflation and Deflation:</b> <ul style="list-style-type: none"> <li>• Nature and characteristics of Business Cycle.</li> <li>• Phases of Business Cycle.</li> <li>• Inflation – Meaning, Types, Causes and control.</li> <li>• Concept of Deflation.</li> </ul>	11
<b>Unit 5</b>	<b>Macro Economic Policies:</b> <ul style="list-style-type: none"> <li>• Creation of Credit</li> <li>• Monetary Policy, Fiscal Policy.</li> <li>• Supply side Economics – An introduction.</li> </ul>	11
<b>Total</b>		<b>48</b>

### **Recommended Books:**

- 1) Ackley G. – Macro Economics: Theory and Policy, Macmillan Publishing Company, New York. 1978
- 2) Ahuja H.L. – Macro Economics: Theory and Policy, S. Chand & Co. Ltd. New Delhi. 2006
- 3) Gupta S.B. – Monetary Economics, S. Chand & Co. Ltd. New Delhi. 2002
- 4) Shapiro E. – Macro Economic Analysis, Galgotia Publications, New Delhi. 1996  
5<sup>th</sup> Ed.
- 5) Jhingan M. L. – Macro Economic Theory: Vrinda Publications, New Delhi. 2006
- 6) William Branson – Macro Economics: Theory and Policy. 1988 2nd Edn.
- 7) J. Harvey and H. Johnson – Introduction to Macro Economics
- 8) D. N. Dwivedi – Macro Economics – Tata McGraw Hill, New Delhi-2006



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**B.B.A. SEM – III BBA**

**Subject: IT in Management**  
**(Course Code - 306)**

**Objectives:**

1. To understand the role of IT in Management.
2. To understand the basics of operating systems.
3. To know the current happenings.

<b>Chapter No.</b>	<b>Topic Name</b>	<b>No. Of Lectures</b>
<b>Unit 1</b>	<b>Managing Hardware and Software Assets:</b> <ul style="list-style-type: none"><li>• Computer Hardware and Information Technology Infrastructure.</li><li>• Categories of Computers and Computer System.</li><li>• Types of Software's.</li><li>• Managing Hardware and Software Assets.</li></ul>	8
<b>Unit 2</b>	<b>Managing Data Resources:</b> <ul style="list-style-type: none"><li>• Organizing Data in a Traditional File Environment.</li><li>• The Database Approach to Data Management.</li><li>• Creating a Database Environment.</li><li>• Database Trends.</li></ul>	6
<b>Unit 3</b>	<b>Networking:</b> <ul style="list-style-type: none"><li>• Concept, Basic elements of a Communication System, Data transmission media, Topologies, LAN, MAN, WAN, Internet.</li></ul> <b>Current Trends in IT management:</b> <ul style="list-style-type: none"><li>• Use of Social Networks in Business.</li><li>• Use of ICT enabled application in Business.</li></ul> (design a case study to understand the requirement of IT infrastructure in management of business)	12
<b>Unit 4</b>	<b>The Internet and The New Information Technology Infrastructure :</b> <ul style="list-style-type: none"><li>• The IT infrastructure for the Digital Firm.</li><li>• The Internet : The IT infrastructure for the Digital Firm.</li><li>• The World Wide Web.</li><li>• Management Issues and Decisions.</li></ul>	12

<b>Unit 5</b>	<b>Understanding the Business values of System and Managing Change:</b> <ul style="list-style-type: none"> <li>• Understanding the Business Values of Information System.</li> <li>• The Importance of Change Management in Information System Success and Failure.</li> <li>• Managing Implementations.</li> </ul>	10
	<b>Total</b>	<b>48</b>

**Books Recommended:-**

- 1) Computer Fundamentals by P.K. Sinha & Priti Sinha, 3rd edition, BPB pub.
- 2) Computers Today by S. Basandra Galgotia Pub.
- 3) Microsoft Office 2000 by Vipra Computers, Vipra Printers Pvt. Ltd.
- 4) Advanced Microsoft Office 2000 by Meredith Flynn, Nita Rutkosky, BPB Pub
- 5) using Microsoft office 2007 by Ed Bott, Woody Leonhard, Pearson publication
- 6) using Microsoft office 2010 by, Pearson publication
- 7) Managing Information System – W.S. Jawadekar
- 8) Managing Information System – Kenneth C. Laudon & Jane P. Laudon
- 9) Information Technology – Williams / Tata McGraw H
- 10) Management Information System : Kenneth C. Laudon, Jane P Laudon

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**B.B.A. SEM – IV**

**Subject: Production & Operations Management**  
**(Course Code - 401)**

**Objectives:**

1. To provide goods and services at the right time, at the right place at the right manufacturing cost of the right quality.
2. To understand manufacturing technology and its role in developing business strategy.
3. To identify the role of operation function.
4. To understand the external and internal effects of five operation performance objectives

Sr. No	Topics	Number of Lectures
<b>UNIT 1</b>	<b>Introduction:</b> <ul style="list-style-type: none"> <li>• Meaning, Nature and Scope of Production Management, Historical Development of Production Management, Objectives of Production Management, Functions of Production Management, Qualities of Production Manager, Responsibilities of Production Manager</li> <li>• <b>Plant Location:</b> Importance and Factors responsible for Plant Location Decision</li> <li>• <b>Classification or Types of Production System:</b> Job Shop Production, Batch Intermittent Production, Continuous Production and Cellular Production</li> <li>• <b>Plant Layout:</b> Definition, Objectives and Types, Factors influencing Plant Layout</li> </ul>	10
<b>UNIT 2</b>	<b>Product Design and Product Development:</b> <ul style="list-style-type: none"> <li>• Definition of Product Design, Factors affecting Product Design, Product Policy of an Organisation.</li> <li>• <b>Product Development:</b> Meaning of Product Development, Relationship between research, development and design, Stages of Product Development, Techniques or Tools of Product Development, Factors responsible for Product Development.</li> </ul>	8
<b>UNIT 3</b>	<b>Production Planning and Control:</b> <ul style="list-style-type: none"> <li>• Meaning, Nature, Objectives, Functions, Importance and</li> </ul>	6

	<p>Problems of Production Planning and Control.</p> <ul style="list-style-type: none"> <li>• Production Procedure, Factors determining Production Planning and Control, Techniques or Tools of Production Planning and Control.</li> </ul>	
<b>UNIT 4</b>	<p><b>Productivity and Ergonomics:</b></p> <ul style="list-style-type: none"> <li>• <b>Productivity:</b> Concept and Definition of Productivity, Importance of Productivity, Measurement of Productivity and Productivity Measurement Models, Techniques of Productivity Improvement, Factors influencing Productivity.</li> <li>• <b>Ergonomics:</b> Introduction and Definition of Ergonomics, Objectives of Ergonomics, Components of Ergonomics.</li> </ul>	8
<b>Unit 5</b>	<p><b>Quality Management:</b></p> <ul style="list-style-type: none"> <li>• <b>Six Sigma:</b> Introduction &amp; Meaning, Benefits, Steps in implementing Six Sigma.</li> <li>• <b>Kaizen:</b> Introduction &amp; Meaning, Principles, Procedure for Implementation, Benefits and Reasons for failure.</li> <li>• <b>Just-In-Time (JIT):</b> Introduction &amp; Meaning, Objectives, Benefits, Methodology in implementation of JIT, Basic Elements of JIT, Enabling JIT to Occur.</li> <li>• <b>Quality Circle (QC):</b> Introduction &amp; Meaning, Objectives, Benefits, Limitations, Organisation for Quality Circles, Causes of Quality Circle Failure.</li> <li>• <b>Total Quality Management (TQM):</b> Introduction &amp; Definition, Major Ingredients in TQM, Principles of TQM, Need &amp; Importance of TQM, Limitations of TQM, Dimensions or Characteristics of TQM, TQM Models, Key Issues for achieving TQM Objectives.</li> <li>• <b>ISO 9000:</b> Introduction &amp; Meaning, ISO Standards for Quality System, Factors for selecting an ISO Model, Clauses in ISO, Essential Steps in implementing an ISO.</li> </ul>	16
	<b>Total</b>	48

#### Recommended Books:

1. Production and operations management -K.Aswathappa K. ShridharaBhat
2. Production and operations management -L.C.Jhamb
3. Plant Layout and Material Handling - James Apple & John Wileysons
4. Production & Operations Management - R S Goel
5. A Key to Production Management - KalyaniPublicaion, Ludhiyana
6. Production & Operation Management - S N Chavy, TMH Delhi
7. Modern Production and Operation Management - Elwood S Butta
8. Production and operations management - Ajay Garg

**University of Pune**  
**(Pattern – 2013)w.e.f. 2014-2015**

**B.B.A.SEM-IV**  
**Subject :Industrial Relations and Labour Law**  
**(Course Code - 402)**

**Objectives:**

1. To impart the students with the knowledge about complexities between labour and management relationships.
2. To make the students aware about mechanisms of Industrial Dispute and friendly interventions to deal with employee-employer problems.
3. To impart the students with the knowledge of laws & how law affects the industry & labour.

<b>Sr. No</b>	<b>Topics</b>	<b>No of Lectures</b>
<b>Unit 1</b>	<b>Introduction to Industrial Relations:</b> <ul style="list-style-type: none"><li>• Meaning, definition, importance, scope of Industrial Relations and factors in Industrial Relations</li><li>• Approaches towards the study of Industrial Relations (Psychological Approach , Sociological Approach, Socio Ethical Approach, Gandhian Approach, Industrial Relations Approach and HR Approach)</li><li>• Evolution of Industrial Relations</li><li>• Trade Unions: concept, functions, TU Movement in India</li></ul>	04
<b>Unit 2</b>	<b>Industrial Disputes, Collective Bargaining &amp; Workers Participation in Management:</b> <ul style="list-style-type: none"><li>• Meaning, definition &amp; Causes of Industrial Disputes</li><li>• Model Grievance Procedure</li><li>• Types of Conflict Resolution: Negotiation, Investigation, Mediation, Conciliation, arbitration &amp; Adjudication.</li></ul>	12

	<p>Works Committee, Conciliation Officer, Board of Conciliation, Court of Enquiry, Labour Court, Industrial Tribunal &amp; National Tribunal.</p> <ul style="list-style-type: none"> <li>• Collective Bargaining – Meaning, Characteristics, Importance, Process, Pre-requisites and Types.</li> <li>• Employee Engagement: Concept, Importance &amp; Employee Engagement in India.</li> <li>• Workers Participation in Management(WPM): Meaning, Pre-Requisites, Advantages &amp; Disadvantages, Levels and Types Labor Laws.</li> </ul>	
<b>Unit 3</b>	<p><b>The Industrial Disputes Act,1946 &amp; The Factories ACT 1948:</b></p> <p><b>The Industrial Disputes Act,1946 -</b></p> <ul style="list-style-type: none"> <li>• Definitions, Authorities under the Act, Power &amp; Duties of Authorities, Strike &amp; lockout, Lay-off ,retrenchment, closure and dismissal, Grievance Redressal Machinery, Penalties</li> </ul> <p><b>The Factories Act, 1948 -</b></p> <ul style="list-style-type: none"> <li>• Definitions, Authorities, Provisions regarding Safety, Provisions regarding Health, Provisions regarding Welfare, Provisions regarding Leave with Wages, Provisions regarding Working hours of adults, Penalties.</li> </ul>	12
<b>Unit 4</b>	<p><b>The Payment of Wages Act, 1936 &amp; The Minimum Wages Act ,1948:</b></p> <p><b>The Payment of Wages Act, 1936 -</b></p> <ul style="list-style-type: none"> <li>• Definitions, Provisions, Penalties.</li> </ul> <p><b>The Minimum Wages Act ,1948 -</b></p> <ul style="list-style-type: none"> <li>• Definitions, Provisions, Penalties.</li> </ul>	10
<b>Unit 5</b>	<p><b>Trade Union Laws:</b></p> <ul style="list-style-type: none"> <li>• The Trade Union Act 1926: Definitions, authorities and all provisions.</li> <li>• Maharashtra Recognition of Trade Union and Prevention of</li> </ul>	10

	Unfair Labour practices Act, 1971: Definition, authorities and all provisions under the Act.	
	<b>Total Lectures</b>	<b>48</b>

**Recommended Books :**

1. Dynamics of IR – Mamoria, Mamoria and Gankar
2. Industrial Relations -Arun Monappa
3. Personnel and HRM- P Subbarao
4. Industrial & Labour Laws -S.P. Jain
5. Industrial Law - P.L. Malik
6. Bare Acts.

**University of Pune**

**(Pattern – 2013)w.e.f. 2014-2015**

**BBA SEM-IV**

**Subject: Business Taxation  
(Course Code - 403)**

**Objectives:**

1. To understand the basic concepts and definitions under the Income Tax Act, 1961.
2. To update the students with latest development in the subject of taxation.
3. To Acquire knowledge about Computation of Income under different heads of Income of Income Tax Act, 1961.
4. To acquire knowledge about the submission of Income Tax Return, Advance Tax, Tax deducted at Source, Tax Collection Authorities.
5. To prepare students Competent enough to take up to employment in Tax planner.
6. To develop ability to calculate taxable income of firms, co-operative societies and charitable trust.

<b>Sr.No</b>	<b>Topics</b>	<b>Number of Lectures</b>
<b>Unit 1</b>	<b>Income Tax Act -1961(Meaning,Concepts and Definitions)</b> <ul style="list-style-type: none"><li>• History of Income Tax in India,</li><li>• Fundamental concepts and definitions under Income Tax Act 1961,</li><li>• canons of Taxation,</li><li>• objective of Income Tax,</li><li>• Taxation structure in India,</li><li>• Concept and definitions- Income Person,Assessee, Assessment year, Previous year, Residential Status of an Assessee.</li></ul>	12
<b>Unit 2</b>	<b>Computation of Taxable Income under the different heads of Income:</b> <b>a) Income From Salary :</b> Salient features, meaning of salary, allowances and tax Liability- Perquisites and their Valuation- Deduction from salary. (Theory and Problems)	12



	<p><b>b) Income from House Property :</b> Basis of Chargeability-Annual Value- Self occupied and let out property- Deductions allowed. (Theory and Problems).</p> <p><b>c) Profits and Gains of Business and Profession :</b> Definitions, Deductions expressly allowed and disallowed (Theory and Problems). Chargeability- Meaning and concept of Short term and long term capital gains-permissible deductions (Theory and problems).</p> <p><b>d) Income from Other Sources</b> Chargeability- Meaning and concept –Inclusion and deduction.( Theory only).</p>	
<b>Unit 3</b>	<p><b>Computation of Total Taxable Income of an Individual:</b></p> <ul style="list-style-type: none"> <li>• Meaning and concept, Gross Total Income - deduction u/s-80 and Tax Liability for respective Assessment year.</li> </ul>	12
<b>Unit 4</b>	<p><b>Miscellaneous:</b></p> <ul style="list-style-type: none"> <li>• Tax deducted at source, Return of Income, Advance payment of Tax, methods of payment of Tax, forms of Returns, Refund of Tax. ( Theory only )</li> </ul>	06
<b>Unit 5</b>	<p><b>Assessment of various Entities: (TheoryOnly)</b></p> <ul style="list-style-type: none"> <li>• Assessment of firms and their partners.</li> <li>• Assessment of co-operative societies.</li> <li>• Assessment of charitable trust.</li> </ul>	06
	<b>Total</b>	<b>48</b>

**Notes:**

1. Amendments made prior to commencement of Academic Year in the above act should be considered.
2. Theory questions will carry 50% marks.
3. Problems will carry 50 % marks.

**Recommended books:**

1. Indian Income Tax Act--H.C.Malhotra
2. Practical Approach to Income Tax-- Dr.GirishAhujaandDr. Ravi Gupta.
3. Income Tax Act –R. N. Lakhotia
4. Students guide to Income Tax.--Dr.VinodSinghnia./ Dr. Monica Singhnia.
5. Income Tax.--Dr.GirishAhuja and Dr.RaviGupta , -Bharat Prakashan.
6. Indian Income Tax Act.--Dr.VinodSinghnia.
7. Hand Book of Income Tax Law.-- T. N. Manoharam.
8. Direct Tax—B.B. Lal and N. Vashisht.

**University of Pune**  
**(Pattern-2013) w.e.f 2014-2015**

**B. B. A. SEM – IV**

**Subject: International Business**  
**(Course Code - 404)**

**Objectives:**

1. To acquaint the students with emerging issues in international business.
2. To study the impact of international business environment on foreign market operations.
3. To understand the importance of foreign trade for Indian economy.

<b>Sr. No.</b>	<b>Topics</b>	<b>Number of lectures</b>
<b>Unit 1</b>	<b>Introduction:</b> <ul style="list-style-type: none"><li>• Nature.</li><li>• Theories of International Trade</li><li>• Ricardo's Theory</li><li>• Heckscher- Ohlin Theory.</li></ul>	10
<b>Unit 2</b>	<b>Multinational Enterprises:</b> <ul style="list-style-type: none"><li>• Meaning of International Corporations.</li><li>• Role and importance of Multi-national Corporations in international business.</li></ul>	6
<b>Unit 3</b>	<b>International Finance:</b> <ul style="list-style-type: none"><li>• Meaning of Exchange Rate.</li><li>• Determination of Exchange rate – Fixed, Flexible and Managed.</li><li>• Concept of Spot rate, Forward rate and Futures</li><li>• Balance of Trade and Balance of Payments</li><li>• International Monetary Fund (IMF) – Objectives and Functions.</li><li>• World Bank - Objectives and Functions</li></ul>	14
<b>Unit 4</b>	<b>Regional Economic Grouping:</b> <ul style="list-style-type: none"><li>• Evolution, structure and functions of WTO</li><li>• European Union (EU)</li><li>• North American Free Trade Agreement (NAFTA)</li><li>• Association of South East Asian Nations (ASEAN)</li><li>• South Asian Association for Regional Cooperation (SAARC)</li></ul>	8

<b>Unit 5</b>	<b>India's Foreign Trade:</b> <ul style="list-style-type: none"> <li>• Composition and Direction of India's Foreign Trade since 2000</li> <li>• Case studies in International Business with reference to Indian Economy on - <ul style="list-style-type: none"> <li>a. International Marketing</li> <li>b. International Finance</li> <li>c. International Human Resource Management</li> </ul> </li> </ul>	10
	<b>Total</b>	<b>48</b>

### **Recommended Books:**

1. International Economics – Miltiades Chacholiades, Mc-Graw Hill Publishing Co, New York. 1990.
2. International Economics – W. Charles Sawyer and Richard L. Sprinkle, Prentice Hall of India Pvt. Ltd. Delhi. 2003
3. International Economics – M. L. Jhingan, Vrinda Publications, Delhi.2006.
4. International Business – Competing in the Global Market Place – Charles Hill, ArunKumarJain, Tata McGraw Hill, New Delhi. 2008.
5. International Economics -Francis Cherunilam.
6. International Business - K Aswathappa,TataMcGraw Hill

**University of Pune**

**(Pattern – 2013)w.e.f. 2014-2015**

**BBA SEM – IV**

**Subject: Management Information System  
(Course Code - 405)**

**Objectives:**

1. To understand the concepts of Information System
2. To study the concepts of system analysis and design
3. To understand the issues in MIS

<b>Sr. No</b>	<b>Topics</b>	<b>No. of Lectures</b>
<b>Unit 1</b>	<b>Management Information Systems:</b> <ul style="list-style-type: none"><li>• Need, Purpose and Objectives, Contemporary Approaches to Management Information Systems (MIS), Information as a strategic Resource, Use of information for competitive Advantage, Management Information Systems as an instrument for the organizational change .</li></ul>	10
<b>Unit 2</b>	<b>Information, Management and Decision Making:</b> <ul style="list-style-type: none"><li>• Models of Decision Making, Classical, Administrative and Herbert Simon's Models Attributes of information and its relevance to Decision Making, Types of information.</li></ul>	10
<b>Unit 3</b>	<b>Systems Analysis and Design:</b> <ul style="list-style-type: none"><li>• Systems Development Life Cycle, Alternative System Building Approaches, Prototyping model Spiral model, Rapid Development Tools, CASE Tools.</li></ul>	10
<b>Unit 4</b>	<b>Decision Support Systems:</b> <ul style="list-style-type: none"><li>• Group Decision Support Systems, Executive Information Systems, Executive Support Systems, Expert Systems and Knowledge Based Expert Systems, Artificial Intelligence.</li></ul>	09
<b>Unit 5</b>	<b>Management Issues in MIS:</b> <ul style="list-style-type: none"><li>• Information Security and Control, Quality Assurance, Ethical and Social Dimensions, Intellectual Property Rights as related to IT Services /IT Products Managing Global Information Systems.</li></ul>	09
	<b>Total</b>	<b>48</b>

**Reference Books:-**

1. Management Information Systems, Laudon and Laudon, 7th Edition, Pearson Education Asia.
2. Management Information Systems, Jawadekar, Tata McGraw Hill.
3. Management Information Systems, Davis and Olson, Tata McGraw Hill.
4. Analysis and Design of Information Systems, Rajaraman, Prentice Hall.
5. Decision Support Systems and Intelligent Systems, Turban and Aronson, Pearson Education Asia.
6. Management Information Systems, Schulthesis, Tata McGraw Hill.
7. Management Information Systems - Sadagopan, Prentice Hall.
8. Management Information Systems - JayantOke.

**University of Pune**

**(Pattern – 2013)w.e.f. 2014-2015**

**BBA SEM - IV**

**Subject: Business Exposure**

**(Course Code - 406)**

**Objectives:**

1. To develop the understanding of the student with a realistic and practical perception of the industry its layout, procedures, processes, organization structure
2. The objective of the Industrial Visit is to help students gain firsthand information regarding the functioning of the Industry which presents the students with opportunities to plan, organize and engage in active learning experiences both inside and outside the classroom

**Guidelines for subject teachers for preparing students for the visit:**

The preparation should be such so as to guide students towards recognizing the important elements **in an industrial visit** and provide support materials necessary to increase the effectiveness of this experience

**1. Draw up a questionnaire so that a student may ask during the actual visit:**

**Questionnaire for the process:**

- Devising the questionnaire:
- Class brainstorming
- Dividing the class into groups
- Assign a section of the process to each group
- Each group draws up a set of questions
- Compile final questionnaire
- Issue final questionnaire

**Content of the questionnaire:**

- Considerations of the location of the industry
- Explore the processes running in organization
- Investigate policies and Procedures
- Explore the compliance of policies and Procedures
- Analyze the economics of the process
- Investigate the health and safety considerations
- Investigate the skills and expertise of the workforce

- Investigate the career opportunities
- Investigate the environmental considerations
- Examine the quality control in the process

## **2. Assign roles to particular students**

### **3. Appropriate clothing for the day**

**The Outcome of the visit should enable the students to:**

1. Understand the industry process
2. Experience actual chemistry and human interactions at the industry
3. Become aware of the roles of different people the organization
4. Become aware of career opportunities
5. Recognize the need for health and safety in the workplace
6. Focus students on specific aspects of their studies

### **Ancillary investigations by students**

1. Health and safety aspects
2. Environmental aspects
3. Waste management aspects
4. Career identification and planning

### **Post-visit activities by students**

1. Write a full report on visit
2. Prepare presentations on ancillary investigations
3. Thank to the company in writing

### **Report by students**

1. Aims and objectives
2. Report on the industrial process
3. Conclusion and recommendations

### **Evaluation by the teacher**

1. What have the students got out of the visit?
2. Deficiencies of the visit
3. How could the visit be improved in next time?

### **Assessment:**

The division of marks will be as under:

- a. Scrutiny of reports by the teacher: 50 Marks.
- b. Viva based on field visits: 50 Marks.

**Each student shall visit four industries**

**Second Year Bachelor of Business Administration (S.Y.B.B.A.)**

**Theory and Practical Subjects for Semester III, IV**

**Theory Subject for Semester -III :**

1. 301 - Personality Development
2. 302 - Business Ethics
3. 303 - Human Resource Management and Organization Behaviour
4. 305 - Business Economics
5. 306 - IT in Management

**Theory Subject for Semester – IV :**

1. 401 - Production and Operations Management
2. 402 - Industrial Relations and Labor Law
3. 404 - International business
4. 405 - Management Information System

**Practical Subject for Semester – III :**

1. 304 - Management Accounting

**Practical Subject for Semester – IV :**

1. 403 - Business Taxation



**Second Year Bachelor of Business Administration (S.Y.B.B.A.)**

**Pattern of Question Paper of Theory Papers w.e.f.2014-2015**

**Time : 3 Hours**

**Total Marks 80**

**Instructions :**

1. All questions are compulsory.
2. Figures to the right indicate full marks.

**Q.1) Theory Question(15 marks)**

**OR**

Theory Question

**Q.2) Theory Question (15 marks)**

**OR**

Theory Question

**Q.3) Theory Question (15 marks)**

**OR**

Theory Question

**Q.4) Theory Question (15 marks)**

**OR**

Theory Question

**Q.5) Write Short Note (any 4 out of 6) (20 marks)**

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**Second Year Bachelor of Business Administration (S.Y.B.B.A.)**

**Pattern of Question Paper of Practical Paper w.e.f.2014-2015**

**Subject : Management Accounting (304)**

**Time : 3 Hours**

**Total Marks 80**

**Instructions :**

1. All questions are compulsory.
2. Figures to the right indicate full marks.

**Q.1) Theory Question (16 marks)**

**OR**

Theory Question

**Q.2) Practical Problem(16 marks)**

**OR**

Theory Question

**Q.3) Practical Problem (16 marks)**

**OR**

Theory Question

**Q.4) Practical Problem (Compulsory) (16 marks)**

**Q.5) Write Short Note (any 4 out of 6) (16 marks)**

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**Second Year Bachelor of Business Administration (S.Y.B.B.A.)**

**Pattern of Question Paper of Practical Paper w.e.f.2014-2015**

**Subject : Business Taxation (403)**

**Time : 3 Hours**

**Total Marks 80**

**Instructions :**

1. All questions are compulsory.
2. Figures to the right indicate full marks.

**Total Marks 80**

**Q.1) Theory Question (16 marks)**

**OR**

Theory Question

**Q.2) Theory Question (16 marks)**

**OR**

Theory Question

**Q.3) A) Short Notes (any 2 out of 4) (08 marks)**

**B) Practical Problem (08 marks)**

**Q.4) Practical Problem (12 marks)**

**OR**

Practical Problem

**Q.5) Practical Problem (Compulsory) (20 marks)**

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**Savitribai Phule Pune University  
(Pattern – 2013) w.e.f. 2015-2016**

**T.Y. B.B.A.  
Semester V  
Compulsory Paper**

**Subject Name :- Supply Chain and Logistics Management**

**Course Code :- 501**

**Objectives:**

1. To introduce the fundamental concepts in Materials and Logistics Management.
2. To familiarize with the issues in core functions in materials and logistics management

Unit Number	Particulars	No. of lectures
<b>1</b>	<b>Supply Chain Management –</b> 1.1 Concept, objectives, significance 1.2 Process view of a supply chain-cycle and push pull view 1.3 Drivers/components of supply chain – Facilities, Inventory, Transportation, Information, Material Handling 1.4 Achieving tradeoff between customer service and cost	10
<b>2</b>	<b>Physical distribution –</b> 2.1 Definition, Importance, participants in physical distribution process. 2.2 Marketing Channels – Definition and Importance 2.3 Different forms of channels - Unconventional channels - Channels for Consumer goods, Industrial Goods & Services – Integrated Marketing Channels – Horizontal, Vertical, Multi channel 2.4 Functions of Marketing Channels 2.5 Channel Management – Channel Selection Process & criteria 2.6 Performance appraisal of Channel Members - Channel Conflicts & Techniques to resolve channel conflicts	10
<b>3</b>	<b>3.1 Procurement -</b> Supplier Management, Management Supplier Selection, Tendering, E-Tendering, Negotiation <b>3.2 Warehouse and Dispatch Management -</b> Types of Warehousing, Warehouse Layout Docking and Marshalling, Warehouse Safety Management.	10
<b>4</b>	<b>Inventory -</b> 4.1 Need and Types of Inventory - 4.2 Costs associated with Inventory– Basic EOQ Model - EOQ with discounts; ABC Analysis - ( <b><i>Numericals expected on Basic EOQ, EOQ with discounts &amp; ABC</i></b> ) 4.3 Stacking and Racking Systems. LIFO , FIFO	10
<b>5</b>	<b>Current trends in Supply chain management –</b> 5.1 Green Supply Chain Management	8

	5.2 Role and Future of IT in the Supply Chain 5.3 Customer Relationship Management 5.4 Supplier Relationship Management 5.5 E-Business and the Supply Chain; E-Business in Practice	
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. *Supply Chain Management* by Sunil Chopra, Peter Meindl & D.V. Kalra
2. *Inventory Management* by L.C. Jhamb
3. *Principles and Practices of Costing* by Sunita Pokharna, Success Publications, Pune
4. *Sales and Distribution Management* by Krishna K. Havaladar & Vasant M Cavale
5. *Purchasing and Supply Management* by Dobler and Burt
6. *Supply Chain Management Best Practices* by David Blanchard
7. *Channel Management & Retail Management* by Meenal Dhotre
8. *The Supply Chain handbook* by James A. Tompkins, Dale A. Harmelink

## Compulsory Paper

**Subject Name :- Entrepreneurship Development**

**Course Code :- 502**

**Objectives:**

1. To create entrepreneurial awareness among the students.
2. To help students to up bring out their own business plan.
3. To develop knowledge and understanding in creating and managing new venture.

Unit Number	Particulars	No. of lectures
<b>1</b>	<b>Entrepreneur and Entrepreneurship:</b> 1.1 Concept of Entrepreneur, Manager, Intrapreneur 1.1.1 Definition ,meaning and functions of an entrepreneur 1.1.2 Concept of Manager 1.1.3 Roles and Responsibilities of Manager 1.1.4 Concept of Intrapreneur 1.2. Need and Importance of Entrepreneurship 1.3. Enterprise v/s Entrepreneurship 1.4. Self Employment v/s Entrepreneurship 1.5. Problem of Unemployment and Importance of wealth creation 1.6. Entrepreneurial career as an option.	<b>10</b>
<b>2</b>	<b>Business opportunity Identification and Preliminary Project Report(PPR):</b> 2.1 Opportunity Search: Divergent Thinking Mode: 2.1.1 Meaning ,Objectives 2.1.2 Tools and Techniques: Environmental scanning for business opportunity Identification 2.2 Opportunity Selection: Convergent Thinking Mode: 2.2.1 Meaning ,Objectives 2.2.2 Tools And Techniques: Market Survey 2.3 Preliminary Project Report(PPR)	<b>10</b>
<b>3</b>	<b>Business Plan:</b> 3.1 Meaning and ,Objectives of Business Plan 3.2 Elements of Business Plan 3.3 Business Planning Process - Self Audit, Evaluation of Business Environment, Setting Objectives, Forecasting Market Conditions, Stating actions and resources required, Evaluating Proposed plan, Assessing Alternative strategic plans, Controlling the plan through Annual Budget	<b>10</b>
<b>4</b>	<b>Institutional Support to New Venture (Students are expected to study the assistance scheme of following institutions)</b> 4.1 District Industries Center(DIC)	<b>12</b>  3

	<p>4.2 Maharashtra Industrial Development Corporation(MIDC)  4.3 Small Industries Service Sector(SISI)  4.4 Micro, Small &amp; Medium Enterprise(MSME)</p> <p>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 Udyami Mitra Yojana (RUGMY)  f) Prime Minister Employment Generation Programme (PMEGP)</p>	
<b>5</b>	<p><b>Study of Entrepreneurs' Biographies:</b>  5.1 Rahul Bajaj  5.2 Kiran Muzumdar Shaw  5.3 Azim Premji  5.4 Sabeer Bhatia</p>	<b>6</b>
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. Desai Vasant: "Management of Small Scale Industries" - Himalaya Publishing House
2. Taneja Satish and Gupta: "Entrepreneurship Development-New Venture Creation" - Galgotia Publishing Company, New Delhi
3. Jain P.C: Handbook For New Entrepreneurs Entrepreneurship Development Institute of India
4. Sangle B. R. : Business Environment & Entrepreneurship, Success Publications, Pune
5. Gupta C.B. & Srinivas: "Entrepreneurial Development"- Sultan D, Chand & Sons, New Delhi
6. Prof Rajeev Roy: "Entrepreneurship" - Oxford University Press
7. Edward D. Bono: "Opportunities"

## Compulsory Paper

**Subject Name :- Business Law**

**Course Code :- 503**

### Objectives:

1. To understand basic legal terms and concepts used in law pertaining to business
2. To comprehend applicability of legal principles to situations in Business world by referring to few decided leading cases.

Unit Number	Particulars	No. of lectures
1	<b>Indian Contract Act 1872</b> 1.1 Definition, kinds and concepts of contracts, Essentials U/S10 1.2 Offer and Acceptance 1.3 Consideration 1.4 Legality and Objects of consideration 1.5 Capacity of Parties 1.6 Free Consent 1.7 Void Agreements and Agreements opposed to public policy 1.8 Performance of Contract. 1.9 Discharge of Contract and Remedies.	10
2	<b>The Sale of Goods Act 1930</b> 2.1 Contract of Sales of Goods-Essentials 2.2 Distinction between Sale and Agreement to Sale 2.3 Subject matter of Contract of Sale-Classification of goods & Concept of Price 2.4 Conditions and Warranties-Types and Distinction 2.5 Transfer of Property-Possession & Risk, Passing of property, Goods sent on approval or "on sale or return" basis, Sale by Non-owner 2.6 Performance of a contract of sale-Delivery of goods, Rights and duties of the buyer, buyers liability for rejecting or refusing delivery 2.7 Rights of unpaid Seller 2.8 Remedies for Breach of Contract of Sale	8
3	<b>The Companies Act, 1956</b> 3.1 Company-Definition, Meaning, Features and Types of Companies 3.2 Incorporation of a Company-Mode of forming ,Documents to be filed with registrar, Certificate of Incorporation, Effects of Registration, Promoter and his position 3.3 Memorandum of Association-Its contents and alteration, Doctrine of Ultra Vires 3.4 Article Of Association- Its contents and alteration-Comparison between Articles and Memorandum, Doctrine of	8



	Indoor Management 3.5 Prospectus- Registration and contents 3.6 Statement in lieu of Prospectus	
<b>4</b>	<b>Information Technology Act, 2000</b> 4.1 Preliminary and Definitions 4.2 Digital Signature: Concept, Authentication of electronic records 4.3 Electronic Governance (Legal recognition of electronic records, Legal recognition of digital signatures, Use of electronic records and digital signatures in Government and its agencies) 4.4 Advantages and Disadvantages of E-Governance	<b>8</b>
<b>5</b>	<b>The Right To Information Act, 2005</b> 5.1 Preliminary & Definitions 5.2 Right to Information and obligations of Public Authority: 5.3 Designation of Public Information Officers: 5.4 Request for obtaining information, Disposal of request, Exemption from disclosure of information. 5.5 Grounds for rejection to access in certain cases, Severability, Third party information 5.6 The Central Information Commission: • Constitution of State Information Commission. • Tenure of office and conditions of service. • Removal of State Chief Information Commissioner or State Information Commissioner • Powers & Functions of the Information Commissions, Appeals and Penalty	<b>14</b>
	<b>Total</b>	<b>48</b>

**Reference Books:**

- 1) *Business and Commercial Laws-Sen and Mitra.*
- 2) *Mercantile Law-S. U. Jadhavar, Success Publications, Pune*
- 3) *Business Law-G. M. Dumbre, Success Publications, Pune.*
- 4) *An Introduction to Mercantile Laws-N. D. Kapoor*
- 5) *Business Laws-N. M. Wechlekar*
- 6) *Company Law-Avatar Singh*
- 7) *Law of Contract-Avtar Singh*
- 8) *Business Laws-Kuchhal M.C.*
- 9) *Business Law for Management-Bulchandani K.R.*
- 10) *Consumer Protection Act in India. Niraj Kumar*
- 11) *Consumer protection in India. V.K.Agrawal*
- 12) *Consumer Grievance Redressal under CPA. Deepa Sharma.*
- 13) *Commentary on the Information Technology Act 2000 by Bhansali S.R*
- 14) *E Governance Issues and Strategies by Chaudhary, Suman Kalyan & Nayak, Sudhanshu Shekhar*
- 15) *Information Technology Act, 2005*

## Compulsory Paper

**Subject Name -: Research Methodology**

**Course Code -: 504**

### Objectives:

1. To provide the students with basic understanding of research process and tools for the same.
2. To provide an understanding of the tools and techniques necessary for research and report writing.

Unit Number	Particulars	No. of lectures
1	<b>Introduction to Research</b> 1.1 Research – Meaning, Characteristics & Importance 1.2 Basic Research Process – An overview & steps involved 1.3 Research Design – Meaning, Characteristics of a good research design 1.4 Components of Research Design 1.5 Sampling Design – Steps involved & Types of Samplings	10
2	<b>Sources of Collection of Data:</b> 2.1 Primary Data: Concept and Definitions 2.2 Respondents: Concept and Meaning 2.3 Secondary Data: Concept and Definition 2.4 Types of sources of secondary data	8
3	<b>Methods of Collecting of Data:</b> 3.1 Primary Data: Methods of collecting primary data, 3.1.1 Survey Method: Types of surveys 3.1.2 Questionnaire Method: Types of questions, Essentials of good questionnaire 3.1.3 Interview Method: Types of Interviews 3.1.4 Experimentation & Observation Methods: Types of observations 3.1.5 Focus Group Methods like Panel groups & Group Discussions 3.2 Secondary Data: Methods of collecting secondary data 3.2.1 Evaluating Quality of Data 3.2.2 Advantages and Disadvantages of Secondary Data	10
4	<b>Data Processing &amp; Analysis</b> 4.1 Data Processing – Editing, Codification, Classification, Tabulation, Scaling & Measurement (Should be taught with help of computer) 4.2 Data Analysis – Methods of analyzing data 4.3 Hypothesis - Concept and Types of Errors 4.4 Hypothesis Testing – Chi Square Test, Z-test & t-test	10

<b>5</b>	<b>Writing Skills for Business Research:</b> 5.1 Project Report Writing – Selecting and defining topic, Writing Chapters, Subject Matter, Style and Structure 5.2 Research Paper Writing – Structure of research paper, referencing styles 5.3 One Research Paper to be written and presented by student <b>(50 % Weightage in Internal Evaluation to be given for the same)</b>	<b>10</b>
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. Ghosh, B.N. *Scientific Method and Social Research* (Sterling: New Delhi)
2. Kothari. C.R. *Research Methodology – Methods and Techniques* (New Age: New Delhi)
3. Sangale B. R. *Research Methodology – (Success Publications, Pune)*
4. Donald. R. Cooper and Pamela S. Schindler, *Business Research Methods* (Irwin McGraw-Hill Publications, New Delhi).
5. Naresh K. Malhotra, *Basic Marketing Research 4/E* (Pearson Education Publications).
6. S. N. Murthy and U. Bhojanna, *Business Research Methods.* (Excel Books, New Delhi).

## Finance Special Paper I

**Subject Name -: Analysis of Financial Statements**

**Course Code -: 505 – A**

### **Objectives:**

1. This course is designed to prepare students for interpretation and analysis of financial statements effectively.
2. To make the student well acquainted with current financial practices
3. This course is designed primarily for students who expect to be intensive users of financial statements as part of their professional responsibilities.

<b>Unit Number</b>	<b>Particulars</b>	<b>No. of lectures</b>
<b>1</b>	<b>Financial Statements of Corporate Organizations</b> 1.1 Meaning of Financial statements 1.2 Need of Financial statements 1.3 Importance of Financial statements. 1.4 Preparation of Financial Statements as per schedule VI of the Amended Companies Act 2013 1.5 Revised Schedules 1.6 How to read company's Balance Sheet	<b>8</b>
<b>2</b>	<b>Introduction to analysis and Interpretation of financial statements</b> 2.1 Analysis and Interpretation of financial statements – Meaning/ introduction 2.2 Types of financial analysis 2.3 Advantages of financial analysis 2.4 Limitations of financial analysis 2.5 Techniques of financial analysis i. Comparative financial statements ii. Trend Analysis iii. Common Size Financial Statements iv. Funds Flow Analysis v. Cash Flow Analysis vi. Ratio Analysis	<b>8</b>

<p><b>3</b></p>	<p><b>Ratio Analysis</b>  3.1 Concept of Ratio  3.2 Meaning of Ratio Analysis  3.3 Interpretation of Ratios  3.4 Classification of Ratios  i) Liquidity Ratios  ii) Turnover Ratios  iii) Solvency Ratios  iv) Profitability Ratios  V) Miscellaneous Group  3.5 Role of Ratio  3.6 Advantages of Ratio Analysis  3.7 Limitations of Ratio Analysis  3.8 <b>Practical Problems</b></p>	<p><b>10</b></p>
<p><b>4</b></p>	<p><b>Cash Flow Analysis</b>  4.1 Meaning of Cash Flow Statement  4.2 Objectives of Cash Flow Statement  4.3 Uses of Cash Flow Statement  4.4 Limitations of Cash Flow Statement  4.5 Preparation of Cash Flow Statement  4.6 Methods of Cash Flow Statement  a) Direct Method – b) Indirect Method  4.7 Cash Flow Activities –  Operating, Investing, Financing  4.8 <b>Practical Problems on Indirect Method</b></p>	<p><b>11</b></p>
<p><b>5</b></p>	<p><b>Funds Flow Analysis</b>  5.1 Concept of Fund  5.2 Meaning of Fund Flow Statement  5.3 Uses of Fund Flow Statement  5.4 Limitations of Fund Flow Statement  5.5 Preparation of Fund Flow Statement  a) Funds From Operations  b) Statement of Changes in Working Capital</p>	<p><b>11</b></p>

	c) Funds Flow Statement.	
	<b>5.6 Practical Problems</b>	
	<b>Total</b>	<b>48</b>

**Allocation of Marks:**

Theory - 50%

Practical problems - 50%

**Reference Books:**

1. *N.M. Vechlekar*                      *Financial Management*
2. *G. M. Dumbre*                      *Advanced Management Accounting, Success Publications, Pune*
3. *I.M Pandey*                              *Financial Management*
4. *Ravi. M. Kishore*                      *Financial Management*
5. *P.C Pardeshi*                              *Business Finance.*
6. *Khan and Jain*                              *Financial Management*
7. *N.D.Kapoor*                              *Financial Management*
8. *Prasanna Chandra*                      *Financial Management*
9. *Prof.Satish Inamdar*                      *Financial Statement and Analysis*

## Marketing Special Paper I

**Subject Name -: Sales Management**

**Course Code -: 505 – B**

### **Objectives:**

1. To provide the students with basic understanding of the processes and skills necessary to be successful in personal selling and insights about recent trends in sales management.

2. To provide an understanding of the tools and techniques necessary to effectively manage the sales function - organization - sales individual.

3. To provide students with advanced skills in the areas of interpersonal communications, Motivational techniques

<b>Unit Number</b>	<b>Particulars</b>	<b>No. of lectures</b>
<b>1</b>	<b>Introduction to Sales Management:</b> 1.1 Definition 1.2 Meaning 1.3 Objectives 1.4 Role of sales management in marketing 1.5 Recent trends in sales management 1.6 Ethical and legal issues involved in sales management	<b>10</b>
<b>2</b>	<b>Sales Organization:</b> 2.1 Need for sales organization 2.2 Types and structures of sales organization 2.3 Principles for building successful sales organization 2.4 Functions and responsibilities of sales manager	<b>8</b>
<b>3</b>	<b>Managing the Sales Force:</b> 3.1 <b>Recruitment and Selection:</b> Sales personnel selection process, criteria used for selection of sales personnel 3.2 <b>Training:</b> Importance, Areas of sales training- Company specific knowledge, product knowledge, Industry and market trend knowledge, Customers and technology, Relationship Selling, Customer education, Value added Selling. 3.3 <b>Motivation:</b> Motivation and productivity of sales force, Types of compensation plans, sales meetings, sales contests, fine tuning of compensation plan 3.4 <b>Sales Reporting:</b> Sales records, Sales reports, Sample of Sales Report Format, Key Performance Indicators of sales	<b>10</b>
<b>4</b>	<b>Sales planning and control:</b> 4.1 <b>Sales planning:</b> Sales forecasting – concept and methods- qualitative and quantitative 4.2. Market and Sales potential- concept and methods 4.3 Sales quotas- concept, purpose and types	<b>10</b>

	4.4 <b>Sales control:</b> process of sales control- Goal setting, Performance Measurement, diagnosis and corrective actions	
<b>5</b>	<b>Personal Selling and Relationship Management:</b> 5.1 <b>Personal Selling:</b> concept, process, Tools for personal selling 5.2 Effective selling techniques 5.3 Concepts of Sales leads, sales calls, types of sales calls, sales presentation 5.4 Characteristics of a successful salesman 5.5 Use of technology in personal selling 5.6 <b>Relationship Management:</b> concept 5.7 Role of relationship management in personal Selling 5.8 Characteristics of relationship	<b>10</b>
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. *Sales and Distribution Management by Havaladar & Cavale, TMGH*
2. *Sales Management by Still, Cundiff & Govani, Pearson Education*
3. *Sales and Distribution Management, SL Gupta, Excel books*
4. *Marketing Management, B. R. Sangale, Success Publications, Pune*
5. *Retailing Management by Michael Levy & Barton Weitz, TMGH, 5thEdition*
6. *Building a Winning Sales Team – Gini Graham & Scott*
7. *Sales Management Handbook – Forsyth Ptrick*
8. *Professional Sales Management – Anderson, Hair and Bush*
9. *Sales Management - Richard R Still Edward W. Cundiff*
10. *International Marketing – Robert Reed*
11. *Strategies for selling-Gerald A. Michaelson*



## Human Resource Management Special Paper I

**Subject Name -:** Human Resource Management Principles and Functions

**Course Code -:** 505 – C

**Objective:**

To introduce the concept, principles and practices of H.R.M. to the students

<b>Unit Number</b>	<b>Particulars</b>	<b>No. of lectures</b>
<b>1</b>	<b>Human Resource Management and HR planning</b> 1.1. Introduction to Human Resource Management 1.2. Nature of Human Resource Management 1.3. Scope & Functions of HRM 1.4. Objectives of HRM 1.5. Role of H.R. manager 1.6. Strategic HRM: Meaning, Objectives & Challenges 1.7. HR Planning: Meaning, Definition 1.8. Need for HR Planning 1.9. Process HR Planning 1.10. Job Analysis, Job Design & Job Evaluation	<b>12</b>
<b>2</b>	<b>HR Recruitment and Selection</b> 2.1. Recruitment: Meaning & Definition 2.2. Recruitment Source: Internal vs. External 2.3. E-recruiting Methods, Benefits and Limitations 2.4. Factors Affecting Recruitment 2.5. Selection: Meaning & Process 2.6. E-selection, Advantages and Disadvantages. 2.7. Promotion: Policy and Types 2.8. Transfer: Policy and Procedure for Transfer 2.9. Demotion: Meaning, Causes of Demotion 2.10. Labor Turnover: Meaning. Measurement of Labor Turnover, Causes and Control measures	<b>10</b>
<b>3</b>	<b>Training, development and evaluation</b> 3.1. Training: Meaning, Objectives & Need 3.2. Training Process & Evaluation 3.3. Methods of Training: On the Job & Off the Job 3.4. Management Development: Meaning & Methods of MDP 3.5. Management Development Process and Evaluation 3.6. Performance Appraisal: Meaning, Definition & Need 3.7. Techniques of PA: Traditional & Modern Techniques 3.8. Possible Errors or Problems in Appraisal 3.9. E-performance Management: Meaning, Advantages & Disadvantages 3.10. Performance Management System: Meaning & Importance	<b>12</b>

<b>4</b>	<b>Personnel records reports and audit</b> 4.1. Meaning & Significance of Records and Reports 4.2. Essentials of a good Record and good Report 4.3. Personnel Audit: Objective, Scope & Importance 4.4. Methods of Analysis 4.5. Audit Report: Meaning & Importance	<b>6</b>
<b>5</b>	<b>New trends in HRM and exit policy</b> 5.1. Exit Policy: Meaning & Procedure 5.2. Challenges in implementing Exit Policy 5.3. Voluntary Retirement Schemes: Meaning, Merits & Demerits 5.4. Effects of Excess Manpower 5.5. HR in International Context: Global competency and Global Dimensions 5.6. Developing Cross Cultural Sensitivity 5.7. Human Resource Accounting 5.8. Human Resource Audit 5.9. Bench marking 5.10. Human Resource Research	<b>8</b>
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. *Personnel Management: - Bhatia S. K. and Singh Nirmal*
2. *Business Administration – G. M. Dumbre, Success Publications, Pune*
3. *Personnel Management: - Kumar Arun and Sharma Rachana*
4. *Human Resource Management- Ashwathappa*
5. *International Human Resource Management by Peter J Dowling, Device E Welch, 4th Edition.*
6. *International Human Resource Management by K Aswathappa and Sadhna Dash, TMGH*

## Service Sector Management Special Paper I

**Subject Name -: Management of Services**

**Course Code -: 505 – D**

**Objectives:**

1. To inculcate in depth knowledge of services as an essential economic activity.
2. To get overall understanding about special features of services, various concepts and issues related with management of services.

Unit Number	Particulars	No. of lectures
<b>1</b>	<b>An Introduction to services</b> 1.1 Concept of services – Definitions and meaning 1.2 Characteristics of services 1.3 Differences between goods and services 1.4 Stages of Economic Development - Preindustrial Society, Industrial Society, Post Industrial Society 1.5 Dependency of Manufacturing on Services 1.6 Fastest Growing Services – Banking, Insurance, Wholesale and Retail Trading, Health care, Travel and Tourism, I.T. and B.P.O. 1.7 Role of services in the economy 1.8 Management challenges in the service sector	<b>10</b>
<b>2</b>	<b>Classification of services</b> 2.1 Bases for Classifying services 2.2 Service Package 2.3 Distinctive Characteristics of Service Operations 2.4 Nature of service Act 2.5 Relationship of service organisation with customers, Customization and Judgment in Service Delivery 2.6 Nature of demand and supply of service delivery	<b>8</b>
<b>3</b>	<b>Managing Service Operations</b> 3.1 Forecasting demand for services – Meaning and Techniques 3.2 Managing Service Capacity - Strategies for managing demand, Strategies for managing supply 3.3 Yield management – Meaning, Characteristics and Applications 3.4 Managing waiting lines - Inevitability of waiting, The Psychology of waiting. 3.5 Queuing systems – Meaning, Essential features of Queuing Systems.	<b>10</b>
<b>4</b>	<b>Designing of Service Enterprise</b> 4.1 New service development – Meaning, Process cycle 4.2 Service design elements, service blueprinting, Benchmarking 4.3 Generic approaches to service system design 4.4 Technology in services	<b>12</b>

	4.5 Service quality – meaning, Scope of Service Quality, Service Quality Improvement – i) Quality and Productivity Improvement ii) Quality tools for Analysis and Problem solving – Check Sheet, Run Chart, Histogram, Pareto Chart, Flowchart, Cause and Effect Diagram, Scatter Diagram, Control Chart etc. iii) Programs for organizational quality improvement – Personnel Programs for Quality Assurance, Quality-Improvement Program to Achieve Zero Defects, Deming’s 14-Point Program, ISO 9000 and Six-Sigma.	
<b>5</b>	<b>Globalization of Services</b> 5.1 Meaning and importance of globalization of services 5.2 Globalization and Indian services 5.3 Domestic growth and expansion strategies – focused service, focused network, clustered service and diversified network 5.4 Franchising – meaning, nature, benefits and issues 5.5 Global service strategies – Multi country expansion, importing customers, following your customers, service off-shoring and Beating the Clock.	<b>8</b>
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. *Service Management – Operations, Strategy, information Technology*, James A. Fitzsimmons & Mona J. Fitzsimmons, Tata McGRAW-Hill.
2. *Services Management*, Sanjay V. Patankar, Himalaya Publishing House, Mumbai.
3. *Services Marketing – M. G. Mulla*, Success Publications, Pune.
4. *Marketing Management – B. R. Sangale*, Success Publications, Pune.
5. *Services Management*, Dr. K.Ramachandra, B. Chandrashekara and S. Shivakumar, Himalaya Publishing House, Mumbai.
6. *Services Marketing –Text and cases*, Rajendra Nargoundkar, Tata McGRAW-Hills.
7. *Services Marketing – Govind Apte*, Oxford University Press 2004.

## Agri Business Management Special Paper I

**Subject Name -:** Agricultural and Rural Development

**Course Code -:** 505 – E

**Objectives:**

1. To study the importance of rural economy of India
2. To understand the role of agribusiness management in development of economy

Unit Number	Particulars	No. of lectures
<b>1</b>	<b>Introduction to Agribusiness Management</b> 1.1 Indian Agricultural Economy – Characteristics, importance and Economic Planning, 1.2 Meaning, Scope and Importance of Agribusiness Management 1.3 Basic Infrastructural Facilities for Agribusiness 1.4 Linkages of Agro Industries to Indian Economy	<b>8</b>
<b>2</b>	<b>Rural Credit</b> 2.1 Role of Commercial Banks in Agricultural Sector 2.2 Role of National Bank for Agriculture and Rural Development (NABARD) 2.3 Role of cooperative institutions 2.4 Role of Regional Rural Banks (RRBs) 2.5 Introduction to Microfinance and concept of Self help Group	<b>12</b>
<b>3</b>	<b>Reforms in Indian Agriculture</b> 3.1 Land Reforms: Abolition of Zamindari Act, Tenancy reforms 3.2 Government Schemes/ programmes in Agriculture Sector: National Food Security Mission (NFSM); Rashtriya Krishi Vikas Mission (RKVM); National Rural Employment Guarantee Act (NREGA) 3.3 Irrigation	<b>12</b>
<b>4</b>	<b>Agricultural Taxation in India</b> 4.1 Importance of agricultural taxation for a developing country like India 4.2 Agricultural Income Tax	<b>6</b>
<b>5</b>	<b>Role of Corporate Sector and Agri Export</b> 5.1 Management Decisions 5.2 Export of Agricultural Products – Export Potential of Agro Based Products 5.3 Agricultural Export Zones 5.4 New Export Promotion Scheme (NEPS) 5.5 Role of NGOs in promotion of export of Agricultural produce	<b>10</b>
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. *Indian Economy : Dutt and Sundaram.*
2. *Indian Economy : A.N. Agarwal.*
3. *Agri. Business Management : Smita Diwase*
4. *Agricultural Business Management: Prof. H. L. Nagaraja Muthy; Himalaya Publishing House*

## Finance Special Paper II

**Subject Name :- Long Term Finance**

**Course Code :- 506 – A**

**Objectives:**

1. To make the study of long-term financing
2. To make the student well-acquainted regarding current financial structure

<b>Unit Number</b>	<b>Particulars</b>	<b>No. of lectures</b>
<b>1</b>	<b>Sources of Finance:</b> 1.1 Owned and Borrowed funds 1.2 Equity Shares, Preference Shares 1.3 Debentures, Term Loan, Lease Financing, Hire Purchasing	10
<b>2</b>	<b>Capital Structure:</b> 2.1 Meaning, factors affecting Capital Structure – Internal factors, External factors and General factors 2.2 Cost of Capital, Trading on Equity, Capital Gearing and Leverages	14
<b>3</b>	<b>Capital Budgeting:</b> 3.1 Meaning 3.2 Techniques of Capital Budgeting 3.3 Mutually Exclusive Proposals	8
<b>4</b>	<b>Specialized Private Financial Institutions-</b> objectives and functions of 4.1 IFCI 4.2 IDBI 4.3 ICICI 4.4 SFCs 4.5 UTI	10
<b>5</b>	<b>Dividend Decisions:</b> 5.1 Dividend policy, determinants of dividend policy 5.2 Types of dividend policy 5.3 Forms of dividend	6
	<b>Total</b>	<b>48</b>

**Topic for practical problems:**

1. Leverages
2. Cost of Capital and Capital Structure

**Reference Books:**

1. *I.M.Pandey – Financial Management – Vikas Publishing House*
2. *Ravi M.Kishore – Financial Management*

3. *G. M. Dumbre – Modern Banking, Success Publications, Pune.*
4. *P.C.Pardeshi – Business Finance*
5. *Khan and Jain – Financial Management – Tata McGraw Hill*
6. *Prasanna Chandra – Financial Management – Tata McGraw hill*
7. *Appannaiah, Reddy, Satyaprakash – Financial Management – Himalaya Publishing Pvt. Ltd*
8. *Satish Inamdar – Financial Statement and Analysis*



## Marketing Special Paper II

Subject Name -: Retail Management

Course Code -: 506 – B

### Objectives:

1. To provide insights into all functional areas of retailing.
2. To give a perspective of the Indian retail scenario.
3. To identify the paradigm shifts in retailing business with increasing scope of technology and e-business.

Unit Number	Particulars	No. of lectures
1	<p><b>Retailing:</b></p> <p><b>1.1 Overview of retailing:</b> Definition, Scope , Role and Functions of retailers, Advantages of Retailing, Organized and Unorganized Retailing, Indian Retail Scenario Vs. Global Retail Scenario , Drivers of retail change in India, Emerging Trends in Retailing in India , Role of Retail in Nation's Economy.</p> <p><b>1.2.Classification of Retailers:</b></p> <p><b>a. Traditional Retail Formats : (Store Based Retail Formats)</b> Independent stores, chain stores, Franchisee, Discount Stores, Cooperatives, Specialty stores, supermarkets, departmental stores, hypermarkets, convenience stores, chain stores, off price retailers etc.</p> <p><b>b. Modern Retail Formats: (Non Store Based Retail Formats)</b> Direct Selling, Direct Marketing, Catalog Marketing, Tele Marketing, Automatic Vending Machines, Airport Retailing, Kiosks, Electronic Shopping</p>	12
2	<p><b>Retail Location and site selection, store layout &amp; design and visual merchandising, category management:</b></p> <p><b>2.1 Retail Location and Site Selection:</b> Concept of location and site, factors to be considered in retail locations, important retail locations- central business district-destination locations-stand alone locations-convenience locations, process of retail location and site selection- selection of a city, deciding about trade location in the city, analysis of alternative sites</p> <p><b>2.2 Store Design and Store Layout:</b> The concept of store design, element of store design(interior and exterior), Store layout- Types of layout , factors affecting store</p>	11

	<p>layout, store facade</p> <p><b>2.3 Visual Merchandising:</b> Concept, Need and importance, tools used for visual merchandising and store atmospherics</p>	
<b>3</b>	<p><b>Retail Merchandising, Merchandise Planning and Category Management:</b></p> <p><b>3.1 Retail Merchandising:</b> Concept and principles of merchandising,</p> <p><b>3.2 Merchandise Planning:</b> Concept of merchandise planning, types of merchandise, process of merchandise planning, introduction of Private label brands</p> <p><b>3.3 Category Management:</b> Definition and process</p>	<b>08</b>
<b>4</b>	<p><b>Promotion mix in retailing and Retail Strategies</b></p> <p><b>4.1 Promotion Mix in Retailing:</b> Concept, need and objectives of promotion mix, elements of promotion mix, tool of promotion mix in store advertisements, outdoor advertisement, online advertising,</p> <p><b>4.2 Retail Strategies:</b> Differentiation strategy, growth strategy, expansion strategy, pricing strategy</p>	<b>09</b>
<b>5</b>	<p><b>Current trends in retailing:</b></p> <p><b>5.1 Role of IT in retailing:</b> Electronic Data Interchange(EDI), Database Management, Data Warehousing, Data Mining, Radio Frequency Identification(RFID), E-tailing, Bar Coding</p> <p><b>5.2 Rural Marketing -Retail:</b> Concept of rural marketing, Emerging models in rural markets Opportunities and Challenges in rural retail marketing.</p> <p><b>5.3 Mall Management:</b> Nature and concept of a mall, growth of malls globally and in India, Indian Malls Vs. Western countries Malls.</p>	<b>08</b>
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. *Retailing Management : Michael Levy and Barton Weitz, TMGH, 5th Edition*
2. *Retail Management: Swapna Pradhan, TTMGH*
3. *Retail Management : Gibson Vedamani, Jaico Books*
4. *Fundamentals of Retailing: K V S Madaan, McGraw Hill*
5. *Retail Marketing Management: David Gilbert, Pearson Publication*
6. *Retail Management : Arif Sheikh, Himalaya Publishing*

**Supplementary Reading Material**

1. *It happened in India by Kishor Biyani, Rupa and Company*
2. *Business Today , November 1999, Mall Management , pp. 7-22*

**Websites**

1. [www.indiaretailing.com](http://www.indiaretailing.com)
2. [www.imageretail.com](http://www.imageretail.com)

## Human Resource Management Special Paper II

**Subject Name -:** Human Resource Practices

**Course Code -:** 506 – C

**Objectives:**

To familiarize the students with it & practices

Unit Number	Particulars	No. of lectures
<b>1</b>	<b>A Introduction to Strategic HRM</b> 1.1 What is Strategy & Strategic Management? 1.2 Functional Level strategies 1.3.Challenges of Strategic HRM <b>B Job Analysis – Job Description &amp; Job Specification</b> 1.4 Work Scheduling 1.5 Job stress	
<b>2</b>	<b>A Executive Compensation</b> 2.1 Introduction 2.2 Methods/ Techniques 2.3 Importance <b>B. Working Conditions &amp; Welfare</b> 2.4 Importance Working Condition 2.5 Employee welfare- Importance, Types. 2.6 Industrial Accidents- causes and prevention, Accidents reports & records.	
<b>3</b>	<b>Organizational Development</b> 3.1 Concept & objectives 3.2 OD programme 3.3 OD Process and OD Culture 3.4 Ethics- organizational	
<b>4</b>	<b>A. Employee Grievance &amp; Discipline</b> 4.1 Meaning & Need for Discipline 4.2 Objectives 4.3 Causes of Indiscipline & its Actions 4.4 Essentials of a good Disciplinary System <b>B. Grievance causes &amp; its Procedure</b>	
<b>5</b>	<b>E- Human Resource</b> 5.1 E- Job Design 5.2 E- Human Resource Planning 5.3 E- Recruitment & E- Selection 5.4 E-Compensation 5.5 E- HR Records & E- HR Information 5.6 E-HR Audit	
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. *Human Resource Management- V S P Rao (Excel Books)*
2. *Personnel & Human Resource Management- P. Subba Rao (Himalaya Publishing House)*
3. *Human Resource Management- Ashwathappa (McGraw-Hill)*
4. *Human Resource Management – S. S. Shete (Success Publications, Pune)*
5. *Fundamentals of Human Resource Management- Gary Dessler (Pearson Education; First edition (2010))*
6. *E-Human Resources Management: Managing knowledge people – Teresa Torres, Mario Arias, Oliva*
7. *Strategic Human Resource Management – A general Managerial Approach- Charlis R. Greer; second edition*

## Service Sector Management Special Paper II

Subject Name -: Marketing Services

Course Code -: 506 – D

Objectives:

Unit Number	Particulars	No. of lectures
1	<b>Introduction</b> 1.1 Meaning & Scope of Services Marketing, 1.2 Nature and characteristics of services, 1.3 Classification of services, 1.4 Importance of services marketing,	8
2	<b>Delivering quality services</b> 2.1 Services based components of quality, perceived quality, 2.2 Gaps in quality, 2.3 Bench marking, 2.4 TQM and customer satisfaction measurement techniques, 2.5 Strategies for improvement of service quality service guarantee.	10
3	<b>Services Marketing Mix</b> 3.1 Concept and definition of Marketing Mix 3.2 Four P's(Product, Price, Place and Promotion) 3.3 Extended Ps of Marketing (People, Process and Physical evidence)	10
4	<b>Managing service competition</b> 4.1 Guidelines for managing service competition, 4.2 Approaches to service competition, 4.3 Promotional planning and marketing strategy for services	10
5	<b>Recent Trends of Services Marketing In India</b> 5.1 Role of IT services. 5.2 Types of E- Services – 5.2.1 E- services–Financial services, 5.2.2 Hospitality services, 5.2.3 Education services, 5.2.4 IT services, 5.2.5 Hotel & Tourism services, 5.2.6 Event management services, 5.2.7 Consultancy services	10
	<b>Total</b>	<b>48</b>

### Reference Books:

1. *Services Marketing – (Concepts, Practices and Case from Indian Environment)*  
Dr. S. Shajahan, Himalaya Publication House
2. *Services Marketing – Vasanti Vanugopal Raghu V.N. Himalaya Publications House*

3. *Services Marketing – Text and cases Hansh V. Varma Parsons Educations*
4. *Services Marketing – M. G. Mulla, Success Publications, Pune.*
5. *Services Marketing Text and Cases - Harsh V Varma*
6. *Principles of Marketing - Phillip Kotler and Gary Armstrong*
7. *Marketing - V.S. Ramaswamy and S Namankumari*

## Agri Business Management Special Paper II

**Subject Name -:** International Agricultural Systems

**Course Code -:** 506 – E

**Objectives:**

1. To study of farming system and recent issues in agriculture sector.
2. To understand export potential of Agri. Business

Unit Number	Particulars	No. of lectures
1.	<b>Study of Farming System in various countries of the world.</b> 1.1 Israeli System 1.2 Chinese System 1.3 American System	12
2.	<b>Recent Issues in Agriculture.</b> 2.1 Genetically modified crops. 2.2 Ecological farming and sustainable agriculture	10
3	<b>WTO and Agriculture.</b> 3.1 Agreement on Agriculture(AoA) 3.2 Controversy regarding Agricultural Subsidies 3.3 India's New Patent Regime	12
4.	<b>Export potential of Agri Business</b> 4.1 Agricultural SEZs 4.2 Agro Processing Zones (APZs) 4.3 Agro Export Zones (AEZs) 4.4 Initiatives for Export Promotions	08
5.	<b>Foreign Direct Investment</b> 5.1 Meaning, Significance 5.2 FDI Vs Exports in relation to Agriculture	06
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. *Indian Economy : Dutt and Sundaram*
2. *Agri.Business Management : Smita Diwase*
3. *Agri.Business Management: A.C. Broadway and Broadway*
4. *Indian Economy : A.N. Agarwal*
5. *Indian Economy : Mishra Puri*

**T.Y. B.B.A.  
Semester VI**

**Compulsory Paper**

**Subject Name :- Business Planning and Project Management**

**Course Code :- 601**

**Objectives:**

To acquaint the students with the planning process in business and familiarize them with the function and techniques of project management

Unit Number	Particulars	No. of lectures
<b>1</b>	<p><b>Planning:</b></p> <p>1.1 Introduction, Meaning, Definition, Characteristic, objective, nature of Planning</p> <p>1.2 Advantages and limitations of planning</p> <p>1.3 Steps in planning process</p> <p>1.4 Methods of planning</p> <p>1.5 Essentials of a good planning</p> <p>1.6 Obstacles in planning, Planning Premises and Classification of Planning Premises</p> <p>1.7 Plan and Planning, Business Planning</p> <p><b>Planning and Forecasting :</b></p> <p>1.8 Introduction, Meaning, Definition, Characteristics, Process,</p> <p>1.9 Importance of forecasting</p> <p>1.10 Areas of forecasting</p> <p>1.11 Forecasting Techniques- Types, Methods</p> <p>1.12 Advantages of forecasting, Limitations of forecasting</p> <p>1.13 Difference between forecasting and planning</p>	<b>10</b>
<b>2</b>	<p><b>Project Management –</b></p> <p>2.1 Definition of a “Project”</p> <p>2.2 Why project Management, The project Life-Cycle, Project Management Maturity</p> <p>2.3 Project Selection and Criteria of Choice</p> <p>2.4 The Nature of Project Selection Models, Types of Project Selection Models</p> <p>2.5 Project Portfolio Process, Project Proposals.</p> <p>2.6 The Project Manager – Qualities , Project Management and the Project Manager, Special Demands on the Project Manager</p> <p>2.7 Problems of Cultural Differences, Impact of Institutional Environments, Project Organization,</p> <p>2.8 The project as Part of the Functional Organization, Pure Project Organization, The Matrix organization</p> <p>2.9 Choosing an Organizational form The Project Team.</p>	<b>10</b>



<b>3</b>	<b>Initial Project Coordination</b> 3.1 The Nature of Negotiation, Partnering, Chartering and change, Conflict and the project life cycle. 3.2 Estimating Project Budgets, Improving the Process of Cost Estimation.	<b>10</b>
<b>4</b>	<b>Network Techniques</b> 4.1 PERT and CPM 4.2 Risk Analysis Using Simulation with Crystal Ball 2000 4.3 Critical Path Method- Crashing a Project, The Resource Allocation Problem, Resource Loading, Resource Leveling, Constrained Resource Allocation 4.4 The Planning-Monitoring-Controlling Cycle, Information Needs and the Reporting Process, Earned Value Analysis 4.5 The Fundamental Purposes of Control, Three Types of Control Processes, Comments on the Design of Control Systems, Control as a Function of Management.	<b>10</b>
<b>5</b>	<b>Purposes of Evaluation</b> 5.1 Goals of the System 5.2 The Project Audit, Construction and Use of the Audit Report, The Project Audit Life Cycle, some essentials of an Audit/Evolution 5.3 The Varieties of Project Termination, when to Terminate a Project, The Termination Process.	<b>8</b>
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. *Production and Operation Management:K. Ashwathappa and Siddharth Bhat, Himalaya Publishing House,2010 editions*
2. *Project Management- Samule J Mantel, Jr, Jack R. Meredith, Scott M. Shafer, Margaret M, Sutton with M.R. Gopalan, Wiley India Pvt. Ltd.*
3. *Business Administration with G. M. Dumbre, Success Publications, Pune.*
4. *Successful Project Management- Milton D. Rosenau, Jr., Cregory D. Githens, Wiley India Pvt. Ltd*
5. *Project Management- Vasant Desai, Himalaya Publishing House*
6. *Project Management : A Managerial Approach, Jack R. Meredith, Samuel J. Mantel Jr. Wiley India Pvt. Ltd.*
7. *Principles of Management – T. Ramasamy, Himalaya Publishing House*
8. *The McGraw-Hill 36-Hour Project Management Course -McGraw-Hill*

## Compulsory Paper

**Subject Name -:** Event Management

**Course Code -:** 602

**Objectives:** To acquaint the students with concepts, issues and various aspects of event management.

Unit Number	Particulars	No. of lectures
1	<p><b><u>Introduction to Event and Event Management</u></b>            1.1 Introduction and Definition of Event.            1.2 Event Designing, 5 C's of Events.            1.3 5 W's of Event.            1.4 Types of Events.            1.5 Categories of Event and its characteristics.            1.6 Objectives of Event Management.            1.7 Problems associated with traditional media.</p>	08
2	<p><b><u>Facets of Event Management</u></b>            2.1 <u>Event Infrastructure</u>: Core Concept, Core People, Core Talent, Core Structure.            2.2 <u>Clients</u>: Set Objectives for the Event, Negotiating Contracts with Event Organizers, Locating Interaction Points, Banners , Displays etc., at the Event, Preparing the Company's Staff for the Event, Post-event Follow-up.            2.3 <u>Event Organizers</u>: Role of Event Organizer, Qualities of an Event Organizer, Steps in Organizing an event.            2.4 <u>Venue</u>: In-house Venue, External Venue.</p>	10
3	<p><b><u>Execution of Event:</u></b>            3.1 <u>Networking Components</u>: Print Media, Radio Television, The Internet, Cable Network, Outdoor Media, Direct Media.            3.2 <u>Types of promotion methods used in events</u>: Sales Promotions, Audience Interaction, Public Relations, Merchandising, In-venue Publicity, Direct Marketing, Advertising, Public relations.            3.3 <u>Activities in Event Management</u>: Pre-event Activities, During-event Activities, Post-event Activities.            3.4 <u>Functions of Event Management</u>: Planning, Organizing, Staffing, Leading and Coordination, Controlling.            3.5 <u>Event Management Information System</u>.            3.6 <u>Technology in Event Management</u>.- Role and Importance.</p>	10
4	<p><b><u>Marketing of Event</u></b>            4.1 <u>Concept of Market in Events</u>            *Revenue Generating Customers.            *Nonrevenue Generating Customers.            4.2 Segmentation for Events, Niche marketing in events.            4.3 Targeting.</p>	10

	<p>4.4 Positioning of Events.  4.5 Branding in Events.  4.6 Reach Interaction Matrix.  4.7 Concept of Pricing in Events.  4.8 Legislation and Tax Laws.  4.9 Marketing Communication Tool.  4.10 Implementation of Marketing Plan.  4.11 Relationship Building.  4.12 <u>The Diverse Marketing Needs Addressed by Events: Brand Building, Focusing the Target Market, Creating Opportunities for Better Deals with Different Media, Events and the Economy.</u>  4.13 Concept of Ambush Marketing.</p>	
<b>5</b>	<p><b><u>Strategies of Event Management</u></b>  5.1 Strategic Approach.  5.2 Critical Success Factor Analysis.  5.3 <u>Strategic Alternatives Arising From Environmental Analysis:</u> Maintenance Strategy, Developmental Strategy, Preemptive Strategy, Survival Strategy.  5.4 <u>Strategic Alternatives Arising from Competitive Analysis:</u> Sustenance Strategy, Rebuttal Strategy, Accomplishment Strategy, Venture Strategy.  5.5 Strategic Alternatives Arising from Defined Objectives.  5.6 PREP Model.  5.7 Risk versus Return Matrix.  5.8 Forms of Revenue Generation.  5.9 <u>The Basic Evaluation Process:</u> Establishing Tangible Objectives and Sensitivity in Evaluation, Measuring Performance, Correcting deviations, Critical Evaluation Points in Events.</p>	<b>10</b>
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. *Event Management: Wagen, Lynn Van Der, Pearson Education, 2012*
2. *Event Marketing and Management: Gaur, Sanjaya Singh, Vikas Publishing House Pvt Ltd. 2003*
3. *Business Management : G. M. Dumbre, Success Publications, Pune.*
4. *Event Planning And Management: Sharma, Diwakar, Deep & Deep Publication Pvt Ltd. 2005*
5. *Events Management: Raj, Razaq, SAGE Publication India Pvt. Ltd. 2009*

## Compulsory Paper

**Subject Name -: Management Control System**

**Course Code -: 603**

**Objectives:**

To introduce to the students the function of management control, its nature, functional areas, and techniques.

<b>Unit Number</b>	<b>Particulars</b>	<b>No. of lectures</b>
<b>1</b>	<b>Introduction To Management Control System</b> 1.1 The control function- Elements of Control- Nature of Control – Problems in control 1.2 Management Control – Characteristics, Principles & Types of Management Control 1.3 Factors Affecting Managerial Philosophy 1.4 Management Control Systems - Elements of MCS – Designing of MCS – 10 commandments of Effective Control System	<b>10</b>
<b>2</b>	<b>Management Controls In Functional Areas</b> 2.1 Production Control: Need – Procedure – Techniques Of Production Control 2.2 Inventory Control: Classification Of Inventories – Motives For Holding Inventories- Determination Of Stock Levels 2.3 Marketing Control: Process Of Marketing Control- Importance Of Marketing Control System- Tools And Techniques Of Marketing Control 2.4 Control In Personnel Area: Reasons For Workers Resistance To Controls- Kind Of Control Devices 2.5 IT Measures And Control – Installation Of Management Information & Control System, Structured & unstructured Decision	<b>12</b>
<b>3</b>	<b>Computers Systems</b> 3.1 Computer for Management Control Purposes- Are Computers essential for MIS? 3.2 Computers and Information System – Manual Systems – Mechanical Systems- MIS – Decision Support Systems- Characteristics of DSS- Where to apply DSS- Expert Systems.	<b>8</b>
<b>4</b>	<b>Management Control Of Projects</b> 4.1 Meaning of project – Aspects of Project – Factors affecting Project - 4.2 Project Planning – Time Dimension – Cost Dimension- Quality Dimension 4.3 Project Control- Reports Costs and Time- Reports on output- Revisions.	<b>10</b>

<b>5</b>	<b>Implementing MCS for small &amp; medium size companies</b> 5.1 Methodology of implementing Management Controls - Roles and responsibilities in implementing Management Control. 5.2 Management Control Structure - Responsibility centre, cost centre, profit centre, investment centre. 5.3 MCS in service & non-profit organizations.	<b>8</b>
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. Anthony R. N. and John Dearden: *Management Control Systems*
2. 3. Bhattacharya S. K.: *Managerial Planning & Control System*
4. Mark G. Simkin : *Computer information systems for Business*
5. Robert J. Mockler: *Readings in Management Control*
6. Subhash Das : *Management Control Systems.*
7. P. Saravanavel : *MCS – H.P. House*
8. Arora Ashok & Akshay Bhatia, *Excel Books, New Delhi: Information Systems for Managers*

## Compulsory Paper

Subject Name -: E- Commerce

Course Code -: 604

### Objectives:

1. To know the concept of electronic commerce
2. To know the concept of Cyber Law & Cyber Jurisprudence
3. To know Internet marketing techniques

Unit Number	Particulars	No. of lectures
1	<b>E- Commerce and Business Model Concepts</b> 1.1 Main Activities of E Commerce 1.2 Definition 1.3 Goals 1.4 Technical Components 1.5 Functions 1.6 Status 1.7 Prospects 1.8 Significance 1.9 Advantages 1.10 Disadvantages  <b>E-Commerce Business Models</b> 1.11 Major Business to Consumer (B2C)Business Model Portal, E-tailor 1.12 Major Business to Business (B2B) Business Model 1.13 E Distributor, E-Procurement, Exchanges 1.14 Business models in Emerging E-Commerce Areas - C2C, P2P, and B2G.	11
2	<b>E-Money</b> 2.1 Real World Cash 2.2 E-Money 2.3 Requirements 2.4 Types of Electronic Payment Media 2.5 B2B E-Payment Systems  <b>Viruses</b> 2.6 Types of Viruses 2.7 Spyware & Adware 2.8 Virus Characteristics 2.9 Protection against Fraud & Viruses	10
3	<b>E-Marketing</b> 3.1 Identifying Goals	11

	3.2 Browsing Behavior Model 3.3 Online Marketing 3.4 E Advertising 3.5 Internet Marketing Trends 3.6 Target Markets 3.7 E-Branding 3.8 Marketing Strategies 3.9 Consumer Online: The Internet Audience and Consumer Behavior 3.10 E-cycle of Internet Marketing.	
<b>4</b>	<b>Cyber Law Concepts</b> 4.1 E Contract 4.2 Jurisdiction Concept 4.3 Choice of Law 4.4 Minimum Contacts 4.5 Internet Jurisdiction 4.6 Contractual Obligation in cyberspace 4.7 Active Vs Passive Websites 4.8 E-mail Transactions	<b>8</b>
<b>5</b>	<b>Cyber Jurisprudence</b> 5.1 Evolution of New System 5.2 Legal Meaning of Software 5.3 Legal Issues for Internet Commerce 5.4 Cyber Attack –Trojan, Virus ,Worm, Spam 5.5 Hacking – Phishing, IP Spoofing.	<b>8</b>
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. *E – Commerce Concepts – Models – Strategies*, Himalaya Publishing House. ISBN : 978-81-8488-096-0; C.S.V. Murthy
2. *Electronic Commerce From Vision to Fulfillment*, 3rd Edition, PHI. ISBN : 81-203-3027-7; Elias M. Awad
3. *E – Commerce An Indian Approach*, 2nd Edition, PHI ISBN : 81-203-2788-8; P.T.Joseph, S.J.
4. *Laws Relating to Computers Internet & E-Commerce*, 4th Edition, Universal Law Publishing Company. ISBN : 978-81-7534-778-6; Nandan Kamath
5. *E-Commerce –The Cutting Edge of Business* Second Edition; Kamlesh K Bajaj, Debjani Nag
6. *E-Commerce –Business ,Technology, society*; Kenneth C.Laudon,Carol Guercio Traver
7. *Introduction to E-Commerce*; Zheng Qin

## Finance Special Paper III

**Subject Name :- Financial Services**

**Course Code :- 605 A**

**Objectives:**

- 1) To study in detail various financial services in India
- 2) To make the students well acquainted regarding financial markets

Unit Number	Particulars	No. of lectures
<b>1</b>	<b>Indian Financial System : An Overview</b> 1.1 Introduction to Financial System 1.2 Structure of Financial System - Financial Institutions , Financial Markets, Financial Instruments and Financial Services 1.3 Overview of Indian Financial System since 1991 1.4 Financial Intermediaries in Financial System: - Merchant Bankers, Underwriters, Depositories, Brokers, Sub brokers, Bankers etc.	<b>9</b>
<b>2</b>	<b>Introduction to Financial Markets</b> 2.1 Capital Market- Primary Market – Management of IPO, Secondary Market – Stock Exchanges in India – Introduction , NSE , BSE , OTCEI 2.2 Role of SEBI as a regulatory authority 2.3 Introduction to Derivatives, Futures and Options 2.4 Money Market – Introduction , Money Market instruments – Call and Notice money market , Treasury Bill , Commercial Papers , Certificate of Deposits , Money Market Mutual Fund , Inter corporate deposits 2.5 Difference between Money Market and Capital Market	<b>14</b>
<b>3</b>	<b>Financial Services in India</b> 3.1 Mutual Fund 3.2 Factoring and Forfeiting 3.3 Credit Rating 3.4 Venture Capital	<b>9</b>
<b>4</b>	<b>Banking and Insurance Sector in India :-</b> 4.1 Introduction 4.2 Structure of Banking and Insurance Sector in India 4.3 Role of RBI and IRDA as a regulatory authority	<b>5</b>
<b>5</b>	<b>Recent Trends in Accounting and Finance</b> 5.1 Zero Base Budgeting 5.2 Inflation Accounting 5.3 Human Resource Accounting 5.4 Activity Based Costing 5.5 Mergers and Acquisition	<b>11</b>
	<b>Total</b>	<b>48</b>



**Reference Books:**

1. Kohak MA :- *Financial Services*
2. L M Bhole and Jitendra Mahakut – *Financial Institutions and Markets*
3. G. M. Dumbre – *Modern Banking, Success Publications, Pune.*
4. S. S. Shete – *Financial Marketing and Institutions in India, Success Publications, Pune.*
5. Dr. S Gurusamy :- *Essentials of Financial Services*
6. M Y Khan :- *Indian Financial System*
7. Rajesh Kothari :- *Financial Services in India , Concept and Application*

## Marketing Special Paper III

**Subject Name -: Advertising and Sales Promotion**

**Course Code -: 605 B**

**Objectives:**

1. To develop knowledge and understanding of importance and functions of advertising.
2. To understand Key features of Sales Promotion

Unit Number	Particulars	No. of lectures
<b>1</b>	<p><b>Introduction and Measurement of Effective Advertising</b></p> <p>1.1 Advertising – Evolution, Meaning, Definition, Classification, Benefits, Functions, Criticism, Ethics, Social issues</p> <p>1.2 Strategic Advertising Decision - Setting Advertising Objectives, Deciding Advertising Budget, Advertising Framework planning and Organization.</p> <p>1.3 Advertising Campaign – Meaning, Basis of Campaign, Length of Campaign, Parameters governing advertising Campaign, Planning of advertising of Campaign</p> <p>1.4 Advertising Agency – Meaning, Definition, Functions, Types, Advantages, Structure, Advertiser and Advertising Interface</p> <p>1.5 Advertising Effectiveness – Objective of measuring Advertising Effectiveness, Difficulties and Evaluation of Advertising Effectiveness</p> <p>1.6 Advertising Control – Control of Advertising by Practitioners</p>	<b>12</b>
<b>2</b>	<p><b>Copy Decisions</b></p> <p>2.1 Advertising Copy --Meaning, Objectives, Elements, Features, Types of Copy</p> <p>2.2 Advertising Layout – Principles, Components, Visualization of Layout, Layout Format,</p> <p>2.3 Copy Creation – Approaches, Principles, Styles of Copy creation, Verbal Versus Visual Thinking, Pre Testing methods and Measurements.</p>	<b>10</b>
<b>3</b>	<p><b>Media Decisions</b></p> <p>3.1 Advertising Media – Meaning, Definition, Functions, Types of Media</p> <p>3.2 Media Planning – Importance, Process, Difficulties, Basics of Reach, Frequency, Continuity in Media Planning</p> <p>3.3 Media Research – Meaning, Importance, Functions, Process of Media Research</p> <p>3.4 Media Selection – Approaches and factors affecting Media Selection</p>	<b>10</b>
<b>4</b>	<p><b>Sales Promotion And Brand Equity</b></p> <p>4.1 Sales Promotion – Meaning, Definition, Objectives of sales</p>	<b>10</b>

	<p>promotion, Factors affecting Sales Promotion Growth, Techniques of Sales Promotion</p> <p>4.2 Strategic Sales Promotion -- Strategies and Practices in Sales Promotion, Cross Promotions, Surrogate Selling, Bait and Switch advertising issues.</p> <p>4.3 Brand Equity – Concepts and Criteria, Building, Measuring and Managing Brand Equity, Linking Advertising and sales promotion to achieve “Brand standing”, Leveraging Brand values for business and non-business contexts.</p>	
<b>5</b>	<p><b>Role of Information Technology in Advertising and Sales Promotion</b></p> <p>5.1 Comparison of Traditional and Modern Advertising</p> <p>5.2 Internet Advertising – Purpose, Types, Advantages, disadvantages of internet Advertising</p> <p>5.3 Pre-Requisites of Online Advertising</p> <p>5.4 E – Advertising Guidelines</p> <p>5.5 Internet Advertising today</p>	<b>6</b>
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. *Advertising and Promotions - Belch & Belch, Tata McGraw Hill 2001*
2. *Advertising Management - Rajeev Batra, John G. Myers & David A Aaker-PHI*
3. *Otto Kleepner’s Advertising Procedure – PH*
4. *Advertising Management – Rawal C. N., Success Publications, Pune.*
5. *International Edition - Contemporary Advertising Irwin/McGraw –Hill*
6. *Integrated Marketing Communications - Duncon- TMH*
7. *Foundations of Advertising Theory & Practice- S.A.Chunawalla & K.C.Sethia- Himalaya Publishing*
8. *Integrated Advertising, Promotion and Marketing Communication- By Clow Baack*
9. *Advertising Management- Manendra Mohan*
10. *Advertising Management- Batra, Myers & Aaker*
11. *Sales Promotion: M.N.Mishra*
12. *Advertising and Promotion- George Belch and Michael Belch*
13. *Marketing Management – Philip Kotler, Keller Jha- Pearson Education, 11th Edition*

## Human Resource Management Special Paper III

**Subject Name :- Labour Laws**

**Course Code :- 605 C**

**Objective:**

To acquaint the students with important legal provisions governing the industrial employees

Unit Number	Particulars	No. of lectures
<b>1</b>	<b>An Introduction to Labour Laws in India</b> 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 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) 1.7 International Labour Organization	<b>10</b>
<b>2</b>	<b>The Employees Provident Funds And Miscellaneous Provisions Act,1952</b> 2.1 Scope, Application and Definitions 2.2 Schemes under the Act 2.3 Chapter II of the Act(Employee Provident Fund Scheme, State Board, appointment of Officers, Employees Pension Scheme and Fund, Employee Deposit Linked insurance Scheme, Inspectors.) 2.4 Membership of the Fund.	<b>10</b>
<b>3</b>	<b>The Employees State Insurance Act,1948</b> 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)	<b>10</b>
<b>4</b>	<b>The Child Labour (Prohibition and Regulation) Act,1986</b> 4.1 Part I (Preliminary) 4.2 Part II (prohibition of Employment of Children in Certain Occupations and Processes) 4.3 Part III (Regulation of Conditions of Work of Children) 4.4 Part IV (Miscellaneous- Penalties)	<b>08</b>

	4.5 IPEC(International Programme on Elimination of Child Labour)	
<b>5</b>	<b>Maternity Benefits Act,1961</b> 5.1 Extent, Application and Definitions 5.2 Employment or work prohibited by women in certain periods 5.3 Right to Payment of Maternity Benefits 5.4 Payment of Maternity benefits in case of death of women 5.5. Payment of Medical Bonus 5.6 Leave for Miscarriage and wages for Tubectomy Operation 5.7 Leave for Pregnancy illness, delivery, premature birth of a child, Medical Termination of Pregnancy, Nursing Breaks 5.8 Appointment of Inspectors, Powers and Duties	<b>10</b>
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. *Bare Acts*
2. *Business Law – G. M. Dumbre, Success Publications, Pune.*
3. *Industrial and Labour Laws-S.P.Jain*
4. *Industrial Law - P.L. Malik*
5. *Labour Laws- Taxman*
6. *Labour & Industrial Laws-S.K.Puri*
7. *Labour & Industrial Laws-Goswami V.G.*
8. *Labour & Industrial Laws- Mishra S.N.*
9. *Labour & Industrial Laws- K.M.Pillai*

## Service Sector Management Special Paper III

Subject Name -: Special Services of Marketing in India

Course Code -: 605 D

### Objective:

1. To create a right understanding about nature of services in India.
2. To develop a right approach towards marketing of services in India.
3. To make students aware about upcoming areas of services in India.

Unit Number	Particulars	No. of lectures
1	<b>Introduction:-</b> 1.1 Introduction 1.2 Concept and objectives of Services Marketing 1.3 Reasons of growth of Service Sector 1.4 Role of Services in Indian Economy 1.5 Challenges of Service Marketing	8
2	<b>Marketing of Bank Services and Insurance Services:-</b> 2.1 Introduction to banking services, Concepts and objectives, Bank Marketing in Indian prospective, Application of Indian concepts in Indian Banking. 2.2 Introduction to Life insurance services, Concepts and objectives, Marketing of Life Insurance in India, Marketing approach of Life Insurance ( Study of 4P's of Marketing Mix)	10
3	<b>Tourism, Hospitality and Health Care Services:-</b> 3.1 Tourism marketing concept - Market segmentation for tourism, Special Characteristics of Indian Tourism Marketing. 3.2 Uses of hospitality services, Health care marketing, Study of 7p's of marketing mix. 3.3 Introduction to Health Care Services, Consumer buying behaviour in health care services.	10
4	<b>Marketing of Other Services:-</b> 4.1 Emerging trends and its features : 4.2 Marketing of Higher Education, Political Marketing, Airline Marketing, Cellular and Entertainment Services, Internet services	10
5	<b>Technology in Services:-</b> 7.1 Technology in services 7.2 The emergence of self service 7.3 Automation in services 7.4 Technological innovations in services: Challenges of adopting new technology in service 7.5 Managing the new technology adoption process	10
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. *Services Marketing* - S.M.Jha, Himalaya Publication House
2. *Services Marketing* - P.K.Sinha, S.C.Sahoo, Himalaya Publication House
3. *Services Marketing* – M. G. Mulla, Success Publications, Pune.
4. *Services Marketing* – Vasanti Venugopal, Raghu V.N., Himalaya Publication House
5. *Service Management* – James A. Fitzsimmons, Mona J. Fitzsimmons, TATA McGraw Hill
6. *Marketing of Services - An Indian Perspective – Text and Cases*, Dr. S. L. Gupta, V.V. Ratna, Wisdom Publications, Delhi.

## Agri Business Management Special Paper III

**Subject Name -:** Recent Trends in Agri business

**Course Code -:** 605 E

**Objectives:**

1. To study the agro base industries in Indian economy
2. To understand services associated with Agriculture Business.

Unit Number	Particulars	No. of lectures
<b>1</b>	<b>Introduction</b> 1.1 Agro based industries and their linkages to the Indian Economy. 1.2 Impact of International Agri. Business on Indian Economy. 1.3 Contract Framing.	<b>10</b>
<b>2</b>	<b>Inputs in Agriculture</b> 2.1 Agricultural Research and Education. 2.2 Agricultural Insurance.	<b>8</b>
<b>3</b>	<b>Agro based Industries.</b> 3.1 Food Processing Industries – Meaning, Future prospects of Processed food industry, constraints in export of processed food 3.2 Poultry Industries. 3.3. Dairy Industry – Characteristics, product range, future growth 3.4. Sugar Industry 3.5. Cotton Textiles Industry	<b>12</b>
<b>4</b>	<b>Services Associated with agriculture.</b> 4.1 Processing of Agricultural Products. 4.2 Agricultural Marketing 4.3 Agricultural Retailing. 4.4 Agricultural Finance. 4.5 HRM in agri business	<b>10</b>
<b>5</b>	<b>Standardization and legislation :</b> 5.1 Co-operative Management 5.2 Co-operative Marketing 5.3 Cooperative Institutions. 5.4 Grading and Standardization, Bureau of Indian Standards (BIS) 5.5 Business Legislation – Essential Commodities Act, Food Adulteration Act, Food safety and standards, Consumer Protection Act.	<b>8</b>
	<b>Total</b>	<b>48</b>



**Reference Books:**

1. *Indian Economy : Dutt and Sundaram*
2. *Agri.Business Management : Smita Diwase*
3. *Agri.Business Management: A.C. Broadway and Broadway*
4. *Indian Economy : A.N. Agarwal*
5. *Indian Economy : Mishra Puri*

## Finance Special Paper IV

**Subject Name :- Cases in Finance/ Project**

**Course Code :- 606 A**

The student shall write a project report on the topics selected under the guidance of a faculty and submit one hard binding copy and one soft copy of the same to the Principal of the college before 31st March. Soft copy should be conserved at college level. The project shall be assessed both internally (20 marks) and externally (30 marks). For external evaluation there will be a viva voce. Such viva-voce shall be conducted by a panel of two referees appointed by the University.

Total Lectures: 24 Project + 24 Cases in Finance = 48

### Topics for Project:

1. Projected financial statements to be submitted to the bank for loan proposal.
2. Analysis & interpretations of financial statement with the help of Techniques like Ratio analysis, Fund flow Analysis, Cash flow Analysis.
3. Project related Insurance sector.
4. Working Capital Management.

The students can select any other topic related to finance, for their project in consultation with their respective teacher. At least ten cases covering the following aspects should be studied.

- A. Capital Budgeting
- B. Working Capital
- C. Cost of Capital

Total Lectures: 24 Project + 24 Cases in Marketing = 48

NOTE: Scheme of marking for this paper will be as follows:

Project work	30
Viva voce (conducted by internal as well as external to be appointed by University)	20
Theory Paper on cases in finance	50
	-----
	Total 100 marks

Project report should be evaluated by both internal and external examiner. Each examiner will allot marks out of 50 i.e. project work 30 marks and viva voce 20 marks. The total marks given by both internal and external examiner will be out of 100 and will be converted into marks out of 50.

**Sample Case No 1:**

Jay Industries Ltd. is considering purchasing a new machine. Two alternative models are under consideration. The comparative data of the two machines are as follows:

Particulars	Machine X	Machine Y
Cost of Machine	3,00,000	5,00,000
Estimated Life	10 years	10 years
Estimated Saving is Scrap p.a.	20,000	30,000
Additional Cost of Supervision p.a	24,000	32,000
Additional Cost of Maintenance p.a.	14,000	22,000
Cost of Indirect Material p.a.	12,000	16,000
Additional Savings in Wages p.a	1,80,000	2,40,000

Rate of Taxation: 50% of the Profits. Assume Targeted Cost of Capital @ 10%. As a Finance Executive advice Management regarding which machine may be a profitable investment by calculating Annual Cash Flow, Payback Period, NPV and PL. Total PV @ 10% for 10 years = 6.144

**Sample Case No 2:**

The following information is related to Parekh Industries Pvt. Ltd., Pune. Budgeted Sales (78,000 units) Rs. 46.80 lakhs. 25% Sales are Cash Sales

**Analysis of Selling Price**

Raw Material	60% of Selling Price
Direct Labour	6.00 per unit
Variable Overheads	1.00 per unit
Fixed Overheads	5 Lakhs (Including Rs. 1, 10,000 as depreciation)

It is estimated that:

- (a) Holding Period of:
  - Raw Materials – 3 weeks
  - Work-in-Process – 1 week
  - Finished Goods – 2 week
- (b) Suppliers will give 4 weeks credit.
- (c) Customers are allowed 4 weeks credit.
- (d) Wages are paid after 4 weeks.
- (e) Lag in payment of overheads will be 2 weeks.
- (f) Cash in Hand Rs. 50,000.

Prepare a statement showing working capital requirement for a year using cash cost approach. Year = 52 weeks

## Marketing Special Paper IV

**Subject Name :- Cases in Marketing / Project**

**Course Code :- 606 B**

### **Objectives:**

To understand of application of theory into practice

The student shall write a project report on the topics selected under the guidance of a faculty and submit one hard binding copy and one soft copy of the same to the Principal of the college before 31st March. Soft copy should be conserved at college level. The project shall be assessed both internally (20 marks) and externally (30 marks). For external evaluation there will be a viva voce. Such viva-voce shall be conducted by a panel of two referees appointed by the University.

Total Lectures: 24 Project + 24 Cases in Marketing = 48

### **CASES STUDIES :- ( 50 Marks)**

#### **1. Introduction to Case Studies:-**

Case – Meaning – Objectives of Case Studies –  
Characteristics & Importance of Case Studies –  
Guidelines for Case Studies & Cases Discussion.

#### **2. Topics for Case Studies:-**

- Advertising & Sales Promotions
- Consumer Behavior
- Buyer Behavior
- Industrial Marketing
- Service Marketing
- Brand Marketing
- Retail Marketing
- Rural Marketing
- Sales and Distribution Management
- International Marketing
- Marketing Research
- New & Existing Products
- E-Commerce / On-line Marketing

### **Sample Case No-1**

Computer Consumables Ltd. (CCL) is a small scale company with a product portfolio consisting of printer Ribbons, Cartridges and Ink Jet refill packs. The company's turnover in its first year (i.e. year ending March 2014) is Rs. 2-5 crores. It has a marketing department consisting of one G.M. (Mktg.), one Sales Manager, one Dispatch Assistant and Five Sales Engineers covering Maharashtra and Gujarat. Next year's sales turnover target is Rs. 5 Crore. The G.M. (Mktg.) has proposed addition of two

Product/Brand Executives and twenty Sales Engineers. The Managing Director is not convinced of the utility of product/brand executives to his company. He also has hesitation about the return on investment (ROI) of additional Rs. 25 lakh towards salary of additional staff in marketing department.

- 1) Identify and allot new territories for Sales Engineers and the Sales Targets.
- 2) Develop an advertising plan for CCL.

### **Sample Case No-2**

For unless the consumer walked into a retailer and specially asked for Frooti, the retailer might choose to push any other product, including those on which the retailer margins were higher or those that were then undertaking a major promotional activity. Indeed, the sales of Frooti had been falling over the years. Besides just competition from products in other categories, its market shares in the 'tetra pack' category was also gradually falling, as new players had entered the segment and were using the same packaging technique. Clearly, something needed to be done. Frooti had acquired an 'old boy' image, as a 'kids-only' product, perhaps due its 'tetra pack' packaging as opposed to the glass and PET bottles used by other beverage manufacturers. Consumers typically consumed the product using a straw, something seen as 'for kids'.

- (1) How could the brand re-position itself in the market? In particular, it needed to drop the perception of being only for kids.
- (2) What should Frooti have done when its market share was falling consistently?

### **Sample Case No -3**

Jack and Jill of Goa, are two partners, engaged in the business of manufacturing and selling sports equipments under the brand name 'J2'. They cater to the needs of indoor and outdoor sports and recreation activities.

Recently they have acquired an imported sewing machine, which can stitch cotton as well as synthetic fabrics. The machine is being used to stitch anoraks, track-suits, tents, tent-covers, etc. The machine is so versatile, that it can stitch jackets, jerkins, rajais and quilts, which are so commonly used in central and northern states, in winter. Inspired by this impressive range of products, that they can create, Jack and Jill wish to chalk-out an elaborate marketing action-plan. Extend your advice for the following:

- (1) Analyze this case with suitable title.
- (2) Suggest Market Segmentation for their new non-sports products.

### **Reference Books:**

1. Sales Management handbook – Forsyth P. Trick
2. Sales Management – Richard R Still Edward W. Cundiff
3. Retail Management – Gibson Vedamani
4. Channel Management & Retail Management – Minal Dhotre
5. Advertising and Promotions – Belch & Belch
6. Marketing Management – Rajan Saxena
7. Principles of Marketing 9th Edition – Philip Kotler and Garry Armstrong

## Human Resource Management Special Paper IV

**Subject Name -: Cases in Human Resource Management / Project**

**Course Code -: 606 C**

### **Objectives:**

To understand of application of theory into practice

### **Unit 1. Introduction to Case Studies:-**

Case – Meaning – Objectives of Case Studies –Characteristics & Importance of Case Studies – Cases Discussion

### **Guidelines for Analyzing Case Studies on the following points**

- Facts of the case
- Analysis
- Solution
- Action points
- Conclusion

### **Unit 2. Topics for Case studies:-**

1. Recruitment and Selection
2. Training & Development
3. Working conditions
4. Salary and Wage Administration -Pay scales and Grades
5. Performance Management System
6. Grievance Handling
7. Settlement of Industrial disputes-Industrial Relations
8. Transfer- Promotion-Demotion
9. Labor Welfare
10. Retrenchment- Layoffs
11. VRS

### **Sample Case 1:**

Sidhdheshwar Textile Ltd. is employing about 600 employees. During the last 6 to 7 years, the company is earning good profits. Due to general recessionary trends and other adverse factors, its profits are reduced beyond expectation. The internal unions of workers 'Solapur Majadur Sangh' and staff members (two separate unions) are insisting for 20% bonus, while the company is ready to give 15% bonus. Several rounds of negotiations were proved fruitless. Surprisingly, one day just before Diwali staff union decided to accept 15% bonus. The news was not welcomed by the Solapur Majadur Sangh. Some office-bearers of the Solapur Majadur Sangh charged the company to adopt 'divide and rule' policy. The company representatives refused to have done unfair labour practice. When the allegations were again made, company suspended six office-

bearers of Solapur Majadur Sangh, pending enquiry. The workers declared strike as a protest. The indefinite strike of workers deprived the other union's members 15% bonus, which was acceptable to them.

*Questions:*

- (a) Comment on the Industrial relations of the company in the context of bonus policy.*
- (b) What crucial role should the Personnel Manager play to ensure peace and harmony?*
- (c) Is the action of suspending union office-bearers correct? Examine pros and cons.*

**Sample Case 2:**

Mr. Patole is a Branch Manager of 'Janata Co-operative Bank Ltd.' at one of its village branches. His staff includes two clerks and one attender. Very often, Mr. Patole was left alone in the Bank after 5 p.m. to tally accounts, daybooks and complete all other formalities. On 30 December, Mr. Patole was working till past 2 a.m. tallying the accounts, since hardly one day was left for closing the accounts for the year. On this fateful night, the Branch Manager was attacked by a band of robbers, who looted the bank after brutally wounding Mr. Patole right hand, which had to be amputated, later. After his recovery, the Branch Manager applied for compensation. The Bank Management was of the opinion that Mr. Patole violated the job specifications by working beyond the stipulated hours of work. He, in its view, was not entitled to any compensation as the accident occurred during non employment hours. They also called for an explanation as to why the amount lost cannot be recovered from his salary and the provident fund.

*Questions:*

- (a) Analyze the case with suitable title.*
- (b) How do you justify the bank's stand in this case?*
- (c) What modifications do you suggest in job description to overcome such incidents in future?*

## Service Sector Management Special Paper IV

**Subject Name :- Cases in Service Sector Management / Project**

**Course Code :- 606 D**

### **Objectives:**

To understand of application of theory into practice

### **Unit 1. Introduction to Case Studies:-**

Case – Meaning – Objectives of Case Studies –Characteristics & Importance of Case Studies – Cases Discussion

### **Guidelines for Analyzing Case Studies on the following points**

Facts of the case

Theoretical implications: Market research: Methodologies of research.

SWOT

Analysis

Solution

Action points

Conclusion

### **Sample Case1:**

Mr. Kishore runs a hotel in a populated residential area. This hotel was started by his grandfather 50 years back. Since then this hotel was their only family business. However over the past few years the hotel faced consistent losses as the popularity of the hotel had reduced and not many people visited their hotel. Mr. Kishore is very concerned about this issue and wants to conduct a research to find the causes.

Q1. Frame a strategy to conduct a research to find the reasons for reduction in the customer walk-in's of the restaurant.

Q2. Design a questionnaire to collect customer feedback regarding food quality, service, ambience, etc.

### **Sample Case2:**

Mr. Joshi, had just retired as a primary school teacher. He has opened an account with a private sector bank. He used to pay his house rent by cheque every month. He had dropped a new cheque book request slip in the ATM drop box and was expecting the same to reach him in a week's time. However he did not receive the cheque book even after ten days. He required cheques urgently and hence went to the bank to complain about the issue, after waiting for 45 minutes he was called by a customer care officer. The officer told him that he can be issued a emergency cheque book for which he will have to pay a charge of Rs. 250/- The officer did not agree to the fact that Mr. Joshi had applied for the cheque book and did not receive one, hence he should not be charged for this cheque book. Mr. Joshi was not happy with the service he received.



Q1. What should have been the officials approach towards Mr. Joshi as a senior citizen?

Q2. What should Mr. Joshi do to safeguard his interest as a customer of this bank?

**Sample Case no.3:**

Using a mobile today has become a necessity rather than luxury, everyone, irrespective of income class can now afford a mobile phone. The telecom service providing companies are providing SIM cards at very low prices to target the masses. However the users consistently complain about services issues of these companies. One of such issues is pop up's that are recurrently appearing on the mobile screens and for people who are not aware about it, are unknowingly subscribing for unwanted services, like dialer tone, daily astrology, act. It becomes very difficult for a common man to disable the services. All the more they have to pay for the service they did not even want.

Q1. Is this activity of the telecom service providers Ethical? Explain with justification.

**Sample Case no.4:**

“Pretty Lady” is a reputed ladies wellness centre being run in a residential locality for almost a decade. The proprietors wish to conduct a survey to find out the perception of the customers about the quality of service being offered.

Q1. State the importance of quality in service sector

Q2. Prepare a questionnaire to collect the feedback of customers on quality of the service being provided.

**Sample Case no.5:**

Digital Marketing has evolved as a new channel of distribution in the retail sector. Hundreds of websites have started selling multiple products and brands online.

Many people are finding this option as a convenient one, due to their hectic schedules. However there is no face to face interaction between the seller and the buyer, making good service all the more important. The growth of this channel of distribution has also increased the demand for logistic services which would deliver these products to the door step of the customers. It is very important for this sector to provide good service to make sure the customer doesn't switch over to the competitors.

Q1. Analyse this case and suggest how the service factors can be improved by this channel of distribution.

## **Agri Business Management Special Paper IV**

**Subject Name -: Cases in Agri Business Management / Project**

**Course Code -: 606 E**

### **Objectives:**

To understand of application of theory into practice

### **Unit 1. Introduction to Case Studies:-**

Case – Meaning – Objectives of Case Studies –Characteristics & Importance of Case Studies – Cases Discussion

### **Guidelines for Analyzing Case Studies on the following points**

- Introduction to case
- Facts of the case
- Actual Practical Solution for case with alternate if applicable
- Conclusion about the case

### **Unit 2. Topics for Case studies**

- a. Rural Credit System.
- b. Role of Corporate Sector & Agri Export
- c. Reforms in Indian Agriculture
- d. Agro Based Industries
- e. Services Associated with Agriculture

### **Sample Case 1:**

The distraught farmers of Maharashtra are at loss to understand the measures to protect their agricultural income. Severe drought conditions have destroyed their crop, 80 of the farmers are not aware of the schemes like Crop Insurance and relief aid from the Government.

Advise them on following points:

- i. Information regarding Insuring Crops.
- ii. The Crops that could be covered under Crop Insurance Scheme.
- iii. The agencies that provide Crop Insurance Scheme.
- iv. The procedure to get the relief aid from the Government and the rules and regulation.

### **Sample Case 2:**

Kisan is a young farmer in the draught prone Marathwada. He wishes to develop a Horticulture Farm.

- i. What suggestions will you give?
- ii. Suggest the types of crops he could grow in the land where water is scarce.
- iii. Suggest water conservation techniques that are more suitable

**Sample Case 3:**

A group of people in Maharashtra decide to develop a dairy plant on co-operative basis, (Amul Model), give advice on following points:

- i. Procedure to establish co-operative dairy.
- ii. Resources required for development.
- iii. Various avenues of business except milk (Milk By-products)

**Sample Case 4:**

Suresh has a limited cultivable agricultural land. He is totally dependent on the agricultural income which is very less. Advise him on following points:

- i. A small side business which complements his agricultural land.
- ii. The procedure to open such business.
- iii. The resources that are required.

Support your answers with suitable examples

**Sample Case 5:**

Ram is a farmer from Marathwada, which is facing server drought conditions and scarcity of water. He suffered heavy losses but decides to do proper planning next year.

Suggest:

- (i) Water Conservation Methods
- (ii) Rain Harvesting
- (iii) Maximum Yield with minimum use of water

**Third Year Bachelor of Business Administration (T.Y.B.B.A.)**

**Pattern of Question paper of Theory papers**

Time: 3 Hours

Total Marks: 80

**Instructions:**

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Draw neat and well labeled diagrams wherever necessary.

Q.1) Theory question (15)

**OR**

Theory Question

Q.2) Theory question (15)

**OR**

Theory Question

Q.3) Theory question (15)

**OR**

Theory Question

Q.4) Theory question (15)

**OR**

Theory Question

Q.5) Write Short Notes (Any **four** out of **six**) (20)

**Third Year Bachelor of Business Administration (B.B.A.) Semester VI**

**Pattern of Question paper of 606- Project/ Cases**

Time: 2 Hours

Total Marks: 50

**Instructions:**

1. **Q1.is compulsory.**
2. **Attempt any two** from the remaining.
3. Figures to the right indicate full marks.

Q1.	Case study	20
Q2.	Case study	15
Q3.	Case study	15
Q4.	Case study	15

**Third Year Bachelor of Business Administration (B.B.A.) Semester VI**

**Pattern of Question paper of 505 (A) – Analysis of Financial Statements**

Time: 3 Hours

Total Marks: 80

**Instructions:**

1. All Questions are Compulsory.
2. Figures to the right indicate full marks.
3. Use of calculator is allowed.

Q.1) Theory question (16)

**OR**

Theory Question

Q.2) Theory question (16)

**OR**

Theory Question

Q3. Write Short Notes (Any **two** out of **four**) (8)

Q4. (A) Practical Problem (10)

(B) Practical Problem (10)

Q5. Practical Problem (20)

**Third Year Bachelor of Business Administration (B.B.A.) Semester VI**

**Pattern of Question paper of 506 (A) – Long Term Finance**

Time: 3 Hours

Total Marks: 80

**Instructions:**

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Use of calculator is allowed.

Q1. Practical Problem (15)

Q2. Theory Question (15)

**OR**

Theory Question

Q3. Theory Question (15)

**OR**

Theory Question

Q4. Theory Question (15)

**OR**

Theory Question

Q5. Write Short Notes (Any four out of six) (20)

# **Revised Syllabi for Three - Year Integrated B.Com. Degree course (From June 2013)**

## **1) INTRODUCTION**

The revised syllabi for B.Com Degree Course will be introduced in the following order.

- |      |                    |           |
|------|--------------------|-----------|
| i)   | First Year B.Com.  | 2013-2014 |
| ii)  | Second Year B.Com. | 2014-2015 |
| iii) | Third Year B.Com.  | 2015-2016 |

The B.Com. Degree Course (Revised Structure) will consist of three Years. The first year annual examination will be held at the end of the first year. The Second Year annual examination will be held at the end of the second year. The Third annual examination shall be held at the end of the third year.

## **2) ELIGIBILITY**

1. No Candidates shall be admitted to enter the First Year of the B.Com. Degree Course (Revised Structure) 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 subject.
2. No candidate shall be admitted to the annual examination of the First year B.Com. (Revised Structure) unless he/ she has satisfactorily kept two terms for the course at the college at the college affiliated to this University.
3. No candidate shall be admitted to the annual examination of the Second Year unless he/she has kept two terms satisfactorily for the course at the college affiliated to this University.
4. No candidate shall be admitted to the Third year of the B.Com. Degree Course (Revised Structure) unless he/she has passed in all the papers at the First Year B.Com. Examination and has passed in all the papers at the first Year B.Com. Examination and has satisfactorily kept terms for the second year and also two terms for the third year of B.Com. satisfactorily in a college affiliated to this University.

## **3) A.T.K.T. Rules :**

As far as A.T.K.T. is concerned, a student who fails in two theories and one practical head of passing at F.Y.B.Com may be admitted to S.Y.B.Com. likewise a student who fails in the two theory and one practical head of passing at S.Y.B.Com may be admitted to T.Y.B.Com. But a student passing S.Y.B.Com but fails in any subject at F.Y.B.Com cannot be admitted to T.Y.B.Com.



4) (A) Revised Structure of B.Com. Course.

<b>F.Y.B.Com. w.e.f. 2013-14</b>	
<b>Sr. No.</b>	<b>Compulsory / Main Subjects</b>
<b>101</b>	Compulsory English
<b>102</b>	Financial Accounting
<b>103</b>	Business Economics (Micro)
<b>104 (A)</b>	Business Mathematics and Statistics
	or
<b>104 (B)</b>	Computer Concepts and Applications
<b>105</b>	<b>Optional Group (Any one of the following)</b> a) Organizational Skill Development. b) Banking & Finance c) Commercial Geography d) Defense Organization and Management in India e) Co-Operation. f) Managerial Economics
<b>106</b>	<b>Optional Group (Any one of the following)</b> a) Essentials of E-Commerce b) Insurance & Transport c) Marketing & Salesmanship d) Consumer Protection & Business Ethics. e) Business Environment & Entrepreneurship f) Foundation Course in Commerce
<b>107</b>	<b>(Any one of the language from the following groups)</b> <b>Modern Indian Languages (M.I.L.) -:</b> Compulsory English / Marathi / Hindi / Gujarathi / Sindhi / Urdu / Persian.  <b>Modern European Languages (M.E.L.) -:</b> French / German.  <b>Ancient Indian Languages (A.I.L.) -:</b> Sanskrit.  <b>Arabic.</b>

<b>S.Y.B.Com. w.e.f. 2014-15</b>	
<b>Sr. No.</b>	<b>Compulsory / Main Subjects</b>
<b>201</b>	<b>Business Communication.</b>
<b>202</b>	Corporate Accounting.
<b>203</b>	Business Economics (Macro)
<b>204</b>	Business Management
<b>205</b>	Elements of Company Law
<b>206</b>	<b>Special Subject – Paper I</b> <b>(Any one of the following)</b> a) Business Administration b) Banking & Finance. c) Business Laws & Practices.

	d) Co-operation & Rural Development. <b>e) Cost &amp; Works Accounting.</b> f) Business Statistics. g) Business Entrepreneurship. h) Marketing Management. i) Agricultural & Industrial Economics. j) Defense Budgeting, Finance & Management. k) Insurance, Transport & Tourism. l) Computer Programming and Applications.
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<b>T.Y. B.Com. w.e.f. 2015-16</b>	
<b>Sr. No.</b>	<b>Compulsory / Main Subjects</b>
<b>301</b>	Business Regulatory Framework (Mercantile Law)
<b>302</b>	Advanced Accounting.
<b>303 (A)</b>	Indian & Global Economic Development
	Or
<b>303 (B)</b>	International Economics
<b>304</b>	Auditing & Taxation
<b>305</b>	<b>Special Subject – Paper II</b> <b>(Same special subject offered at S.Y. B.Com.)</b> <ul style="list-style-type: none"> <li>a) Business Administration</li> <li>b) Banking &amp; Finance.</li> <li>c) Business Laws &amp; Practices.</li> <li>d) Co-operation &amp; Rural Development.</li> <li>e) Cost &amp; Works Accounting.</li> <li>f) Business Statistics.</li> <li>g) Business Entrepreneurship.</li> <li>h) Marketing Management.</li> <li>i) Agricultural &amp; Industrial Economics.</li> <li>j) Defense Budgeting, Finance &amp; Management.</li> <li>k) Insurance, Transport &amp; Tourism.</li> <li>l) Computer Programming and Applications.</li> </ul>
<b>306</b>	<b>Special Subject – Paper III</b> <b>(Same special subject offered at S.Y. B.Com.)</b> <ul style="list-style-type: none"> <li>a) Business Administration</li> <li>b) Banking &amp; Finance.</li> <li>c) Business Laws &amp; Practices.</li> <li>d) Co-operation &amp; Rural Development.</li> <li>e) Cost &amp; Works Accounting.</li> <li>f) Business Statistics.</li> <li>g) Business Entrepreneurship.</li> <li>h) Marketing Management.</li> <li>i) Agricultural &amp; Industrial Economics.</li> <li>j) Defense Budgeting, Finance &amp; Management.</li> <li>k) Insurance, Transport &amp; Tourism.</li> <li>l) Computer Programming and Applications.</li> </ul>

**B) Subjects Carrying Practical's**

There will be practical examination for the F.Y.B.Com. for the subject Financial Accounting. There will be practical and practical examinations for the special subjects at S.Y.B.Com. and T.Y.B.Com. levels. There will be Practical for the S.Y.B.Com level Compulsory subject Business Communication & for T.Y.B.Com Auditing & Taxation.

(C) A Student must offer the same Special Subject at T.Y.B.Com. which he has offered at S.Y.B.Com.

(D) In an exceptional cases, a student may change the subject chosen by him at second year during the first term of the third year provided he keeps the additional terms of the new subject at S.Y.B.Com.

**4. EXTERNAL CANDIDATES**

- 1) The student who has registered his name as the external student will appear at the annual examination.
- 2) The result of external student will be declared on the basis of Annual Examination of 80 marks for practical subjects by converting the same out of 100.
- 3) No foreign student shall be allowed to register as an External Student.

**5. MEDIUM OF INSTRUCTION.**

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. WORKLOAD**

The present norms of workload of lectures, tutorials and practicals per subject in respect of B.Com. Course shall continue.

**7. UNIVERSITY TERMS**

The dates for the commencement and conclusion of the first and the second terms shall be as determined by the University Authorities. The terms can be kept only by duly admitted students. The present relevant ordinances pertaining to grant of terms will be applicable.

**8. 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.

**9. 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.

**10. RESTRUCTURING OF COURSES**

This new revised structure shall be made applicable to the colleges implementing 'Restructured Programme' at the undergraduate level from June, 2004. The existing pattern of 'C', 'D', and 'E' Components shall be continued.

The Colleges under the Restructured Programme which has revised their structure in the light of the "2008 Pattern" shall be introduced with effect from academic year 2010-11.

**11. SETTING OF QUESTION PAPERS**

1. A candidate shall have the option of answering the question in any of the subjects either in Marathi or English except in languages.
2. The question papers shall be framed so as to ensure that no part of the syllabus is left out of study by a student.
3. The question paper shall be balanced in respect of various topics outlined in the syllabus.
4. The question papers shall have combination of long and short answer type question. As far as possible short answer type questions should not exceed 15 to 20 percent.
5. There shall be no overall option in the question paper, instead, there shall be internal options (such as either/ or and three short answers out of five etc.).
6. In case of question paper under the Special Subject (Paper No. III) one question carrying 10 marks will be set on current knowledge in relating subject in the academic year.

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**S.Y. B.Com.**  
**Compulsory Paper**

**Subject Name -: Business Communication.**

**Course Code -: 201.**

**Objectives of the Course:**

1. To understand the concept, process and importance of communication.
2. To develop awareness regarding new trends in business communication.
3. To provide knowledge of various media of communication.
4. To develop business communication skills through the application and exercises.

**Medium of Instruction : English**

Unit No.	TERM: I	Periods
<b>1</b>	<b>Introduction of Business Communication:</b> Introduction, Meaning, Definition, Features, Process of Communication, Principles, Importance, Barriers to Communication & Remedies.	<b>12</b>
<b>2</b>	<b>Methods and Channels of Communication:</b> Methods of Communication-Merits and Demerits&Channels of Communication in the Organisation and their Types, Merits & Demerits	<b>10</b>
<b>3</b>	<b>Soft Skills:</b> Meaning, Definition, Importance of Soft Skills <b>Elements of Soft Skills:</b> 1) Grooming Manners and Etiquettes 2) Effective Speaking 3) Interview Skills 4) Listening 5) Group Discussion 6) Oral Presentation	<b>16</b>
<b>4</b>	<b>Business Letters:</b> Meaning, Importance, Qualities or Essentials, Physical Appearance, and Layout of Business Letter	<b>10</b>
<b>Total Periods</b>		<b>48</b>
<b>TERM: II</b>		
<b>5</b>	<b>Types and Drafting of Business Letters:</b> 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	<b>16</b>
<b>6</b>	<b>Job Application Letters:</b> Meaning, Types & Drafting of Job Application Letters, Bio-Data/Resume	<b>08</b>

	/Curriculum Vitae	
<b>7</b>	<b>Internal and other Correspondence:</b> 1) Office Memo (Memorandums) 2) Office Orders 3) Office Circulars 4) Form Memos or Letters 5) Press Releases	<b>12</b>
<b>8</b>	<b>New Technologies in Business Communication:</b> Internet: Email, Websites, Electronic Clearance System, Writing a Blog Social Media Network: Twitter, Facebook, LinkedIn, YouTube, Cellular Phone, WhatsApp Voice Mail Short Messaging Services Video Conferencing Mobile	<b>12</b>
	<b>Total Periods</b>	<b>48</b>

#### Recommended Books:

1. Asha Kaul (1999), "Business Communication", Prentice Hall of India, New Delhi.
2. Chaturvedi P. D. & Chaturvedi Mukesh (2012), "Managerial Communication", Pearson, Delhi.
3. Madhukar R. K. (2005), "Business Communication", Vikas Publishing House Pvt. Ltd., New Delhi.
4. Mamoria C. B. & Gankar S. V. (2008), "Personnel Management", Himalaya Publishing House, Mumbai.
5. Nawal Mallika (2012), "Business Communication", Cengage Learning, Delhi.
6. Rajendra Pal & Korlahalli (2007), "Essentials of Business Communication", Sultan Chand & Sons, New Delhi.
7. Sharma R. C. & Krishan Mohan, "Business Correspondence & Report Writing", Tata McGraw Hill Publishing Co. Ltd.
8. Sinha K. K. (2003), "Business Communication", Galgotia Publishing Company, New Delhi.
9. Sinha K. K. (2008), "Business Communication", Galgotia Publishing Company, New Delhi.
10. Vasishth Neeru & Rajput Namita (2006), "Business Communication", Kitab Mahal, Allahabad.

#### Assessment Pattern

Internal Assessment (Term End Examination)	:	20 Marks
Practical Examination	:	20 Marks
Annual Examination	:	<u>60 Marks</u>
<b>Total Marks</b>	:	<b><u>100 Marks</u></b>

## Question Paper Pattern

### Term End Examination

Q. 1: Answers in 20 Words: (Attempt any Seven) (Total 10 Questions)	:	14 Marks
Q. 2: Answer in 50 Words: (Attempt any Two) (Total 4 Questions)	:	08 Marks
Q. 3: Answer in 100 Words (Attempt any Three) (Total 5 Questions)	:	18 Marks
Q. 4: Answer in 500 Words (Attempt any One) (Total 2 Questions)	:	20 Marks

### Annual Examination:

Q. 1: Term I Syllabus <b>OR</b> Q. 1: Term I Syllabus	:	16 Marks
Q. 2: Term I Syllabus <b>OR</b> Q. 2: Term I Syllabus	:	16 Marks
Q. 3: A: Term I Syllabus <b>OR</b> Q. 3: A: Term I Syllabus	:	08 Marks
Q. 3: B: Term II Syllabus <b>OR</b> Q. 3: B: Term II Syllabus	:	08 Marks
Q. 4: Term II Syllabus <b>OR</b> Q. 4: Term II Syllabus	:	16 Marks
Q. 5: Short Notes (Attempt any Four) (Total 6 Short Notes on Term II Syllabus)	:	16 Marks

### Guidelines for completion of Practicals:

- 1) At least Four Practicals should be completed during the academic year by students in consultation with subject teacher.
- 2) Practical should be based on visit as well as library assignments.
- 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 practicals, then the student shall not be eligible for appearing at the practical examination.

**List of suggested Topics for Practicals:**

<b>Sr. No.</b>	<b>Topics</b>
1	Analysis of Case Studies on Business Communication
2	Analysis of Posters/Pictures (Non-Verbal)
3	Barriers to Communication through Case Studies
4	Barriers to Listening through attending seminars/conferences/public meetings.
5	Drafting of Unsolicited/Solicited Job Application Letter with Bio-Data/Resume/CV
6	Collection & Drafting of various Business Letters
7	Group Discussions
8	Class Room Presentations on various Topics
9	Interview Skills
10	Use of Technology in Communication
11	Drafting of Memos
12	Drafting of Press Releases/Notes
13	Drafting of Office Orders
14	Drafting of Office Circulars
15	Any other topics to be suggested by the Subject Teachers



**S.Y. B.Com.**  
**Compulsory Paper**  
**Subject Name :- Corporate Accounting**  
**Course Code :- 202**

**Objectives:-**

To enable the students to develop awareness about Corporate Accounting in conformity with the provisions of Companies Act and Accounting as per Indian Accounting Standards.

1. To make aware the students about the conceptual aspect of corporate accounting
2. To enable the students to develop skills for Computerized Accounting
3. To enable the students to develop skills about accounting standards

**Term – I**

Unit	Topic and Contents	No. of Lectures
<b>1.</b>	<b>Accounting Standards:-</b> Detailed Study of Accounting Standards 5, 6, 10, 14, 21 with Practical Examples numerical case studies, Application nature.	<b>08</b>
<b>2.</b>	<b>Company Final Accounts:-</b> Preparation of Final Accounts- Forms and contents as per Provisions of Companies Act (As Amendment upto the beginning of the relevant academic year) As per Revised Schedule- VI	<b>14</b>
<b>3.</b>	<b>Company Liquidation Accounts:-</b> Meaning of Liquidation- Modes of winding up – (a) Preparation of Liquidator final statement of Account (b) Preparation of Statement of Affairs and Deficiency Account.	<b>12</b>
<b>4.</b>	<b>Computerized Accounting Practices:-</b> Conceptual background - (a) Inventory Accounting (b) Payroll Accounting (c) MIS Reports including Demonstration and Hands Experience.	<b>14</b>
<b>Total</b>		<b>48</b>

**Term – II**

Unit	Topic and Contents	No. of Lectures
<b>5.</b>	<b>Accounting for Amalgamation, Absorption and External Reconstruction of Companies:-</b> Meaning- Vendor and Purchasing Companies- Purchase Consideration- Accounting entries- and Preparation of Balance Sheet after Amalgamation, Absorption and External Reconstruction.	<b>14</b>
<b>6.</b>	<b>Accounting for Internal Reconstruction:-</b> Meaning- Alteration of Share Capital, Reduction of Share Capital-Accounting Entries and preparation of Balance Sheet After Internal Reconstruction	<b>10</b>
<b>7.</b>	<b>Holding Company Account:-</b>	<b>14</b>

	Preparation of consolidated Balance sheet of Holding Company with one subsidiary only. Adjustment of inter company transactions, unrealized profit of stock.	
<b>8.</b>	<b>Valuations of Shares:-</b> Concept of Valuation, Need for Valuation, Special Factors affecting Valuation of Shares, Methods of Valuation - (a) Net Assets Method, (b) Yield Basis Method, (c) Fair Value Method.	<b>10</b>
	<b>Total</b>	<b>48</b>

**Notes:-**

1. Question Paper for Termend and Annual Examination should consist of :
  - Theory Questions :- 30%
  - Problems :- 70%
2. In the Question Paper of Annual Examination, the weightage to the syllabus should be as follows:
  - i) 40% on the total syllabus of the First Term.
  - ii) 60% on the total syllabus of the Second Term.
3. Colleges are required to use only licensed copy of software.

**Recommended Books:-**

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. Corporate Accounting: By Dr. K. N. Jagtap, Dr. S. D. Zagade, Dr. H. M. Jare
9. Accounting Standard: By D. S. Rawat.
10. Accounting Standards –as issued by Institute of Chartered Accountants of India.

**Journals:-**

1. The Chartered Accountant : Journal of the Institute of Chartered Accountants of India.
2. The Accounting World : ICFAI Hyderabad
3. Journal of Accounting & Finance : Accounting Research Association of Jaipur.

**S.Y. B.Com.**  
**Compulsory Paper**  
**Subject Name -: Business Economics (Macro)**  
**Course Code -: 203**

**Objectives:**

1. The objective of the course is to familiarize the students the basic concept of Macro Economics and application.
2. To Study the behavior of the economy as a whole.
3. To Study the relationship among broad aggregates.
4. To apply economic reasoning to problems of the economy.

<b>Term – I</b>		
<b>Sr. No</b>	<b>Topic</b>	<b>No. of Lectures</b>
<b>UNIT- 1</b>	<b><u>Basic Concepts of macro Economics</u></b> 1.1 Meaning of Macro Economics 1.2 Nature and Scope of Macro Economics 1.3 Significance and limitations of Macro Economics 1.4 Difference between Micro and Macro Economics	<b>08</b>
<b>UNIT- 2</b>	<b><u>National Income</u></b> 2.1 Meaning & Importance of National Income 2.2 Concept - a) Gross National Product (GNP) b) Net National Product (NNP) c) Income at Factor cost or National Income at Factor Prices d) Per Capita Income e) Personal Income ( PI ) f) Disposable Income( DI ) 2.3 Measurement of National Income – Circular Flow of Income-Two sector model 2.4 Difficulties in Measurement of National Income	<b>14</b>
<b>UNIT- 3</b>	<b><u>Money</u></b> 3.1 Meaning and functions of Money 3.2 Demand for Money – Classical and Keynesian Approach 3.3 Supply of Money a) Role of Central Bank – Credit Control- Quantitative and Qualitative b) Reserve Bank of India’s New Money Measures 3.4 Role of Commercial Banks – Process of Multiple Credit Creation and its limitations	<b>12</b>
<b>UNIT- 4</b>	<b><u>Value of Money</u></b> 4.1 Meaning & Concept of Value of Money 4.2 Quantity Theory of Money 4.3 Cash Balance approach – Cambridge Equation - Pigou, Marshall, Keynes 4.4 Milton Friedman’s Approach 4.5 Difference between Quantity Theory and Cash Balance Approach	<b>14</b>

	Theory	
<b>Term - II</b>		
<b>UNIT- 5</b>	<b><u>Inflation and Deflation</u></b> 5.1 Inflation and Deflation – Meaning, Causes and effects 5.2 Demand Pull and cost Push inflation 5.3 Inflationary Gap 5.4 Philips Curve – Supply side Economics 5.5 Stagflation	<b>10</b>
<b>UNIT- 6</b>	<b><u>Trade Cycle -</u></b> 6.1 Meaning, Definition and features of Trade Cycle 6.2 Phases of Trade Cycle 6.3 Policy for control of Trade Cycle – Monetary and Fiscal Measures	<b>12</b>
<b>UNIT- 7</b>	<b><u>Theories of Output and Employment</u></b> 7.1 Classical Theories of Employment – Says , Pigou , Fisher 7.2 Keynesian Criticism on Classical Theories of Employment 7.3 Keynesian Theory of Employment	<b>12</b>
<b>UNIT-8</b>	<b><u>Public Finance</u></b> 8.1 Meaning, Nature and Scope of Public Finance 8.2 Principle of Maximum Social advantage-Dr. Dalton’s Approach 8.3 Public Revenue and Expenditure 8.4 Types of Taxation 8.5 Principles of Taxation 8.6 Effects of Taxation 8.7 Causes of increasing Public Expenditure	<b>14</b>

#### **Basic Reading List**

1. Ackey, G (1976) Macro Economics Theory and Policy, Macmillan Publishing Company, New York
2. Ahuja H. L. (2002) Macroeconomics Theory and Policy, Chand and Co. Ltd New Delhi.
3. D’souza Errol (2008) Macroeconomics : Person Publication, New Delhi.
4. Gupta S.B. (1994) Monetary Economics, S. Chand and Co. Delhi
5. Jingan M.L. (2002) Macro Economic Theory, Vrinda Publication, Delhi
6. Vaish M. C. (2002) Macro Economic Theory, Vikas Publishing House, N. Delhi
7. Shapiro E (1996) Macro Economic Analysis; Galgotia Publication, New Delhi

#### **ADDITIONAL READING LIST**

1. Dillard, D. (1960), The Economics of John Maynard Keynes, Crosby Lockwood and Sons, London.
2. Day A.C.L. (1960) Outline of Monetary Economics, Oxford University Press, Oxford
3. Higgins, B. (1963), Economic Development: Principles, Problems and Policies, Central Book Depot, Allahbad.
4. Keynes, J.M. (1936), The General Theory of Employment, Interest and Money, Macmillan, London.
5. Kindleberger, C.P. (1958), Economic Development, McGraw-Hill Book Company, New York.
6. Lucas, R. (1981), Studies in Business Cycle Theory, MIT Press, Cambridge, Massachusetts.

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**S.Y. B.Com.**  
**Compulsory Paper**  
**Subject Name -: Business Management**  
**Course Code -: 204**

**Objective:**

1. To provide basic knowledge & understanding about business management concept.
2. To provide an understanding about various functions of management.

UNIT NO	CHAPTER	PERIODS
	TERM-I	
<b>Unit –I</b>	<b>OVERVIEW OF MANAGEMENT</b> Meaning, Definition, Management: Is it Science, Art or profession? Characteristics of Professional Management. The need of Management Study. Process of Management, Level Of Management, Managerial Skills, Challenges before management , Brief Review of Management Thought with reference to FW Taylor & Henry Fayol	<b>12</b>
<b>Unit –II</b>	<b>PLANNING &amp; DECISION MAKING.</b> Planning-Meaning, Definition, Nature, Importance, Forms, Types Of Planning, Steps in Planning, Limitations Of Planning. Forecasting-Meaning & Techniques. Decision Making- Meaning, Types Of Decisions & Steps In Decision Making.	<b>12</b>
<b>Unit III</b>	<b>ORGANIZATION &amp; STAFFING</b> Meaning, Process & Principles, Departmentalization, Organization Structure, Authority and Responsibility, Delegation of authority, Difficulties in delegation of Authority, Centralization verses Decentralization, Team Work. Staffing-Meaning, Need & Importance of Staffing, Recruitment-Sources and Methods of Recruitment.	<b>12</b>
<b>Unit IV</b>	<b>DIRECTION &amp; COMMUNICATION</b> Direction- Meaning, Elements, Principles, Techniques & importance.. Communication-Meaning, Types, Process of Communication & importance of effective Communication. Barriers to Communication.	<b>12</b>
	<b>Total</b>	<b>48</b>
	<b>TERM-II</b>	
<b>UNIT-V</b>	<b>MOTIVATION</b> Meaning, importance, Theories of motivation, Maslow’s Need Hierarchy Theory, Herzberg’s Two factors Theory, Douglas Mc Gregor’s Theory of X & Y & Ouchi’Theory Z. McClelland’s Theory.	<b>12</b>
<b>UNIT-VI</b>	<b>LEADERSHIP</b> Meaning, Importance, Qualities & Functions of a Leader, Leadership Styles for Effective Management .Contribution of Mahatma Gandhi, Dr. Babasaheb Ambedkar & Pandit Jawaharlal Neharu	<b>12</b>

<b>Unit- VII</b>	<b>CO-ORDINATION AND CONTROL</b> Meaning and Need , Techniques of establishing Co-ordination, difficulties in establishing co-ordination, Control-Need, steps in the process of control & Techniques.	<b>12</b>
<b>Unit-VIII</b>	<b>RECENT TRENDS IN BUSINESS MANAGEMENT</b> Business Ethics, Corporate Social Responsibility, Corporate Governance, Disaster Management, Management of Change	<b>12</b>
	<b>Total</b>	<b>48</b>

**Recommended Books:**

1. Principles of Management - Koontz & O'Donnel
2. The Management Process - R S Davar
3. Essentials of Management - Koontz & O' Donnel Tralel McGrow Hill Publishing House
4. Business Administration - Mritunjoy Banerjee
5. Principles & Practice - T N Chhabra, Dhanapat Rai & Co.of Management.
6. Management – LM .Prasad.
7. Super Highway: Bill Gates Foundation
8. Makers of Modern India - NBT Publishers
9. Indian Business leaders

**S.Y. B.Com.**  
**Compulsory Paper**  
**Subject Name -: Elements of Company Law.**  
**Course Code -: 205**

**Objectives:**

- 1) To impart students with the knowledge of fundamentals of Company Law.
- 2) To update the knowledge of provisions of the Companies Act of 2013.
- 3) To apprise the students of new concepts involving in company law regime.
- 4) To acquaint the students with the duties and responsibilities of Key Managerial Personnel.
- 5) To impart students the provisions and procedures under company law.

<b>Term – I</b>		
<b>Sr. No.</b>	<b>Topic</b>	<b>Lectures</b>
<b>Unit 1</b>	<p><b>Introduction to the New Act &amp; Concept of Companies:</b></p> <p>1.1. Background and Salient Features of the Act of 2013, Overview of the changes introduced by the Act of 2013;</p> <p>1.2. Nature and types of Companies, Definitions and important features of a Company- Distinction between a company and a partnership - Lifting or Piercing the Corporate Veil</p> <p>1.3. Types of Companies based on various criteria including one man company, dormant company, sick and small company, associate company.</p> <p>1.4. Distinction between private and public company (Advantages, Disadvantages and privileges of both the companies) - Conversion of a private company into a public company - Conversion of a public company into a private company.</p>	<b>13</b>
<b>Unit 2</b>	<p><b>Formation and Incorporation of a Company:</b></p> <p>2.1. Stages in the Formation and Incorporation.</p> <p style="padding-left: 20px;">2.1.1. Promotion: Meaning of the term ‘Promoter’ / Promoter Group - Legal Position of Promoters, Pre-incorporation contracts.</p> <p style="padding-left: 20px;">2.1.2. Registration/ Incorporation of a company : - Procedure, Documents to be filed with ROC. Certificate of Incorporation- Effects of Certificate of Registration.</p> <p style="padding-left: 20px;">2.1.3. Floatation/ Raising of capital.</p> <p style="padding-left: 20px;">2.1.4. Commencement of business.</p>	<b>8</b>
<b>Unit 3</b>	<p><b>Documents relating to Incorporation and Raising of Capital:</b></p> <p>3.1 <b>Memorandum of Association:</b> Meaning and importance- Form and contents- Alteration of memorandum.</p> <p>3.2 <b>Articles of Association:</b> Meaning- Relationship of and distinction between Memorandum of association and Articles of association- Contents and form of Articles- Alteration of articles- Doctrine of constructive notice- Doctrine of Indoor Management.</p> <p>3.3 <b>Prospectus:</b> Meaning and Definition- Contents- Abridged form of</p>	<b>07</b>

	prospectus- Statutory requirements in relation to prospectus- Deemed prospectus- Shelf prospectus - Statement in lieu of prospectus- Mis-statement in a prospectus and Liabilities for Mis-statement.	
<b>Unit 4</b>	<b>Capital of the Company</b> 4.1 Various Modes for Raising of Share Capital including private placement, public issue, rights issue, bonus shares. 4.2 ESOS, Sweat Equity Shares, Buy-back of shares. 4.3 Allotment of Shares: Meaning- - Statutory provisions for allotment, improper and irregular allotment- Consequences of irregular allotment. 4.4 Calls On Shares: Meaning- Requisites of a valid call, Calls in advance 4.5 Share Certificates: Meaning, Provisions regarding issue of share certificates - Duplicate Share Certificate. 4.6 Share Capital – Meaning, Structure (Kinds) – Concept of Securities – Definition, Nature and Kinds of Shares.	<b>14</b>
<b>Unit 5</b>	<b>Forfeiture, Surrender &amp; Transfer of Shares</b> 5.1 Forfeiture and Surrender of Shares: Meaning of forfeiture of shares: - Conditions/Rules of valid forfeiture- Effect of forfeiture- Re-issue of forfeited shares- Annulment of forfeiture- 5.2 Surrender of shares 5.3 Transfer and transmission of shares - meaning and procedure distinction between transfer and transmission 5.4 Nomination of shares	<b>6</b>
	<b>Term – II</b>	
<b>Sr. No.</b>	<b>TOPIC</b>	<b>Lectures</b>
<b>Unit 6</b>	<b>E-Governance and E-Filing:</b> 6.1 Introduction- Meaning of E-Governance 6.2 Advantages of E-Governance, 6.3 Basic understanding of MCA Portal 6.4 E-filing (Ss. 397 to 402), DIN-Directors Identification Number (Ss. 153-159)	<b>06</b>
<b>Unit 7</b>	<b>Management of Company:</b> 7.1 Board of Directors: Definition, Powers, Restrictions, Prohibition on Board. (Ss. 179 to 183) 7.2 Director: Meaning and Legal position of directors. 7.3 Types of Directors – Types including Executive, Non-Executive, Independent, Additional, Alternate, Interested, Nominee Director, Related Party Transactions (Ss. 188) 7.4 Appointment of Directors, Qualifications and Disqualifications. 7.5 Powers, Duties, Liabilities of Directors, Remedies for Breach of Duties. 7.6 Loans to Directors (S. 185), Remuneration of Directors	<b>10</b>
<b>Unit 8</b>	<b>Key Managerial Personnel (KMP)</b> 8.1 Meaning, Definition and Appointments of Managing Director,	<b>10</b>



	<p>Whole Time Director,  Manager,  Company Secretary  Term of office/ Tenure of appointment, Remuneration –</p> <p>8.2 Distinction between Managing Director, Manager and Whole Time Director - Role (Powers, Functions of above KMP)</p> <p>8.3 Corporate Social Responsibility (CSR) [U/S 135] – Concept who is Accountable, CSR Committee, Activities under CSR,</p> <p>8.4 Role of Board of Directors.</p> <p>8.5 Prevention of Oppression and Mismanagement (Ss. 241 to 246)</p>	
<b>Unit 9</b>	<p><b>Company Meetings:</b></p> <p>9.1 Board Meeting – Meaning and Kinds</p> <p>9.2 Conduct of Meetings - Formalities of valid meeting [Provisions regarding agenda, notice, quorum, proxies, voting, resolutions (procedure and kinds) minutes, filing of resolutions, Virtual Meeting]</p> <p>9.3 Meeting of Share Holders  General Body Meetings, Types of Meetings  A. Annual General Meeting (AGM), Ss. 96 to 99  B. Extraordinary General Meeting (EOGM) – S. 100</p> <p>9.4 Provisions regarding convening, constitution, conducting of General Meetings contained in Ss. 101 to 114</p>	<b>12</b>
<b>Unit 10</b>	<p><b>10.1 Revival and Re-habilitation of Sick Companies (S. 253-269)</b></p> <p><b>10.2 Compromises, Arrangements and Amalgamation:</b> Concept and Purposes of Compromises, Arrangements, Amalgamation, Reconstruction – Fine distinction between these terms.:</p> <p><b>10.3 Winding –up:</b> Meaning of winding-up, Dissolution of company, Conceptual understanding of winding-up by the Tribunal, Compulsory winding-up, Members’ voluntary winding-up, Creditors’ voluntary winding-up</p>	<b>10</b>

<b>Recommended Books</b>
<ol style="list-style-type: none"> <li>1) Bharat’s – Companies Act, 2013 with comments, Edited by: Ravi Puliani, Advocate Mahesh Puliani, Bharat Law House Pvt. Ltd., New Delhi, 19<sup>th</sup> Edition, 2013.</li> <li>2) Introduction to Company Law, Karn Gupta, Publication: LexisNexis, 2013, Gurgaon, Haryana, India.</li> <li>3) The Companies Act, 2013. With notes to Legislative Clauses. 2014 Edition. Corporate Professionals – where excellence is Law, CCH – a Wolters Kluwer business. Wolters Kluwer (India) Pvt. Ltd., DLF – Cyber City, Gurgaon, Haryana (India)</li> <li>4) Insights into the New Company Law – PrachiManekar LexisNexis, Gurgaon, Haryana, India, 2013.</li> <li>5) Taxman’s, Company Law Ready Reckoner, V.S. Datey, Printed at – Tan Prints (India) Pvt. Ltd. Jhajjar, Haryana, India., 13<sup>th</sup> September, 2013.</li> <li>6) Analysis of Companies Act, 2013, Corporate Professionals – where excellence is Law., CCH – a Wolterskluwer business., Corporate Professionals India Pvt. Ltd., New Delhi, India., Published by – Wolters Kluwer (India) Pvt. Ltd., 2013.</li> </ol>

**S.Y. B.Com.**  
**Business Administration Special Paper I**  
**Subject Name -: Business Administration**  
**Course Code -: 206 – A.**

**Objectives:**

1. To provide basic knowledge about various forms of business organizations
2. To acquaint the students about business environment and its implications thereon.
3. To aware them with the recent trends in business

UNIT NO	CHAPTER	PERIODS
	<b>TERM-I</b>	
<b>UNIT-I</b>	<b>BUSINESS ADMINISTRATION CONCEPTS</b> 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 Organization. Functions of Administration	<b>12</b>
<b>UNIT-II</b>	<b>FORMS OF BUSINESS ORGANIZATION</b> Sole Proprietorship, Partnership Firm, Limited Liability Partnership, Joint Ventures, Joint Stock Company, Co-operative Society- features, Merits & Limitations. Non Profit joint Stock Company under section 25 of the Companies Act Suitability of a form of organization- Factors determining the suitability of form of Organisation	<b>12</b>
<b>UNIT III</b>	<b>BUSINESS ENVIRONMENT</b> Meaning, Constituents of business environment-Economic, International, Social, Legal, Cultural, Educational, Political, Technological & Natural. Interaction of business & environmental forces. Social Responsibilities	<b>12</b>
<b>UNIT IV</b>	<b>BUSINESS PROMOTION</b> Business Unit- Promotion: Concept of promotion, stages in business promotion, Factors affecting location & Size, Present trends in location, size of business unit. Role of Govt in the promotion of SEZ	<b>12</b>
	<b>Total</b>	<b>48</b>
	<b>TERM-II</b>	
<b>UNIT- V</b>	<b>LEGAL ASPECTS</b> Compliance of legal requirements in promoting business unit, Licensing, Registration, Filing returns & other documents. Important legal provisions governing promotion & establishment of unit.	<b>12</b>
<b>UNIT-VI</b>	<b>PRODUCTIVITY</b> Meaning, Importance & measurement of productivity. Factors affecting productivity, techniques, Measures to boost productivity, Role of National Productivity Council- Product Quality Control ISO-9000, 14000, Quality Circles	<b>12</b>
<b>UNIT-VII</b>	<b>RECENT TRENDS IN BUSINESS MANAGEMENT</b> Liberalisation, Privatization, Globalization -meaning, concept –implications & consequences, SEZ, BPO, KPO and LPO .Public Private Partnership .MKCL	<b>12</b>

<b>UNIT-VIII</b>	<b>INDUSTRIAL SICKNESS</b> Meaning, definition, symptoms, causes & Consequences of industrial sickness. Role of Government in prevention of industrial sickness. Role of BIFR.	<b>12</b>
	<b>Total</b>	<b>48</b>

### Recommended Books

1. Modern Business Organization & Management N. Mishra Allied Publishers – Bombay
2. Essentials of Business Administration K. Aswathappa – Himalaya Publications
3. Business Administration :S.C.Saxena – Sahitya Bhavan Agra
4. The Administrative Process :Stephen Robbins -
5. Business Organization
6. Industrial Administration & Management: J Batty McDonald
7. MKCL annual Report

**S.Y. B.Com.**  
**Banking & Finance Special Paper I**  
**Subject Name -: Indian Banking System - I**  
**Course Code -: 206 – B.**

**Objectives:**

1. To create the awareness among the students of Indian banking system.
2. To enable students to understand the reforms and other developments in the Indian Banking
3. To provide students insight into the functions and role of Reserve Bank of India.

<b>Term – I</b>		
<b>Sr. No</b>	<b>Topic</b>	<b>No. of Lectures</b>
<b>UNIT 1</b>	<b>Structure and Role of Indian Banking System:</b> Structure of Indian Banking System Central bank - Commercial banks - Cooperative banks – Developmental Banks- Regional Rural Banks - Local Area Banks Difference between scheduled and non scheduled bank Role of banking system in the economic growth and development	<b>12</b>
<b>UNIT 2</b>	<b>Private sector banks:</b> A) Private sector banks in India: Their progress and performance after <b>Banking Sector Reforms</b> B) Foreign banks in India: Their problems and prospects of Foreign Banks Regulation of Foreign banks in India	<b>12</b>
<b>UNIT 3</b>	<b>Nationalized banks:</b> Social control over banks, Nationalization of banks - Arguments for and against nationalization, Objectives of nationalization, Progress of nationalized banks pertaining to branch expansion, deposit mobilization, credit development and priority sector lending: Lead Bank Scheme,	<b>12</b>
<b>UNIT 4</b>	<b>State Bank of India</b> Evolution of State Bank of India, organization and management of State Bank of India, Subsidiary Banks to State Bank of India. Role of State Bank of India : As an agent of the RBI, as a commercial bank, its role in industrial finance, in foreign exchange business, in agricultural finance and rural development, and in assisting weaker Sections of the Society Merger of SBI Subsidiaries.	<b>12</b>
	<b>Total Period</b>	<b>48</b>
<b>Term II</b>		
<b>UNIT 5</b>	<b>Regional Rural Banks and National Bank for Agricultural and Rural            Development (NABARD) :</b> A) Reasons for establishment of Regional Rural Banks (RRBs), Meaning of RRBs, Difference between RRBs and Commercial banks, Objectives of RRBs, Organization and Management of RRBs, Functions of RRBs, Progress, performance and problems of RRBs, <b>Consolidation of RRB`s</b> B) <b>National Bank for Agricultural and Rural Development (NABARD):</b> Objectives, Functions and Performance	<b>12</b>
<b>UNIT 6</b>	<b>Cooperative Credit System :</b>	<b>12</b>

	<p>A) Principles of cooperation, Evolution of cooperative credit system.  Meaning, objectives, organization, functions, progress and problems of:</p> <ol style="list-style-type: none"> <li>1. Primary Agricultural Cooperative Credit societies,</li> <li>2. District Central Cooperative banks,</li> <li>3. State Cooperative Banks</li> </ol> <p>B) Urban Cooperative Credit Societies  C) Urban Cooperative Banks</p>	
<b>UNIT 7</b>	<p><b>Reserve Bank of India (RBI) :</b>  Evolution of the Reserve Bank of India,  Organization and Management of the RBI</p> <p><b>A) Functions of the RBI:</b>  Issue and Management of currency  Banker to the government  Bankers' bank: lender of the last resort, central clearance  Supervision of banking system, controller of credit-Qualitative and  Quantitative methods of credit control,  Custodian of foreign exchange reserves  Collections and furnishing of credit information  Agricultural finance, Export finance, Industrial finance</p> <p><b>B) Changing role of RBI:</b> Promotional role, Development role &amp; Super  regulation work.</p>	<b>12</b>
<b>UNIT 8</b>	<p><b>Banking Sector Reforms:</b>  Rationale and objectives of reforms,  Problems of nationalized banks</p> <p><b>A) Recommendations of the Narasimham Committee (I)</b>  Reforms of the committee pertaining to-  Deregulation of interest rate,  CRR (Cash Reserve Ratio),  SLR (Statutory Liquidity Ratio),  CD Ratio- Credit Deposit Ratio  Interest rate structure, Directed credit programme,  Income recognition, Asset classification,  Capital adequacy norms, Provisioning,  Redefining of the NPAs  Management of Non Performing Assets (NPAs),  Debt Recovery Tribunals,</p> <p><b>B) Recommendations of the Narasimham Committee (II)</b>  Consolidation of banking system,  Directed credit programme,  Revision in the Capital adequacy</p> <p><b>C) Financial Inclusion:</b> Role of Micro Finance – Development of Self Help  Groups</p>	<b>12</b>
	<b>Total Period</b>	<b>48</b>

**Recommended Books:**

1. Functions and Working of the RBI: Reserve Bank of India Publications.
2. Financial Sector Reforms and India's Economic Development: N.A.Majumdar
3. Central Banking and Economic Development: Vasant Desai
4. Monetary Economics: S.B. Gupta
5. Banking in India - S. Panandikar
6. Banking: S.N. Maheshwari
7. Report on Trends and Progress of Banking in India: Reserve Bank of India Publication.
8. Indian Banking System (भारतीय बँक व्यवसाय प्रणाली) - Prin. Dr. B. R. Sangle
9. Indian Banking System (भारतीय बँक व्यवसाय प्रणाली) - Prin. Dr. B. R. Sangle,  
Dr. Murtadak, Dr.M. U. Mulani, Dr. T. N. Salve
10. Annual Reports of Banks
11. Indian banking system - Dr. Rita Swami
12. Indian Banking System - Dr. B.R. Sangle, Dr. G.T. Sangle, Dr. Kayande Patil and  
Prof. N.C. Pawar
13. Indian Banking System - Prof. S.V. Joshi, Dr. C.P. Rodrigues and Prof. Azhar Khan

**S.Y. B.Com.**  
**Business Laws & Practices Special Paper I**  
**Subject Name -: Business Laws & Practices.**  
**Course Code -: 206 – C.**

**Objectives –**

- 1) To impart the students with the knowledge and understanding important Business Laws.
- 2) To acquaint the students with Laws of Insurance, Life Insurance, Marine Insurance, Fire and other insurance.

Sr. No.	Topic	No. of Lectures
<b>Term – I</b>		
<b>Unit - 1</b>	<b>The Maharashtra Agricultural Produce Marketing (Regulation) Act, 1963 –</b>	12
	<b>Background, Meaning, Definition –</b>	
	Agricultural Produce, Agriculturist, Broker, Buyer, bye-laws, Commission Agent, Director, Coolee, Local Authority, Market Area, Market Committee, Processor, Secretary, Retail sales, State Marketing Board. Agriculture Produce, Marketing (Clause 6 to 10). State Agricultural Produce Marketing Board (Clause 39 A to 39 O) Amalgamation of division of market committees office and servants of market committee.	
<b>Unit - 2</b>	<b>The Law of Insurance -</b>	12
	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.	
<b>Unit - 3</b>	<b>Life Insurance -</b>	12
	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.	
<b>Unit - 4</b>	<b>Fire Insurance -</b>	12
	Meaning of Fire Insurance, Definition of Fire Insurance, Types of Fire Insurance Policies, Basic Principles in Fire Insurance Policies, Settlement of Claims of Fire Insurance, Difference between Life Insurance & Fire Insurance, Private Insurance Companies in India, Social Corporate Responsibilities of Private Insurance Companies.	

<b>Term - II</b>		
<b>Sr. No.</b>	<b>Topic</b>	<b>No. of Lectures</b>
<b>Unit - 5</b>	<b>Marine Insurance &amp; Other Insurance –</b> Meaning, Definitions, Type of Marine Insurance Policies, Terms in Marine Insurance Policy. Difference between Fire Insurance & Marine Insurance, Difference between Life Insurance & Marine Insurance. Contract of Fire Insurance, Motor Insurance Policy. Theft & Burglary Insurance Personal Accident Insurance, Rural Insurance in India.	12
<b>Unit - 6</b>	<b>Maharashtra Co-operative Societies Act, 1960</b> Definition and Features of a Co-operative Society. Types of Co-operative Societies. <b>Restriction on the society -</b> Registration, Cancellation of Registration and De-registration of a Society. Bye Laws and Amendments of bye-laws.	12
<b>Unit - 7</b>	<b>The Industrial Dispute Act, 1947 (Section 1 to 7, 22 to 29)</b> Introduction and Definitions, Machinery for Settlement of Disputes, Strikes, Lockout, Layoff, Retrenchment, Closure and Re-starting of Undertaking.	12
<b>Unit - 8</b>	<b>Partnership Act, 1952</b> <ul style="list-style-type: none"> <li>• Meaning of Partnership, Features of Partnership</li> <li>• Registration &amp; Formation of Partnership.</li> <li>• Kinds of Partners.</li> <li>• Rights, Duties and Liabilities of a Partner.</li> <li>• Reconstitution of Partnership Firm.</li> <li>• Incoming Partners.</li> <li>• Outing Partners.</li> <li>• Dissolution of a Partnership Firm.</li> </ul>	12

<b>Recommended Books</b>		
<b>References –</b>		
1. Labour and Industrial Laws	-	M.N. Mishra central Publications, Allahabad
2. Business Laws	-	Kuchhal M.C.
3. Industrial Law	-	P.L. Malir
4. Business Law	-	Avtar Sing
5. Mercantile Law	-	P.L. Ma...
6. Business Law	-	S.D. Geet and M.S. Patil



**S.Y. B.Com.**

**Co-operation and Rural Development Special Paper I**

**Subject Name -: Co-operation and Rural Development.**

**Course Code -: 206 – D.**

**Objectives:-**

1. To acquaint students with the Concept of Co-operation.
2. To acquaint students with Co-operative legislation.
3. To create awareness regarding the role of State Govt. in development of Co-operative sector in Maharashtra.
4. To acquaint students with the role of Social reformers in rural development .
5. To understand the role of “Panchayat Raj “ in rural development.
6. To make the students aware about Globalization and its effects on rural development

<b>Sr. No.</b>	<b>Topic</b>	<b>No- of Lectures</b>
<b>Unit 1</b>	<b>Co-operative Legislation in India</b> 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	12
<b>Unit 2</b>	<b>Multi-state Co-operative Societies Act</b> 2.1 History, need and objectives 2.2 Registration of Societies 2.3 Bye- laws of Co-operative societies 2.4 Management of Co-operative Societies 2.5 Role of Central Registrar	12
<b>Unit 3</b>	<b>Maharashtra State Co-operative Societies Act 1960</b> 3.1 Maharashtra Co-operative Societies Act 1960 amended up to August 2013 –Provisions regarding a) Registration of Co-operative Societies b) Membership of Co-operative Societies c) Privileges and Duties of Co-operative Societies d) Management of Co-operative Societies e) Supervision of Co-operative Societies f) Audit of Co-operative Societies g) Role of Registrar for Co-operative Societies of Maharashtra State	12
<b>Unit 4</b>	<b>Functions, Progress and Problems of Co-operatives</b> 4.1 Agriculture Credit through Co-operatives a) Primary Agriculture Credit Societies(PACS) b) District Central Co-operative Banks c) State Co-operative Bank 4.2 Co-operative Sugar Factories 4.3 Dairy Co-operatives 4.4 Non Agricultural Credit Co-operatives 4.5 Urban Co-operative Banks 4.6 Housing Co-operative Societies 4.7 Consumer Co-operatives	12

<b>Term – II</b>		
<b>Unit 5</b>	<b>Rural Development</b> 5.1 Definition, Meaning, Scope and Objectives 5.2 Significance of Rural Development 5.3 Role of Co-operative movement in Rural Development of Maharashtra 5.4 Approaches of Rural Development a) Individual Approaches b) Group Approaches c) Mass Approach	12
<b>Unit 6</b>	<b>Role of Social Reformers in Rural Development . (Thought &amp; Work)</b> 6.1 Mahatma Jotiba Phule 6.2 Chhatrapati Shahu Maharaj 6.3 Mahatma Gandhi. 6.4 Dr. Babasaheb Ambedkar. 6.5 Karmaveer Bhaurao Patil 6.6 Dr. Dhananjayrao Gadgil. 6.7 Dr. Panjabrao Deshmukh	12
<b>Unit 7</b>	<b>Rural Development and Panchayat Raj System</b> 7.1 Concept and Structure of Panchayat Raj 7.2 Importance of Panchayat Raj System 7.3 Important Provisions of Panchayat Raj Act 7.4 Effects of Panchayat Raj System on Rural Development 7.5 Limitations of Panchayat Raj	12
<b>Unit 8</b>	<b>a) Rural Development through Peoples Participation</b> 8.1 Concept of Peoples Participation 8.2 Importance of Peoples Participation 8.3 Mahatma Gandhi National Rural Employment Guarantee Scheme 8.4 Development Strategy of Model Villages	06
	<b>b) Globalization and Rural Development</b> 8.5 Concept of Globalization 8.6 Merits and Demerits of Globalization 8.7 Opportunities of Globalization for Rural Development 8.8 Effects of Globalization on Rural Development	06

**Recommended Books :**

- 1) G.S.Kamat –Cases in Co-operative management.
- 2) K.K.Taimani- Co-operative Organization and Management.
- 3) G.S.Kamat – New Dimensions of Co-operative Management.
- 4) Vasant Desai – Fundamentals of Rural Development.
- 5) V.M.Dandekar and Rath – Poverty in India.
- 6) Dr. P.R.Dubhashi – Rural Development and Administration in India.
- 7) V.Reddy – Rural Development in India.
- 8) S.K. Gopal – Co-operative Farming in India.
- 9) B. Mukharji – Community Development.
- 10) I.C.A State and C-operative Movement.

**S.Y. B.Com.**  
**Cost and Works Accounting Special Paper I**  
**Subject Name -: Cost and Works Accounting.**  
**Course Code -: 206 – E.**

**Objectives:**

*To Impart The Knowledge Of:*

1. Basic Cost concepts.
2. Elements of cost.
3. Ascertainment of Material and Labour Cost.

SR. NO.	TOPIC	LECTURES
<b>Unit 1</b>	<b>Basics Of Cost Accounting</b>	
1.1	Concept of Cost, Costing, Cost Accounting and Cost	16
1.2	Accountancy.	
1.3	Limitations of Financial Accounting.	
1.4	Origin of Costing.	
1.5	Objectives of Costing.	
1.6	Advantages & Limitations of Costing.	
1.7	Difference Between Financial Accounting and Cost Accounting. Cost Units and Cost Center.	
<b>Unit 2</b>	<b>Elements Of Cost</b>	
2.1	Material, Labour and other Expenses.	16
2.2	Classification of Costs.	
2.3	Preparation of Cost Sheet, Quotation, Tenders.	
<b>Unit 3</b>	<b>Material Control</b>	
3.1	Need and Essentials of Material Control.	16
3.2	Functions of Purchase Department.	
3.3	Purchase Procedure.	
3.4	Purchase Documentation.	
3.5	Stock Levels.	
3.6	Economic Order Quantity. (EOQ)	

**Term – II**

SR.NO.	TOPIC	LECTURES
<b>Unit 4</b>	<b>Material Accounting</b>	
4.1	Stores Location and Layout.	16
4.2	Types of Stores Organization.	
4.3	Classification and Codification of Material.	
4.4	<u>Stores and Material Records –</u> Bin Card, & Store Ledger etc.	
4.5	<u>Issue of Material and Pricing Methods of Issue of Material:-</u> (a) FIFO. (b) LIFO. (c) Simple Average Methods. (d) Weighted Average Methods.	
4.6	Stock valuation, Use of computer in store Accounting.	

<b>Unit 5</b>	<b>Inventory Control</b>	
5.1	Stock Taking, Periodic and Perpetual Method.	08
5.2	ABC Analysis.	
5.3	Inventory Ratios.	
<b>Unit 6</b>	<b>Labour Cost, Remuneration And Incentives</b>	
6.1	Records & Methods Of Time Keeping and Time Booking Study of New Methods.	12
6.2	<b><u>Methods Of Remuneration-</u></b> ❖ Time Rate System, ❖ Piece Rate system, ❖ Taylor's Differential Piece rate System.	
6.3	<b><u>Incentive Plan-</u></b> Halsay Premium Plan,	
6.4	❖ Rowan Premium Plan. ❖ Group Bonus Schemes.	
<b>Unit 7</b>	<b>Other Aspects Of Labour</b>	
7.1	Labour Turnover.	10
7.2	Job Analysis & Job Evaluation Key.	
7.3	Merit Rating.	
<b>Unit8</b>	<b>Direct Cost</b>	
8.1	Concept and Illustrations.	02
		<b>Total 48</b>

**Note-**

Allocation of Marks

50% for Theory

50% for Practical Problem.

❖ **Teaching Methodology**

1. Class Room Lectures.
2. Guest Lectures.
3. Visit to Industries.
4. Group Discussion.
5. Collection of Records & Documents.

❖ **Recommended Books :**

1. S.P. Lyengar - Cost Accounting Principles and Practice, Sultan Chand , & Sons Accounting Taxman's, New Delhi.
2. M.N. Arora - Cost Accounting Principles and Practice Vikas Publishing House Pvt.Ltd. New Delhi.
3. S.N. Maheshwari and S.N.Mittal- Cost Accounting, Theory and Problems, Mahavir book Depot, New Delhi.

4. B.L. Lall and G.L. Sharma - Theory and Techniques of Cost Accounting. Himalaya Publishing House, New Delhi.
5. V.K. Saxena and Vashista - Cost Accounting – Text book. Sultan Chand and Sons – New Delhi
6. V.K. Saxena and Vashista - Cost Audit and Management Audit. Sultan Chand and Sons – New Delhi
7. Jain and Narang - Cost Accounting Principles and Practice. Kalyani Publishers
8. N.K. Prasad - Principles and Practice of Cost Accounting Book Syndicate Pvt. Ltd., Calcutta.
9. N.K. Prasad - Advanced Cost Accounting Syndicate Pvt Ltd., Calcutta.
10. R.K. Motwani - Practical Costing. Pointer Publisher, Jaipur
11. R.S.N. Pillai and V. Bhagavati - Cost Accounting.
12. Horne, Frain and Datar - Cost Accounting and Managerial Emphasis.
13. Cost Accounting - Bhatta HSM, Himalaya Publication
14. Cost Accounting - Prabhu Dev, Himalaya Publication
15. Advanced Cost Accounting - Made Gowda, Himalaya Publication

**Journals -**

1. Cost Accounting Standards - The ICWA of India, Calcutta
2. Management Accountant - The ICWA of India, Calcutta

Website - [icwajournal@hotmail.com](mailto:icwajournal@hotmail.com)

CD: -On Cost-Sheet Prepared by Asian Center for Research and Training, Pune.  
Trimurti, 27B, Damle Complex, Hanuman Nagar, Senapati Bapat Road, Pune-16  
[director\\_acrtpune@yahoo.co.in](mailto:director_acrtpune@yahoo.co.in)

**S.Y. B.Com.**  
**Business Statistics Special Paper I**  
**Subject Name -: Business Statistics.**  
**Course Code -: 206 – F.**

**Objectives:**

1. To understand and Master the concepts, techniques & applications of Statistical Methods and Operations Research.
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.

Sr. No.	Topic	No. of Lectures
<b>Unit 1</b>	<b>Theory of Attributes (up to order three only):</b> 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, Independent and Association of two attributes, Yule’s Coefficient of association, example and problems.	14
<b>Unit 2</b>	<b>Multiple Regression, Multiple and Partial Correlation:</b> Introduction, Multiple Regression, Statement of equation of plane of regression of $X_1$ on $X_2$ and $X_3$ , Standard Error of Estimate, Partial and Multiple Correlation, Advantages and limitations of multiple Correlation Analysis. example and problems	16
<b>Unit 3</b>	<b>Vital Statistics :</b> Introduction, Methods of collecting vital Statistics, Mortality rates : CDR, ASDR, STDR (direct method), Fertility rates: CBR, ASFR, TFR, GFR Population Growth rate: GRR and NRR, example and problems	10
<b>Unit 4</b>	<b>Life Tables:</b> Introduction, Construction of life table, functions ( $l_x$ , $L_x$ , $p_x$ , $q_x$ , $e_x$ , $T_x$ ) and their interpretation, Expectation of life, example and problems.	08
<b>Term 2</b>		
<b>Unit 5</b>	<b>Time Series:</b> 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 trend line and second degree curve, Exponential smoothing, Example and problems	14

<b>Unit 6</b>	<b>Simplex Method:</b> Definition of Linear programming problem , Canonical and standard form duality relation between primal and dual, example and problems on simplex method two iterations only, meaning of unbounded solution, basic feasible solution, alternate solution, degenerate solution	14
<b>Unit 7</b>	<b>Transportation Problem (T.P). / optimization (only minimization):</b> Introduction, balanced and unbalanced TP, Initial Basic Feasible Solution IBFS using NWCR, MMM, VAM, Optimal solution using MODI method. Example and problems.	14
<b>Unit 8</b>	<b>Assignment Problem (A.P):</b> Introduction, concept minimization and maximization, Hungarian method example and problems	06

**Recommended Books :**

1. S.P Gupta - Statistical Methods
2. S.C. Gupta - Fundamentals of Statistics
3. J.S Chandran - Statistics for Business and Economics
4. Dr. A.B. Rao - Quantitative Techniques for Business
5. Business Statistics - S. C. Gupta, Gupta Indra
6. Operation Research - V. K. Kapoor
7. Statistical Methods - S. P. Gupta

**S.Y. B.Com.**  
**Business Entrepreneurship Special Paper I**  
**Subject Name -: Business Entrepreneurship.**  
**Course Code -: 206 – G.**

**Objectives:**

1. To create entrepreneurial awareness among the students.
2. To provide the conceptual background of types & patterns of Entrepreneurship
3. To develop Entrepreneurial competencies among students.

<b>Term – I</b>		
<b>Sr.No.</b>	<b>Topic</b>	<b>No. of Lectures</b>
<u>UNIT1</u>	<u>Entrepreneur &amp; Entrepreneurship</u> Definition, meaning - functions of an entrepreneur - Need & importance of Entrepreneurship - Problem of unemployment - importance of wealth creation - Enterprise v/s Entrepreneurship - Self-employment v/s Entrepreneurship - Entrepreneurial Competencies - Behavioral pattern of an Entrepreneur - Entrepreneurial Motives - David C. McClelland's Theory of Need for Achievement & Kakinada Experiment	12
<u>UNIT2</u>	<u>Study of Biographies of Entrepreneurs (Co-operatives sector)</u> 1. Dr. Vitthalrao Vikhe Patil, Pravranagar 2. Karamveer Bhaurao Patil, Satara 3. Shree. Bhausahab Hire, Nashik 4. Sahkar Maharshi Bhausahab Santuji Thorat, Sangamner 5. Shree Ratnappa Kumbhar, Sangali 6. Shree Dhanjajrao Gadgil, Pune	12
<u>UNIT3</u>	<u>Creativity &amp; Innovation</u> Creativity – meaning - Creativity Process - Techniques & tools of creativity Innovation: Meaning - Sources of innovation – Peter Drucker's Principles of innovation - Do's & Don'ts of innovation	12
<u>UNIT4</u>	<u>Business Ethics &amp; Social Responsibility of Business</u> Business goals - Social responsibility - Business Ethics – Social responsibility towards their stakeholders: Investors – Owners – employees - Govt. & Society at large - Leadership by Example - Code of ethics - Ethical structure - Social Audit Brief introduction to corporate Governance	12

<b>Term – II</b>		
<b>Sr. No.</b>	<b>Topic</b>	<b>No. of Lectures</b>
<u>UNIT1</u>	<u>Group Entrepreneurship</u> Concept - meaning & significance - Individual Entrepreneurship v/s Group Entrepreneurship - Advantages & disadvantages of Group Entrepreneurship Self-Help group - Definition - meaning & Evolution - Nature - scope of – SHG - Administration functions & operation SHG's - Do's & Don'ts with suitable illustration of Self-Help group	12
<u>UNIT2</u>	<u>Various Entrepreneurial opportunities - Role of service sector in national Economy</u> Types of service ventures, Service - industry management, Success	12



	factors in service ventures - Opportunities to service industry in rural & urban areas Distinction between service industry & manufacturing industries.	
<u>UNIT3</u>	Franchising – Definition - meaning & Types - Advantages to the franchisee & franchisor - Franchisee Relationship Steps in starting franchisee - Cautions in franchising - Business process outsourcing	12
<u>UNIT4</u>	Challenges in Entrepreneurship Development Challenges-Social, Cultural, Educational, political, economical, International situation, Cross Cultural aspects Measures & Challenges of globalization & entrepreneurship development in India	12

**Recommended Books :**

1. Desai Vasant - “Dynamics of Entrepreneurial Development & Management”, Himalaya Publication House.
2. Hisrich Robert D. & Michael, ‘Entrepreneurship’, Tata McGraw Hill Publishing Company, New Delhi.
3. Chary S.N. “Business Guru speak”, Macmillan Business Books 2002
4. Drucker Peter-Innovation & Entrepreneurship Heinemann London (1985)
5. Piramal Gita-Business Legends – Penguin Book India (p.)Ltd.1998.
6. Gupta & Shrinivasan ‘Entrepreneurial Development’, Sultan Chand & Co.
7. Pandit Shrinivas- Thought Leaders- Tata McGraw Hill Publishing Company.
8. Devkar Yogiraj -‘Udyojakata’ Continental Publication,Pune.
9. Piramal Gita-‘Business Maharaje’ Tra.Ashok Jain,Mehata Publishing House,Pune.
10. Amrutghatha, Amey Prakashan, Pune. (Autobiography of Bhausahab Thorat)
11. Amrutmanthan , Amey Prakashan, Pune. (Autobiography of Bhausahab Thorat)

**Journals :**

1. ‘Journal of Entrepreneurship’, Entrepreneurship Development Institute of India,Ahmedabad.
2. Mahratta Chamber of Commerce, Industries & Agriculture, Pune’s Magazine – “Sampada”.
3. MCED’s –“Udyojak”.
4. “Vanijya Vishwa” ,The Poona Merchant Chamber’s Magazine.

VCD’s on ‘Entrepreneurship’ & ‘Motivation’ Produced by Asian Centre for Research & Training ‘Trimurti’,27/B,’Damle Bunglow’,Hanumannagar, Senapati Bapat Road,Pune 411016.

Email: director\_acrt@yahoo.co.in,acrtpune@gmail.com

[www.http://sites.google.com/site/acrtpune](http://sites.google.com/site/acrtpune).

**Practical’s :** At least 4 practical’s should be completed during the academic year.

1. Interview with entrepreneur.
2. Case study of each entrepreneurs mentioned in syllabus (5).
3. Social Responsibility of business.
4. Visit to industry.
5. Social audit.
6. Business Ethics.
7. S H G
8. Group entrepreneurship.
9. Franchising.
10. Information about service industry.

**S.Y. B.Com.**  
**Marketing Management Special Paper I**  
**Subject Name -: Marketing Management.**  
**Course Code -: 206 – H.**

**Objectives:-**

- To orient the students recent trends in marketing management
- To create awareness about marketing of eco friendly products in the society through students
- To inculcate knowledge of various aspects of marketing management through practical approach
- To acquaint the students with the use of E-Commerce in competitive environment
- To help the students understand the influences of marketing management on consumer behavior

**FIRST TERM**

Unit No.	Unit Details	Lectures
1.	<b>Elements of Marketing Management:</b> Meaning, Nature and Scope of Marketing Management - Components of Marketing Management - Marketing Management Philosophy - Marketing Characteristics in Indian context - Marketing Management process - Marketing Planning.	16
2.	<b>Current Marketing Environment in India :</b> A) with special reference to Liberalization, Globalization and Privatization- economic environment- demographic- technological - natural - political - socio cultural. B) Change in market practices- global marketing- case studies	10
3.	<b>Marketing Communications –</b> Meaning, Definition and objectives - Marketing Communication Mix- Traditional Media-New Age Media-Marketing Communication through product cues – Different forms of appeal for communication.	12
4.	<b>Services Marketing :-</b> Unique features of Services - classification of services – Growth of Services: The global and the Indian scene- new generation services – tasks involved in services marketing.	10

**SECOND TERM**

Unit No.	Unit Details	Lectures
5.	<b>E- Marketing:-</b> Meaning, Definition and utility of e-marketing. Advantages, limitations and challenges before e – marketing. Online and Offline marketing, Present status of e-marketing in India, Scope for e -marketing in Indian scenario – online marketing strategies	14
6.	<b>Rural Marketing:-</b> Introduction – basic features – contemporary rural marketing environment- problems, challenges and marketing strategies – present status of rural marketing in India.	12
7.	<b>Green Marketing:-</b> Meaning, Definition and Importance - Role of Marketing Manager in Green Marketing- Marketing mix of green marketing – principles of success of green	12

	products – case studies.	
<b>8.</b>	<b>Consumer Behavior and Buying decision process:</b> Definition- consumer behavior and marketing – factors influencing consumer behavior and buying decision- various buying motives – stages involved in buying decision	<b>10</b>

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### Suggested references Books

1. Marketing Management – Philip Kotler
2. Marketing Management – Rajan Saxena (Latest Edition)
3. Marketing Management, Indian context – global prespective -Ramaswami Namakumari
4. Marketing Management – Pankaj Madan & Hemraj Verma Amit Mittal
5. Marketing Management (Text and Cases) - Rajagopal
6. Marketing Concepts and Cases – Michael J. Etzel, Bruce J. Walkar, Willam J. Stanton, Ajay Pandit
7. Introduction to e- Commerce- Nidhi Dhawan
8. Electronic Commerce –Bharat Bhaskar
9. Retailing and E-tailing - S.L.Gupta, Mittal & Nayyar
10. E- Commerce: Fundamentals and Applications- Henry Chan, Lee
11. Marketing in the new global order: challenges and opportunities –Tapan Panda and Navin Donthu

**S.Y. B.Com.**  
**Special Paper I**  
**Subject Name -: Agricultural and Industrial Economics.**  
**Course Code -: 206 – I.**

**Objectives:**

1. To study the basic concepts of Agricultural and Industrial Economics.
2. To understand the working of the Agricultural and industrial sector.

<b>Term-I</b>		
Sr. No.	Topic	No. of Lectures
<b>Unit-1</b>	<b><u>Basic Concept of Agricultural Economics</u></b> 1.1 Definition , Nature and scope of Agricultural Economics 1.2 Importance of Agriculture in Indian Economy	08
<b>Unit-2</b>	<b><u>Role of Agriculture</u></b> 2.1 Role of Agriculture in Economic Development 2.2 Peculiarities of Agriculture as Sector of Economy. 2.3 Nature of risk and uncertainly in Agriculture. 2.4 Measures to control risk and uncertainly	10
<b>Unit-3</b>	<b><u>Organization of Agricultural Production</u></b> 3.1 Concept of forming firm 3.2 Farm Management inputs and outputs 3.3 Size of the farm small versus large.	10
<b>Unit-4</b>	<b><u>Demand for Agricultural Product</u></b> 4.1 Nature of demand for agricultural product 4.2 Different purposes of demand 4.3 Factor affecting demand for agricultural product 4.4 Pattern and trend of demand main agricultural product	10
<b>Unit-5</b>	<b><u>Supply of Agricultural Product</u></b> 5.1 Nature of supply of agricultural product 5.2 Factors affecting supply (Technology, Fertilizers, Irrigation etc.) 5.3 Supply during short and long period.	10
<b><u>Term-II</u></b>		
<b>Unit-6</b>	<b><u>Introduction of Industrial Economics</u></b> 6.1 Definition , meaning, nature, scope and importance of Industrial Economics. 6.2 Scope and significance of Industrial Economics 6.3 The concept of plant, firm and industry.	8

<b>Unit-7</b>	<b><u>Organization of Industrial Production</u></b> 7.1 Traditional and modern approach to the theory of firm 7.3 Optimum size of firm 7.3 Factors affecting optimum size of firm	10
<b>Unit-8</b>	<b><u>Location of Industry</u></b> 8.1 Theories of location of industries-Weber and Sergeant Florence 8.2 Factors affecting location of industries	10
<b>Unit-9</b>	<b><u>Diversification and combination</u></b> 9.1 Meaning of diversification of Industry 9.2 Types of diversification of firm 9.3 Industrial Integration 9.4 Combination of Industries 9.5 Industrial Monopoly – Causes and affects 9.6 Survival of small firm in modern economy	10
<b>Unit-10</b>	<b><u>Industrial Productivity and Efficiency</u></b> 10.1 Industrial productivity – meaning 10.2 Factors affecting industrial productivity 10.3 Industrial efficacy – Economic and Non-Economic aspect	10

**Recommended Books :**

1. Agricultural Economics and Indian Agriculture: Dr. S.S. Chinna – Kalyani Publishes – Ludhiana – New Delhi.
2. Agricultural Problems in India – C.B.Mammoria 1976.
3. Hey D.A. and D.J.Morris – Industrial Economics and Organization: Theory and Evidence.
4. S.C.Kuchal – Industrial Economy of India, 1981.
5. Cherunillam International Economics 1999, Tata McGraw Hill Co.Ltd.
6. Dutt and Sundharam – Indian Economy, S.C.Chand & Co. 2008.

**S.Y. B.Com.**  
**Special Paper I**  
**Subject Name -: Defense Budgeting, Finance & Management.**  
**Course Code -: 206 – J.**

**Objective:** To acquaint the students with the economic and financial aspects of Defence.

<b>Term – I</b>		
<b>Sr. No.</b>	<b>Topic</b>	<b>No. of Lectures</b>
<b>UNIT 1</b>	<b>Defence as an Economic Problem</b> a) Silent Features of India Economy b) Relationship between defence and Economy c) Defence as an Economic Problem – Meaning and Importance	12
<b>UNIT 2</b>	<b>Peace Time Economy</b> a) Aims and Objectives b) Merits and Demerits c) Pre-war preparation d) Mobilization of resource for defence	12
<b>UNIT 3</b>	<b>War–time Economy</b> a) Aims and Objectives b) Merits and Demerits c) Techniques of controlling inflation and rationing Methods of war finance	12
<b>UNIT 4</b>	<b>Defence production in India</b> a) Role in Defence Production Public Sector Undertaking b) Role of private sector in Defence production c) Role of Foreign Collaboration d) Role of Defence Research and Development Organization e) Self Reliance Programme & Transfer of Technology	12
<b>Term – II</b>		
<b>Sr. No.</b>	<b>Topic</b>	<b>No. of Lectures</b>
<b>UNIT 5</b>	<b>Defence planning in India</b> a) Meaning and Importance of Defence Planning b) Meaning and programming c) Definition of Budget and Budgeting d) Types of Budgeting e) Importance of Zero Base Budgeting	12

<b>UNIT 6</b>	<b>Defence Expenditure</b> a) Productivity or Non-Productivity b) More or Less Analysis c) Causes of Increasing Defence Expenditure d) Impact of Decreased Expenditure on Armed Forces	24
<b>UNIT 7</b>	<b>Factors determining the size of Defence Expenditure</b> a) External and Internal Security Threat Perception b) Political Ideology c) Leadership d) National Power/Capability etc.	12
<b>UNIT 8</b>	<b>Analysis of India's Defence Expenditure</b> a) Phase I – 1947-1962 b) Phase II – 1962-1971 c) Phase III – 1971-1990 d) Phase IV – 1990 to present day	12

**Recommended Books :**

1. Agrwal, Rajesh K., Defence Production & Development (New Delhi: Gulab Vazirani for Arnold – Heinemann Publisher, 1978)
2. Deger, S. & Sen, S., Military Expenditure in the Third World Countries: The Economic Effects (London: Routledge & Kegan Paul, 1986)
3. Dutta, Meena & Sharma Jai Narain., Defence Economics (New Delhi: Deep & Deep Publication)
4. Ghosh, Ameya, India's Defence Budget & Expenditure Management in a Wider Context (New Delhi: Lancer Publishers & Spantech, 1996)
5. Kennedy, Gavin, Defence Economics (London: Gerald Duckworth and Co. Ltd., 1983)
6. Hitch, Charles J., and Mcken, Ronald N. The Economics of Defence in the Nuclear Age (Combridge, Mass: Havard University Press, 1960)
7. Khanna, D. D. and Mehrotra, P. N. Defence Versus Development: A case study of India, (New Delhi: Indus Publication Company, 1993)
8. Nada, Ravi, National Security Perspective Policy and Planning (New Delhi: Lancer Books, 1991)
9. Subramanyam, K., India's Security Perspective, Policy and Planning (New Delhi: Lancer Books, 1991)
10. Thomas, Raju, G. C., The Defence of India: A Budgetary Perspective of Strategu and Politics (Meerut: The Macmillan Company of India Limited, 1978)
11. Thomas, Raju G. C., Indian Security Policy (Princeton, New Jersey: University Press, 1986)

**S.Y. B.Com.**  
**Special Paper I**  
**Subject Name -: Insurance Transport and Clearance**  
**Course Code -: 206 – K.**

**Objectives:**

- 1) To acquaint the students with basic concepts in insurance and tourism.
- 2) To develop a right understanding to study various facets of insurance and tourism.
- 3) To aware about the Role and importance of insurance and tourism business

<b>Term-1</b>		
<b>Sr. No.</b>	<b>Topic</b>	<b>No. of Lecturers</b>
<b>Topic -1</b>	Basic principles of insurance, Working of Life Insurance business, Organizational structure of Life Insurance business, Life Insurance scenario in India.	10
<b>Topic-2</b>	Types of life insurance policies- whole life, endowment, money back, group insurance, unit linked insurance policy, pension plan. Role of insurance agent, field officer, surveyor, assessor and responsibilities of insurer.	10
<b>Topic-3</b>	Principles of General Insurance, Comparison between General and Life Insurance. Study and scope of General Insurance in India. Introduction to the marketing of General Insurance business in India. Insurance contribution to Gross Domestic Product (GDP).	10
<b>Topic-4</b>	Role of General Insurance Company of India (GIC). Types of General Insurance- Fire, Marine, Motor, Personal Accident, Health, Engineering, Crop etc. Study of various policies and insurance cover , study of risk factors, insurance claims.	10
<b>Topic-5</b>	Regulations of insurance business in India, Insurance Regulatory Development Authority (IRDA) Economical Growth and Employment Development in Insurance Sector. Opportunities and challenges before Indian Insurance business, Career in insurance business.	08
<b>Term-II</b>		
<b>Sr. No.</b>	<b>Topic</b>	<b>No. of Lecturers</b>
<b>Topic -1</b>	Tourism-Types of tourists, tourism, recreation and leisure and study of tourism activities. Inter regional and intra regional tourism. Potential areas of tourism development and need for tourism planning, Govt. policies for Tourism Development.	10



<b>Topic-2</b>	Forms of Tourism- Religious, ethnical, geographical, educational, health, sports, heritage, historical, hill region and coastal region. Potential areas for tourism development- Health, Agro & Sport tourism.	10
<b>Topic-3</b>	Tour operators- their responsibilities, planning of tour- pre tour and post tour activities. Essentials of tour planning tour packages- types of tours, group tours, packages, travel agency resources, time table, calendars, study of local weather conditions. Carrier in tourism industry.	10
<b>Topic-4</b>	Tourism Accommodation- significance and types of accommodation - Hotels holiday homes, resorts, cottages, tent houses, dharamshalas. Hotel meal plans, rates, rooms category, locations and reservations. Current trends in Tourism industry.	10
<b>Topic-5</b>	Impact of tourism on -Economy- environment, social and cultural aspects of the society. Current scenario of Tourism in India. Opportunities and challenges before Indian Tourism.	08

### **Recommended books and reports**

1. Insurance- Principles and Practices- M.N. Mishra, Dr. S.B. Mishra (S. Chand)
  2. Insurance- Principles and Practices- Vinayakan, N.M. Radhaswamy & V. Vasudevan.
  3. Life Insurance in India- G.R. Desai
  4. Insurance Theory and Practice-Nalini Prava Tripathy, Prabir Pal (PHI Publication)
  5. General Insurance- Principles and Practice- by P. Mitra, Academic Publication
  6. Life Insurance in India- by Suryapal Singh, Sahitya Bhavan Publication
  7. IRDA -Annual Reports & Journal.
  8. LIC council reports.
  9. Annual Reports of LIC of India.
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1. Tourism Promotion and Development- G.S. Batra & R.C. Agarwal
  2. Tourism Industry in India- Dr. M. Selvam.
  3. Tourism Development in India- A Satish Babu
  4. Geography of Transport in India- Dr. B.C. Vaidya, Concept Publication, New Delhi.
  5. Tourism Development in India- By S.J. Srivastava.

**S.Y. B.Com.**  
**Computer Programming and Application Special Paper I**  
**Subject Name -: Computer Programming and Application.**  
**Course Code -: 206 – L.**  
**(First Term) (VB Script)**

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**Objective:**

- To learn to use VBScript, transform Web pages from static text and images into functional, interactive, and dynamic e-commerce tools.
- To embed VBScript code in an HTML document.
- To use VBScript operators; write code that makes decisions based on existing conditions, using control structures and loops.
- To enable communication with a Web page visitor using Message and Input boxes.
- To use the DOM to control the layout of HTML pages, add effects, and get information from users.

Sr. No.	Topic Name	No. of Lectures
<b><u>Unit 1</u></b>	<b><u>Introduction To VBScript</u></b> 1.1VBScript and the Web 1.1.1 VBScript's Popularity 1.1.2 VBScript Defined 1.1.3 Platform or Host Dependence 1.1.4 Scripting Languages 1.2VBScript Basics 1.2.1 Embedding VBScript in HTML 1.2.2 VBScript to Display Information 1.2.3 Hiding VBScript from Older Browsers 1.2.4 Code Documentation and Formatting	06
<b><u>Unit 2</u></b>	<b><u>Variables ,Arrays, and VBScript Operators</u></b> 2.1 Variables, Subtypes, and Constants 2.1.1 Variables Defined, Declared 2.1.2 Variants and Subtypes 2.1.3 Assigning Values to Variables 2.1.4 Determining Variant Subtype 2.1.5 Data Subtype Conversion 2.1.6 Numeric and Literal Constants 2.2 Arrays 2.2.1 Groups of Similar Variables 2.2.2 One-Dimensional Arrays 2.2.3 Multi-Dimensional Arrays 2.3 VBScript Operators 2.3.1 VBScript Operators 2.3.2 Arithmetic Operator Precedence 2.3.3 Comparison Operators 2.3.4 Logic Operators 2.3.5 String Concatenation	14

	2.4 Program Control and Structure 2.4.1 Control Statements 2.4.2 Four Control Structures 2.4.3 Using Loops	
<b>Unit 3</b>	<b><u>VBScript Procedures and Control Structures</u></b> 3.1 VBScript Procedures 3.1.1 Procedures 3.1.2 Subroutine Procedures 3.1.3 Scope of Variables 3.1.4 Function Procedures 3.1.5 Randomize and RND 3.2 Strings and Numbers 3.2.1 Strings 3.2.2 Formatting Numbers 3.3 Message and Input Boxes 3.3.1 Message Box 3.3.2 Input Boxes 3.4 Dates and Times 3.4.1 Dates and Times 3.4.2 Splitting Up Dates and Times 3.4.3 Page Updates	10
<b>Unit 4</b>	<b><u>Handling Documents and Events</u></b> 4.1 The Document Object Model 4.1.1 What Does VBScript Manipulate? 4.1.2 History and Background of the DOM 4.1.3 Properties, Methods, Events and Collections 4.1.4 Internet Explorer 5.x DOM 4.2 Event Handlers 4.2.1 Top-Down vs. Event-Driven Programming 4.2.2 Mouse Events 4.2.3 Keyboard Events 4.2.4 Validation and Error Handling	10
<b>Unit 5</b>	<b><u>Working With Database</u></b> 5.1 Basic Database Connectivity (MS Access or MySQL) 5.1.1 Introduction to Basic Queries with Select, Insert, Update, Delete commands 5.1.2 Send and Retrieve Data through Forms	08

**Books:**

- VBScript Programmer's Reference-Third Edition by Adrian Kingsley-Hughes, Kathie Kingsley-Hughes and Daniel Read  
ISBN-13 9788126514915, WROX-Wiley
- Microsoft VBScript: Step by Step Paperback by Bargain Price
- VBScript in a Nutshell, 2nd Edition, Paul Lomax, Matt Childs, Ron Petrusha, ISBN-13: 978-0596004880, Publication- O'Reilly Media

(Second Term) (RDBMS)

**Objective:**

You will learn how to create and access data using Structured Query Language (SQL), the programming language used by most relational database management systems.

<u>Sr. No.</u>	<u>Topic Name</u>	<u>No. of Lectures</u>
<b><u>Unit 1</u></b>	<b><u>Structured Query Language – I</u></b> 1.1 Introduction 1.2 What is RDBMS? 1.3 Introduction to SQL 1.4 SQL Language Elements 1.5 Classification of SQL commands 1.7 Creating and Managing Tables 1.8 Applying Constraints	<b>10</b>
<b><u>Unit 2</u></b>	<b><u>Structured Query Language – II</u></b> 2.1 Introduction 2.2 Basic Data Retrieval 2.2.1 Column Aliases 2.2.2 Duplicate Rows 2.3 Restricting and Sorting Data 2.4 Dual Table 2.5 Single Row Functions 2.5.1 Numeric Functions 2.5.2 Character Functions 2.5.3 Date Time Functions 2.5.4 Conversion Functions 2.6 Joins	<b>10</b>
<b><u>Unit 3</u></b>	<b><u>Advanced Queries And Database Objects</u></b> 3.1 Introduction 3.2 Aggregate Functions 3.3 Group by Having Clause 3.3.1 Comparing Having clause and where clause 3.4 Creating Other Database Objects 3.4.1 Views 3.4.2 Indexes 3.4.3 Sequences 3.4.4 Synonyms 3.5 Sub queries 3.5.1 Sub query in DDL and DML commands	<b>10</b>
<b><u>Unit 4</u></b>	<b><u>Security Privileges, SET Operators &amp; Datetime Functions</u></b> 4.1 Introduction 4.2 Enhancements to GROUP BY function 4.2.1 ROLLUP Operator	<b>10</b>

	4.2.2 CUBE Operator 4.2.3 GROUPING Function 4.3 SET OPERATORS 4.3.1 INTERSECT Operator 4.3.2 UNION Operator 4.3.3 UNION ALL Operator 4.3.4 MINUS Operator 4.4 DATETIME FUNCTIONS 4.4.1 Parsing Date and Time 4.5 Controlling User Access 4.5.1 System privileges 4.5.2 Object Privileges 4.5.3 What a user can grant? 4.5.4 GRANT/REVOKE PRIVILEGES	
<b><u>Unit 5</u></b>	<b><u>Advanced Subqueries</u></b> 5.1 Introduction 5.2 Multiple Column Subqueries 5.2.1 Coding Subqueries in the FROM clause 5.3 Scalar Subqueries 5.4 Correlated Subquery 5.5 WITH clause 5.5.1 Functions of the WITH clause 5.6 Hierarchical Queries	<b>08</b>

**Books:**

- SQL: THE COMPLETE REFERENCE 3rd Edition Author: James Groff, Paul Weinberg, Andy Oppel  
Tata Mc-graw Hill Publishing Co.ltd.-New Delhi ISBN : 9781259003882
- SQL, PL/SQL: The Programming Language Of Oracle (With CD-ROM) 4th Revised Edition Author: Ivan Bayross BPB PUBLICATIONS  
ISBN-13 9788176569644
- Oracle Database 11G: The Complete Refere 1st Edition Author: KEVIN LONEY , Tata Mcgraw Hill Education Private Limited  
ISBN-13 9780070140790
- 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
- Learning MySQL by O'reilly, Seyed M.M Tahaghogi, Hugh E. Williams, Oreilly Media

# **Revised Syllabi for Three - Year Integrated B.Com. Degree course (From June 2013)**

## **1) INTRODUCTION**

The revised syllabi for B.Com Degree Course will be introduced in the following order.

<b>i)</b>	First Year B.Com.	2013-2014
<b>ii)</b>	Second Year B.Com.	2014-2015
<b>iii)</b>	Third Year B.Com.	2015-2016

The B.Com. Degree Course (Revised Structure) will consist of three Years. The first year annual examination will be held at the end of the first year. The Second Year annual examination will be held at the end of the second year. The Third annual examination shall be held at the end of the third year.

## **2) ELIGIBILITY**

1. No Candidates shall be admitted to enter the First Year of the B.Com. Degree Course (Revised Structure) 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 subject.
2. No candidate shall be admitted to the annual examination of the First year B.Com. (Revised Structure) unless he/ she has satisfactorily kept two terms for the course at the college at the college affiliated to this University.
3. No candidate shall be admitted to the annual examination of the Second Year unless he/she has kept two terms satisfactorily for the course at the college affiliated to this University.
4. No candidate shall be admitted to the Third year of the B.Com. Degree Course (Revised Structure) unless he/she has passed in all the papers at the First Year B.Com. Examination and has passed in all the papers at the first Year B.Com. Examination and has satisfactorily kept terms for the second year and also two terms for the third year of B.Com. satisfactorily in a college affiliated to this University.

## **3) A.T.K.T. Rules :**

As far as A.T.K.T. is concerned, a student who fails in two theories and one practical head of passing at F.Y.B.Com may be admitted to S.Y.B.Com. likewise a student who fails in the two theory and one practical head of passing at S.Y.B.Com may be admitted to T.Y.B.Com. But a student passing S.Y.B.Com but fails in any subject at F.Y.B.Com cannot be admitted to T.Y.B.Com.

**4) (A) Revised Structure of B.Com. Course.**

<b>F.Y.B.Com. w.e.f. 2013-14</b>	
<b>Sr. No.</b>	<b>Compulsory / Main Subjects</b>
<b>101</b>	Compulsory English
<b>102</b>	Financial Accounting
<b>103</b>	Business Economics (Micro)
<b>104 (A)</b>	Business Mathematics and Statistics
	or
<b>104 (B)</b>	Computer Concepts and Applications
<b>105</b>	<b>Optional Group (Any one of the following)</b> a) Organizational Skill Development. b) Banking & Finance c) Commercial Geography d) Defense Organization and Management in India e) Co-Operation. f) Managerial Economics
<b>106</b>	<b>Optional Group (Any one of the following)</b> a) Essentials of E-Commerce b) Insurance & Transport c) Marketing & Salesmanship d) Consumer Protection & Business Ethics. e) Business Environment & Entrepreneurship f) Foundation Course in Commerce
<b>107</b>	<b>(Any one of the language from the following groups)</b> <b>Modern Indian Languages (M.I.L.)</b> :- Compulsory English / Marathi / Hindi / Gujarathi / Sindhi / Urdu / Persian.  <b>Modern European Languages (M.E.L.)</b> :- French / German.  <b>Ancient Indian Languages (A.I.L.)</b> :- Sanskrit.  <b>Arabic.</b>

<b>S.Y.B.Com. w.e.f. 2014-15</b>	
<b>Sr. No.</b>	<b>Compulsory / Main Subjects</b>
<b>201</b>	Business Communication.
<b>202</b>	Corporate Accounting.
<b>203</b>	Business Economics (Macro)
<b>204</b>	Business Management
<b>205</b>	Elements of Company Law
<b>206</b>	<b>Special Subject – Paper I</b> <b>(Any one of the following)</b> a) Business Administration b) Banking & Finance.

	<ul style="list-style-type: none"> <li>c) Business Laws &amp; Practices.</li> <li>d) Co-operation &amp; Rural Development.</li> <li>e) Cost &amp; Works Accounting.</li> <li>f) Business Statistics.</li> <li>g) Business Entrepreneurship.</li> <li>h) Marketing Management.</li> <li>i) Agricultural &amp; Industrial Economics.</li> <li>j) Defense Budgeting, Finance &amp; Management.</li> <li>k) Insurance, Transport &amp; Tourism.</li> <li>l) Computer Programming and Applications.</li> </ul>
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<b>T.Y. B.Com. w.e.f. 2015-16</b>	
<b>Sr. No.</b>	<b>Compulsory / Main Subjects</b>
<b>301</b>	Business Regulatory Framework (Mercantile Law)
<b>302</b>	Advanced Accounting.
<b>303 (A)</b>	Indian & Global Economic Development
	Or
<b>303 (B)</b>	International Economics
<b>304</b>	<b>Auditing &amp; Taxation</b>
<b>305</b>	<b>Special Subject – Paper II</b> <b>(Same special subject offered at S.Y. B.Com.)</b> <ul style="list-style-type: none"> <li>a) Business Administration</li> <li>b) Banking &amp; Finance.</li> <li>c) Business Laws &amp; Practices.</li> <li>d) Co-operation &amp; Rural Development.</li> <li>e) Cost &amp; Works Accounting.</li> <li>f) Business Statistics.</li> <li>g) Business Entrepreneurship.</li> <li>h) Marketing Management.</li> <li>i) Agricultural &amp; Industrial Economics.</li> <li>j) Defense Budgeting, Finance &amp; Management.</li> <li>k) Insurance, Transport &amp; Tourism.</li> <li>l) Computer Programming and Applications.</li> </ul>
<b>306</b>	<b>Special Subject – Paper III</b> <b>(Same special subject offered at S.Y. B.Com.)</b> <ul style="list-style-type: none"> <li>a) Business Administration</li> <li>b) Banking &amp; Finance.</li> <li>c) Business Laws &amp; Practices.</li> <li>d) Co-operation &amp; Rural Development.</li> <li>e) Cost &amp; Works Accounting.</li> <li>f) Business Statistics.</li> <li>g) Business Entrepreneurship.</li> <li><b>h) Marketing Management.</b></li> <li>i) Agricultural &amp; Industrial Economics.</li> <li>j) Defense Budgeting, Finance &amp; Management.</li> <li>k) Insurance, Transport &amp; Tourism.</li> <li>l) Computer Programming and Applications.</li> </ul>



**B) Subjects Carrying Practical's**

There will be practical examination for the F.Y.B.Com. for the subject Financial Accounting. There will be practical and practical examinations for the special subjects at S.Y.B.Com. and T.Y.B.Com. levels. There will be Practical for the S.Y.B.Com level Compulsory subject Business Communication & for T.Y.B.Com Auditing & Taxation.

**(C)** A Student must offer the same Special Subject at T.Y.B.Com. which he has offered at S.Y.B.Com.

**(D)** In an exceptional cases, a student may change the subject chosen by him at second year during the first term of the third year provided he keeps the additional terms of the new subject at S.Y.B.Com.

**4. EXTERNAL CANDIDATES**

- 1) The student who has registered his name as the external student will appear at the annual examination.
- 2) The result of external student will be declared on the basis of Annual Examination of 80 marks for practical subjects by converting the same out of 100.
- 3) No foreign student shall be allowed to register as an External Student.

**5. MEDIUM OF INSTRUCTION.**

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. WORKLOAD**

The present norms of workload of lectures, tutorials and practicals per subject in respect of B.Com. Course shall continue.

**7. UNIVERSITY TERMS**

The dates for the commencement and conclusion of the first and the second terms shall be as determined by the University Authorities. The terms can be kept only by duly admitted students. The present relevant ordinances pertaining to grant of terms will be applicable.

**8. 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.

**9. 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.

#### **10. RESTRUCTURING OF COURSES**

This new revised structure shall be made applicable to the colleges implementing 'Restructured Programme' at the undergraduate level from June, 2004. The existing pattern of 'C', 'D', and 'E' Components shall be continued.

The Colleges under the Restructured Programme which has revised their structure in the light of the "2008 Pattern" shall be introduced with effect from academic year 2010-11.

#### **11. SETTING OF QUESTION PAPERS**

1. A candidate shall have the option of answering the question in any of the subjects either in Marathi or English except in languages.
2. The question papers shall be framed so as to ensure that no part of the syllabus is left out of study by a student.
3. The question paper shall be balanced in respect of various topics outlined in the syllabus.
4. The question papers shall have combination of long and short answer type question. As far as possible short answer type questions should not exceed 15 to 20 percent.
5. There shall be no overall option in the question paper, instead, there shall be internal options (such as either/ or and three short answers out of five etc.).
6. In case of question paper under the Special Subject (Paper No. III) one question carrying 10 marks will be set on current knowledge in relating subject in the academic year.

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**T.Y. B.Com.**  
**Compulsory Paper**  
**Subject Name -: Business Regulatory Framework (Mercantile Law)**  
**Course Code -: 301.**

**Objectives:-**

1. To acquaint students with the basic concepts, terms & provisions of Mercantile and Business Laws.
2. To develop the awareness among the students regarding these laws affecting business, trade and commerce.

**Term I**

Unit No.	Topic	Lectures
<b>1</b>	<b>Law of Contract - General Principles.</b> (Indian Contract Act, 1872) <ul style="list-style-type: none"> <li>• Definition, Concept and kinds of contract</li> <li>• Offer and Acceptance.</li> <li>• Capacity of parties.</li> <li>• Consideration.</li> <li>• Consent and free consent.</li> <li>• Legality of object and consideration.</li> <li>• Void Agreements.</li> <li>• Discharge of contract.</li> <li>• Breach of contract and remedies (Including damages, meaning, kinds and rules for ascertaining damages)</li> </ul>	<b>20</b>
<b>2</b>	<b>Law of Partnerships:</b> <b>2.1. Indian Partnership Act 1932:</b> Partnership; Definition and Characteristics, Types of Partners, Rights, Duties and Liabilities of Partners, Dissolution of Partnership. <b>2.2. Limited Liability Partnership Act 2008:</b> Limited Liability Partnership (LLP); Concept, Nature and Advantages, Difference between LLP and Partnership Firm, Difference between LLP and company, Partners and designated partners, 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)	<b>04</b>  <b>05</b>
<b>3</b>	<b>Sale of Goods.(Sale of Goods Act,1930)</b> Contract of sale-Concept and Essentials. Sale and agreement to sale. Goods-Concept and kinds. Conditions and warranties. (Definition, Distinction, implied conditions and warranties)Transfer by non-owners. Rights of Unpaid Seller and Remedial Measures.	<b>14</b>
<b>4</b>	<b>E-Contracts (E-Transactions/E-Commerce.):</b> <ul style="list-style-type: none"> <li>• Significance of E-Transactions /E-Commerce. <ul style="list-style-type: none"> <li>▪ Nature.</li> </ul> </li> </ul>	<b>05</b>

	<ul style="list-style-type: none"> <li>▪ Formation.</li> <li>▪ Legality.</li> <li>▪ Recognition.</li> </ul> <p>(Chapter 4.Sec.11-13 of I T Act,2000 relating to attribution, acknowledgement, dispatch of E-Records)</p> <ul style="list-style-type: none"> <li>• Digital Signatures –Meaning &amp; functions, Digital Signature certificates [Sections 35-39]</li> <li>• Legal issues involved in E-Contracts.</li> </ul>	
<b>Term II</b>		
<b>5</b>	<b>The Consumer Protection Act, 1986</b> <ul style="list-style-type: none"> <li>• Salient features of the C.P. Act.</li> <li>• Definitions-Consumer, Complainant, Services, Defect &amp; Deficiency, Complainant, unfair trade practice, restrictive trade practice.</li> <li>• Consumer Protection Councils.</li> <li>• Procedure to file complaint &amp; Procedure to deal with complaint &amp; Reliefs available to consumer.(Sec.12 to14)</li> <li>• Consumer Disputes Redressal Agencies. (Composition, Jurisdiction, Powers and Functions.)</li> </ul>	<b>12</b>
<b>6</b>	<b>Intellectual Property Rights : (IPRs)</b> <ul style="list-style-type: none"> <li>• WIPO: Brief summary of objectives, organs, programmes&amp; activities of WIPO.TRIPS: As an agreement to protect IPR-Objectives &amp; categories of IPR covered by TRIPS.</li> <li>• Definition and conceptual understanding of following IPRs under the relevant Indian current statutes.</li> <li>• Patent: Definition &amp; concept, Rights &amp; obligation of Patentee, its term.</li> <li>• Copyright: Characteristics &amp; subject matter of copyright, Author &amp; his Rights, term.</li> <li>• Trademark: Characteristics, functions, illustrations, various marks, term, internet domain name- Rights of trademark holder.</li> <li>• Design: Importance, characteristics, Rights of design holder.</li> <li>• Geographical Indications, Confidential Information &amp; Trade Secrets, Traditional knowledge—Meaning &amp; scope of these IPRs.</li> </ul>	<b>16</b>
<b>7</b>	<b>Negotiable Instruments Act, 1881:</b> <ul style="list-style-type: none"> <li>• Concept of Negotiable Instruments: Characteristics, Meaning Important relevant definitions under the Act</li> <li>• Definitions, Essentials of promissory note, bill of exchange and cheque. Distinction between these instruments. Crossing of cheques – It’s meaning and types.</li> <li>• Holder and holder in due course, Privileges of holder in due course.</li> <li>• Negotiation, endorsement, kinds of endorsement.</li> <li>• Liabilities of parties to negotiable instruments.</li> <li>• Dishonour of N. I., kinds, law relating to notice of dishonour. Dishonour of cheques.</li> </ul>	<b>14</b>
<b>8</b>	<b>Arbitration &amp; Conciliation:</b> <ul style="list-style-type: none"> <li>• Concept of Arbitration &amp; Conciliation.</li> <li>• Definition &amp; Essentials of Arbitration Agreement.</li> </ul>	<b>06</b>

	<ul style="list-style-type: none"> <li>• Power and Duties of Arbitration. Conciliation proceeding. (Provisions of Arbitration &amp; Conciliation Act,1996 in nutshell to be covered.)</li> </ul>	
	<b>Total</b>	<b>48</b>

**Recommended Books:**

- 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
- 5) An Introduction to Mercantile Laws :-N.D.Kapoor
- 6) Business Laws :- N.M.Wechlekar
- 7) Company Law :-Avtar Singh
- 8) Business Law for Management :-Bulchandani K.R
- 9) Negotiable Instruments Act :-Khergamwala
- 10) Intellectual Property Law:-P.Narayan.
- 11) Cyber Laws :- Krishna Kumar
- 12) Consumer Protection Act In India :-Niraj Kumar
- 13) Consumer Grievance Redressal under CPA :-Deepa Sharma.
- 14) Business Law – Dilip Shinde, Kiran Nerkar, Shantnu Jog, Anant Deshmukh  
(Sai Jyoti Publication)

**T.Y. B.Com.**  
**Compulsory Paper**  
**Subject Name :- Advanced Accounting.**  
**Course Code :- 302**

**Objectives:-**

- ❖ To impart the knowledge of various accounting concepts
- ❖ To instill the knowledge about accounting procedures, methods and techniques.
- ❖ To acquaint them with practical approach to accounts writing by using software package.

**TERM - I**

Unit No.	Topic and Contents	No. of Lectures
1.	<b>Accounting Standards &amp; Financial Reporting (Introduction to IFRS-Fair Value Accounting):-</b> Brief Review of Indian Accounting Standard :- AS- 3, AS-7, AS-12, AS-15 AS-17 to AS-25 simple practical examples of application nature.	12
2.	<b>Final Accounts of Banking Companies :-</b> * Introduction of Banking Company - Legal Provisions - Non Performing Assets (NPA) - Reserve Fund - Acceptance, Endorsements & Other Obligations - Bills for Collection - Rebate on Bills Discounted - Provision for Bad and Doubtful Debts - Preparation of Final Accounts in vertical form as per Banking Regulation Act 1949. * Introduction to Core Banking System.	12
3.	<b>Insurance Claim Accounts :-</b> <b>A. Claim for Loss of Stock</b> - Introduction - Procedure for Calculation - Average Clause - Treatment of abnormal items of goods - Under & Overvaluation of Stock. <b>B. Claim for Loss of Profit</b> - Introduction - Indemnity under policy - Some important terms - Procedure for ascertaining claims. <b>C. Claim for Loss of Fixed Assets</b> - Introduction - Some important terms - Procedure for ascertaining claims.	12
4.	<b>Final Accounts of Co-operative Societies :-</b> a. Credit Co-operative Societies :- b. Consumer Co-operative Societies :- Meaning - Allocation of Profit as per Maharashtra State Co-operative Societies Act. Preparation of Final Accounts of Credit Co-operative Societies and Consumer Co-operative Societies.	12
<b>TOTAL</b>		<b>48</b>
<b>TERM - II</b>		
5.	<b>Computerized accounting practices:-</b> A. VAT & VAT Report B. Service Tax C. Central Value Added Tax D. Income Tax - Tax Deducted at Source (TDS) Including entries with the help of Accounting Software. (Demonstration and Hands Experience.)	12
6.	<b>Branch Accounts :-</b> Stock and Debtors System :- Introduction - Types of Branches - Goods supplied at Cost & Invoice Price.	12

<b>7.</b>	<b>Single Entry System :-</b> Conversion of Single Entry into Double Entry :- Introduction - Preparation of Cash Book - Total Debtor Account - Total Creditor Account - Final Accounts.	<b>12</b>
<b>8.</b>	<b>Analysis of Financial Statements :-</b> Ratio Analysis :- Meaning - Objectives - Nature of Ratio analysis - Problems on Ratio Analysis restricted to the following Ratio only - *Gross Profit Ratio *Net Profit Ratio * Operating Ratio * Stock Turnover Ratio * Debtor Turnover Ratio * Current Ratio * Liquid Ratio * Debt to Equity Ratio.	<b>12</b>
<b>TOTAL</b>		<b>48</b>

**Allocation of Marks :-**

Theory :-	30%
Problems :-	70%
Total :-	100%

**Recommended Books:-**

1. 1. Advanced Accounts: By M.C. Shukla & S.P. Grewal (S.Chand & Co. Ltd. New Delhi)
2. 2. Advanced Accountancy: By S.P. Jain & K.N. Narang ( Kalyani Publishers, New Delhi)
3. 3. Advanced Accountancy: By R.L.Gupta & M. Radhaswamy (Sultan Chand & Sons, New Delhi)
4. Advanced Accounting: By Dr. K.N. Jagtap, Dr. S. Zagade.
5. Student Guide to Accounting Standards : D.S. Rawat (Taxmann, New Delhi)
6. Accounting Standards : Sanjeev Singhal.
7. Principal of Management Accounting : Dr. S.N. Maheshwari.
8. Advanced Management Accounting : Ravi Kishor.

**Journals:-**

1. The Chartered Accountant: Journal of the Institute of Chartered Accountants of India.
2. The Accounting World : ICFAI Hyderabad

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**T.Y. B.Com.**  
**Compulsory Paper**  
**Subject Name :- Indian & Global Economic Development**  
**Course Code :- 303 (A)**

**Objectives:**

- 1) To expose students to a new approach to the study of the Indian Economy.
- 2) To help the students in analyzing the present status of the Indian Economy.
- 3) To enable students to understand the process of integration of the Indian Economy with other economics of the world.
- 4) To acquaint students with the emerging issues in policies of India's foreign trade.

Unit No.	Topic		Lectures
<b>1</b>	<b>Introduction</b>		12
	1.1	Basic Characteristics of the Indian Economy as an emerging economy.	
	1.2	Comparison of the Indian Economy with developed economies with respect to	
	1.2.1	National Income	
	1.2.2	Per-Capita Income	
	1.2.3	Agriculture	
	1.2.4	Industry	
	1.2.5	Service Sector	
<b>2</b>	<b>Agricultural Development in India Since Independence</b>		12
	2.1	Place of Agriculture in Indian Economy	
	2.2	Constraints in Agricultural Development	
	2.3	Rural Indebtedness – Causes and measures	
	2.4	Agricultural Marketing – Problems and measures	
	2.5	Price Policy – Minimum Support Price (M.S.P.)	
<b>3</b>	<b>Industrial Development in India Since 1991</b>		12
	3.1	Role of Industrialization in Economic development	
	3.2	Role of Small, Medium and Large Scale Enterprises (SMEs) – Problems & Prospects	
	3.3	New Industrial Policy 1991	
	3.4	Evaluation of Industrial Policy 1991	
<b>4</b>	<b>Infrastructure in India Since 1991</b>		12
	4.1	Role of Basic infrastructure in economic development of India.	
	4.2	Private v/s Public investment in infrastructure development	
	4.3	Role of Private Sector in infrastructural development	
	4.4	Role of Public Sector in infrastructural development	
<b>TERM - II</b>			
<b>5</b>	<b>Human Resource Development</b>		12
	5.1	Role of Human Resource in Economic Development	
	5.2	Concept of Human Development Index (HDI)	



Unit No.	Topic		Lectures
	5.3	Concept of Human Poverty Index	
	5.4	Concept of Gender – related development index	
	5.5	Gender Employment measures	
<b>6</b>	<b>Global Economic Development and Foreign Capital</b>		12
	6.1	Meaning and Challenges of Liberalization, Privatization & Globalization.	
	6.2	Meaning and Role of Foreign Capital	
	6.3	Need for Foreign Capital	
	6.4	Forms of foreign capital	
	6.5	Advantages & Disadvantages of Foreign Capital	
<b>7</b>	<b>Foreign Trade and Balance of Payment</b>		12
	7.1	Importance of Foreign Trade in Economic Development.	
	7.2	Concept of Balance of Trade and Balance of Payment	
	7.3	India's Balance of Payment Position since 1991	
	7.4	Convertibility of Indian Rupee – Current & Capital Account	
	7.5	Current Export – Import Policy (EXIM Policy)	
<b>8</b>	<b>Regional &amp; International Economic co-operation Importance, Objectives, Structure and functions of -</b>		12
	8.1	South Asian Association for Regional co-operation (SAARC)	
	8.2	International Monetary Fund (IMF)	
	8.3	World Bank or International Bank for Reconstruction and Development (IBRD)	
	8.4	World Trade Organization (WTO)	
	8.5	BRICS – Introduction & Functions	

#### Recommended Books :

- 1) Indian Economy – S.K.Misra and V.K.Puri, Himalaya Publishing House, Delhi.
- 2) International Business Environment – Black and Sundaram, Prentice Hall India.
- 3) The Global Business Environment – Tayebmonis H. Sage Publication, New Delhi.
- 4) International Business – Competing in the Global Market place – Charles Hill, Arun kumar Jain, Tata McGraw Hill.
- 5) International Economics – M.L.Jhingana Vrinda Publications, Delhi.
- 6) Indian Economy – Ruddar Datta and K.P.M. Sundaram S. Chand and Co. New Delhi.
- 7) Indian Economy – Problems of Development and Planning A.N.Agarwal, New Age International Publishers.

Economic Survey – Government of India

UNDP, Human Development Report.

World Bank, World Development Report

Magazines / Journals

Reports, Web sites

**T.Y. B.Com.**  
**Compulsory Paper**  
**Subject Name -: International Economics**  
**Course Code -: 303 (B)**

**Objectives :**

- 1) To study the theories of International Trade.
- 2) To highlight the trends and challenges faced by nations in a challenging global environment.

**TERM-I**

Unit No.	Topic	Lectures	
<b>1</b>	<b>Introduction</b>	12	
	1.1		Meaning and Scope of International Economics.
	1.2		Importance of International Trade
	1.3		Domestic Trade Vs International Trade
	1.4		Role of International Trade in Economic Growth
<b>2</b>	<b>Theories of International Trade</b>	12	
	2.1		Theory of absolute cost advantage
	2.2		Theory of comparative cost advantage
	2.3		Theory of factor endowment (Heckscher-ohlin Theory, Leontief Paradox)
	2.4		Intra Industrial Trade
<b>3</b>	<b>Terms of Trade</b>	12	
	3.1		Concept of Terms of Trade A) Gross Barter Terms of Trade B) Net Barter Terms of Trade C) Income Terms of Trade and Trade Policy D) Single Factorial Terms of Trade E) Double Factorial Terms of Trade
	3.2		Factors affecting on Terms of Trade
	3.3		Free Trade Policy – Meaning, Arguments for and against
	3.4		Protection Policy – Meaning, Arguments for and against
<b>4</b>	<b>Regional and International Economic Co-operation</b>	12	
	4.1		Regional Co-operation – European Union (E.U)
	4.2		South Asian Association for Regional co-operation (SAARC)
	4.3		Concept of Trade Blocks and Economic Integration
	4.3.1		South American Preferential Trading Arrangement (SAPTA)
	4.3.2		North Atlantic free Trade Agreement (NAFTA)
	4.4		BRICS – Introduction & Functions
<b>TERM - II</b>			
<b>5</b>	<b>Balance of Payment</b>	12	
	5.1		Concept of Balance of Trade and Balance of Payments
	5.2		Balance of Payment on current Account and Capital Account
	5.3		Measures to correct disequilibrium of Balance of Payment
	5.4		Causes of disequilibrium of Balance of Payment

Unit No.	Topic		Lectures
	5.5	Convertibility of Rupee on Current and Capital Account.	
<b>6</b>	<b>Foreign Exchange Rate</b>		12
	6.1	Meaning of Foreign exchange rate	
	6.2	Fixed v/s flexible exchange rate	
	6.3	Theories of Exchange Rate	
	6.3.1	Purchasing Power Parity Theory	
	6.3.2	Balance of Payments Theory	
<b>7</b>	<b>Foreign Exchange Market</b>		12
	7.1	Structure of foreign exchange market	
	7.2	Management of Foreign Exchange -inflow and outflow of foreign capital.	
	7.3	Euro Dollar Market – Nature and Scope	
	7.4	Advantages & Disadvantages of Foreign Exchange Market.	
<b>8</b>	<b>Factor Mobility and Foreign Trade Policy</b>		12
	8.1	Foreign Capital – Meaning of Foreign Direct Investment and Foreign Institutional Investments	
	8.2	Role of Multi National Corporations (MNC's)	
	8.3	Motives and effects of International Labour Migration	
	8.4	India's Foreign Trade Policy since 1991 Features, Trends and Evaluation.	

**Recommended Books :**

- 1) Dr.D.M.Mithani – International Economics (Himalaya Publishing house ltd)
- 2) Z.M.Jhingan : International Economics (Vrinda Publication)
- 3) Dr.Mrs.Nirmal Bhalerao & S.S.M.Desai – International Economics (Himalaya Publishing house ltd)
- 4) Deminic Salvatove – International Economics
- 5) Francis Cherulliom - International Economics (Prentice hall)
- 6) L.M.Bhole – Financial Institutions Markets (Tata McGraw Hill)
- 7) H.R.Macharaju – International Financial Markets and India (Wheeler Publication)
- 8) RBI Report on Currency Finance

Magazines / Journals , Reports, Websites

**T.Y. B.Com.**  
**Compulsory Paper**  
**Subject Name :- Auditing & Taxation**  
**Course Code :- 304**

**Objectives :-** The Study of Various Components of this course will enable the students:

1. To acquaint themselves about the concept and principles of Auditing, Audit process, Assurance Standards, Tax Audit, and Audit of computerized Systems.
2. To get knowledge about preparation of Audit report.
3. To understand the basic concepts and to acquire knowledge about Computation of Income, Submission of Income Tax Return, Advance Tax, and Tax deducted at Source, Tax Collection Authorities under the Income Tax Act, 1961.

**Term I Section**  
**Section- I Auditing**

Unit No.	Topic	Lectures
1.	<b>Introduction to Principles of Auditing and Audit Process.</b> 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	12
2.	<b>Checking, Vouching and Audit Report</b> Test checking-Vouching of Cash Book-Verification and Valuation of Assets and Liabilities. Qualified and Clean Audit Report-Audit Certificate-Difference between Audit Report and Audit Certificate. Auditing and Assurance Standards. (AAS- 1,2,3,4,5,28,29)	12
3.	<b>Company Auditor</b> Qualification, Disqualifications, Appointment, Removal, Rights, Duties and liabilities.	08
4.	<b>Tax Audit</b> Definition of Accountant-Scope of Auditor's Role under Income Tax Act Compulsory Tax Audit- Certification for Claiming exemptions- Selective Tax Audit Tax Consultancy and Representation- Proforma of Computerized Systems.	08
5.	<b>Audit of Computerized Systems</b> Auditing in an EDP environment-planning an audit in a computer Environment - problems encountered in an EDP environment-General EDP Control - EDP Application Control- System Development- Data transfer- Audit practice in relation to computerized systems-Computer Assisted Audit Techniques (Factors and Preparation of CAAT)	08
	<b>Total</b>	<b>48</b>

**Term II**  
**Section - II Income Tax**

Unit No.	Topic	Lectures
1.	<b>Important Concepts and Definitions under Income Tax Act-1961.</b> Income, Person, Assessee, Assessment year, Pervious year, Agricultural Income, Exempted Income, Residential Status of an Assessee, PAN, TAN	08



	House Property	regarding Income from house property, Determination of gross annual value of self occupied property,	Property owner/ Guest lecture
7.	Profits & Gains of Business & Profession	Meaning of business & profession, procedure for computing taxable profit of business and profession	Visit to Business Firm
8.	Deduction Under Sec.80 C to 80 U	Deduction Under Sec.80 C to 80 U	Visit to Tax Consultant/ Guest lecture
9.	Income Tax Returns -Form 16, ITR - I,II, III,IV	Filling and collecting the Form No. 16, Filling and collecting ITRs	Visit to Tax Consultant/ Guest lecture

#### Recommended Books

1. Practical Auditing -: Spicer and Peglar
2. Auditing Principles -: Jagadish Prasad
3. A Handbook of Practical Auditing -: B.N. Tondon
4. Auditing assurance standards- -: The Institute of Chartered Accountants of India
5. Indian Income Tax -: Dr.Vinod Singhanian
6. Income Tax- -: Ahuja and Gupta
7. Income Tax Act -: R.N.Lakhotia
8. Indian Income Tax Act -: H.C.Malhotra
9. Income Tax -: Manoharem
10. Student guide to Income Tax -: Dr.Vinod Singhanian

**T.Y. B.Com.**  
**Business Administration Special Paper II**  
**Subject Name :- Business Administration**  
**Course Code :- 305 – a.**

**Objective :-**

To acquaint the students with basic concepts & functions of HRD and nature of Marketing functions of a business enterprise.

**Term I :- Human Resource Development.**

Unit No.	Content	Lectures
<b>1.</b>	<b>Human Resource function</b> 1.1 Meaning, Objectives of Human Resource Function, Difference between H.R.M. and H.R.D. 1.2 Organization, Scope and functions of Human Resource Department in Modern Business. 1.3 Human Resource Planning – Nature and Scope, Job analysis - Job description - Job specification. 1.4 Emerging Concept of H.R.D. – Quality Circles –Kaizen - Voluntary Retirement Schemes.	<b>14</b>
<b>2.</b>	<b>Recruitment and Training</b> 2.1 Methods or sources of Recruitment of manpower, Role of Recruitment Agencies- Selection Process. 2.2 Types of Interviews- Interview Techniques. 2.3 Objectives and importance of Training and Development. 2.4 Types and Methods of Training Programmes.	<b>10</b>
<b>3.</b>	<b>Employee Career and Succession planning</b> 3.1 Aims and objectives of career planning. 3.2 Career Planning Process – Career Planning Structure. 3.3 Succession Planning - Meaning Need and importance. 3.4 Types of Career Opportunities A) <b>Public Sector</b> :- State and Local Government level - Personnel officer, Purchasing officer, secretary, Director of Administration Accountant etc. B) <b>Private sector</b> :-Marketing and Sales, Production and Material Management, Financial sector, Management as a profession, Insurance Industry, Accounting and Management Information System.	<b>12</b>
<b>4.</b>	<b>Performance Appraisal Management.</b> 4.1 Concept and Importance. 4.2 Performance Appraisal Process. 4.3 Methods and Techniques. 4.4 Merits and limitations of performance appraisal.	<b>12</b>
<b>Total</b>		<b>48</b>

**Term II :- Marketing Functions.**

Unit No.	Content	Lectures
<b>1.</b>	<b>Introduction</b> 1.1 Meaning and scope of Marketing. 1.2 Objectives of Marketing.	<b>10</b>

	1.3 Classification of marketing. 1.4 Functions of Marketing.	
<b>2.</b>	<b>Marketing Mix</b> 2.1 Meaning and Importance of Product, Product mix, product life cycle. New product development- Types of new product, Branding, Packaging, Labeling. 2.2 Price – Meaning, Factors affecting Pricing Decisions, Methods of Pricing. 2.3 Place – Functions of distribution channels, Types of distribution channels, Impact of technology on Distribution. 2.4 Promotion – Meaning of sales promotion, Importance, Methods and New techniques of sales promotion.	<b>13</b>
<b>3.</b>	<b>Advertising</b> 3.1 Advertising- Meaning, Scope, Importance, Role of advertising in modern business, Criticism on Advertising practices. 3.2 Advertising media – Different medias of advertising, Selection of advertising media. 3.3 Ethics in advertising- Ethics and appeals in Advertising, Advertising Standards Council of India. 3.4 Future of advertising – Advertising in depression and crisis, Employment opportunities in advertising field.	<b>13</b>
<b>4.</b>	<b>Modern Marketing Trends</b> 4.1 Global marketing – Meaning, Scope, Importance, International marketing Challenges and Problems. 4.2 Marketing Research- Meaning, Scope and Methods of Marketing research. 4.3 Retailing- Meaning, New Trends in Marketing, Direct Marketing, Malls, Franchising. 4.4 Recent Trends in Marketing- i) E-Marketing ii) Telemarketing iii) Internet Marketing iv) M-Marketing.	<b>12</b>
	<b>Total</b>	<b>48</b>

<b>Recommended Books</b>	
1.	Personnel and Human Resource Management – A M Sharm(Himalaya Publishing House)
2.	Personnel Management and Industrial Relations- R S Davar (Vikas Publishing House)
3.	Human Resource Development and Management- Biswanath Ghosh (Vikas Publishing House)
4.	Personnel Management – C.B. Mamaria, S V Gankar (Himalaya Publishing House)
5.	Human Resource Management – AShwathappa
6.	Basics of Marketing- Cannon
7.	Marketing Management, Philips, Kotler
8.	Marketing – Gandhi
9.	Principles of Marketing – Sherlekar S.A.
10.	International Marketing- P. Saravanavel (Himalaya Publishing House)
11.	Modern Marketing Management- R.S. Davar



**T.Y. B.Com.**  
**Banking & Finance Special Paper II**  
**Subject Name :- Financial Markets and Institutions in India.**  
**Course Code :- 305 – b.**

**Objectives :**

1. To acquaint the students with Financial Markets and its various segments.
2. To give the students and understanding of the operations and developments in financial markets in India.
3. To enable them to gain an insight into the functioning and role of financial institutions in the Indian Economy.

**Term - I**

Unit No.	Topic	Lectures
1	Indian Financial System : <b>A)</b> Financial Institutions - Regulatory, Intermediary and Non-Intermediaries. <b>B)</b> Financial Markets - Money and Capital Markets. <b>C)</b> Financial Instruments <b>D)</b> Indicators of Financial Development <b>E)</b> Role of Financial System in Economic Development	12
2	Indian Money Market 2.1 Meaning and Scope of Indian Money Market 2.2 Structure and Characteristics of Money Market 2.3 Functions of Indian Money Market 2.4 Institutions in the Money Market 2.5 Deficiencies of Indian Money Market. 2.6 Reforms in Indian Money Market after 1991	12
3	Indian Capital Market <b>3.1</b> Meaning and Scope of Indian Capital Market. <b>3.2</b> Characteristics of Capital Market. <b>3.3</b> Participants of Capital Market BSE - Bombay Stock Exchange NSE -National Stock Exchange OTCEI - Over the Counter Exchange of India. <b>3.4</b> Primary and Secondary Markets : its working <b>3.5</b> Reforms in Indian Capital Market after 1991.	12
4	Foreign Exchange Market <b>1.</b> Meaning, Segments, Participants. <b>2.</b> Spot, Forward Market <b>3.</b> Basics of Exchange Rate Determination <b>4.</b> Rate Quotations <b>5.</b> Methods of Foreign Exchange <b>6.</b> Exchange Risk Management	12
		48

**TERM - II**

5	NBFIs (Non-Banking Financial Institutions 5.1 Meaning and Types of NBFIs	
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	5.2 Distinction between Bank And NBFIs 5.3 Functions of Following : 1. Lease Financing 2. Mutual Funds 3. Factoring 4. Housing Finance 5. Venture Capital 6. Merchant Bank	12
6	Development Financial Institutions (DFIs) Working and Progress of : 1. IFCI - Industrial Finance Corporation of India 2. SIDBI - Small Industries Development Bank of India 3. SFCs - State Finance Corporations. 4. NSSIDC - National Small Scale Industrial Development Corporation 5. Mudra Bank 6. Bharatiya Mahila Bank	12
7	Investment Institutions in India Organization, Working & Functions of 7.1 UTI - Unit Trust of India. 7.2 Life Insurance Companies - Public & Private. 7.3 Non Life Insurance Companies - Public & Private. 7.4 Post office Savings Schemes 7.5 Provident Funds 7.6 Pension Funds	12
8	Regulatory Institutions In Market : Organization Functions & Working of 8.1 SEBI - Security Exchange Board of India 8.2 IRDA - Insurance Regulatory & Development Authority. 7.3 PFRDA - Provident Fund Regulatory Development Authority.	12
		48
<b>Recommended Books</b>		
1. Financial Institution and Market : L. M. Bhole 2. Financial market and institutions of India : Dr. MukundMahajan, NiraliPrakashan 3. Indian Banking System : Dr. B. R. Sangale, Success Publication, Pune. 4. Business Finance and Financial Services : Dr. MukundKohok 5. Indian Financial System : Dr. M. Y. Khan 6. Investment and Securities Markets in India : V. A. Avadhani 7. Economic Reforms and Capital Markets in India : Anand Mittal 8. BharatiyaVittaBajar : Dr. Shinde S. G., Success Publication, Pune. Financial Market and Institutions in India :Dr. Sunil Shete, Succes Publication.		

**T.Y. B.Com.**

**Business Laws & Practices Special Paper II**

**Subject Name -: Business Laws & Practices.**

**Course Code -: 305 – c.**

**Objectives –**

- 1) To impart the students with the knowledge and understanding of important business Laws including labour laws.
- 2) To acquaint the students with certain provisions of Company law and its governance.

**Term I**

<b>Unit No.</b>	<b>Topic</b>	<b>Lectures</b>
<b>1</b>	<b>The Factories Act, 1948 (Sections 1-20)</b> Objects and Definitions, Approval, Licensing and Registration of Factories, The Inspecting Staff, Provisions Regarding Worker's Health, Provisions Regarding Safety and Welfare of Workers.	<b>12</b>
<b>2</b>	<b>The Payment of Wages Act, 1936 (Sections 1 to 12,12a, 12b,13,13a &amp;20)</b> Introduction, Definitions, Rules for Payment of Wages, Deductions from Wages, Administration of Payment of Wages Act.	<b>08</b>
<b>3</b>	<b>The Trade Union Act, 1926 (Sections 1 to 27)</b> Object and Definitions, Registration of Trade Union, Privileges of a Registered Trade Union, Change of Name, Amalgamation, Dissolution.	<b>10</b>
<b>4.</b>	<b>The Payment of Bonus Act, 1965 (Sections 1to3,8 to 12,20 to 25 and29)</b> Introduction - Application of the Act, Definitions, Minimum and Maximum Bonus, Eligibility for Bonus, Available Surplus, Time Limit for Payment of Bonus.	<b>08</b>
<b>5.</b>	<b>The Employees Provident funds and Miscellaneous Provisions Act, 1952</b> Object and scope of the Act, Applicability and Constitutional validity of the Act., Definitions, Employees' Provident Fund Scheme, Employees' pension scheme and Employees Deposit Linked Insurance scheme Authorities - Under the Act, and their workings, penalties, offences and protection.	<b>10</b>
<b>Term II</b>		<b>48</b>
<b>6.</b>	<b>Historical Development of Company Law in India :</b> Development of various concepts and trends in company law – Social responsibilities of companies – Development of company law administration.	<b>10</b>
<b>7.</b>	<b>Prevention of Oppression and Mismanagement.</b> Meaning of oppression, who can apply to court, Rule of Majority, protection of minority interest, remedies and rights of minority shareholders, Prevention of oppression and mismanagement, powers of the court	<b>12</b>
<b>8</b>	<b>Inspection and Investigations:</b> Inspection and investigation suo-moto - Investigation by Government -	<b>10</b>

	Rights and duties of Inspector - Report by an Inspector.	
<b>9</b>	<b>Compromise and Arrangement:</b> Schemes for Compromise and Arrangement - Persons entitled to apply for sanction of court - Powers of court - Conditions for sanction of compromise - Effect of sanction	<b>10</b>
<b>10.</b>	<b>Rules of Corporate Governance :</b> History, Concept of corporate Governance – Cadbury Committee Report – Principles of Morality and business ethics –Code of conduct for professionals.	<b>06</b>
		<b>48</b>

**Recommended Books :-**

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  
(Sai Jyoti Publication)

**T.Y. B.Com.**  
**Co-operation and Rural Development Special Paper II**  
**Subject Name :- Co-operation and Rural Development.**  
**Course Code :- 305 – d.**

**Objectives:-**

1. To acquaint students with the Co-operative Management.
2. To study the Co-operative Organization and Management.

**Term I**

Sr. No.	Topics	Lectures
<b>Unit 1</b>	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. 1.4 Functions of Co-operative Management	10
<b>Unit 2</b>	Management and it's Role 2.1 Evaluation of Co-operative Management 2.2 Levels of Management. 2.3 Board of Directors and Executives Duties, Responsibilities and Role in Co-operative Management. 2.4 Professionalisation of Management- Need and Significance.	10
<b>Unit 3</b>	Human Resource Management in Co-operative 3.1 Human Relationship in Co-operative. 3.2 Co-operative Philosophy and H.R.D. 3.3 Recruitment 3.4 Training and Managerial Development 3.5 Appraisal and Evaluation	10
<b>Unit 4</b>	Decision Making in Co-operative Management 4.1 Decision Making – Meaning and Importance's. 4.2 Decision Making Process – Steps Involved 4.3 Measures to overcome the defects in Co-operative Management. 4.4 Trends in Co-operative Management in Global Scenario.	10
<b>Unit 5</b>	Co-operative Administration 5.1 Organizational structure of Co-operative Department in Maharashtra. 5.2 Powers, Functions and Responsibilities of Registrar. 5.3 Problems of Co-operative Administration in Maharashtra.	08
	Total	48

**Term II**

Sr. No.	Topics	Lectures
<b>Unit 6</b>	Financial Management of Co-operatives 6.1 Meaning, Nature and Importance of Financial Management. 6.2 Sources of Finance to Co-operative. 6.3 Distinction between Corporate Finance and Co-operative Finance. 6.4 Significance of financial Management in Co-operatives.	<b>10</b>
<b>Unit 7</b>	Financial Planning 7.1 Meaning and Characteristic	<b>10</b>

	7.2 Estimation of Financial Requirement. 7.3 Capital and Funds of Co-operatives and their raising. 7.4 Budget and Accounting of Co-operatives.	
<b>Unit 8</b>	Financial Control 8.1 Meaning and Need 8.2 Proper utilization of Funds and Capital. 8.3 Investment Policy- Profitability and Security. 8.4 Operating Expenditure and Cost Control	<b>08</b>
<b>Unit 9</b>	Co-operative Audit 9.1 Meaning, Definition and Nature of Co-operative Audit 9.2 Objectives and Significance of Co-operative Audit. 9.3 Provisions of co-operative law related to Audit. 9.4 Types of Audit – Statutory Audit, Re-Audit, Test Audit and Internal Audit.	<b>10</b>
<b>Unit 10</b>	Co-operative Auditor 10.1 Powers and Duties of Auditor 10.2 Audit Report and Rectification. 10.3 Importance of Audit Report.	<b>08</b>
	Total	<b>48</b>

#### **Recommended Books :**

- 1) G.S.Kamat –New Dimensions of Co-operative management-Himalaya Publication House, Mumbai
- 2) Dr.Nakkiran S.A.- Co-operative Management principals and techniques Himalaya Publication House, Mumbai
- 3) Ram Krishna Y.- Management of Co-operatives Jaico Publishing Home, New Delhi.
- 4) Goel B.B- Co-operative Management and Administration, Deep and Deep Publication, New Delhi.
- 5) Kulandaiswamy V. Principles and Practice of Co-operative Management - Rainbow Publications, Coimbatore.
- 6) Taimani K.K. – Managing the Co-operative Enterprise, Minerva Associates, Calcutta.
- 7) G.S.Kamat – Cases in Co-operative Management.
- 8) Jagdish Killol- The Maharashtra Co-operative Societies Rules 1961-Amended up to 2014.

**T.Y. B.Com.**  
**Cost and Works Accounting Special Paper II**  
**Subject Name :- Cost and Works Accounting.**  
**Course Code :- 305 – e.**

**Objectives :-**

1. To provide Knowledge about the concepts and principles application of Overheads
2. To provide also understanding various methods of costing and their applications.

**Level of Knowledge :- Basic Knowledge.**

**Term I**

Unit No.	Topic	No. of Lectures
<b>1.</b>	<b>Overheads:</b>	<b>6</b>
	1.1. Meaning and definition of overheads. 1.2. Classification of overheads	
<b>2.</b>	<b>Accounting of Overheads (Part-I)</b>	<b>14</b>
	2.1 Collection and Allocation of overheads. 2.2 Apportionment and Re-apportionment of overheads	
<b>3.</b>	<b>Accounting of Overheads (Part-II)</b>	<b>20</b>
	3.1 Absorption - Meaning, Methods of Overhead Absorption 3.4 Under and Over Absorption of overheads- Meaning, Reasons and Accounting treatment	
<b>4.</b>	<b>Activity Based Costing</b>	<b>8</b>
	4.1 Definitions-Stages in Activity Based Costing	
	4.2 Purpose and Benefits of Activity Based Costing	
	4.3 Cost Drivers 4.4 Problems on Activity Based Costing [Simple Problems only]	
<b>Total</b>		<b>48</b>

**Term II**

Unit No.	Topic	Lecture
<b>5.</b>	<b>Methods of Costing:</b>	<b>08</b>
	5.1 Introduction to Methods of Costing. 5.2 Job Costing- Meaning, Features, Advantages and Limitations	
<b>6.</b>	<b>Contract Costing:</b>	<b>16</b>
	6.1 Meaning and Features of Contract Costing	
	6.2 Work Certified and Uncertified, Escalation clause, Cost Plus contract, work-in- progress 6.3 Profit on incomplete contract	
<b>7.</b>	<b>Process Costing</b>	<b>14</b>
	7.1 Meaning and features of process costing	
	7.2 Preparation of process accounts including normal and abnormal loss/gain 7.3 Joint Products and By Products [Theory Only]	
<b>8.</b>	<b>Service Costing:</b>	<b>10</b>

	8.1 Meaning, Features and Applications. 8.2 Cost Unit-Simple and composite 8.3 Cost Sheet for Motor transport service 8.4 Cost Statement for Hospital and Hotel Organization	
	<b>Total</b>	<b>48</b>

**Note -:** Allocation of Marks -:

- a) 50 % for Theory.
- b) 50% for Practical Problems.

#### **Areas of Practical Problems**

- Accounting & Control of Overhead. [Part I]5  
Primary Distribution of Overheads, Repeated & Simultaneous equation methods only.
- Accounting & Control of Overhead. [Part II]  
Problems on Machine Hour Rate Only.
- Contract Costing - Preparation of Contract Account & Contractive Account [without B/s]Simple Problem without Escalation clause
- Process Costing Simple Problems on Process Costing [Where there is no work in process].
- Service Costing - Cost Sheet for Motor Transport and Hotel and hospital industry Service.

<b>Books Journals and Websites Recommended for Cost and Works Accounting Paper I, II and III</b>	
1.	Prof. Subhash jagtap -: Practice in Advanced costing and Management Accounting. Nirali Prakashan, Pune
2.	Ravi Kishor -: Advanced Cost Accounting and Cost Systems Taxman's Allied Service Pvt. Ltd., New Delhi.
3.	S.P. Lyengar -: Cost Accounting Principles and Practice, Sultan Chand & Sons Accounting, Taxman's, New Delhi.
4.	Ravi Kishor -: Students Guide to Cost Accounting Taxman's, New Delhi.
5.	M.N. Arora -: Cost Accounting Principles and Practice Vikas Publishing House Pvt. Ltd., New Delhi
6.	S.N. Maheshwari and S.N. Mittal -: Cost Accounting, Theory and Problems, Mahavir book Depot, New Delhi.
7.	B.L. Lall and G.L. Sharma -: Theory and Techniques of Cost Accounting. Himalaya Publishing House, New Delhi.
8.	V.K. Saxena and Vashista -: Cost Accounting – Text book. Sultan Chand and Sons, New Delhi
9.	V.K. Saxena and Vashista -: Cost Audit and Management Audit. Sultan Chand and Sons, New Delhi
10.	Jain and Narang -: Cost Accounting Principles and Practice. Kalyani Publishers
11.	N.K. Prasad -: Principles and Practice of Cost Accounting Book Syndicate Pvt. Ltd., Calcutta.
12.	N.K. Prasad -: Advanced Cost Accounting Syndicae Pvt Ltd., Calcutta.
13.	R.K. Motwani -: Practical Costing. Pointer Publisher, Jaipur
14.	R.S.N. Pillai and V. Bhagavati -: Cost Accounting.



15. Hornefgrain and Datar -: Cost Accounting and Managerial Emphasis.
16. Dr.J.P.Bhosale -: Management Accounting, Vision Publication
17. Prof.Jagtap, Nare & Pagar -: Cost & Works Accounting, Paper-II
18. Journal -: Cost Accounting Standards issued by ICWAI, Kolkata
19. Journal -: Management Accountant Issued by ICWA of India, Calcutta.
20. Website -: - [www.icwai.org](http://www.icwai.org)& [www.aicmas.com](http://www.aicmas.com).

**T.Y. B.Com.**  
**Business Statistics Special Paper II**  
**Subject Name :- Business Statistics.**  
**Course Code :- 305 – f.**

**Objectives:**

1. To distinguish between random and non-random experiments.
2. To find probabilities of events.
3. To apply standard distribution to different situations.
4. To test the hypotheses.

Sr. No.	Topic	No. of Lectures
<b>Term 1</b>		
Unit 1	<b>Introduction to Probability:</b> Definitions of : Permutation, Combination, Sample Space, Event, different types of events, Probability of an event, Conditional Probability, Independence of two events, Partition of sample space. Bayes Theorem (statement only). Examples and problems.	12
Unit 2	<b>Uni-variate Discrete Probability Distribution:</b> Definitions of : random variable, discrete random variable, probability distribution of discrete random variable, Probability mass function (p.m.f.), Cumulative distribution function, mean , variance and standard deviation. Properties of distribution function. Examples and problems.	12
Unit 3	<b>Some Standard Discrete Probability Distributions :</b> 1. Bernoulli: p.m.f., mean and variance. (statement only) 2. Binomial: p.m.f., mean, variance and additive property. (statement only) real life situation. 3. Poisson: p.m.f., mean, variance and additive property.(statement only) real life situation. Examples and problems.	12
Unit 4	<b>Bi-variate Discrete Probability Distribution:</b> Bivariate discrete random variable, Joint probability distribution of bivariate discrete random variable, marginal and conditional distribution and independence of two variables. Examples and problems.	12
<b>Term 2</b>		
Unit 5	<b>Normal Distribution:</b> Normal Distribution :Definition, p.d.f. curve, properties of normal distribution, state mean and variance, standard normal variate, problems to evaluate probabilities(using statistical table and excel), additive property for two variables (statement only). Fitting of normal distribution using Excel.Examples and problems.	14
Unit 6	<b>Test Of Hypothesis-I:</b> 1. Definitions of :Hypothesis, Null hypothesis, Alternating hypothesis, Critical region, Types of Errors, Level of significance,	18

	<p>P-value.</p> <p>2. Test for Population Mean (for large and exact sample): Describe test procedure for testing</p> <ol style="list-style-type: none"> <li><math>H_0: \mu = \mu_0</math> against <math>H_1: \mu \neq \mu_0</math> and</li> <li><math>H_0: \mu_1 = \mu_2</math> against <math>H_1: \mu_1 \neq \mu_2</math>. If population variance is known.</li> </ol> <p>3. Test for Population Mean: Describe test procedure for testing</p> <ol style="list-style-type: none"> <li><math>H_0: \mu = \mu_0</math> against <math>H_1: \mu \neq \mu_0</math> and</li> <li><math>H_0: \mu_1 = \mu_2</math> against <math>H_1: \mu_1 \neq \mu_2</math>. If population variance is unknown.</li> </ol> <p>4. Describe the test procedure for paired t-test.</p> <p>5. Test for population proportion : Describe test procedures for testing</p> <ol style="list-style-type: none"> <li><math>H_0: P = P_0</math> against <math>H_1: P \neq P_0</math> and</li> <li><math>H_0: P_1 = P_2</math> against <math>H_1: P_1 \neq P_2</math>.</li> </ol>	
Unit 7	<p><b>Test Of Hypothesis-II:</b></p> <p>1. Describe Chi-square test for testing</p> <ol style="list-style-type: none"> <li>Goodness of fit.</li> <li>Independence of attributes.</li> </ol> <p>2. Describe test procedure for testing <math>H_0: \sigma_1^2 = \sigma_2^2</math> against <math>H_1: \sigma_1^2 \neq \sigma_2^2</math> (test based on F-distribution)</p>	8
Unit 8	<p><b>Non-parametric Tests :</b></p> <p>Introduction , sign test, run test, Kolmogrove – Smirnov test, Mann whitney test.</p>	8

#### List of Practicals

Sr. No.	Name of Experiment
1	Applications of Binomial and Poisson Distribution.
2	Bi-variate Probability Distribution.
3	Applications of Normal distribution.
4	Testing of Population means and proportions.
5	Test based on Chi-square and F distributions.
6	Non parametric test.

#### Books Recommended:

1. Fundamentals of Mathematical Statistics: Gupta, Kapoor V.K.
2. Fundamentals of Statistics: S.C. Gupta
3. Business Statistics : Gupta Indra
4. Fundamentals of Statistics: D.N. Elhance
5. Statistical Methods: S.P.Gupta

**T.Y. B.Com.**  
**Business Entrepreneurship Special Paper II**  
**Subject Name :- Business Entrepreneurship.**  
**Course Code :- 305 – g.**

**Objective :** To enable students to understand the basic concepts of entrepreneurship and preparing a business plan to start a small industry.

1. To Develop Knowledge and understanding in creating and managing new venture.
2. To Equip students with necessary tools and techniques to set up their own business venture.
3. To Help students to bring out their own business plan.
4. To make students aware about business crises and sickness.

**Term I**

Unit No	Topic	Lectures
1	<b>SMALL SCALE INDUSTRIES</b> Definition - Meaning - Product Range - Capital Investment - Meaning and importance of Tiny Industries, Ancillary Industries, Cottage Industries. Role played by SSI in the development of Indian Economy. Problems faced by SSI's and the steps taken to solve the problems - Policies Governing SSI's.	12 Hrs
2	<b>FORMATION OF SMALL SCALE INDUSTRY</b> Business opportunity, scanning the environment for opportunities, evaluation of alternatives and selection based on personal competencies. Steps involved in the formation of a small business venture: location, clearances and permits required, formalities, licensing and registration procedure.	12 Hrs
3	<b>BUSINESS PLAN PREPARATION :</b> Meaning and importance - objectives - Selection of suitable form of organisation - Precautions to be taken by an entrepreneur while preparing Business Plan. Project Appraisal - Break - even Analysis and Ratio Analysis : Debt : Service Coverage Ratio - Gross Profit : Net Profit Ratio and Return on Investment ( ROI ), Project Audit	14 Hrs
4	<b>PROJECT ASSISTANCE</b> Financial assistance through SFC's, SIDBI, Commercial Banks, IFCI - Non-financial assistance from DIC, SISI, KVIC - Financial incentives for SSI's and Tax Concessions - Assistance for obtaining Raw Material, Machinery, Land and Building, Venture Capital and Technical Assistance	10 Hrs
<b>Total</b>		<b>48 Hrs</b>

**Term II**

Unit No	Topic	Lectures
5	<b>BUSINESS PLAN (BP) IMPLEMENTATION</b>	12 Hrs

	Meaning - importance - preparation of Business Plan, Financial aspects, Marketing aspects, Human Resource aspects, Technical aspects, Social aspects of Business Plan. Common pitfalls to be avoided in preparation of a Business Plan.	
6	<b>SMALL ENTERPRISE MANAGEMENT :</b> ( As Distinct from corporate sector management ) Functional v/s Integrated Approach Structured v/s Flexible Approach Logical v/s Creative Approach Start up phase Management: Difference of opinion with in promoting team - Avoiding failure – Problem-Solving, Creativity and Innovation, Stability Phase Management, Growth phase Management,	12 Hrs
7	<b>BUSINESS CRISES AND SICKNESS :</b> Types of Business Crises, Starting crises, Cash crises, Delegation Crises, Leadership Crises, Financial Crises, Prosperity Crises, Succession Crises, Sickness : Meaning and Definition, Symptoms, Causes, Turnaround Strategies, Revival Schemes of Sickness,	12 Hrs
8	<b>SKILL DEVELOPMENT</b> <ul style="list-style-type: none"> <li>• Preparation of a Project report to start a SSI Unit.</li> <li>• Preparing a letter to the concerned authority-seeking license to the SSP Unit (You propose to start).</li> <li>• Format of a business plan.</li> <li>• A Report on the survey of SSI units in the region where college is located</li> <li>• Chart showing financial assistance available to SSI along with rates of interest</li> <li>• Chart showing tax concessions to SSI both direct and indirect.</li> <li>• Success stories of Entrepreneurs in the region. (Any Two)</li> <li>• Documents required for Registration of SSI</li> </ul>	12 Hrs
<b>Total</b>		<b>48 Hrs</b>

### Recommended Books

1. Desai Vasant -: "Management of Small Scale Industries" Himalaya Publishing House.
2. Khanka S.S. -: "Entrepreneurial Development" S.Chand.
3. Gupta S.S. -: "Entrepreneurial Development" Sultan Chand & Sons.
4. Taneja Satish and Gupta S.L. "Entrepreneurship Development - New Venture Creation" Gaigotia Publishing Company, New Delhi.
5. Chandra P. - 'Project - Preparation, Appraisal and Implementation' - Tata McGraw Hill, New Delhi.
6. Jain P.C. (ed.) 'Handbook for New Entrepreneurs' - Entrepreneurship Development Institute of India, Ahmedabad.

7. Pandey G.N. - 'A Complete Guide to Successful Entrepreneurship' Vikas Publishing House Pvt. Ltd.
8. Maharashtra Centre for Entrepreneurship Development - 'Project Profile', 'Profile for SSI Projects.'
9. Edward D. Boao - 'Opportunities'.
10. Prof. John Mullins - 'The New Business Road Tests' - Pearson.
11. Prof. Rajeev Roy - 'Entrepreneurship' Oxford University Press.
12. Rashmi Bansal - 'Stay Hungry Stay Foolish' - CIIFIM, Ahmedabad.
13. Dr. Patel V.G. - 'When The Going Gets Tough' - Tata McGraw Hill, New Delhi.
14. dovagr yaaogaraja Á ]VaogasaMQal Á SaaQaa mhNajao saapDola – ka^inTnaonTla p`kaSana, puNao
15. rSmal bansala Á sTo hMga`I sTo fUilaSa<sup>3</sup>marazi Anauvaad Á ivadulaa Taokokr´
16. Mark. J. Dollinger, Entrepreneurship - Strategies and Resources, Pearson Edition.
17. Udai Pareek and T.V. Rao, Developing Entrepreneurship
18. S.V.S. Sharma, Developing Entrepreneurship, Issues and Problems
19. Srivastava, A Practical Guide to Industrial Entrepreneurs
20. Anil Kumar: Small Business and Entrepreneurship I.K. International Publishers
21. Government of India, Report of the committee on Development of small and medium entrepreneurs, 1975
22. Bharusali, Entrepreneur Development
23. Vidya Hattangadi : Entrepreneurial
24. Dr. Venkataramanappa : : Entrepreneurship Development
25. B. Janakiraman , Rizwana M: Entrepreneurship Development
26. N.V.R Naidu : Entrepreneurship Development, I.K. International Publishers
27. Business Entrepreneurship – Dr. M. B. Sonawane
28. Business Entrepreneurship – Dr. Sudhakar Jadhavar (Dean Commerce Faculty)
29. Business Entrepreneurship –Dr. S. L. Shirgave.

**T.Y. B.Com.**  
**Marketing Management Special Paper II**  
**Subject Name -: Marketing Management.**  
**Course Code -: 305 – h.**

**Objectives of the Paper**

- I. To understand the concept and functioning of marketing planning and sales management
- II. To know marketing strategies and organization
- III. To inform various facets of marketing with regulatory aspects
- IV. To understand marketing in globalize scenario

**First Term**

**Unit I**

**Marketing Planning and Sales Forecasting**

Meaning of Marketing Planning  
Importance of Marketing Planning  
Types of Marketing Plan  
Elements of a Marketing Plan  
Process of Preparing a Marketing Plan  
Meaning of Sales Forecast, Sales Budgets and Sales Quota  
Sales Forecasting Methods  
Forecasting Techniques  
(12 Periods)

**Unit 2**

**Social Marketing:**

Meaning and Objectives of Social Marketing  
Social Responsibility of Marketing Manager  
Impact of Marketing on Society and Other Business  
Social Criticism of Marketing  
Recent Trends in Social Marketing  
(16 Periods)

**Unit 3**

**Marketing Organisations**

Meaning of Marketing Organisation  
Changing role of Marketing Organisation  
Factors affecting on Marketing Organisation  
Essentials of an effective Marketing Organisation  
Types of Marketing Organisation  
(10 Periods)

**Unit 4**

**Marketing Strategies**

Concept of Strategy  
Characteristics of Strategy  
Meaning of Marketing Strategy  
Competitive Marketing Strategies

Competitive Strategies in Global Environment

Benchmarking – A total for effective Marketing Strategy – meaning, process and advantages of

Benchmarking

(10 Periods)

## **Second Term**

### **Unit 5**

#### **Agricultural marketing**

Meaning of Agriculture Marketing

Types of Agri-Products

Features of Agri-Products

Types of Markets – Defects of Agri- marketing and remedies

Marketing Intelligence System and Agriculture Marketing

Distinction between manufacture goods marketing and Agriculture goods marketing

(14 Periods)

### **Unit 6**

#### **International Marketing**

Meaning, nature, need and importance of International Marketing

International Marketing Vs Domestic Marketing

Problems and Challenges in International Marketing

Mode of entry in International Market

Scope of International Marketing

(12 Periods)

### **Unit 7**

#### **Marketing Regulations**

Importance of Marketing Regulations in Marketing.

Relevance and importance of following Acts in the Context Marketing Management

Consumer Protection Acts, 1986

Trade Mark Acts, 1999

Competition Acts, 2002

Indian Patent (amendment) Acts, 2005

Bureau of Indian Standards Act

(12 Periods)

### **Unit 8**

#### **Globalization and Marketing**

Meaning of Globalization

Features of Globalization

Marketing in 21<sup>st</sup> Century

Impact of Globalization on marketing

Benefits and limitation of Globalization

Case study related to Global Marketing

(10 Periods)

### **Recommended:**

#### **Books:**

T.Y. B.Com. w.e.f. 2015-16



Philip Kotler	Marketing Management
David Carson	International Marketing: A Comparative System Approach, Wiley, New York
Steven M. Bungess	The New Marketing Halfway House, Zebra Press, South Africa
David J. Schwartz	Marketing Today: A Basic Approach Harcourt Brace Jovanovich, New York
Thomas V. Boroma	The Marketing Edge: Making Strategic Work The Free Press, New York
Peter Doyle	Value-based Marketing: Marketing Strategies for Corporate Growth and Shareholder value John Wiley, Crichester, England
E. Jenome McCarthy	Basic Marketing: A Managerial Approach Irwin, Homewood, Illinois

**Suggested mode of conducting practical**

1. Guest lecture
2. Library assignment
3. Case study
4. Field visit
5. Conducting Survey
6. Presentation

T.Y. B.Com.

**Agricultural and Industrial Economics Special Paper II**

**Subject Name :- Agricultural and Industrial Economics.**

**Course Code :- 305 - i.**

**Objectives -**

1. To study the agricultural development in India.
2. To analyze the importance of industrial development in India

<b>Term I - Agricultural Development in India</b>		
<b>Unit</b>	<b>Topic</b>	<b>Lectures</b>
1.	<b>Agriculture :-</b> 1.1 Role of Agriculture in Indian Economy 1.2 Progress of Agriculture since 1991. 1.3 Concept & Problems of Productivity 1.4 Causes of low Productivity in Indian Agriculture 1.5 Measures adopted to improve the productivity 1.6 Causes and its effects on sub-division and fragmentation of land holding	10
2.	<b>Land Reforms :-</b> 2.1 Technological & Institutional Reforms 2.2 Evaluation of Land Reforms.	08
3.	<b>Agriculture Labour :-</b> 3.1 Types of Agriculture Labour. 3.2 Causes of increase Agriculture Labour. 3.3 Government Policy Measures : EGS/MGNREGA	10
4.	<b>Problems of Farming :-</b> 4.1 Seasonal changes and farming 4.2 Minimum support price of crops. 4.3 Purchasing of foods by Government 4.4 Role of Government in natural calamities 4.5 Problems of Farmers Suicide. 4.6 Land Acquisition	12
5.	<b>Agricultural Processing :-</b> 5.1 Role of Agricultural Processing in India 5.2 Scope & Importance of Agricultural Processing. 5.3 Problems & remedial measures of Agricultural Processing.	08
		<b>Total 48</b>
<b>Term II - Industrial Development</b>		
<b>Unit</b>	<b>Topic</b>	<b>Lectures</b>
6.	<b>Industry &amp; Economic Development :-</b> 6.1 Role of Industry in India 6.2 Highlights of Industrial growth Since 1991 6.3 Ownership of Industry 6.4 Pattern of Ownership of Indian Industries 6.5 Public & Private Sector. 6.6 Role of Small Scale Industries.	10

	6.7 Problems & Policy measures adopted to their developments.	
7.	<b>Major Industries in India :-</b> 7.1 Sugar & Textile. 7.2 Iron & Steel. 7.3 Power Generation.	<b>10</b>
8.	<b>Industrial Labour :-</b> 8.1 Government wage policy 8.2 Industrial Dispute – Causes and Measures 8.3 Social Security & Welfare Measures.	<b>08</b>
9.	<b>Industrial Finance :-</b> 9.1 Problems of Industrial Finance 9.2 Sources of Industrial Finance 9.3 IDBI, IFCI, ICICI, SFC.	<b>10</b>
10.	<b>Public Enterprises :-</b> 10.1 Government policy of Public Enterprises. 10.2 Problems of Public Enterprises 10.3 Arguments against Privatization of Public Enterprises	

**Recommended Books :**

1. S.K.Misra and V.K.Puri : Indian Economy - Himalaya Publishing House, Delhi.
  2. Khedkar B.D. : Indian Economy, Success Publication, Pune
  3. Sundaram & Black : The International Business Environment, New Delhi
  4. Agrawal A.N. Indian Economy – Vikas Publication
  5. Khem Farooq A. Business and society, S.Chand Delhi
  6. Dutt R & Sundaram K.P.M – Indian Economy, s.chand delhi
  7. Dutt Rudder : Economic Reforms in India – A Critique – S Chand, New Delhi
  8. Hedge: Environmental Economics, MaMillan
- K.V. Srivyya and V.R.M. Das : Indian Industrial Economy, Chand & Com.New Delhi 1977.

**T.Y. B.Com.**

**Defense Budgeting, Finance & Management Special Paper II**  
**Subject Name -: Defense Budgeting, Finance & Management.**  
**Course Code -: 305 – j.**

**Aim of the paper**

One of the crying needs of the hour is to ensure that the National Security objectives are met-in a cost effective manner. Against such backdrop, the aim can be achieved by educating the students and disseminating the information and by giving the planners, decision makers and administrators all the information they need in an easily understandable form. By studying this paper students will understand all the financial aspects of budgetary and defence production in India.

**Term I**

<b>Unit No.</b>	<b>Topic</b>	<b>Lectures</b>
<b>1.</b>	<b>Rationale of Defence Production in India.</b> a. Economic aspects of Defence Production. b. Political aspects of Defence Production.	<b>12</b>
<b>2.</b>	<b>Defence and Development.</b> a. Concept of Defence v/s Development. b. Evaluation of the Debate. c. Future prospects of the debate	<b>12</b>
<b>3.</b>	<b>Government Policies towards Defence Production in India.</b> a. Industrial Policy Resolution of the Government 1947-48, 1956-57, Since 1991 onwards. b. Weapons Procurement Policies in India since 1947.	<b>12</b>
<b>4.</b>	<b>Structure of Defence Production.</b> a. Department of Defence Production in the Ministry of Defence b. Structure and Functions. c. Defence Public Sector Undertakings - Basic Aims and Objectives. d. Information & role of Defence Public Sector Undertakings.	<b>12</b>
<b>Total</b>		<b>48</b>

**Term II**

<b>Unit No.</b>	<b>Topic</b>	<b>Lectures</b>
<b>5.</b>	<b>Role of Private Sector in Defence Production.</b> a. Status of Indigenous arms production in India. b. Problems of prospectus of arms production in India.	<b>12</b>
<b>6.</b>	<b>Defence Management.</b> a. Nature, Scope, Function and Principles of Management. b. Principles and Types of Organisation, Military and Non Military Organisations.	<b>12</b>
<b>7.</b>	<b>Decision making in Armed Forces.</b> a. Organisational aspects of Decision Making. b. Decision making process in India.	<b>12</b>
<b>8.</b>	<b>Logistics Management for Indian Defence.</b> a. An understanding of Logistics management - meaning and concept.	<b>12</b>

	b. Significance and Historical Evaluation. c. Scope of Logistics management. d. Principles of Logistics Management. e. Logistics Planning for Indian Defence.	
<b>Total</b>		<b>48</b>

<b>Recommended Books</b>	
1.	Raju G.C. Thomas, "The Defence of India: A Budgetary Perspective" (MacMillan Publication, New Delhi, 1978)
2.	Subramanyam K., "India's Security Perspective - Policy and Planning", (Lancer Books, New Delhi, 1991).
3.	Nanda Ravi, "National Security Perspective, Policy and Planning", (Lancer Books, New Delhi, 1991).
4.	Khanna D. D. and Malhotra P. N., "Defence vs. Development: A Case Study of India", (Indus Publication Company, New Delhi, 1993).
5.	Kennedy Gavin, "Defence Economics", (Gerald Duckworth & Co. Ltd, 1983).
6.	Ghosh Amiya, "India's Defence Budget & Expenditure Management in Wider Context", (Lancer Publication and Span Tech, Delhi, 1996).
7.	Dutta Meena and Sharma Jai Narayan, "Defence Economics", (Deep and Deep Publication, New Delhi)
8.	Deger S. & Sen S. "Military Expenditure in the Third World Countries: The Economic Effects", (Routlet & Kegan Paul, 1986).
9.	Agarwal Rajesh K., "Defence Production and Development", (Gulab Vazirani for Arnold Heinermann Publishers, 1978).
10.	Thomas Raju G. C., "Indian Security Policy", (Princeton, New Jersey, University Press, 1988).
11.	Robert Loony and David Winterford, "Economic Causes and Consequences of Defence Expenditure in the Middle East and South Asia", (University Press, 1995).
12.	Shrinivas V. N., "Budgeting for Indian Defence: Issues of Contemporary Relevance", (KW Publishers Pvt., Ltd., New Delhi - 2008).
13.	Annual Report, Ministry of Defence, Government of India.
14.	Report of the Finance Commission, Government of India.

**T.Y. B.Com.**  
**Insurance Transport and Clearance Special Paper II**  
**Subject Name -: Insurance Transport and Clearance**  
**Course Code -: 305 – k.**

**Objectives :**

- 1) To know the fundamentals of Life Insurance & General Insurance.
- 2) To create the awareness of Insurance Business & practices .
- 3) To know the knowledge about laws & regulations relating to Life Insurance & General Insurance.

**Term I**

<b>Unit</b>	<b>Topic</b>	<b>Lectures</b>
<b>1</b>	<b>Insurance Management</b> Life Insurance, Claim Settlements ,Maturity Claims – Meaning , Procedure for claim ,types of claims ,survival benefits ,Death claims , early claims , required documents & forms	<b>12</b>
<b>2</b>	<b>Nomination &amp; assignments of policies</b> Difference between Nominations & assignments , policy conditions ,loans & surrender of policies, post maturity claims	<b>12</b>
<b>3</b>	<b>Privatization &amp; Insurance Business</b> Effect of privatization on Insurance Business, Comparative study of private companies & government companies, Malhotra committee report, current trends in global insurance business.	<b>12</b>
<b>4</b>	<b>Laws relating with Insurance Business</b> 1) Commentaries on Insurance Act 1938 2) Life Insurance corporation Act 1956 3) Insurance Regulatory & Development Act 1991 4) Overview of Income Tax Act	<b>12</b>
<b>Total-</b>		<b>48</b>

**Term II**

<b>1</b>	<b>Insurance Management</b> <b>General Insurance</b> Maturity Claims – Meaning ,Procedure for claim , Types of claims, survival benefits ,Death claims , early claims, required documents & forms, Accidental benefits & disability benefits, various conditions in the policy , permanent disability benefits, post maturity claims, payments, importance of timely payment, due dates of payment, methods & rules of payment , current trends of General Insurance in Global Business	<b>12</b>
<b>2</b>	<b>Premium Payments</b> Importance of timely payment, due date of payment Surrender values – Meaning & Conditions, Lapse of policy, forfeiture & revival of policies, special revival scheme, Installment revival scheme, loan cum revival scheme	<b>12</b>

<b>3</b>	<b>Laws related to General Insurance Business</b>	<b>12</b>
	1) Insurance Act 1938	
	2) Insurance Amendment Act 2002	
	3) IRDA Regulations 2002	

<b>4</b>	<b>Insurance Business &amp; Saving Plans</b>	<b>12</b>
	1) Financial planning & Taxation	
	2) Mutual Funds & shares	
	3) Unit Trust & Unit based policies	
	4) Record Keeping & performance for insurance Agents	
	5) Business Targets & Incentives	

**Total- 48**

#### **Recommended Books**

- 1) Principles and Practices of Insurance- Dr. P. Periaswamy  
Himalaya Publishing House, Mumbai
- 2) Theory and Practice of Insurance Business- M. Ariff Khan
- 2) Marketing and Life Insurance Business- P.K. Biswas Roy  
Discovery Publishing House, New Delhi
- 4) Travel and Tourism Business Management – Dr.S.K.Wadekar  
Shanti Prakashan, Ahmedabad (Gujrat)
- 5) Life Insurance Administration, Insurance Institute of India
- 6) Manual for Agents- LIC India

**T.Y. B.Com.**

**Computer Programming and Application Special Paper II**

**Subject Name -: Computer Networking and Cyber Security.**

**Course Code -: 305 – I.**

**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.

**Term-I**

<b>Unit No.</b>	<b>Name of the Topic</b>	<b>No. of Lectures</b>	<b>Ref. Books</b>
1	<b>Chapter 1: Computer Networks.</b> 1.Introduction Computer Network, Topology, Types of Networks 2.Communication Types Serial, Parallel 3.Modes of Communication : Simplex, Half Duplex, full Duplex, Server Based LANs &Peer-to-Peer LANs, Comparison of both 4.Protocols and Standards	14	1,2,3
2	<b>Chapter 2 : Network Models</b> 1.Design issues of the layer 2. Protocol Hierarchy 3.ISO-OSI Reference Model : Layers in the OSI Model, Functions of each layer 4. Terminology : SAP, Connection Oriented services, connectionless services, Peer Entities 5. Internet Model (TCP/IP) 6. Comparison of ISO-OSI & TCP/IP Model 7. Addressing : Physical Addresses, Logical Addresses, Port Addresses 8. IP Addressing : Classfull addressing, Classless addressing	12	1,2,3
3	<b>Chapter 3 :Transmission Media</b> 1.Guided Media (Wired) : Coaxial Cable:- Physical Structure, standards, BNC Connector, Applications, Twisted Pair: Physical Structure, UTP vs STP, Connectors, Applications, Fiber Optics Cable: Physical Structure, Propagation Modes (Single Mode & Multimode), Connectors, Applications. 2. Unguided Media(Wireless) Electromagnetic Spectrum For Wireless Communication, Propagation Methods( Ground, Sky, Line-Of- Sight),Wireless Transmission(Radio Waves, Infra-Red,	12	1,2,3



	Micro- Wave)		
4	<b>Chapter 4 : Wired LANs : Ethernet</b> 1. IEEE Standards 2. Standard Ethernet(MAC Sublayer, Physical layer) 3. Fast Ethernet(MAC Sublayer, Physical layer) 4. Gigabit Ethernet(MAC Sublayer, Physical layer) 5. Network Interface Cards (NIC), Components of NIC, Functions of NIC, Types of NIC.	10	1,2,3
<b>Total No of Lectures</b>		<b>48</b>	

**Term-II**

Unit No.	Topic	No. of Lectures	Ref. Books
5.	<b>Chapter 5 : Wireless LANs</b> 1. IEEE802.11 (Architecture, MAC Sub layer, Frame Format, Frame Types, Addressing Mechanism) 2. Bluetooth (Architecture Piconet and Scatternet Applications)	10	1,2,3
6.	<b>Chapter 6 : Information Security Concepts</b> 1. Information Security Overview: Background and Current Scenario 2. Types of Attacks 3. Goals for Security 4. E-commerce Security 5. Computer Forensics 6. Steganography	10	1,2,3
7	<b>Chapter 7: Security Threats and Vulnerabilities</b> 1. Overview of Security threats 2. Weak / Strong Passwords and Password Cracking 3. Insecure Network connections 4. Malicious Code 5. Programming Bugs	10	
8.	<b>Chapter 8 : Cryptography / Encryption</b> 1. Introduction to Cryptography / Encryption 2. Digital Signatures 3. Public Key infrastructure 4. Applications of Cryptography 5. Tools and techniques of Cryptography	10	
9.	<b>Chapter 9: Wireless Networks and Security</b> 1. Components of wireless networks 2. Security issues in wireless	08	
<b>Total No. Lectures</b>		<b>48</b>	

**Recommended Books:**

- 1) Computer Networks - Andrew Tanenbaum (III Edition)
- 2) Data Communications & Networking - Behrouz Ferouzan (III Edition)
- 3) Complete Guide to Networking - Peter Norton

**T.Y. B.Com.**  
**Business Administration Special Paper III**  
**Subject Name :- Business Administration**  
**Course Code :- 306 – a.**

**Objective :-**

To acquaint the students with the basic concepts in finance and production functions of a business enterprise.

**Term I**

Unit No.	Finance	Lectures
	content	
<b>1</b>	<b>Finance :-</b> 1.1 Money and Finance, Need, Nature and Importance of Finance. 1.2 Finance Functions, Objectives of Financial Management, Functions of Finance Manager. 1.3 Financial need of a modern business organization.	<b>10</b>
<b>2</b>	<b>Financial Planning :-</b> 2.1 Meaning, Nature and characteristics of financial planning. Scope, Importance, Advantages, Limitations, of Financial Planning . 2.2 Steps in financial planning. 2.3 Methods of estimating financial requirements.	<b>12</b>
<b>3</b>	<b>Capitalization and Capital Structure :-</b> 3.1 Capitalization – Concept, Factors governing capitalization, over and under capitalization - Causes and effects, Fair Capitalization. 3.2 Capital Structure- Meaning, Concept and Principles of capital structure, Factors influencing the pattern of capital structure. 3.3 Trading on equity- Concepts and effects.	<b>12</b>
<b>4</b>	<b>Management of Capital :-</b> 4.1 <b>Types of capital-</b> Fixed capital and working capital, owned and borrowed capital, Short and Long term Capital. 4.2 Need, Importance, Factors governing fixed and working capital requirement. 4.3 <b>Sources of capital</b> - Shares, Debentures, Public Deposits, Ploughing back of profits, Loans from Bank and Financial Institutions, Trade creditors, Installment credit etc.	<b>14</b>
<b>Total</b>		<b>48</b>

**Term II**

**(Production, Operations Functions)**

Unit No.	Production, Operations Functions	Lectures
	content	
<b>1</b>	<b>Production management Functions :-</b> 1.1 Meaning, Definition, Functions of Production Management, Responsibilities of Production manager . 1.2 Production Planning - Objectives, Importance, levels of planning. 1.3 Routing & Scheduling - Meaning, Route Sheets, Scheduling, Master and sequential scheduling, scheduling devices.	<b>14</b>

	1.4 Production control- Definition and meaning, Necessity, objectives, factors and techniques of production control	
<b>2</b>	<b>Plant Location and Plant Layout</b> 2.1 Introduction, importance, factors responsible for plant location. 2.2 Plant Layout- Meaning, Definition, Importance of good layout, factors relevant for choice of layout, Line, Process and Product layout. 2.3 Plant Layout - Advantages, disadvantages and techniques.	<b>10</b>
<b>3</b>	<b>Inventory management</b> 3.1 Inventory management -Introduction, methods, and Norms. 3.2 EOQ, Use of Computers in Inventory Management, 3.3 Material Requisition Planning (MRP) , Just In Time ( JIT ),ABC Analysis.	<b>10</b>
<b>4</b>	<b>Material Handling and supply chain management</b> 4.1 Meaning, function of material handling, principles of material handling. 4.2 Common material handling devices fork lift truck, platform truck, straddle carrier, chain hoist, roller and belt conveyor, bridge crane, crawler crane. 4.3 Supply chain management- Theory, Principles, Implications, Factors affecting supply chain management.	<b>14</b>
	<b>Total</b>	<b>48</b>

<b>Recommended Books</b>	
1.	Fundamentals of Business Finance- Dr. R. M. Shrivastav
2.	Corporate Finance- S C Kuchhal
3.	Industrial Finance- M C Kuchhal
4.	Corporate Finance- Dr. P V Kulkarni
5.	Financial Management- Dr. Prasanna Chandra
6.	Production, Operations Management - Dr.B.S. Goel (Pragati Prakashan Meerut)
7.	Operations Management- Norman Gaither, Greg Frazaier (Sengage Learning)
8.	Production Management - Chunawalla

**T.Y. B.Com.**  
**Banking & Finance Special Paper III**  
**Subject Name :- Banking Law and Practices in India.**  
**Course Code :- 306 - b.**

**Objectives:**

1. To acquaint the students with Banking Law and Practice in relation to the Banking system in India
2. To understand the legal aspects of Banking transactions and its implications as Banker and Customer.
3. To make the Students aware of the Banking Law and Practice in India

Term I

Unit No.	Topic	Lectures
1.	LAWS RELATING TO BANKING IN INDIA Provisions of The Banking Regulation Act, 1949, with reference to the following: Definition – Capital - Reserve Fund - Cash Reserve for Non Schedule Banks Liquid Assets – Licensing - Branch Licensing - Management Profit and Loss Account and Balance Sheet – Sec. 10, 29 & 30 Powers of the Reserve Bank of India – Sec. 35 & 36 Voluntary Amalgamation – Sec. 44A Compulsory Amalgamation – Sec. 45 Liquidation – Sec. 45 Banking Regulation Act as applicable to Co-operative Banks.	14
2.	NEGOTIABLE INSTRUMENTS ACT, 1881 Definition, Characteristics and Presumptions of Negotiable Instruments. Promissory Note, Bills of Exchange and Cheque – Definition and Features Parties to Negotiable Instruments Negotiation Presentment Notice of Dishonor Noting and Protesting	14
3.	PAYING BANKER Precautions in Payment of Customers' Cheques Paying Banker's Duties and Rights Statutory Protection to Paying Banker Payment of forged Cheque Return of cheques	10
4.	COLLECTING BANKER Precautions in collecting Customer's Cheques Collecting Banker's - Duties and Rights Statutory Protection to Collecting Banker Dishonor of Cheques by Non-Acceptance and Non-Payment	10
Total		48

Term II

Unit No.	Topic	Lectures
5	RELATIONSHIP BETWEEN BANKER AND CUSTOMER	14

	Definition of Banker and Customer Relationship as Debtor and Creditor Banker as Trustee Banker as Agent Banker's Obligation of Secrecy of Accounts Banker's Lien Right of Set Off Disclosure permitted by the Banker's Practices and Usage Bankers Obligation to honour Cheques Garnishee Order Termination of Relationship	
6	<b>SECURITIES FOR ADVANCES:</b> Principles of Secured Advances Precautions to be taken by the banker while advancing against: a. Documents of title to Goods b. Real Estate c. Fixed Deposit Receipt d. Bullion e. Supply Bills f. Life Insurance Policy g. Shares h. Agricultural Produce	10
7.	<b>MODES OF CREATING CHARGE:</b> Lien , Pledge , Hypothecation Mortgages and types of Mortgages, Precautions to be taken by Bankers while creating and recording charge	10
8.	<b>PROJECT APPRAISAL &amp; RECOVERY MEASURES</b> <b>A) Steps in Project Appraisal - Economic, Technical, Managerial, Operational and Financial Aspects.</b> <b>B) Recovery Measures:</b> i) Legal Measures: Debt Recovery Tribunal – LokAdalat – Corporate Debt ii) Non Legal Measures: Follow up action – One time settlement – Recovery Camps – Recovering through Self Help Groups. Recovery System – Recovery under Securitisation and Reconstruction of financial Assets and enforcement of Security Interest Act, 2003	14
<b>Total</b>		<b>48</b>

#### Recommended Books

1. Practice of Law and Banking -: G.S. Gill
2. Banking Law and Practice -: P.N. Varshney
3. Banking Theory and Law Practice -: E. Gordon, K. Natarajan
4. Banking Law and Practice in India -: M.L. Tannan
5. Banking Law and Practice in India -: Maheshwari
6. Law and Practice of Banking -: Prof. Mugli
7. Banking Theory and Practice -: K.C. Shekar
8. Law and Practice of Banking -: B.M. Lall and Nigam
9. Banking Law & Practices Shri. Prakash Misal, Success Publication.

**T.Y. B.Com.**

**Business Laws & Practices Special Paper III**

**Subject Name :- Business Laws & Practices.**

**Course Code :- 306 - c.**

**Objectives -**

- 1) To impart the students with the knowledge and understanding of important business Laws including tax related laws.
- 2) To acquaint the students with Company law & Secretarial Practice.

**Term I**

<b>Unit No.</b>	<b>Topic</b>	<b>Lectures</b>
<b>1</b>	<b>Central Excise Act 1944</b> Meaning and object of Excise - Definitions- Goods, Manufacture, Production, Excisable Goods - Registration Procedure and Documentation - Valuation - Transaction Value, Valuation under MRP, Tariff Value, Valuation under Central Excise Valuation Rules. Simple Problems on valuation - Daily Stock Account (DSA), Invoicing and Periodical returns, Assessment - Payment of Duty - Method, manner and mode of duty, payment, Account Current and TR - 6 - Challan - CENVAT - Definition of INPUT, CAPITAL GOODS, Manner and availment of CENVAT - SSI Unit - Records, Documents to be maintained, Benefits for SSI Units - SSI Units and Manufacture of Branded goods - SSI Unite and job work	10
<b>2</b>	<b>Service Tax -</b> 1. Meaning, object and scope of the service tax. 2. Taxable Services - Stock Broking. - Advertising - Courier - Tour Operator - Photography Services - Online information and data base access and/or retrieval - services - Value of taxable service 3. Procedure of Registration, Payment of Service Tax, Refund of Service Tax. 4. Return of Service Tax, Assessment and Penalties.	10
<b>3</b>	<b>CUSTOM ACT 1962. ,</b> 1. Meaning object and scope, Definitions - Customs Area, Customs Port / Air Port / Station /Water - Prohibited goods - smuggling - Shipping Bill - Entry - Bill of Entry-Bill of Export - Costal Goods. 2. Levy and exemption from Custom duty - Valuation of goods for purpose of assessment. 3. Clearance of Imported and Exported goods - Confiscations of goods and conveyances and imposition of penalty.	10
<b>4</b>	<b>CENTRAL SALES TAX ACT 1956</b> 1. Definitions - Sale, inter-state sales, intra-state sales, sales during import sales, export, goods, dealer, appropriate state, declared goods. 2. Persons liable to pay CST, Rate of CST, Practical Problems on Calculation of CST payable. 3. Registration under CST Act	10
<b>5</b>	<b>Law of patent &amp; Trade Mark</b>	08

	<p>Patent Act 1970 - Important Definitions, Inventions Net Partner, Application for patents,, Opposition to Grant of Patent, Grant and sealing of patents, Suit concerning infringement of patents, Surrender and revocation of patents, penalties.</p> <p>Trade Mark Act 1999 - Important definitions, procedure of Registration, Duration, Renewal etc. of registration - infringement of Trade Mark -Penalties.</p>	
<b>Term II</b>		<b>48</b>
<b>6</b>	<p><b>Role of company secretary</b></p> <p>Origin &amp; concept - Definition of secretary - Importance of company secretary - Duties, Liabilities &amp; Rights of company secretary - Qualification of Company secretary</p>	12
<b>7</b>	<p><b>Borrowing Powers and Methods of Borrowing</b></p> <p>Statutory Provisions - Unauthorized Borrowings - Security for borrowings - Mortgage - Pledge - Hypothecation - Charge - Fixed Mortgage and Charge - Registration of Charges</p> <p>Method of borrowings -</p> <p>Short-term Borrowings - Loan From Banks - Public Deposits - Companies Acceptance of Deposits Rule 1975 - Repayment of Deposit and Powers of Company</p> <ul style="list-style-type: none"> <li>• Company Law Board</li> <li>• Income Tax on Company Deposits</li> <li>• Regulation by RBI</li> <li>• Long and Medium Term Borrowings</li> </ul> <p>Debentures : Meaning, Kinds - Procedure for Issue of Debentures - Guidelines for Issue of Debentures - Rights of Debenture holders - Liabilities of Trustees - Transfer and Transmission of Debentures - Redemption - Reissue of Redeemed Debentures</p> <ul style="list-style-type: none"> <li>• Appointment of a Receiver and Its Registration</li> <li>• Inter-Company Loans and Investments</li> </ul>	08
<b>8</b>	<p><b>Dividend, Interest &amp; Bonus Shares</b></p> <p><b>Dividend</b></p> <p>Meaning, Statutory Provisions - Conditions under which Dividend may not be paid - Declaration of Dividend - Dividend paid out of Reserves - Unpaid or Unclaimed Dividend Transfer to Central Govt. - Procedure for Payment of Dividend - Dividend Mandates / Authority - Interim Dividend - Loss of Dividend Warrants - Payment of Interest out of Capital - Dividend and Income Tax</p> <p><b>Interest -</b></p> <p>Meaning and Distinction from Dividend - Procedure of paying Interest on Debentures</p> <p><b>Bonus Shares -</b></p> <p>Bonus Shares or Capitalization of Profits - Statutory Provisions / Guidelines for Issue of bonus shares, Procedure for Issue of Bonus Shares - Forms of Issue of Bonus Shares - Effects of Issue of Bonus Shares - Advantages of the Issue of Bonus Shares - Limitations of the</p>	14

	Issue of Bonus Shares	
<b>9</b>	<b>Accounts, Statutory Books &amp; Registers</b> Accounts : Books of Accounts - Annual Accounts - Balance Sheet of a Holding Company - Annual Return - Statutory Books and Registers - Statistical Books	04
<b>10</b>	<b>Company Audit</b> Appointment of Auditors - Special Audit - Audit of Cost Accounts - Removal of Auditors - Remuneration and Expenses of an Auditor - Qualifications and Disqualifications of an Auditor - Rights, Powers and Duties of an Auditor - Auditor's Report - Liabilities of Auditor	10
		48

**Recommended Books :-**

1. Company Law – A.K.Mujumdar (Taxmann Publication Pvt.Ltd.)
2. Company Law – Avtar singh (Eastern Book Comp. Lucknow )
3. Secretarial Practice – M.C. Kuchhal
4. Indirect Taxes – V.S.Datey (Taxmann Publication Pvt.Ltd.)
5. Indirect Taxes- S.C. Mehrotra (Sahitya Bhavan Publication, Agra )
6. Corporate Law – Dilip Shinde, Kiran Nerkar, Abhishek Sahu  
(Sai Jyoti Publication)



**T.Y. B.Com.**

**Co-operation and Rural Development Special Paper III**

**Subject Name -: Co-operation and Rural Development.**

**Course Code -: 306 - d.**

**Objectives -:**

1. To acquaint students with the co-operative marketing
2. To develop the capability of students for knowing different types Marketing.
3. To aware the role of National Agricultural Co-operative Marketing Federation (NAFED)

**Term I**

<b>Unit No.</b>	<b>Topic</b>	<b>Lectures</b>
<b>1</b>	<b>Introduction to Marketing</b> 1.1 Meaning and definition 1.2 Elements 1.3 Objectives 1.4 Importance 1.5 Evaluation of marketing 1.6 Scope of marketing 1.7 Classification of markets - Local, Regional, National and Global markets	<b>10</b>
<b>2</b>	<b>Co-operative Marketing</b> 2.1 Basic concepts and features. 2.2 Structure of cooperative marketing 2.3 Primary Co-operatives Marketing Societies-objects, Functions and Progress. 2.4 District and State Co-operatives marketing societies / Federation - objects, Functions and Progress. 2.5 Development and Evaluation.	<b>10</b>
<b>3</b>	<b>Consumer Co-operatives</b> 3.1 Meaning, Need and Importance 3.2 Structure. 3.2.1 Primary Co-operative Consumer Stores, Student Consumer Stores. 3.2.2 Wholesale Co-operative Stores 3.2.3 Super markets 3.2.4 State Co-operative Consumer Federation 3.2.5 National Co-operative Consumer Federation 3.2.6 Problems of consumer co-operatives 3.3 Evaluation and development	<b>10</b>
<b>4</b>	<b>Other Co-operative and It's Marketing</b> 4.1 Dairy Co-operatives 4.2 Poultry Co-operatives 4.3 Sugar Co-operatives. 4.4 Cotton processing ( Ginning, Spinning Mills)	<b>5</b>
<b>5</b>	<b>Pricing</b> 5.1 Meaning and Objectives of Pricing 5.2 Competitive and Co-operative Pricing 5.3 Agricultural Cost and Price Commission (ACPC)	<b>8</b>

	5.4 Mechanism of estimating of Minimum Support Price (MSP) by ACPC 5.5 Problems related to MSP	
<b>6</b>	<b>Marketing Research</b> 6.1 Concept and Scope 6.2 Steps involved in marketing research 6.3 Globalization and marketing research 6.4 Need and practice of marketing research in co-operatives	<b>5</b>
	<b>Total</b>	<b>48</b>

### Term-II

<b>Unit No.</b>	<b>Topic</b>	<b>Lectures</b>
<b>6.</b>	<b>Marketing Strategy for Co-operatives</b> 6.1 Meaning and definition 6.2 Importance of marketing strategy in co-operatives 6.3 Factors influencing marketing strategy of co-operatives 6.4 Marketing strategy followed by 6.4.1 Agricultural Cooperative Processing. 6.4.2 Co-operative produce Marketing. 6.4.3 Co-operative Service Marketing. 6.5 Strategy for Exporting Agricultural Produce.	<b>12</b>
<b>7.</b>	<b>National Agricultural Co-operative Marketing Federation (NAFED) of India limited.</b> 7.1 Objectives 7.2 Organizational Set-up 7.3 Functions 7.4 Performance and evaluation of NAFED.	<b>8</b>
<b>8.</b>	<b>Agricultural Produce Market Committee</b> 8.1 Organizational Set-up 8.2 Functions 8.3 Progress and Problems	<b>10</b>
<b>9.</b>	<b>Agricultural Produce Market (Regulation) Act, 1963</b> 9.1 Background for Enactment 9.2 Objectives 9.3 Feature of the Act 9.4 Main Provisions.	<b>8</b>
<b>10.</b>	<b>The Agricultural Produce Marketing (Development &amp; Regulation) Act, 2003 (Model Act)</b> 10.1 Objectives 10.2 Basic features. 10.3 Main provisions 10.4 Impact on Agricultural Marketing	<b>10</b>
	<b>Total</b>	<b>48</b>

### **Recommended Books**

Dr. Mukund Tapkir:- Sahakar ,Nirali Prakashan, Pune

Dr G.H.Barhate, Dr.J.R.Bhor and, Prof. L.P.Wakale--Sahakar ,Seth Publication , Mumbai.

G.S.Kamat.- Cases in Co-operative management.

K.K.Taimani.- Co-operative Organization and Management.

G.S.Kamat.- New Dimensions of Co-operative Management.

Dr G.H.Barhate, Prof.B.G.Sahane and Prof, L.P.Wakale---Sahakar vikas , Seth Publication, Mumbai.

Vasant Desai—Fundamentals of Rural Development.

Dr.Dandekar and Rath- Poverty in India.

Dr.P.R.Dubhashi- Rural Development and Administration in India.

V.Reddy- Rural Development in India

S.K.Gopal- Co-operative Farming in India.

I.C.A--State and Co-operative Movement.

K.K.Taimani.- Co-operative Organization and Management.

Dr.D.M.Gujrathi and Prof.A.D.Divekar, Patsansthace Vishwat

**T.Y. B.Com.**  
**Cost and Works Accounting Special Paper III**  
**Subject Name :- Cost and Works Accounting.**  
**Course Code :- 306 – e.**

**Objectives :-**

- 1 To impart knowledge regarding costing techniques.
- 2 To provide training as regards concepts, procedures and legal Provisions of cost audit.

**Level of Knowledge :- Basic Knowledge.**

**Term I**

Unit No.	Topic	Lectures
<b>1.</b>	<b>Marginal Costing:</b>	<b>18</b>
	1.1 Meaning and concepts- Fixed cost, Variable costs, Contribution, Profit-volume Ratio, Break-Even Point & Margin of Safety. 1.2 Cost-Profit-Volume Analysis- Assumptions and limitations of cost volume analysis 1.3 Application of Marginal Costing Technique:- Make or buy decision, Acceptance of export order & Limiting factors.	
<b>2.</b>	<b>Budgetary Control:</b>	<b>12</b>
	2.1 Definition and Meaning of Budget & Budgetary control 2.2 Objectives of Budgetary control 2.3 Procedure of Budgetary control 2.4 Essentials of Budgetary control 2.5 Advantages and Limitations of Budgetary control 2.6 Types of Budgets.	
<b>3.</b>	<b>Uniform costing and Inter-firm Comparison</b>	<b>08</b>
	3.1 Meaning and ,objectives 3.2 Advantages and disadvantages.	
<b>4.</b>	<b>Introduction to management information system in Costing</b>	<b>10</b>
	4.1 Meaning , objectives and Advantages 4.2 Procedure of MIS	
	<b>Total</b>	<b>48</b>

**Term II**

Unit No.	Topic	Lecture
<b>5.</b>	<b>Standard Costing</b>	<b>16</b>
	5.1 Definition and meaning of standard cost & standard Costing . 5.2 Types of standards, setting up of Material & Labour Standards 5.3 Difference between Standard Costing & Budgetary Control. 5.4 Advantages and Limitations of standard costing 5.5 Variance Analysis & its Significance 5.6. 1 Meaning, Types and Causes of Material & Labour variances. 5.6. 2 Problems on Material & Labour variances.	
<b>6</b>	<b>Farm Costing</b>	<b>10</b>
	6.1 Meaning and Features of Farm Costing 6.2 Advantages & Limitations of Farm Costing 6.3 Practical Problems	

<b>7</b>	<b>Cost Accounting Record Rules &amp; Cost Audit:</b>	<b>12</b>
	7.1 Introduction to cost accounting record u/s 148 of the companies Act 2013 7.2 Cost records and Verification of Cost Records 7.3 Cost auditor – Appointment- Rights and duties	
<b>8</b>	<b>Cost Audit (Legal Provisions):</b>	<b>10</b>
	8.1 Cost Audit - Meaning, Scope, objectives & advantages of Cost Audit. 8.2 Cost Audit Report and Annexure to cost Audit Report. 8.3 Introduction to Cost Accounting Standards issued by Institute of Cost and Management of India . 8.4 Generally accepted Cost Accounting principles.	
	<b>Total</b>	<b>48</b>

**Note :-**

Allocation of Marks-

- a) 50% For Theory.
- b) 50% For Practical Problems.

**Areas of Practical Problems:**

Marginal Costing [problems on P/V Ratio BEP, M/S Angle of incidence  
Budgetary Control-[Sales Budget, Cash Budget, Flexible budget .  
Standard Costing-Material & Labour Variances only. [Simple problem]  
Farm Costing [Farm Cost sheet]

<b>Books Journals and Websites Recommended for Cost and Works Accounting Paper I, II and III</b>	
1.	Prof. Subhash jagtap -: Practice in Advanced costing and Management Accounting. Nirali Prakashan, Pune
2.	Ravi Kishor -: Advanced Cost Accounting and Cost Systems Taxman's Allied Service Pvt.Ltd., New Delhi.
3.	S.P. Lyengar -: Cost Accounting Principles and Practice, Sultan Chand & Sons Accounting Taxman's, New Delhi.
4.	Ravi Kishor -: Students Guide to Cost Accounting Taxman's, New Delhi.
5.	M.N. Arora -: Cost Accounting Principles and Practice Vikas Publishing House Pvt. Ltd., New Delhi.
6.	S.N. Maheshwari and S.N. Mittal -: Cost Accounting, Theory and Problems, Mahavir book Depot, New Delhi.
7.	B.L. Lall and G.L. Sharma -: Theory and Techniques of Cost Accounting. Himalaya Publishing House, New Delhi.
8.	V.K. Saxena and Vashista -: Cost Accounting – Text book. Sultan Chand and Sons, New Delhi
9.	V.K. Saxena and Vashista -: Cost Audit and Management Audit. Sultan Chand and Sons, New Delhi
10.	Jain and Narang -: Cost Accounting Principles and Practice. Kalyani Publishers
11.	N.K. Prasad -: Principles and Practice of Cost Accounting Book Syndicate Pvt. Ltd., Calcutta.
12.	N.K. Prasad -: Advanced Cost Accounting Syndicae Pvt. Ltd., Calcutta.
13.	R.K. Motwani -: Practical Costing. Pointer Publisher, Jaipur.
14.	R.S.N. Pillai and V. Bhagavati -: Cost Accounting.
15.	Hornefgrain and Datar -: Cost Accounting and Managerial Emphasis.
16.	Dr.J.P.Bhosale -: Management Accounting, Vision Publication

**T.Y. B.Com.**  
**Business Statistics Special Paper III**  
**Subject Name :- Business Statistics.**  
**Course Code :- 306 – f.**

**Objectives:**

1. To study different optimization techniques.
2. To study different charts.
3. To study simulation.

Sr. No.	Topic	No. of Lectures
<b>Term 1</b>		
Unit 1	<b>Game Theory:</b> Meaning, two person zero-sum game, pure and mix strategies, Pay off tables, saddle points, minimax and maximin principles, Dominance principles. Examples and problems.	10
Unit 2	<b>Statistical Decision Theory:</b> 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, Hurvitz Criterion, Examples and problems.	16
Unit 3	<b>Replacement Problem:</b> Introduction, replacement of Item that deteriorates with time when value of money remains same during the period.	6
Unit 4	<b>Statistical Quality Control :</b> 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 $C_{pk}$	16
<b>Term 2</b>		
Unit 5	<b>CPM/PERT:</b> Meaning and scope, activity, event, node, network, path, critical path, slack, float (total, free, independent), forward pass and backward pass methods. Pessimistic, Most likely and Optimistic times in PERT, mean and variance for each activity, expected duration of project, probability of completion of project, Examples and problems.	16
Unit 6	<b>Simulation:</b> Meaning and scope, Advantages and disadvantages of simulations, Examples and problems, step wise procedure of drawing model sample using EXCEL from i) uniform distribution and ii) normal distribution using Box-Muller transformation.	10
Unit 7	<b>Queuing Theory:</b> Meaning, calling population, queue discipline, inter arrival rate, service	10

	rate, traffic intensity, single channel Poisson arrival with exponential service rate, average waiting time in i) queue and ii) system, average length of i) queue and ii) system. Examples and problems.	
Unit 8	<b>Application of derivative in Business:</b> Algebraic Function: Cost function, Profit function, Revenue function. Derivative and double derivative of some simple algebraic functions and its meaning in computation of maxima and minima of a function. Concept of average cost, marginal cost, variable cost and fixed cost. Examples and problems.	12

#### List of Practicals

Sr. No.	Name of Experiment
1	Game Theory
2	Statistical Decision Theory
3	Statistical Quality Control
4	CPM/PERT
5	Simulation Using Excel
6	Queuing Theory

#### Books Recommended:

1. Operations Research : Harndy, Taha
2. Operations Research: Kantiswroop, Gupta
3. Business Mathematics : J. K. Sharma
4. Statistical Quality Control: Montgomery
5. Fundamentals of Mathematical Statistics: Gupta, Kapoor V.K.
6. Fundamentals of Statistics: S.C. Gupta

#### Pattern of Question Paper (Annual Exam)

**Max. Marks:80**

**Time : 3 hours**

#### Question No.

**Max. Marks**

Q 1 Attempt any five of the following (2x5)	10
Q 2 Attempt any four of the following (5x4)	20
Q 3 Attempt any four of the following (5x4)	20
Q 4 Attempt any two of the following (15x2)	30

**T.Y. B.Com.**  
**Business Entrepreneurship Special Paper III**  
**Subject Name -: Business Entrepreneurship.**  
**Course Code -: 306 – g.**

**Objectives:-**

- 1) To develop the Knowledge and understanding of behavioral aspects of entrepreneurship.
- 2) To acquaint students with the behavioral aspects of members of the team or employees

**Term I**

Unit No.	Topic	Lectures
<b>1.</b>	<b>Organizational Behavior:</b> <b>Organization;</b> Meaning, Definitions, Goals, Approaches. Organizational Behavior – Meaning, Definitions, Need. Nature. Importance & Scope Historical roots of OB. Organizational Behavior Models.	<b>12</b>
<b>2.</b>	<b>Individual Behavior and Personality:</b> Determinants of individual behavior – Personality: Meaning, Definitions, Determinants of Personality, Personality Traits, Personality Development, Emotional Intelligence, Entrepreneurial Personality.	<b>12</b>
<b>3.</b>	<b>The study of Autobiographies of following Entrepreneurs:</b> (1) Dr. Nilakantha Kalyani (2) Shri. D.S. Kulkarni (3) Mr. Aditya Vikram Birla (4) Shri. Dilip Narayan Borawake (5) Mrs. Jyoti Naik (Ejjat Ki Lajjat, Shri Mahila Gruh Udyog, Lijjat Papad) (6) Shri Ramesh J. Chavan-Thundered Unbottled	<b>12</b>
<b>4.</b>	<b>Group and Group Dynamics:</b> Meaning and Definitions of group, Classification of group, Group task Group size – Group formation process. Group Structure. Group Dynamics: Influence in Group Group Cohesion – Helping Behavior, Co – Operation and Competition Improved Work group.	<b>12</b>
<b>Total</b>		<b>48</b>

**Term II**

Unit No.	Topic	Lectures
<b>5.</b>	<b>Team Building:</b> Team - Meaning and Definitions Team v/s Group Types of team Creating high performance team Managing team	<b>12</b>
<b>6.</b>	<b>Stress and Conflict Management:</b> Stress – Meaning and Definitions. Types Sources and Consequences of stress Stress management – Personal and Organizational approach	<b>12</b>



	Conflict Management: Meaning and nature of Conflicts. Types Causes of Conflicts. Remedies to overcome the Conflicts	
<b>7.</b>	<b>Motivation:</b> Motivation at work place – Meaning and Definitions. Need & Types of Motivation Job description & Job analysis Management by Objects (MBO)– Job rotation – Job enrichment – Employee Involvement Programme	<b>12</b>
<b>8.</b>	<b>Organizational Change and Development:</b> Meaning and Definitions Causes of Change A Change Model Resistance to Change Strategies of Change and Development	<b>12</b>
	<b>Total</b>	<b>48</b>

<b>Recommended Books</b>	
1)	Tosi H.L., Rizzo J.R., Carrol S.J. 'Handbook of Organizational Behaviour' – Infinity Books, New Delhi.
2)	Robbins Stephen – 'Organizational Behaviour' Prentice – Hall of India, New Delhi.
3)	Ghandekar (Dr.) Anjali – 'Organisational Behaviour' – Everest Publishing House.
4)	Journal: Shri. Ram Centre for Industrial Relations and Human Resources – 'Indian Journal of Industrial Relations' New Delhi.
5)	Vyavsay Udhojyakata-Dr.Sudhakar Jadhavar Success Publication Pune
6)	Udhojyakanchi Kartutvagatha-Dr.P,C,Shejwalkar

T.Y. B.Com.

**Marketing Management Special Paper III**

**Subject Name -: Marketing Management.**

**Course Code -: 306 - h.**

**Objectives of the Paper**

1. To know detailing of Marketing Research
2. To understand the role Brand and Distribution Management in marketing
3. To inform about Marketing and Economic Development
4. To Know of the importance of control on marketing activities

**First Term**

**Unit 1**

**Advertising I**

**a) Fundamentals of Advertising**

1. Conceptual framework, Nature, Scope and Functions of Advertising
2. Role of Advertising in Modern Business
3. Advertising – Objectives – Types, Benefits and Limitations
4. Ethics in Advertising

**b) Advertising Media**

1. Definitions – Classifications and Characteristics of Different Media
2. Comparative Study of Advertising Media
3. Selection of Media-Factors Affecting Selection of Media
4. Media Mix-Geographical selective-Media Scheduling
5. E-Advertising  
(14 periods)

**Unit 2**

**Advertising II**

**Appeals and Approaches in Advertisement**

1. Introduction- Different Appeals and their Significance
2. Advertising Message
3. Direct and Indirect Appeal
4. Relation between Advertising Appeal and Buying Motive
5. Positive and Negative Emotional Approaches  
(12 periods)

**Unit 3**

**Brand management**

- a) Introduction of Branding
- b) Brand identity
- c) Advertising and Branding
- d) Brand Extension
- e) Identity Sources – symbols, logos, trademarks  
(10 Periods)

#### **Unit 4**

##### **Industrial Marketing**

- a) Introduction to Industrial Marketing
- b) Types of Industrial Goods
- c) Difference between Industrial and Consumer Marketing
- d) Purchasing practices of Industrial customers  
(12 Periods)

#### **Second Term**

#### **Unit 5**

##### **Marketing Research**

- a) Meaning, nature and scope of Marketing Research
- b) Marketing Research process
- c) Types of Research
- d) Types of Data
- e) Types of Questionnaire  
(14 Periods)

#### **Unit 6**

##### **Distribution Management**

- a) Warehousing and Transport decisions
- b) Logistics – meaning, nature
- c) Logistics Function
- d) Warehousing – need, functions
- e) Transportation – modes, factors affecting transportation costs  
(10 Periods)

#### **Unit 7**

##### **Target Marketing**

- a) Meaning, nature, importance
- b) Market Targeting
- c) Selection of Target Segment
- d) Targeting Strategies  
(10 Periods)

#### **Unit 8**

##### **Marketing Control**

- a) Meaning, objectives of Marketing Control
- b) Benefits of Marketing Control: - essential of an effective Marketing Control System
- c) Techniques of Marketing Control
- d) Process of Marketing Control
- e) Marketing Audit – meaning, characteristics, objectives, process of Marketing Audit  
(14 Periods)

**Recommended Books:**

Philip Kotler	Marketing Management
David Carson	International Marketing: A Comparative System Approach, Wiley, New York
Steven M. Bungess	The New Marketing Halfway House, Zebra Press, South Africa
David J. Schwartz	Marketing Today: A Basic Approach Harcourt Brace Jovanovich, New York
Thomas V. Boroma	The Marketing Edge: Making Strategic Work The Free Press, New York
Peter Doyle	Value-based Marketing: Marketing Strategies for Corporate Growth and Shareholder value John Wiley, Crichester, England
E. Jenome McCarthy	Basic Marketing: A Managerial Approach Irwin, Homewood, Illinois
Bert Rosenbloom	Marketing Channels: A Management View Dryden, Hinsdale, Illinois
Edward L. Nash	Direct Marketing: Strategy, Planning, Execution McGraw Hill, New York

**Suggested mode of conducting practical**

1. Guest lecture
2. Library assignment
3. Case study
4. Field visit
5. Conducting Survey
6. Presentation

**T.Y. B.Com.**  
**Agricultural and Industrial Economics Special Paper III**  
**Subject Name :- Agricultural and Industrial Economics.**  
**Course Code :- 306 – i.**

**Objectives –**

1. To study the agricultural development in India.
2. To understand the role of industries in India – in the light of globalization.

<b>Term I – Agriculture and Rural Development</b>		
<b>Unit</b>	<b>Topic</b>	<b>Lectures</b>
1.	<b>Rural Economy of India</b> 1.1 Features of Rural Economy. 1.2 Recent Trends in Agriculture Economy – Horticulture & Sericulture	08
2.	<b>Irrigation and Agricultural Inputs</b> 2.1 Types of Irrigation. 2.2 Modern Changes in Irrigation. 2.3 Plant Analysis and Soil Analysis Methods	10
3.	<b>Rural Credit :-</b> 3.1 Need &Types of Rural Credit. 3.2 Role of cooperative credit. 3.3 Role of NABARD	10
4.	<b>Rural Development Programs :-</b> 4.1 Community Development Programme. 4.2 Intensive Agricultural Area Programme. 4.3 Small Farmers Development Agency.	10
5.	<b>Co-Operation in India :- Functions, Growth and Weaknesses of</b> 5.1 Dairy Cooperatives. 5.2 Poultry Cooperatives. 5.3 Service Cooperatives.	10
		<b>Total 48</b>

<b>Term II – Industrial Development</b>		
<b>Unit</b>	<b>Topic</b>	<b>Lectures</b>
6.	<b>Industrial Policy</b> 6.1 Importance of Industrial Policy 6.2 Impact of Industrial Policy since 1991	08
7.	<b>Industrial Imbalance</b> 7.1 Meaning of Industrial Imbalance. 7.2 Need for balance Regional Development in Indian Industry 7.3 Causes & Measure of Industrial Imbalance in India.	08
8.	<b>Globalization &amp; Industrialization :-</b> 8.1 Concept of Multinational Corporations (MNC's) in India. 8.2 Multinational Corporations & Industrial Development. 8.3 Role of Multinational Corporations in Indian Economy 8.4 Impact of Multinational Corporations in India	12

9.	<b>Special Economic Zones (SEZ's) in India :-</b> 9.1 Role of Government in SEZ. 9.2 Impact of SEZ in India	08
10	<b>Infrastructural Development in India</b> 10.1 Importance of Infrastructural Development in Economic Development 10.2 Role of Private Investment in Infrastructural Development. 10.3 Problems of Public Sector Investment in Infrastructural Development.	12
		<b>Total 48</b>

**Recommended Books :**

1. S.K.Misra and V.K.Puri : Indian Economy - Himalaya Publishing House, Delhi.
2. Khedkar B.D. : Indian Economy, Success Publication, Pune
3. Sundaram & Black : The International Business Environment, New Delhi
4. Agrawal A.N. Indian Economy – Vikas Publication
5. Khem Farooq A. Business and society, S.Chand Delhi
6. Dutt R & Sundaram K.P.M – Indian Economy, s.chand delhi
7. Dutt Rudder : Economic Reforms in India – A Critique – S Chand, New Delhi.
8. Hedge: Environmental Economics, MaMillan.
9. K.V. Srivyya and V.R.M. Das : Indian Industrial Economy, Chand & Com.New Delhi 1977

**T.Y. B.Com.**

**Defense Budgeting, Finance & Management Special Paper III**  
**Subject Name -: Defense Budgeting, Finance & Management.**  
**Course Code -: 306 – j.**

**Aim of the paper**

One of the crying needs of the hour is to ensure that the National Security objectives are met-in a cost effective manner. Against such backdrop, the aim can be achieved by educating the students and disseminating the information and by giving the planners, decision makers and administrators all the information they need in an easily understandable form. By studying this paper students will understand all the financial aspects of budgetary and management systems in India.

**Term I**

<b>Unit No.</b>	<b>Topic</b>	<b>Lectures</b>
<b>1.</b>	<b>Financial Management.</b> a. Purpose, Planning, Control and Need. b. Salient Features of India's Economic System.	<b>10</b>
<b>2.</b>	<b>Economic Theories of Defence.</b> a. Concept of Public Good. b. Defence and Development. c. Basic Macro – Economic Concept.	<b>10</b>
<b>3.</b>	<b>Government Financial System.</b> a. Introduction – Principles, Structure Ministry of Finance, Parliament, Controller and Auditor General.	<b>10</b>
<b>4.</b>	<b>Defence Budget Structure.</b> a. Preparation. b. Allocation and Execution of Defence Budget.	<b>08</b>
<b>5.</b>	<b>Financial Administration in Defence Services.</b> a. Role of Financial Advisor. b. Defence Accounts Department. c. Structure of the Five Year Defence Plan and its Formulation, Approval and Execution.	<b>10</b>
<b>Total</b>		<b>48</b>

**Term II**

<b>Unit No.</b>	<b>Topic</b>	<b>Lectures</b>
<b>6.</b>	<b>New Trends in India's Defence Expenditure.</b> a. Understanding of the Defence Budget. b. Analysis of India's Defence Expenditure Since 1998. c. Impact of Expenditure on Defence Forces.	<b>12</b>
<b>7.</b>	<b>Elements of War Potential.</b> a. Economic Elements. b. Natural Resources and Raw Material. c. Manpower and its utility. d. Industrial Capacity. e. Foreign Aid as a Contributory Element.	<b>12</b>

<b>8.</b>	<b>Effects of War.</b> a. Economic Structure. b. Industry. c. Post War Problem.	<b>12</b>
<b>9.</b>	<b>Challenges in Defence and Financial Management.</b> a. System of Financial Management in Defence. b. Linkages between Planning and Budget. c. Arm Impacts vs. Indigenisation: Progress, Pitfalls and Impact on Defence Budget.	<b>12</b>
<b>Total</b>		<b>48</b>

<b>Recommended Books</b>	
1.	Raju G.C. Thomas, "The Defence of India: A Budgetary Perspective" (MacMillan Publication, New Delhi, 1978)
2.	Subramanyam K., "India's Security Perspective – Policy and Planning", (Lancer Books, New Delhi, 1991).
3.	Nanda Ravi, "National Security Perspective, Policy and Planning", (Lancer Books, New Delhi, 1991).
4.	Khanna D. D. and Malhotra P. N., "Defence vs. Development: A Case Study of India", (Indus Publication Company, New Delhi, 1993).
5.	Kennedy Gavin, "Defence Economics", (Gerald Duckworth & Co. Ltd, 1983).
6.	Ghosh Amiya, "India's Defence Budget & Expenditure Management in Wider Context", (Lancer Publication and Span Tech, Delhi, 1996).
7.	Dutta Meena and Sharma Jai Narayan, "Defence Economics", (Deep and Deep Publication, New Delhi)
8.	Deger S. & Sen S. "Military Expenditure in the Third World Countries: The Economic Effects", (Routlet & Kegan Paul, 1986).
9.	Agarwal Rajesh K., "Defence Production and Development", (Gulab Vazirani for Arnold Heinermann Publishers, 1978).
10.	Thomas Raju G. C., "Indian Security Policy", (Princeton, New Jersey, University Press, 1988).
11.	Robert Loony and David Winterford, "Economic Causes and Consequences of Defence Expenditure in the Middle East and South Asia", (University Press, 1995).
12.	Shrinivas V. N., "Budgeting for Indian Defence: Issues of Contemporary Relevance", (KW Publishers Pvt., Ltd., New Delhi – 2008).
13.	Annual Report, Ministry of Defence, Government of India.
14.	Report of the Finance Commission, Government of India.



**T.Y. B.Com.**

**Insurance Transport and Clearance Special Paper III**

**Subject Name -: Insurance Transport and Clearance**

**Course Code -: 306 – k.**

**Objectives :**

- 1) To understand the importance of travel and tourism industry.
- 2) To study the functions and working of various Travel Organizations.
- 3) To understand the marketing mix and recent trends of Global Tourism and Transport Business.

**Term I**

<b>Unit</b>	<b>Topic</b>	<b>Lectures</b>
<b>1</b>	<b>Development of Tourism</b> Planning for International Tour, Factors considers to travel and tourism business, planning for tour, Reservation, Group Tours, Currency ticket arraignment, Hotel Reservations	<b>12</b>
<b>2</b>	<b>Functions and Working of Travel Organizations</b> IATA ( International Air Travel Agency) WTO ( World Tourism Organization ) IUTO ( International Union of Travel Organization) TAAI ( Travel Agents Association of India) PATA ( Pacific Air Travel Association)	<b>12</b>
<b>3</b>	<b>Tour Planning</b> Requirement documents for foreign tour-Passport, Visa, Health clearance, reading of maps, Role of Embassy, City Guides, Whether conditions, comparative study of tourism in India and Other Countries.	<b>12</b>
<b>4</b>	<b>Transport Means</b> Current scenario of Railway, Road, Water and Air transport in India Significance of Transport in Indian Economy, Role of Air and water transport in global trade. <b>Logistic Management-</b> Elements, Features, Important of logistics management in Business and Industry	<b>12</b>
		<b>Total- 48</b>

**Term II**

<b>1</b>	<b>Development of Tourism</b> Role of Tour and Travel Agents- Advertisement, Publicity, Marketing of group tours, Knowledge of employer packages, schemes, LTC facility to employee, Designing of Package tours suitable to employees.	<b>12</b>
<b>2</b>	<b>Tourism Knowledge of Popular Countries</b> Thailand And Malaysia, Gulf and Dubai, Singapore and Hong Kong, U.K., Europe.	<b>12</b>

<b>3</b>	<b>Reservation and Accommodation</b>	<b>12</b>
	Holiday Homes, Campus, Rest Houses, Hotels, Hostels, motels, Clubs, Availability of Food and Catering Services at various sites	
<b>4</b>	<b>Qualities Required for Tourism Business</b>	<b>12</b>
	a. Product Knowledge	
	b. Customer Orientation	
	c. Communication skills	
	d. Analytical , ability skills	
	e. Motivation and Behavioral skills	
	f. Presentation skills	
	g. Personality Development and Behavioral Aspects	

**Total 48**

#### **Recommended Books**

- 1) Travel and Tourism Management – Foster Dougals, Macmillan London.
- 2) Service Marketing – Jha S.M., Himalaya Publishing House, Mumbai
- 3) Tourism and Travel Management – Bishwanath Ghosh, Vikash Publishing House
- 4) Tourism Management- Wahab & Salah, Tourism International Press, London.
- 5) Travel and Tourism Business Management – Dr.S.K.Wadekar  
Shanti Prakashan, Ahemadabad (Gujrat)

**T.Y. B.Com.**  
**Computer Programming and Application Special Paper III**  
**Subject Name -: Software Engineering.**  
**Course Code -: 306 – I.**

**Objective:**

- a. To understand the different system concepts used in Software Engineering.
- b. To learn the different types applications of Software Engineering.
- c. To know the facts about Software Development.

**Term-I**

<b>Unit No.</b>	<b>Name of the Topic</b>	<b>Number of lectures</b>	<b>Reference Book</b>
<b>1</b>	<b>Introduction to System Concepts</b> 1 Definition , Elements of System 2 Characteristics of System 3 Types of System 4 System Concepts	10	Book1
<b>2</b>	<b>Requirement Analysis</b> 1 Definition of System Analysis 2 Requirement Anticipation 3 Knowledge and Qualities of System Analyst 4 Role of a System Analyst 5 Feasibility Study And It's Types 6 Fact Gathering Techniques 7 SRS(System Requirement Specification)	14	Book1
<b>3</b>	<b>Introduction to Software Engineering</b> 1 Definition Need for software Engineering 2 Software Characteristics 3 Software Qualities ( McCall's Quality Factors	10	Book2
<b>4</b>	<b>Software Development Methodologies</b> 1 SDLC (System Development Life Cycle) 2 Waterfall Model 3 Spiral Model 4 Prototyping Model 5 RAD MODEL	14	Book2
	<b>Total Lectures</b>	<b>48</b>	

**Term-II**

<b>Unit No.</b>	<b>Name of the Topic</b>	<b>Number of lectures</b>	<b>Reference Book</b>
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5	<b>Analysis and Design Tools</b> 1 Entity-Relationship Diagrams 2 Decision Tree and Decision Table 3 Data Flow Diagrams (DFD) 4 Data Dictionary Elements of DD, Advantage of DD 5 Pseudo code 6 Input And Output Design 7 CASE STUDIES (Based on Above Topic solve min.5 case studies)	16	Book1, Book2
6	<b>Structured System Design</b> 1 Modules Concepts and Types of Modules 2 Structured Chart 3 Qualities of Good Design Coupling, Types of Coupling, Cohesion, Types of Cohesion 4 CASE STUDIES (Based on Above Topic solve min.5 case studies)	14	Book1 and Book2
7	<b>Software Testing</b> 1 Definition, Test characteristics 2 Types of testing Black-Box Testing, White-Box Testing, Unit testing, Integration testing 3 Validation 4 Verification 5 Testing Tools	10	Book1 and Book2
8	<b>Risk Management</b> 1 Software risk 2 Risk identification 3 Risk projection	08	Book1
	<b>Total Lectures</b>	<b>48</b>	

**Recommended Books:**

- 1) Software Engineering - Roger s. Pressman.
- 2) SADSE (System Analysis Design) - Prof. Khalkar and Prof. Parthasarathy.

# UNIVERSITY OF PUNE

## Master of Commerce (M.Com.) Semester Pattern with Credit System Revised with effect from June 2013

### **Preamble for Choice Based Credit System**

Since liberalization the socio-political-economic scenario is changing very fast. There is a significant transformation in term educational expectation and aspiration of the learner. The educational system also is witnessing many changes and challenges due to technological growth and changes in the Government policies. Education is no longer a concern of students but it has become a matter of social and economic importance. The changes at the global level has influence the educational system, structure and expectation of the users.

University education needs to take contingency of all these changes and restructure itself to stand in a competitive dynamic environment. Professional stream of learning like Commerce have to be properly upgraded to accommodate challenges of change, expectation of employers' and to offer global opportunities to the learners. From this point of view the course structure of post-graduate programme in Commerce needs to be structured. It has to be according to expectations of the learners, employers and the society. The learning inputs have to be more update, skilled based and with appropriate applications. The course programme should consider desire aptitude, attitude and acumen of the learner.

From this point of view University of Pune has introduced Choice Base Credit System of course structure. This system shall offer a flexible user friendly, opportunity to the learner, will broader the horizon of Commerce education and will give a fair chance to every single learner to exhibit his talent, acquired skills and enhance his personality. It will further enhance his opportunity of global mobility, to acquire different knowledge inputs from different global institutes.

#### **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 for seeking suitable careers in management and entrepreneurship.
- d. To study by students methods of Data collection and their interpretations.
- e. To develop among students Communication, Study and Analytical skills.

## 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. The 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:

<b>Sr. No.</b>	<b>Semester</b>	<b>Total Credits</b>
1	Semester I	16
2	Semester II	16
3	Semester III	16
4	Semester IV	16
	<b>Grand Total</b>	<b>64</b>

Four credits for project work at 4<sup>th</sup> 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 50 marks will be for Internal Assessment (attendance, home assignments, class tests, long term papers, classroom presentation and 50 marks for University Examination. Thus M.Com. degree examination, four Semesters shall be of 1600 marks and of minimum 64 credits altogether. The following shall be the course structure.

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			
Semester I	Core Compulsory	101	Management Accounting	04	04	03	50	50	100	
		102	Strategic Management	04	04	03	50	50	100	
	Core Elective/ Optional Subjects/ Special Subjects	<i>To choose any one Group of the following</i>								
		<b>Group A (Advanced Accounting &amp; Taxation)</b>								
		103	Advanced Accounting	04	04	03	50	50	100	
		104	Income Tax	04	04	03	50	50	100	
		<b>Group B (Commercial Laws &amp; Practices)</b>								
		105	Information system and E-Commerce Practices	04	04	03	50	50	100	
		106	Intellectual Property Laws	04	04	03	50	50	100	
		<b>Group C (Advanced Cost Accounting &amp; Cost system)</b>								
		107	Advanced Cost Accounting	04	04	03	50	50	100	
		108	Costing Technique and Responsibility Accounting	04	04	03	50	50	100	
		<b>Group D (Co-operation &amp; Rural Development)</b>								
		109	Co-operative Movement in India	04	04	03	50	50	100	
		110	Organization of Co-operative Business	04	04	03	50	50	100	
		<b>Group E (Business Practices &amp; Environment)</b>								
		111	Organized Trades and Markets	04	04	03	50	50	100	
		112	Business Environment and Policy	04	04	03	50	50	100	
<b>Group F (Business Administration)</b>										
113	Production and Operation Management	04	04	03	50	50	100			
114	Financial Management	04	04	03	50	50	100			
<b>Group G (Advanced Banking &amp; Finance)</b>										
115	Legal Framework of Banking	04	04	03	50	50	100			
116	Central Banking	04	04	03	50	50	100			
<b>Group H (Advanced Marketing)</b>										
117	Marketing Techniques	04	04	03	50	50	100			
118	Consumer Behaviour	04	04	03	50	50	100			

## Semester II

Semester	Subject Types	Course Code	Title of the Paper	Hrs/ Week	Credit	Exam. Hours	Maximum Marks			
Semester II	Core Compulsory	201	Financial Analysis and Control/ Principals of Financial Accounting	04	04	03	50	50	100	
		202	Industrial Economics/ Economic Environment/Business Statistics/ Quantitative application	04	04	03	50	50	100	
	Core Elective/ Optional Subjects/ Special Subjects	<i>To choose any one Group of the following</i>								
		<b>Group A (Advanced Accounting &amp; Taxation)</b>								
		203	Specialized Areas in Accounting	04	04	03	50	50	100	
		204	Business Tax Assessment & Planning	04	04	03	50	50	100	
		<b>Group B (Commercial Laws &amp; Practices)</b>								
		205	E- Security & Cyber Laws	04	04	03	50	50	100	
		206	Laws Regulating to Copyrights & Design	04	04	03	50	50	100	
		<b>Group C (Advanced Cost Accounting &amp; Cost system)</b>								
		207	Application Cost Accounting	04	04	03	50	50	100	
		208	Cost Control & Cost System	04	04	03	50	50	100	
		<b>Group D (Co-operation &amp; Rural Development)</b>								
		209	International Co-operative Movement	04	04	03	50	50	100	
		210	Management of Co-operative Business	04	04	03	50	50	100	
		<b>Group E (Business Practices &amp; Environment)</b>								
		211	Modern Business Practices	04	04	03	50	50	100	
		212	Business Environment Analysis	04	04	03	50	50	100	
		<b>Group F (Business Administration)</b>								
		213	Business Ethics and Professional Values	04	04	03	50	50	100	
214	Elements of Knowledge Management	04	04	03	50	50	100			
<b>Group G (Advanced Banking &amp; Finance)</b>										
215	Banking Law & Practices	04	04	03	50	50	100			
216	Monetary Policy	04	04	03	50	50	100			
<b>Group H (Advanced Marketing)</b>										
217	Customer Relationship Management & Retailing	04	04	03	50	50	100			
218	Services Marketing	04	04	03	50	50	100			



### Semester III

Semester	Subject Types	Course Code	Title of the Paper	Hrs/Week	Credit	Exam. Hours	Maximum Marks			
Semester III	Core Compulsory	301	Business Finance/ Financial System	04	04	03	50	50	100	
		302	Research Methodology for Business	04	04	03	50	50	100	
	Core Elective/ Optional Subjects/ Special Subjects	<b>To choose any one Group of the following</b>								
		<b>Group A (Advanced Accounting &amp; Taxation)</b>								
		303	Advanced Auditing	04	04	03	50	50	100	
		304	Specialized Auditing	04	04	03	50	50	100	
		<b>Group B (Commercial Laws &amp; Practices)</b>								
		305	Laws Relating to International Business	04	04	03	50	50	100	
		306	WTO – Norms & Practices	04	04	03	50	50	100	
		<b>Group C (Advanced Cost Accounting &amp; Cost system)</b>								
		307	Cost Audit	04	04	03	50	50	100	
		308	Management Audit	04	04	03	50	50	100	
		<b>Group D (Co-operation &amp; Rural Development)</b>								
		309	Co-operative Credit System	04	04	03	50	50	100	
		310	Co-operative Banking System	04	04	03	50	50	100	
		<b>Group E (Business Practices &amp; Environment)</b>								
		311	Entrepreneurial Behaviour	04	04	03	50	50	100	
		312	Entrepreneurship	04	04	03	50	50	100	
		<b>Group F (Business Administration)</b>								
		313	Human Resource Management	04	04	03	50	50	100	
314	Organizational Behaviour	04	04	03	50	50	100			
<b>Group G (Advanced Banking &amp; Finance)</b>										
315	Foreign Exchange	04	04	03	50	50	100			
316	International Finance	04	04	03	50	50	100			
<b>Group H (Advanced Marketing)</b>										
317	International Marketing	04	04	03	50	50	100			
318	Marketing Research	04	04	03	50	50	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/ Portfolio Management	04	04	03	50	50	100	
		402	Industrial Economic Environment/ Operations Research	04	04	03	50	50	100	
			<i>To choose any one Group of the following</i>							
			<b>Group A (Advanced Accounting &amp; Taxation)</b>							
		403	Recent Advances in Accounting, Taxation, Taxation and Auditing	04	04	03	50	50	100	
		404	Project Work/ Case Studies	04	04	03	50	50	100	
			<b>Group B (Commercial Laws &amp; Practices)</b>							
		405	Recent Advances in Commercial Laws and Practices	04	04	03	50	50	100	
		406	Project Work/Case Studies	04	04	03	50	50	100	
			<b>Group C (Advanced Cost Accounting &amp; Cost system)</b>							
		407	Recent Advances in Cost Auditing and Cost System	04	04	03	50	50	100	
		408	Project Work/Case Studies	04	04	03	50	50	100	
			<b>Group D (Co-operation &amp; Rural Development)</b>							
		409	Recent Advances in Co-operative and Rural Development	04	04	03	50	50	100	
		410	Project Work/Case Studies	04	04	03	50	50	100	
			<b>Group E (Business Practices &amp; Environment)</b>							
		411	Recent Advances in Business Practices and Environment	04	04	03	50	50	100	
		412	Project Work/Case Studies	04	04	03	50	50	100	
			<b>Group F (Business Administration)</b>							
		413	Recent Advances in Business Administration	04	04	03	50	50	100	
	414	Project Work/Case Studies	04	04	03	50	50	100		
		<b>Group G (Advanced Banking &amp; Finance)</b>								
	415	Recent Advances in Banking and Finance	04	04	03	50	50	100		
	416	Project Work/Case Studies	04	04	03	50	50	100		
		<b>Group H (Advanced Marketing)</b>								
	417	Recent Advances in Marketing	04	04	03	50	50	100		
	418	Project Work/Case Studies	04	04	03	50	50	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 2013-14 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 50 marks and the University Examination (UE) of 50 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 50 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
Quiz / Home Assignment	10
<b>Total</b>	<b>50</b>

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.

A student cannot register for the third semester, if she/he fails to complete 50% credits of the total credits expected to be ordinarily completed within two semesters.

## 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.

<b>Division of marks</b>	<b>Marks</b>	
A. Synopsis with working bibliography (Internal Assessment) Viva Voce (Internal Assessment)	40 marks 10 marks	50 marks
B. A full project Report (Minimum 50-80 pages) (Internal & External Assessment) Viva Voce (Internal & External Assessment)	40 marks 10 marks	50 marks

As the Research Project is based on the self study done by the candidate and evaluated for 100 marks altogether, 04 credits will be awarded to a successful candidate in this subject. 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 passess in all the courses will be declared to have passed the M.Com. degree with the following honours.

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 three 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 have 16 credits.

## 12. 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 SGPA or CGPA to equivalent percentage is given by:

$$\text{Equivalent percentage marks} = \begin{cases} 10 \times \text{CGPA} & \text{if CGPA /SGPA is in [4.00, 6.00]} \\ 05 \times \text{CGPA} + 30 & \text{if CGPA /SGPA is in [6.00, 9.00]} \\ 25 \times \text{CGPA} - 150 & \text{if CGPA /SGPA is in [9.00, 10.00]} \end{cases}$$

Marks	Grade	Grade Point
100 to 75	O : Outstanding	06
74 to 65	A : Very Good	05
64 to 55	B : Good	04
54 to 50	C : Average	03
49 to 45	D : Satisfactory	02
44 to 40	E : Pass	01
39 to 0	F : Fail	00

(C) GPA	Grade
05.00 – 6.00	O
04.50 – 04.99	A
03.50 – 04.49	B
02.50 – 03.49	C
01.50 – 02.49	D
00.50 – 01.49	E
00.00 – 00.49	F

**13. 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:

<b>Particulars</b>	<b>Periods</b>
Teaching session per programme	48
Assignment/ Test	04
Role play/ Group Discussion	04
Case studies and presentation	04
<b>Total</b>	<b>60</b>

**14. Standard of Passing.**

A. 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.

**15. Award of Class.**

a. 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:-

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.

**16. Medium of Instruction :**

The use of Marathi is allowed for writing answers in the examination except for following courses:

- Management Accounting
- Financial Analysis & Control
- Business Statistics,
- Advanced Accounting and Taxation
- Advanced Cost Accounting and Cost Systems.

**17.** A student (Regular / External) will be admitted to Revised M. Com. Course with effect from June 2013. For the students who have completed the terms for the First Year as per Old Course will be admitted to the Second Year as per Old Course M. Com. The examination as per Old Course will be held simultaneously for three years from April / May 2014.

### 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)

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**M.Com. Part I Semester I**  
**Compulsory Paper**  
**Subject Name -: Management Accounting**  
**Course Code -: 101.**

**Objective -:** The objective of the course is to enable students to acquire sound Knowledge of concepts, methods and techniques of management accounting and to make the students develop competence with their usage in managerial decision making and control.

Unit No.	Topic	Lectures
1.	<b>BASIC CONCEPTS:</b> Management Accounting- Meaning and Definition, Characteristics, Objectives, scope and functions of Management Accounting Financial Accounting, Cost Accounting and Management Accounting Tools and Techniques of Management Accounting - Advantages and Limitations of Management Accounting - Installation of Management Accounting System-Management Accountant : functions and duties - Essential qualities.	<b>06</b>
2.	<b>FINANCIAL STATEMENT ANALYSIS:</b> Introduction - objectives of analysis of financial statement-tools of financial statement analysis - Multi - step income statement, Horizontal analysis, Common sized analysis, Trend analysis, Analytical Balance Sheet.	<b>04</b>
3.	<b>RATIO ANALYSIS:</b> Ratio Analysis-Meaning and rationale, advantages and limitations. Types of Ratios -: Liquidity Ratios, Solvency Ratios, Profitability Ratios, Efficiency Ratios, Integrated Ratios.	<b>08</b>
4.	<b>FUND FLOW AND CASH FLOW STATEMENT:</b> <b>A. Meaning of Fund flow statement</b> -Uses of fund flow statement, Funds Flow Statement and Income Statement. Preparation of Funds Flow Statement. <b>B. Meaning of Cash flow statement</b> - Preparation of Cash Flow Statement. Difference between Cash Flow Analysis and Funds Flow Analysis. Utility of Cash flow Analysis. Limitations of Cash Flow Analysis.	<b>12</b>
5.	<b>WORKING CAPITAL MANAGEMENT:</b> Concept and definition of working capital - Determination of Working capital - Assessment of Working Capital needs - Study of components of working capital, such as cash management, accounts receivable management and inventory management.	<b>12</b>
6.	<b>RESPONSIBILITY ACCOUNTING:</b> Meaning, objectives and structure of Responsibility Accounting as a divisional performance measurement. Types of Responsibility Centers: Cost/Expense Centers, Profit Centers, Investment Centers.	<b>06</b>
<b>Total</b>		



### Recommended Books

1. R. N. Anthony , G. A. Walsh: Management Accounting
2. M. Y. Khan. K. P. Jain: Management Accounting
3. I. M. Pandey: Management Accounting (Vikas)
4. J. Betty: Management Accounting
5. Sr. K. Paul: Management Accounting
6. Dr. Jawaharlal: Management Accounting
7. Dr. Kishor Jagtap: Management Accounting (Success Publication)
8. S. N. Maheshwari: Principles of Management Accounting
9. Ravi M. Kishore: Financial Management (Taxman, New Delhi)
10. Richard M. Lynch and Robert Williamson: Accounting for Management Planning & Control.
11. Ravi Kishor: Advanced Management Accounting (Taxman)

**M.Com. Part I Semester I**  
**Compulsory Paper**  
**Subject Name -: Strategic Management**  
**Course Code -: 102.**

Unit No.	Topic	Peroids
1.	<b>Nature and Scope of Strategic Management:</b> Characteristics, Dimensions – Approaches to Strategic Decision Making, Strategic Management Process – Components of Strategic Management Model, - Policy & Strategic Management, Strategic role of Board of Directors and Top Management, Strategic Implications of Social and Ethical Issues.	<b>06</b>
2.	<b>Strategy Formulation and Strategic Analysis:</b> Company’s Goals, Mission and Social Responsibility, Vision – Objectives Analysis of Board Environment – External Environment Factors Economic, Social, Political, Ecological, International, Industrial – Competitive Forces and Strategy, Industry Analysis (Michael Porter’s Model) Analysis of Strategic advantage, - Resource Audit, Value Chain Analysis, Core Competencies, SWOT Analysis, Analysis of Stakeholders Expectations.	<b>06</b>
3.	<b>Strategic Planning:</b> Conceptual Understanding of Strategic Plan, - Meaning, Stages (Steps), Alternatives, Advantages and Disadvantages of Strategic Planning, How to make it effective?.	<b>10</b>
4.	<b>Strategic Choices/Options:</b> Generating Strategic Alternatives, Strategic Options at Corporate (Company) Level – Stability, Growth and Defensive Strategies, External Growth Strategies – Mergers, Acquisition, Joint Ventures and Strategic Alliance, Evaluation of Strategic Alternatives, - Product Port Folio Models, Selection of Suitable Corporate Strategy.	<b>06</b>
5.	<b>Strategy Implementation:</b> Implementation Issues, Planning and Allocating Resources, – Financing Planning, Manpower Planning, Organizational Structures, - Factors affecting choice of structure, Degree of Flexibility and Autonomy.	<b>06</b>
6.	<b>Functional Strategy:</b> <ol style="list-style-type: none"> <li>i. Marketing Strategy – Nature, Significance, Formulating Marketing Strategy</li> <li>ii. Production Strategy – Need, Formulation of Production of Strategy for an organization.</li> <li>iii. Research and Development (R&amp;D) Strategy –Need, Formulating R and D Strategy</li> <li>iv. Human Resource (HR) Strategy – Acquisition of Human Resources, motivation and maintenance of HR</li> <li>v. Financial Strategy – Need, Financial Objectives, Making Strategic Financial Decisions</li> <li>vi. Logistics Strategy</li> </ol>	<b>08</b>
7.	<b>Strategic Review:</b> Evaluating the Strategic Performance – Criteria and Problems –Concepts of Corporate Restructuring, Business Process Reengineering, Benchmarking, TQM, Six Sigma	<b>08</b>
<b>Total</b>		

### Recommended Books

1. From Strategic Planning to Management -By Ansoff M.Igor, R. P. Declorch, R. I. Hayes (Willey 1976)
2. Cases in Strategic Management – By Buddhiraja S. B. and M. B. Athreeya (TMH Publishing Company, New Delhi, 1996)
3. Business Policy:Strategic Planning and Management, By Ghosh P. K.8<sup>th</sup> Edition Sultan Chand and Sons, New Delhi
4. Strategic Management -Formulation, Implementation and Control By John A PearceII, Richard B. Robinson Jr. 9th Edition (The Mc-Graw Hill Companies)
5. Management Policy and Strategic Management (Concepts, Skills and Practices) By R. M. Srivastava, Himalya Publishing House
6. Contemporary Strategy Analysis By Grant Robert M. 2<sup>nd</sup> Edition Blackwell Publisher (USA)
7. Strategic Management of Organizations and Stakeholders –Concepts and Cases By Harrison and St. John, South western College Publishing, Ohio, USA-1998
8. Strategic Management By Hunger, J. David and Thomas Wheeler, 6th Edition, Addison Wesley Longman Inc., USA
9. Strategic Management Concepts and Cases By J. Thomson, Athur and M. J. Strickland – III, McGraw Hill 2001
10. Strategic Management -By Miller A , McGraw Hill 1998
11. Strategic Management -By Hitt MA et.al, South Western, 2001
12. Essence of Strategic Management –By Bowman, Cliff, Prentice Hall N. J.

**M.Com. Part I Semester I**  
**Advanced Accounting and Taxation Special Paper I.**  
**Subject Title -: Advanced Accounting.**  
**Course Code -: 103**

**Objective -:**

- i. To lay a theoretical foundation of Accounting and Accounting Standards.
- ii. To gain ability to solve problems relating to Company Accounts, Valuations and special types of situations.

UNIT	TOPIC	No. of Lecturers in hours
<b>I</b>	<b>BASIC CONCEPTS:</b> 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.	<b>08</b>
<b>II</b>	<b>COSOLIDATED FINANCIAL STATEMENTS:</b> Consolidated Accounts of Holding and 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.	<b>10</b>
<b>III</b>	<b>LIQUIDATION OF COMPANY:</b> Preparation of Statement of affairs including deficiency /surplus account.	<b>04</b>
<b>IV</b>	<b>VALUATION OF SHARES AND GOODWILL:</b> A. <b>Valuation of Shares</b> - Need for valuation - Methods of valuation of shares- Net Assets method, Dividend yield method, Earning yield method, Return on Capital method, Price/Earning method and Fair value method & DCF Method (Discounted Cash Flow Method). B. <b>Valuation of Goodwill</b> - Need for valuation - Methods of valuing Goodwill - Number of Years purchase of average profits method, Capitalization method - Annuity method - Super profits method.	<b>10</b>
<b>V</b>	<b>LEASE ACCOUNTING:</b> Concept of Leasing: Important Steps in Leasing. Advantages and disadvantages of Leasing. Types of Leasing - Finance Lease - Operating Lease. Accounting treatment of Finance Lease and of Operating Lease. Sale and Leaseback.	<b>08</b>
<b>VI</b>	<b>BRANCH ACCOUNTS:</b> Branch Accounts: Independent Branches- Accounting at Head Office- Accounting at Branch- Some Special Transactions. Foreign Branches- Rules of converting Trial Balance of the foreign Branch in Head Office Currency	<b>08</b>
	<b>TOTAL-</b>	<b>48</b>

**Notes :**

1. Theory questions will carry 20% marks.
2. Practical problems will carry 80% marks.
3. Accounting standards relevant to the topics to be studied.

**List of Books Recommended for Study**

1. Shukla and Grewal: Advanced Accounts. (S. Chand & Co Ltd. New Delhi)
2. Jain and Narang: Advanced Accounts.(Kalyani Publishers, Ludhiana)
3. Sr. K. Paul: Accountancy, Volume-I and II.(New Central Book Agency, Kolkata)
4. R. K. Lele and Jawaharlal: Accounting Theory (Himalaya Publishers)
5. Dr. L. S. Porwal: Accounting Theory (Tata McGraw Hill).
6. Robert Anthony, D.F.Hawkins & K.A. Merchant: Accounting Text & Cases (Tata McGraw Hill).
7. Dr.S.N. Maheshwari: Corporate Accounting (Viakas Publishing House Pvt. Ltd. New Delhi)
8. Dr.Ashok Sehgal & Dr.Deepak Sehgal: Advanced Accounting (Taxmann, New Delhi).

**List of Learning Activities and Allocation of Periods**

<b>Sr. No.</b>	<b>Activities</b>	<b>Learning Hours</b>
1	Quizzes	4
2	Assignments	4
3	Class room tests	4
<b>Total</b>		<b>12 hours</b>

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**M.Com. Part I Semester I**  
**Advanced Accounting and Taxation Special Paper II.**  
**Subject Title :- Income Tax.**  
**Course Code :- 104**

**Objective :-**

- 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 'Firm' assesses.

**INCOME TAX ACT, 1961**

UNIT	TOPIC	No. of Lecturers in hours
<b>I</b>	<b>CONCEPTS AND DEFINITION</b> History of Income Tax in India - Introduction to DTC - 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	<b>06</b>
<b>II</b>	<b>HEADS OF INCOME: SALARIES &amp; HOUSE PROPERTY:</b> <b>A. Salaries:</b> Chargeability -Allowances and Taxability - Perquisites - Valuation of perquisites - Provident Funds - Deduction from salaries (Theory & Advanced problems). <b>B. Income from House Property:</b> Annual Value-Self occupied property and let out property -deemed to be let out property - Permissible deductions. (Theory & Advanced problems).	<b>08</b>
<b>III</b>	<b>HEADS OF INCOME : BUSINESS &amp; PROFESSION:</b> <b>Profits &amp; Gains of Business or Profession:</b> Meaning of Business Profession and Vocation-deductions expressly allowed Depreciation -Specific disallowances - Method of accounting - Maintenance of Books of Account - Audit of Accounts [Theory & Advanced Problems]	<b>10</b>
<b>IV</b>	<b>HEADS OF INCOME : CAPITAL GAINS &amp; OTHER SOURCES:</b> <b>A. Capital Gains:</b> Meaning, Types and Exemptions <b>B. Income from Other Sources:</b> Chargeability - Deductions - Amounts not deductible.(Theory & Advanced Problems)	<b>08</b>
<b>V</b>	<b>COMPUTATION OF TAXABLE INCOME:</b> Clubbing of income - Set off and carry forward of losses - Deductions from Gross Total Income - Computation of Taxable Income of an Individuals and Hindu Undivided Families. (Theory & Advanced Problems)	<b>10</b>
<b>VI</b>	<b>ASSESSMENT OF FIRMS AND THEIR PARTNERS :</b> (Theory & Advanced Problems)	<b>06</b>
	TOTAL-	<b>48</b>

**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.

<b>List of Books Recommended for Study</b>	
1.	Dr. Vinod Singhania: Direct Taxes, Law and Practice, Taxman Publication, New Delhi
2.	Dr. Bhagawati Prasad: Direct Taxes
3.	Girish Ahuja and Ravi Gupta: Direct Taxes, Bharat Law House, New Delhi.
4.	T. N. Manoharan: Hand Book of Income Tax Laws
5.	B.B.Lal & N.Vashisht: Direct Taxes (Pearson)

**List of Learning Activities and Allocation of Periods**

<b>Sr. No.</b>	<b>Activities</b>	<b>Learning Hours</b>
1	Quizzes	4
2	Assignments	4
3	Class room tests	4
<b>Total</b>		<b>12 hours</b>

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**M.Com. Part I Semester I**  
**Commercial Laws and Practices Special Paper I.**  
**Subject Title -: Information Systems and E-Commerce Practices**  
**Course Code -: 105**

**Objective -:**

1. To get acquainted with the concepts and application of Information Systems used in Modern Businesses.
2. To impart knowledge about E-Commerce and familiarize students with E-commerce Modern Applications.

Unit No.	Name of the Unit / Topic	Periods
1.	<p><b>Introduction to Information Systems</b>  System Concepts, 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</p>	10
2.	<p><b>Introduction to E-Commerce</b>  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.</p>	10
3.	<p>Inter organizational Information Systems and 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.</p>	18
4.	<p><b>E-Commerce Supporting functions</b>  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.</p>	10
	<b>Total</b>	<b>48</b>

**[Note: Recent amendments in the Acts and relevant Landmark cases decided by courts are expected to be studied]**



### **Books Recommended**

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. System Analysis, Design and Introduction to Software Engineering – S.Parthasarathy, B.W.Khalkar
5. Text book on Intellectual property rights – N.K. Acharya, Asia Law House
6. Guide to Cyber Laws – B y Rohnay D. Ryder[Wadhwa, Nagpur]
7. Cyber Laws – Justice Yatindra Singh, Universal Law Publishing Co.

**M.Com. Part I Semester I**  
**Commercial Laws and Practices Special Paper II.**  
**Subject Title :- Intellectual Property Laws: Patents, Trade Marks & Biodiversity**  
**Course Code :- 106**

**Objective :-**

1. To make the students familiar with the concept of patents, trademarks, biodiversity;
2. To get the students acquainted with the regulatory regime concerning patents, trademarks, biodiversity ;
3. To make the students realize the commercial significance of patents, trademarks, biodiversity as Intellectual Property and understand the scheme of its protection.

Unit No.	Title & Contents of the Topic	No. of Periods
1	<b>Intellectual Property</b> – Origin, concept, Commercial/cultural dimensions, types/forms (Intellectual Property Rights, IPR) International regulatory regime for IPR (references to International legal Instruments viz. WTO,WIPO, GATT, TRIPS Paris Convention, PCT, Budapest Treaty...)	6
2	<b>Patents</b> —Definition, concept , types of patents, 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.	8
	Working of Patents , Compulsory licenses and revocation, use of patents for government purposes and acquisition of patents, Infringement of patents, ( acts of Infringement & defenses) reliefs for Infringement ( suits), appeals, Offenses & penalties [Chapters 16 to 20 of Patents Act,1970 as amended]	8
	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	4
3	<b>Trade Marks--</b> Definition, concept , types of Trade Marks, Registration of Trade Marks [ Procedure, duration , effect ] Appellate Board [ Establishment, composition, qualifications , procedure and powers, disposal of appeals]	8
	Assignments and Transmission of Trade Marks, Provisions relating to collective & certification Trade Marks, textile goods, Infringement of Trade Marks and remedies, Offenses ( acts of violations, defenses) & Penalties	6
4	<b>Biodiversity Act, 2002</b> —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]	8

**[Note: Recent amendments in the Acts and relevant Landmark cases decided by courts are expected to be studied]**

**Books Recommended**

1. Intellectual Property Law – P. Narayan, Eastern Law House.
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 – 7.
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 (2007)
9. Intellectual Property Laws—Bextly & Sherman, Asia Law House

**M.Com. Part I Semester I**  
**Advanced Cost Accounting and Cost System Special Paper I.**  
**Subject Title :- Advanced Cost Accounting.**  
**Course Code :- 107**

**Objectives:**

1. To acquaint the students with the significance of Cost Accounting in Global Competitive environment.
2. To enable students to learn application of different methods of costing in Manufacturing and Service Industry.

Unit No	Name of the Topic	Periods
1	<b>Nature and Scope of Cost Accounting:</b> <ol style="list-style-type: none"> <li>a. Introduction, Meaning, Definition and Objectives of Cost Accounting, Cost Centre and Cost unit.</li> <li>b. Elements of Cost: Material, Labour and Overheads. Material: Concept, Procurement of Material, concept of Landed cost of material and major currencies (Dollar, Euro, and Pound).</li> <li>c. Storage and Inventory Control Techniques Perpetual Inventory system, ABC Analysis, Inventory Turnover ratios, Just In Time, Economic Ordering Quantity.</li> </ol>	12
2	<b>Labour:</b> <ol style="list-style-type: none"> <li>a. Meaning, Definition and significance of Labour.</li> <li>b. Classification of Labour, Principles and Methods of Remuneration, Performance linked Incentives.</li> <li>c. Accounting of Labour cost, Job Evaluation and Merit Rating.</li> </ol>	12
3	<b>Overheads:</b> <ol style="list-style-type: none"> <li>a. Meaning, Classification, Allocation, Apportionment and Absorption of Overheads.</li> <li>b. Accounting of Overheads:</li> </ol>	12
4	<b>Methods of Costing:</b> <ol style="list-style-type: none"> <li>a. Job costing, Batch Costing and Contract Costing.</li> <li>b. Process costing</li> <li>c. Operating costing (Hospitals, Educational Institutes, Hotels and logistics and Warehouse.)</li> </ol>	12

**Note:**

The breakup of marks in the Examination will be as follows:

- a. 50 % of marks for Theory & 50 % of marks for Practical.
- b. Area of practical problems:
  - Inventory turnover ratio, EOQ.
  - Methods of Remuneration, Time rate, Piece rate, group bonus scheme, Performance linked incentives.
  - Primary and Secondary Distribution of Overheads (Repeated distribution method only).
  - Contract Costing, Process costing and Operating Costing.
- c. Study of Cost Accounting standards: CAS 3 (Revised), CAS 6 and CAS 7.

**References:**

1. Ravi Kishor: Advanced cost Accounting and cost systems, Taxman Allied services Pvt Ltd, New Delhi.
2. N.K. Prasad: Principles and Practice of Cost Accounting, Syndicate Pvt Ltd, Calcutta.
3. Prof. Subhas: Practice in Advanced costing and Management, Nirali Prakashan, Pune.
4. Ravi Kishor: Students guide to Cost Accounting, Taxman's allied services, New Delhi.
5. M. N Arora: Cost Accounting Principles and Practices, Vikas Publishing House, New Delhi.
6. S. N Maheshwari, Cost Accounting Theory and Problems, Mittal shree Mahvir Book Dept, New Delhi.
7. Website: [www.myicwai.com](http://www.myicwai.com).
8. Advanced Cost Accounting and Cost Systems -: Ravi Kishor, P.V. Ratlam, M.L.Basu

**List of Learning Activities and Allocation of Periods**

<b>Sr. No.</b>	<b>Activities</b>	<b>Learning Hours</b>
1	Industrial Visits	4
2	Assignments	4
3	Class room tests	4
<b>Total</b>		<b>12 hours</b>

**M.Com. Part I Semester I**  
**Advanced Cost Accounting and Cost System Special Paper II.**  
**Subject Title -: Costing Techniques and Responsibility Accounting.**  
**Course Code -: 108**

**Objectives:**

- 1) To equip the students for designing and implementing cost control, cost reduction programme and different cost system.
- 2) Relevant Cost Accounting Standard are to be studied
- 3) Level of knowledge –Advanced Techniques of Costing

UNIT NO.	NAME OF THE TOPIC	PERIODS
1	<b>Budgeting &amp; Budgetary Control</b> Types of Budget, All Functional Budget & Master Budget, Key and limiting factor, fixed and flexible, cash budget, Zero base Budget [ZBB]	12
2	<b>Standard Costing –</b> Concept of Standard costs, Setting up of Standards: Variance analysis-Material Labour, Overhead, Sales and profit.	12
3	<b>Uniform Costing &amp; Inter Firm Comparison</b> Reasons for differences in Cost and Costing Practices. The application of Uniform Costing, Advantages and limitations of Uniform Costing. Inter firm comparison Meaning, Advantages and Disadvantages	12
4	<b>Responsibility Accounting and Reporting</b> Definition, Meaning, Principles, controllable and Non-controllable costs. Centers of control, cost Centers, Revenue Center, Responsibility Center, Profit Center and Performance Measurement of Business Center. Reporting to different levels of Management.	12
	<b>Total</b>	<b>48</b>

**Note: - 50% Marks for Theory and 50% Marks for Practical Problems.**

**Areas of Practical Problems (Advanced)**

- 1) Budgetary Control
- 2) Standard Costing
- 3) Performance Measurement of Business Center
- 4) Simple Problem of Responsibility Accounting

**References:**

1. Ravi Kishor: Advanced cost Accounting and cost systems, Taxman Allied services Pvt Ltd, New Delhi.
2. N.K. Prasad: Principles and Practice of Cost Accounting, Syndicate Pvt Ltd, Calcutta.
3. Prof. Subhas: Practice in Advanced costing and Management, Nirali Prakashan, Pune.
4. Ravi Kishor: Students guide to Cost Accounting, Taxman's allied services, New Delhi.
5. M. N Arora: Cost Accounting Principles and Practices, Vikas Publishing House, New Delhi.
6. S. N Maheshwari, Cost Accounting Theory and Problems, Mittal shree Mahvir Book Dept, New Delhi.
7. Website: [www.myicwai.com](http://www.myicwai.com).
8. Advanced Cost Accounting and Cost Systems -: Ravi Kishor, P.V. Ratlam, M.L.Basu

**List of Learning Activities and Allocation of Periods**

Sr. No.	Activities	Learning Hours
1	Industrial Visits	04
2	Assignments	04
3	Class room tests	04
	<b>Total</b>	<b>12 hours</b>

**M.Com. Part I Semester I**  
**Co-operation and Rural Development Special Paper I.**  
**Subject Title -: Co-operative Movement In India**  
**Course Code -: 109**

**Objectives:**

1. To acquaint the students with the Co-operative Movement.
2. To develop the capability of students for knowing different types of Co-operatives.
3. To aware the role of State and Central Govt. in development of co-operative sector.
4. To give basic knowledge about formation of Co-operative society and its administration.

Unit No.	Name of the Topic	Periods
1	<b>Co-operative Movement in India:</b> Evolution of Co-operative Movement in India- Pre and Post Independence Period – Role of Co-operatives in Globalised Economy.	12
2	<b>Co-operative Legislation in India:</b> 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 d. Management. e. Audit Enquiry Inspection & Supervision. f. Settlement of Disputes. g. Liquidation h. Appeal Revision & Reviews.	12
3	<b>Organizational setup of Co-operatives Departments</b> (a) State Level (b) Divisional Level (c) District Level (d) Rights, Duties and Responsibilities of Registrar of Co-operative Societies	12
4	<b>Reports of Various Committees and Institutional Support to Co-operatives:</b> (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.	12
<b>TOTAL</b>		<b>48</b>

**List of Books Recommended for Study**

1. G.S. Kamat: New Dimensions of Co-operative Management
2. G.S. Kamat: Cases in Co-operative Management
3. K.K.Taimani: Co-operative Organisation and Management
4. I L O: Co-operative Management and Administration
5. B.C. Mehta: Consumer Co-operation in India  
Prof L.P. Wakale and Dr. G.H.Barhate: Sahakari Vikas- Sheth Publishing Mumbai

**M.Com. Part I Semester I**  
**Co-operation and Rural Development Special Paper II.**  
**Subject Title :- Organization of Co-operative Business**  
**Course Code :- 110**

**Objectives:**

1. To acquaint the students with the Co-operative movement.
2. To develop the capability of students for knowing different types of Co-operatives.
3. To aware the role of state and central Govt. in development of co-operative sector.

Unit No.	Name of the Topic	Periods
1	<b>Introduction:</b> Principles of Co-operation and Management and their Integration in Cooperatives, Professionalization of Cooperative Management.	12
2	<b>Organization of Co-operatives:</b> Organization Structure of Co-operatives-Organization Chart for Large Scale Co-operative business, Banking Units – Communication and Leadership in Cooperative Organization – Federal Structure of Co-operative Organization – Control over Co-operative Audit and Taxation.	12
3	<b>Co-operatives Education and Training :</b> Importance, Need, Role of Institutions in the Co-operative Training Vaikuntbhai Mehata National Co-operative Institute , Importance of Job Oriented Co-operative Training – National Co-operative Union of India, National Education Centre for Co-operative – National Council for Co-operative Training – State Co-operative Union – District Co-operative Union	12
4	<b>Special Study of Co-operatives in Maharashtra:</b> a) Co-operative Sugar Factory- Growth role of Co-op. Sugar Factory in Rural Development- b) Dairy Co-operatives progress and problems. c) Housing Co-operatives. d) Agricultural and Non-agricultural Credit Co-op. Societies.	12
<b>TOTAL</b>		<b>48</b>

**List of Books Recommended for Study**

1. G.S. Kamat: New Dimensions of Co-operative Management
2. G.S. Kamat: Cases in Co-operative Management
3. K.K.Taimani: Co-operative Organisation and Management
4. I L O: Co-operative Management and Administration
5. B.C. Mehta: Consumer Co-operation in India
6. Prof L.P. Wakale and Dr. G.H.Barhate: Sahakari Vikas- Sheth Publishing Mumbai



**M.Com. Part I Semester I**  
**Business Practices and Environment Special Paper I.**  
**Subject Title -: Organized Trades and Markets**  
**Course Code -: 111**

Unit No.	Name of the Topic	Periods
1	Organized Trade & Markets - Introduction , Meaning and importance - Features of Organized Commodity Markets and Regulated Markets Concept & Objectives of Business - Nature and scope of Business in the modern context – Study of various policies with illustrations - Product buying, selling price and Credit policies.	12
2	Service Sector: - Meaning, Characteristics, types of services, Role, importance and development of Service Sector in India - Business Practices with reference to E-Commerce.	12
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 - Arguments for and against State Trading - Role of State Trading Corporation (STC) - State and privatization of trading Activities. Mall administration & organization – Super Markets.	12
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, Reliance Mart, Innovative Marketing practices.	12

**Recommended Books:-**

1. Principles of Business, Acharya, Govekar, A.R.Sheth & Co. Organization
2. Principles and Practice of Mamoria Joshi Kitab Mahal Marketing
3. Regulated Markets W.R.Natu
4. Marketing CO-operative, G.S.Kamat, Way Maharashtra State Co-op Union
5. Future Trading and Control Ram Desai
6. Bombay Money Market, H. parekh
7. Commodity Marketing and, P.L.Gadgil, Shubhada Saraswat Distributed Trade
8. Business Environment Text & Cases by Francis Cherybilam
9. Financial Derivatives & Risk Management by O. P. Agarwal.

**M.Com. Part I Semester I**  
**Business Practices and Environment Special Paper I.**  
**Subject Title -: Business Environment and Policy.**  
**Course Code -: 112**

Unit No.	Name of the Topic	Periods
1	Business Environment - Meaning, Nature , Importance and scope of Environment – Types of Environment, various aspects of Environment - Business Environment with reference to India.	12
2	Problems of growth of Business Economy – Unemployment, Poverty, regional imbalance. Social injustice, Inflation, Parallel economy, Lack of technical knowledge and information. Opportunities in Environment.	12
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	12
4	Globalization & its impact, Meaning, objectives, importance & scope of Globalization Effect & challenges of Globalization Review of two decades of Globalization	12

**Recommended Books**

Global Economy and Business Environment Francis Cheranilan Himalaya publishing house Text & Cases ( Edn 2001)  
 Business Environment Chhlaaghan, Elliaon Edward Arnold  
 Economic Environment of Business SYBA k Misha, Puri Himalaya publishing house  
 Indian Business through ages FICCI Oxford University Press  
 Business Environment Text & Cases by Francis Cherubilam Environmental Pollution & Health by V. K. Ahluwalia.

**M.Com. Part I Semester I**  
**Business Administration Special Paper I.**  
**Subject Title -: Production and Operations Management**  
**Course Code -: 113**

	<b>No. of Lectures</b>	<b>Credit 04</b>
<p><b>1. Introduction to Production &amp; Operations Management</b>  Meaning &amp; Functions, Types of Production Systems Mass Production/Flow line, Continuous, Intermittent, Batch production, Job Lots etc, Service Systems, - Recent trends in production and service system Plant layout – Objectives, basic principles, types, Safety considerations and environmental aspects.</p>	12	01
<p><b>2. Product Design and Development</b>  Product Design – Meaning – Responsibility, factors, determining the design characteristics of good design, Production Department Stages of Product Design, Factor responsible for product development, tools of product development, product planning, standardization, simplification and diversification. Techniques of Product Development.</p>	12	01
<p><b>3. Production Planning &amp; Control</b>  Production Planning and Control – Meaning, objectives, important procedures, Production Planning, Routing, Scheduling, ERP integrated system Dispatch, follow up, production control -meaning, objectives – factors – factors affecting production control, problems and cases</p>	12	01
<p><b>4. Quality Management and Productivity</b>  Meaning, measurement, techniques, factors affecting productivity measures to boost productivity – ISO 9000 to ISO -4000 – role of NPC Effects of liberalization &amp; globalization on operations management Problems of rationalization, automation, and computerization. Preventive Maintenance, Inspection and Quality Control, Kizen five s'-GMP (Good Manufacturing Practices) Quality Circles, TQM</p>	12	01
	<hr/>	<hr/>
	<b>48</b>	<b>04</b>
<p><b>List of Books Recommended: -</b></p> <ol style="list-style-type: none"> <li>1. Production and operation Management – By B. S. Goel (Pragati Prakashan)</li> <li>2. Production and Operations Management – By S. N. Chary (Tata Mcgraw Hill)</li> <li>3. Modern Production and Operation Management –By Elword Buffa</li> <li>4. Production Planning and Inventory Control –By Magee Budman (Tata Mc Graw Hill)</li> <li>5. ISO 9000 – A manual for TQM – By Suresh D. Saurabh (S. Chand Publication)</li> <li>6. Essentials of Business Administration By K. A. Shantappa</li> <li>7. A Key of Production Management – By Kalyani Publication, Lundhiyana</li> </ol>		

**M.Com. Part I Semester I**  
**Business Administration Special Paper II.**  
**Subject Title :- Financial management**  
**Course Code :- 114**

	No of Lectures	Credit 04
<p><b>1. Introduction</b>  Meaning &amp; definition of Financial Management, Role of Finance Manager, Goals of Financial Management, Financial systems (in India) – Financial Assets, Financial Markets, Financial Intermediaries, Regulatory infrastructure (RBI, SEBI), Trends in Indian Financial System</p>	12	01
<p><b>2. Investment Decisions</b>  Capital Expenditure Decisions, Capital budgeting-purpose, process, types of capital investment decisions, capital budgeting techniques, capital rationing, Investment Decision Methods – Average Rate of Return (ARR), Pay Back, Internal Rate of Return (IRR), Present Value Approach</p>	12	01
<p><b>3. Financial Statements and Financial Analysis</b>  Financial Statements – Concept, their anatomy, Balance Sheet and its utility, Income Statement and its utility, limitation of financial statements. Financial Analysis –Types of analysis, utility, Techniques of Financial Analysis _ Ratio Analysis &amp; Fund Flow Analysis</p>	12	01
<p><b>4. Management of Working Capital</b>  Nature of working capital, understanding working capital management- its significance –circular flow concept, Factors affecting working capital requirements Financing of working capital. Inventory management &amp; Receivable management.</p>	12	01
	48	04
<p><b>List of Books recommended for Studies:-</b></p> <ol style="list-style-type: none"> <li>1. Dr. Prassanna Chandra – Financial Management Theory &amp; Practice published by McGraw Hill 6th Edition</li> <li>2. Financial Management and Policy – By Dr. R. M. Shrivastava, Himalaya Publishing House</li> <li>3. Indian Financial System – Bharati Pathak Dorling Kindersley (India) Pvt. Ltd.</li> <li>4. Business Finance – S. C. Kuchal</li> <li>5. Financial Management – I. M Pandey</li> <li>6. Financial Management – Study material by Alpha group ICFAI Hyderabad</li> <li>7. Financial Management – Dr. P. V. Kulkarni</li> <li>8. Fundamentals of Financial Management By Horne, Wachowicz Jr. Bhaduri Published by Pearson Education 12th Edition</li> </ol>		

**M.Com. Part I Semester I**  
**Advanced Banking & Finance Special 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.

**1. Banking Regulation Act, 1949**

**12**

Provisions relating to: Definition (Sec -5) Business of banking companies (Sec-6) Restrictions on business of banking companies (Sec -8, 19 and 20) Powers of the RBI (Sec -21, 35 and 36 to 36 AD) Winding up of a banking company (Part III and III-A of the Act) Applicability of the Act to Co-operative banks (Sec- 56), Amendments of BRA 1949 up to Dec. 2012

**2. The Negotiable Instrument Act, 1881**

**12**

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), Dishonor of Negotiable Instruments (Sec -91-92), Noting and Protest (Sec -99-104-A), Penalties in case of dishonor of certain cheques for insufficiency of funds in the account (sections 138 to 147), As Amendments of Negotiable Instrument Act up to 2002

**3. A. The Reserve Bank of India Act, 1934**

**12**

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), Changing role of the RBI.

**B. The Foreign exchange Management Act, 1999**

Provisions relating to: Preliminary (Sec 1-2), Regulation and management of foreign exchange (Sec 3 to 9) Authorized person (Section 10 to 12) Contravention and penalties (Section 13 to 15) Adjudication and appeal (Sections 16 to 21 and sections 34-35) Directorate of enforcement (section 36 to 38).

**4. Securitisation and Reconstruction of Financial Assets and Enforcement of Security Interest Act, 2002**

**12**

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

**TOTAL 48**

**List of Books Recommended for Study**

1. Tanna's: Banking – Law & Practice.
2. Banking: Law & Practice – P.N. Varshaney.
3. Management of Banking & Financial Services – Justine Paul and Pamalata Suresh.
4. Legal and Regulatory Aspects of Banking– Published by Indian Institute of Banking & Finance.
5. All relevant & recent Bare Acts.

**M.Com. Part I Semester I**  
**Advanced Banking & Finance Special Paper II.**  
**Subject Title -: Central Banking**  
**Course Code -: 116**

**Objectives:**

1. To study the functions of central bank
2. To understand monetary policy and its instruments

- 1. Evolution of central banking** **08**  
Origin and evolution of central banking.  
Need and Rationale of central bank.  
Evolution of Reserve Bank of India (R.B.I.)
- 2. Functions of Reserve Bank of India** **12**  
**A. The Reserve Bank as currency authority:**  
□ Issue of currency notes, Asset banking for note- issue, Distribution of currency, Currency chests, Recent developments in currency management.  
**B. The Reserve Bank as banker to Government:**  
Maintenance of Government accounts, Banker to the Central Government and the State Governments, Management of public debt  
**C. RBI as a Banker Bank:** Controller of Credit, Lender of Last Resort  
**D. RBI as a Custodian/Manager of Foreign Reserves**  
**E. Promotional Functions of RBI**
- 3. Regulation and supervision of Reserve Bank over Commercial banks.** **10**  
Regulation and supervision over commercial banks:  
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
- 4. Para banking activities** **10**  
Control over management, Annual accounts and audit, □ Subsidiaries of commercial banks,  
□ Credit Information Bureau of India Ltd. (CIBIL) Bank Assurance, □ Inspection of banks: Board for Financial Supervision (BFS) and system of inspection.
- 5. Non-banking financial companies (NBFCs)** **08**  
Regulatory framework for NBFCs:  
Measures for supervision over NBFCs.

**List of Books Recommended for Study**

- 1) Monetary & Financial Sector Reforms in India – Y. Venugopal Reddy.
- 2) Govt. of India- Economic Survey
- 3) R.B.I.: Functions and Working – R.B.I. Publication.
- 4) R.B.I. Bulletins.
- 5) R.B.I. Annual Reports.
- 6) Trends & Progress of Banking in India- R.B.I. Annual

**M.Com. Part I Semester I**  
**Advanced Marketing Special Paper I.**  
**Subject Title -: Marketing Techniques**  
**Course Code -: 117**

**Objectives :**

To study and critically analyze the basic concepts & techniques of Marketing.

Unit No.	Name of the Topic	Periods
<b>1</b>	<b>Marketing an Introduction:</b> Meaning definition Elements. Objectives Importance Advantages and limitations Evolution and Scope Approaches to the study of Marketing/ Marketing Concepts- Production, Product, Selling, Marketing and Holistic Marketing Concept	<b>08</b>
<b>2</b>	<b>Marketing Organisation and Environment</b> Meaning Definition need and importance of a Marketing Organisation, Different types of Marketing Organisations Marketing Environment: Meaning and Definition, Internal and external environmental factors impacting the marketing environment	<b>08</b>
<b>3</b>	<b>- Product Mix—</b> Meaning and Definition of Marketing 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 of brand/branding Brand Creation, Rebranding, Brand Positioning, Brand Equity Brand Contract, Brand Factory Labelling	<b>08</b>
<b>4.</b>	<b>Price and Place Mix</b> Price—definition and elements of price mix. Need, importance and objectives of pricing. Factors influencing pricing. Pricing Strategies. Place – Types of Distribution Channels and factors affecting selection of channel.	<b>08</b>
<b>5</b>	<b>Promotion Mix/ Marketing Communication</b> Elements of Promotion Mix—Advertising- Advertising – Setting the advertising objectives – Role of advertising, advertising media – advertising bud get – evaluating advertising effectiveness – profile of advertising agencies in India. Recent trends in modern advertising – Evaluating marketing communication programs Personal Selling – concept and importance, process of personal selling. Understanding and dealing with different types of customers. Sales Promotion: Meaning, Objectives and importance . Tools or techniques of sales promotion. Public Relations—Concept, history and tools of public relations. P.R agencies in Inda. Public Relations Society of India E- Marketing Promotion – E mails, different types of Web advertising, blogspots Online Sponsorships.	<b>08</b>

<b>6</b>	<b>People Process and Physical Evidence --</b> People as a part of Marketing Mix, customer interaction, customer service Process as part of the Marketing Mix, Physical evidence/ Packaging	<b>08</b>
<b>Total</b>		<b>48</b>

<b>Books Recommended</b>
<ol style="list-style-type: none"> <li>1. Philips Kotlers – Marketing Management</li> <li>2. Marketing Management Cravens – Hills – Woodruff</li> <li>3. Marketing – A Managerial Introduction – Gandhi</li> <li>4. Marketing Information System – Davis – Olsan</li> <li>5. Consumer Behavior – Schiffman – Kanuk</li> <li>6. Principles and Practice of Marketing – John Frair</li> </ol>



**M.Com. Part I Semester I**  
**Advanced Marketing Special Paper II.**  
**Subject Title -: Consumer Behavior.**  
**Course Code -: 118**

**Objective :**

To impart knowledge regarding marketing management techniques and process; to develop understanding of the marketing functions techniques and strategies

<b>Unit No.</b>	<b>Name of the Topic</b>	<b>Periods</b>
1	<b>Introduction to Consumer Behaviour and Market Segmentation:</b> Meaning and Definition. Nature Scope and Application of Consumer Behaviour . Difference between consumer and customer. Market Segmentation: Meaning and definition, Market Criteria for effective Segmentation, Process/ Stages of Market Segmentation , Bases of Segmentation,	<b>08</b>
2	<b>Consumer Perception: Definition of Perception, Elements of Perception,</b> Perception Process, Importance of Perception Perception & Brand. Consumer Perception of Risks.	<b>08</b>
3	<b>Consumer Learning and Memory</b> Meaning Definition and elements of Learning Types of Learned Behaviour Behavioural Theory of Learning General Characteristics of Learning Memory Defined Advertising/Marketing Application	<b>08</b>
4	<b>Personality and Self Concept</b> Personality Defined Theories of Personality Measurement of Personality Self- Concept Defined How Self Concept Develop Brand Personality and Marketing Application	<b>08</b>
5	<b>Motivation and Involvement</b> Concept of Motivation and Motives Theory of Motivation Classifications of Motives Role of Motives Motives Arousal Definition of Involvement Dimensions of Involvement Types of Involvement and Marketing Implications	<b>08</b>
6	<b>Attitude Formation and Change</b> Definition of Attitude Attitude Function Characteristics of Attitude	<b>08</b>

	Sources of Attitude Development Structure Models of Attitudes Strategies for Changing Attitudes and Intentions	
<b>TOTAL</b>		<b>48</b>

**Books Recommended**

1. Consumer Behavior – Hawkins, Best, Coney – TMH, 9/e, 2004
2. Consumer Behaviour – Concepts Applications & Cases – M S Raju & Dominique Xardel
3. Consumer Behavior – Leon Schiffman, Leslie Lazar Kanuk – Pearson / PHI, 8/e
4. Consumer Behavior In Indian Perspective – Suja Nair – Himalaya Publishers
5. Customer Behavior – A Managerial Perspective – Sheth, Mittal – Thomson,
6. Cross cultural marketing – Robert Rugimbana and Sonny Nwankwo
7. Customer Relationship Management – Peeru Ahamed & Sagadevan – Vikas Publishing
8. Consumer Behaviour- Walker
9. Consumer behaviour- Louden, Delebeta
10. Consumer Behavior - J.Paul Peter
11. Consumer Behaviour – Concepts Applications & Cases – M S Raju & Dominique Xardel.

# UNIVERSITY OF PUNE

## Master of Commerce (M.Com.) Semester Pattern with Credit System Revised with effect from June 2013

### **Preamble for Choice Based Credit System**

Since liberalization the socio-political-economic scenario is changing very fast. There is a significant transformation in term educational expectation and aspiration of the learner. The educational system also is witnessing many changes and challenges due to technological growth and changes in the Government policies. Education is no longer a concern of students but it has become a matter of social and economic importance. The changes at the global level has influence the educational system, structure and expectation of the users.

University education needs to take contingency of all these changes and restructure itself to stand in a competitive dynamic environment. Professional stream of learning like Commerce have to be properly upgraded to accommodate challenges of change, expectation of employers' and to offer global opportunities to the learners. From this point of view the course structure of post-graduate programme in Commerce needs to be structured. It has to be according to expectations of the learners, employers and the society. The learning inputs have to be more update, skilled based and with appropriate applications. The course programme should consider desire aptitude, attitude and acumen of the learner.

From this point of view University of Pune has introduced Choice Base Credit System of course structure. This system shall offer a flexible user friendly, opportunity to the learner, will broader the horizon of Commerce education and will give a fair chance to every single learner to exhibit his talent, acquired skills and enhance his personality. It will further enhance his opportunity of global mobility, to acquire different knowledge inputs from different global institutes.

#### **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 for seeking suitable careers in management and entrepreneurship.
- d. To study by students methods of Data collection and their interpretations.
- e. To develop among students Communication, Study and Analytical skills.

## 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. The 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
	<b>Grand Total</b>	<b>64</b>

Four credits for project work at 4<sup>th</sup> 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 50 marks will be for Internal Assessment (attendance, home assignments, class tests, long term papers, classroom presentation and 50 marks for University Examination. Thus M.Com. degree examination, four Semesters shall be of 1600 marks and of minimum 64 credits altogether. The following shall be the course structure.

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			
Semester I	Core Compulsory	101	Management Accounting	04	04	03	50	50	100	
		102	Strategic Management	04	04	03	50	50	100	
	Core Elective/ Optional Subjects/ Special Subjects	<i>To choose any one Group of the following</i>								
		<b>Group A (Advanced Accounting &amp; Taxation)</b>								
		103	Advanced Accounting	04	04	03	50	50	100	
		104	Income Tax	04	04	03	50	50	100	
		<b>Group B (Commercial Laws &amp; Practices)</b>								
		105	Information system and E-Commerce Practices	04	04	03	50	50	100	
		106	Intellectual Property Laws	04	04	03	50	50	100	
		<b>Group C (Advanced Cost Accounting &amp; Cost system)</b>								
		107	Advanced Cost Accounting	04	04	03	50	50	100	
		108	Costing Technique and Responsibility Accounting	04	04	03	50	50	100	
		<b>Group D (Co-operation &amp; Rural Development)</b>								
		109	Co-operative Movement in India	04	04	03	50	50	100	
		110	Organization of Co-operative Business	04	04	03	50	50	100	
		<b>Group E (Business Practices &amp; Environment)</b>								
		111	Organized Trades and Markets	04	04	03	50	50	100	
		112	Business Environment and Policy	04	04	03	50	50	100	
<b>Group F (Business Administration)</b>										
113	Production and Operation Management	04	04	03	50	50	100			
114	Financial Management	04	04	03	50	50	100			
<b>Group G (Advanced Banking &amp; Finance)</b>										
115	Legal Framework of Banking	04	04	03	50	50	100			
116	Central Banking	04	04	03	50	50	100			
<b>Group H (Advanced Marketing)</b>										
117	Marketing Techniques	04	04	03	50	50	100			
118	Consumer Behaviour	04	04	03	50	50	100			

## Semester II

Semester	Subject Types	Course Code	Title of the Paper	Hrs/ Week	Credit	Exam. Hours	Maximum Marks				
Semester II	Core Compulsory	201	Financial Analysis and Control/ Principals of Financial Accounting	04	04	03	50	50	100		
		202	Industrial Economics/ Economic Environment/Business Statistics/ Quantitative application	04	04	03	50	50	100		
			<i>To choose any one Group of the following</i>								
			<b>Group A (Advanced Accounting &amp; Taxation)</b>								
			203	Specialized Areas in Accounting	04	04	03	50	50	100	
			204	Business Tax Assessment & Planning	04	04	03	50	50	100	
				<b>Group B (Commercial Laws &amp; Practices)</b>							
			205	E- Security & Cyber Laws	04	04	03	50	50	100	
			206	Laws Regulating to Copyrights & Design	04	04	03	50	50	100	
				<b>Group C (Advanced Cost Accounting &amp; Cost system)</b>							
			207	Application Cost Accounting	04	04	03	50	50	100	
			208	Cost Control & Cost System	04	04	03	50	50	100	
				<b>Group D (Co-operation &amp; Rural Development)</b>							
			209	International Co-operative Movement	04	04	03	50	50	100	
			210	Management of Co-operative Business	04	04	03	50	50	100	
				<b>Group E (Business Practices &amp; Environment)</b>							
			211	Modern Business Practices	04	04	03	50	50	100	
			212	Business Environment Analysis	04	04	03	50	50	100	
				<b>Group F (Business Administration)</b>							
			213	Business Ethics and Professional Values	04	04	03	50	50	100	
		214	Elements of Knowledge Management	04	04	03	50	50	100		
			<b>Group G (Advanced Banking &amp; Finance)</b>								
		215	Banking Law & Practices	04	04	03	50	50	100		
		216	Monetary Policy	04	04	03	50	50	100		
			<b>Group H (Advanced Marketing)</b>								
		217	Customer Relationship Management & Retailing	04	04	03	50	50	100		
		218	Services Marketing	04	04	03	50	50	100		

### Semester III

Semester	Subject Types	Course Code	Title of the Paper	Hrs/ Week	Credit	Exam. Hours	Maximum Marks			
Semester III	Core Compulsory	301	Business Finance/ Financial System	04	04	03	50	50	100	
		302	Research Methodology for Business	04	04	03	50	50	100	
	Core Elective/ Optional Subjects/ Special Subjects	<b>To choose any one Group of the following</b>								
		<b>Group A (Advanced Accounting &amp; Taxation)</b>								
		303	Advanced Auditing	04	04	03	50	50	100	
		304	Specialized Auditing	04	04	03	50	50	100	
		<b>Group B (Commercial Laws &amp; Practices)</b>								
		305	Laws Relating to International Business	04	04	03	50	50	100	
		306	WTO – Norms & Practices	04	04	03	50	50	100	
		<b>Group C (Advanced Cost Accounting &amp; Cost system)</b>								
		307	Cost Audit	04	04	03	50	50	100	
		308	Management Audit	04	04	03	50	50	100	
		<b>Group D (Co-operation &amp; Rural Development)</b>								
		309	Co-operative Credit System	04	04	03	50	50	100	
		310	Co-operative Banking System	04	04	03	50	50	100	
		<b>Group E (Business Practices &amp; Environment)</b>								
		311	Entrepreneurial Behaviour	04	04	03	50	50	100	
		312	Entrepreneurship	04	04	03	50	50	100	
		<b>Group F (Business Administration)</b>								
		313	Human Resource Management	04	04	03	50	50	100	
314	Organizational Behaviour	04	04	03	50	50	100			
<b>Group G (Advanced Banking &amp; Finance)</b>										
315	Foreign Exchange	04	04	03	50	50	100			
316	International Finance	04	04	03	50	50	100			
<b>Group H (Advanced Marketing)</b>										
317	International Marketing	04	04	03	50	50	100			
318	Marketing Research	04	04	03	50	50	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/ Portfolio Management	04	04	03	50	50	100	
		402	Industrial Economic Environment/ Operations Research	04	04	03	50	50	100	
		<i>To choose any one Group of the following</i>								
		<b>Group A (Advanced Accounting &amp; Taxation)</b>								
		403	Recent Advances in Accounting, Taxation, Taxation and Auditing	04	04	03	50	50	100	
		404	Project Work/ Case Studies	04	04	03	50	50	100	
		<b>Group B (Commercial Laws &amp; Practices)</b>								
		405	Recent Advances in Commercial Laws and Practices	04	04	03	50	50	100	
		406	Project Work/Case Studies	04	04	03	50	50	100	
		<b>Group C (Advanced Cost Accounting &amp; Cost system)</b>								
		407	Recent Advances in Cost Auditing and Cost System	04	04	03	50	50	100	
		408	Project Work/Case Studies	04	04	03	50	50	100	
		<b>Group D (Co-operation &amp; Rural Development)</b>								
		409	Recent Advances in Co-operative and Rural Development	04	04	03	50	50	100	
		410	Project Work/Case Studies	04	04	03	50	50	100	
		<b>Group E (Business Practices &amp; Environment)</b>								
		411	Recent Advances in Business Practices and Environment	04	04	03	50	50	100	
		412	Project Work/Case Studies	04	04	03	50	50	100	
		<b>Group F (Business Administration)</b>								
		413	Recent Advances in Business Administration	04	04	03	50	50	100	
	414	Project Work/Case Studies	04	04	03	50	50	100		
	<b>Group G (Advanced Banking &amp; Finance)</b>									
	415	Recent Advances in Banking and Finance	04	04	03	50	50	100		
	416	Project Work/Case Studies	04	04	03	50	50	100		
	<b>Group H (Advanced Marketing)</b>									
	417	Recent Advances in Marketing	04	04	03	50	50	100		
	418	Project Work/Case Studies	04	04	03	50	50	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 2013-14 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 50 marks and the University Examination (UE) of 50 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 50 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
Quiz / Home Assignment	10
<b>Total</b>	<b>50</b>

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.

A student cannot register for the third semester, if she/he fails to complete 50% credits of the total credits expected to be ordinarily completed within two semesters.

## 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.

<b>Division of marks</b>	<b>Marks</b>	
A. Synopsis with working bibliography (Internal Assessment) Viva Voce (Internal Assessment)	40 marks 10 marks	50 marks
B. A full project Report (Minimum 50-80 pages) (Internal & External Assessment) Viva Voce (Internal & External Assessment)	40 marks 10 marks	50 marks

As the Research Project is based on the self study done by the candidate and evaluated for 100 marks altogether, 04 credits will be awarded to a successful candidate in this subject. 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 passess in all the courses will be declared to have passed the M.Com. degree with the following honours.

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 three 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 have 16 credits.

## 12. 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 SGPA or CGPA to equivalent percentage is given by:

$$\text{Equivalent percentage marks} = \begin{cases} 10 \times \text{CGPA} & \text{if CGPA /SGPA is in [4.00, 6.00]} \\ 05 \times \text{CGPA} + 30 & \text{if CGPA /SGPA is in [6.00, 9.00]} \\ 25 \times \text{CGPA} - 150 & \text{if CGPA /SGPA is in [9.00, 10.00]} \end{cases}$$

Marks	Grade	Grade Point
100 to 75	O : Outstanding	06
74 to 65	A : Very Good	05
64 to 55	B : Good	04
54 to 50	C : Average	03
49 to 45	D : Satisfactory	02
44 to 40	E : Pass	01
39 to 0	F : Fail	00

(C) GPA	Grade
05.00 – 6.00	O
04.50 – 04.99	A
03.50 – 04.49	B
02.50 – 03.49	C
01.50 – 02.49	D
00.50 – 01.49	E
00.00 – 00.49	F

### 13. 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
<b>Total</b>	<b>60</b>

### 14. Standard of Passing.

A. 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.

### 15. Award of Class.

a. 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:-

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.

### 16. Medium of Instruction :

The use of Marathi is allowed for writing answers in the examination except for following courses:

- Management Accounting
- Financial Analysis & Control
- Business Statistics,
- Advanced Accounting and Taxation
- Advanced Cost Accounting and Cost Systems.

17. A student (Regular / External) will be admitted to Revised M. Com. Course with effect from June 2013. For the students who have completed the terms for the First Year as per Old Course will be admitted to the Second Year as per Old Course M. Com. The examination as per Old Course will be held simultaneously for three years from April / May 2014.

### **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)

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**M.Com. Part I Semester II**  
**Compulsory Paper**  
**Subject Name -: Financial Analysis & Control.**  
**Course Code -: 201.**

**Objective -:** The objective of the course is to enable students to acquire sound knowledge of concepts, methods and techniques of management accounting and to make the students develop competence with their usage in managerial decision making and control.

UNIT	TOPIC	No. of Lectures in hours
<b>I</b>	<b>LONG TERM INVESTMENT DECISIONS:</b> Capital budgeting - Meaning- Importance - Evaluation technique and methods - Pay back, rate of Return, Discounted Pay Back Period- Discounted Cash flow - Net present value - Internal Rate of Return, Modified Internal Rate of Return- Profitability Index. Relationship between risk and returns.	<b>10</b>
<b>II</b>	<b>COST OF CAPITAL:</b> Meaning - Definition and assumptions - Explicit and implicit cost - Measurement of specific cost - Cost of debt - Preference Shares - Equity shares - Retained earnings - Weighted average cost of capital	<b>10</b>
<b>III</b>	<b>MARGINAL COSTING:</b> Meaning of Marginal Cost and Marginal Costing, advantages, limitations. Fixed and Variable cost, Contribution, Break-even analysis, Profit volume ratio, Limiting factor.	<b>08</b>
<b>IV</b>	<b>SHORT RUN MANAGERIAL DECISION ANALYSIS:</b> Introduction-Analytical Framework. Decision Situations:- Sales Volume related Decisions-Sale or further process-Make or buy - Product Line/divisions/departments - Short run use of scarce resources - Operate or shut down.	<b>08</b>
<b>V</b>	<b>BUDGET AND BUDGETARY CONTROL:</b> Meaning, Definition and scope of budget and budgetary control- Types of budgets - Financial budget - Master budget, Flexible budget - Capital budget.	<b>06</b>
<b>VI</b>	<b>STANDARD COSTING:</b> Concept, Advantages; Types of Standards-Variance analysis: Materials, Labour, Overhead - Managerial uses of Variances	<b>06</b>
<b>TOTAL -</b>		<b>48</b>

**List of Books Recommended for Study:-**

1. R. N. Anthony , G. A. Walsh: Management Accounting
2. M. Y. Khan. K. P. Jain: Management Accounting
3. I. M. Pandey: Management Accounting (Vikas)
4. J. Betty: Management Accounting
5. Dr. Kishor N. Jagtap: Management Accounting (Success)
6. Sr. K. Paul: Management Accounting
7. Dr. Jawaharlal: Management Accounting

**List of Learning Activities and Allocation of Periods**

<b>Sr. No.</b>	<b>Activities</b>	<b>Learning Hours</b>
1	Quizzes	4
2	Assignments	4
3	Class room tests	4
<b>Total</b>		<b>12 hours</b>

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## M.Com. Part I Semester II

### Optional Paper

**Subject Name :- Industrial Economics**

**Course Code :- 202 - A.**

#### Objectives:

- 1) To study the basic concepts of Industrial Economics.
- 2) To study the significance and problems of Industrialization.
- 3) To study the impact of Industrialization on Indian Economy.

<b>Chapter No.</b>	<b>Particulars</b>	<b>Total Lectures (48)</b>
<b>1.</b>	<b>Introduction</b> 1.1 Meaning, Definition, Nature, Scope and Limitations of Industrial Economics. 1.2 Need and Significance of Industrial Economics. 1.3 Relationship between Industrial Development and Economic Development.	<b>8</b>
<b>2.</b>	<b>Industrial Location.</b> 2.1 Meaning of Industrial Location. 2.2 Factors Influencing Industrial Location. 2.3 Alfred Weber's Theory of Location. 2.4 Sargent Florences Theory of Location. 2.5 August Losch's Theory of Location.	<b>8</b>
<b>3.</b>	<b>Industrial Productivity.</b> 3.1 Meaning, Definition and Measurement of Industrial Productivity. 3.2 Factors Influencing Industrial Productivity. 3.3 Industrial Productivity. 3.4 Measures adopted by the Indian Government to Improve Industrial Productivity.	<b>8</b>
<b>4.</b>	<b>Industrial Efficiency and Profitability.</b> 4.1 Meaning, Definition and Measurement of Industrial Efficiency. 4.2 Factors affecting Industrial Efficiency. 4.3 Measures adopted by Indian Government, Industries and other agencies to Improve Industrial Efficiency. 4.4 Meaning, Definition and Measurement of Industrial Profitability.	<b>8</b>
<b>5.</b>	<b>Industrial Profile and Problems.</b> 5.1 Structure and Organisation of Large Industries in India. 5.2 Private Sector Enterprises: Role, Functions and Problems. 5.3 Public Sector Enterprises: Role, Functions and Problems. 5.4 Disinvestment Policies. 5.5 Micro, Small and Medium Enterprises (MSME) Role and Problems.	<b>8</b>
<b>6.</b>	<b>Industrial Imbalance.</b> 6.1 Meaning of Industrial Imbalance. 6.2 Causes and Effects of Industrial Imbalances. 6.3 Measures adopted by the Indian Government to reduce Industrial Imbalance 6.4 Regional Industrial imbalance - Special focus on Maharashtra	<b>8</b>



### Recommended Books

1. S.C. Kuchal – Industrial Economy of India.
  2. D.R. Gadgil – Industrial Evolution in India, Oxford. 1948
  3. K.V. Sivayya and V.B.M.Das – Indian Industrial Economy, Chand and Co. Ltd. New Delhi 1999 Publishing House.
  4. S.C. Kuchal – Major Industries in India, Chaitanya Publishing House, Allahabad.
  5. Bagchi and banerjee : change and choice in Indian industry, centre for studies in social science in culcatta.
  6. A. Donald Hay Dereck, Mouris : Industrial Economics : Theory and Evidence, Oxford
  7. K.N.Prasad : Indian Economy Since Independence.
  8. Solman Fabucant : A premier on Productivity, Prentice Hall.
- 
- i. [www.newagepublishers.com/samplechapter/000386.pdf](http://www.newagepublishers.com/samplechapter/000386.pdf)
  - ii. [www.indecon.com/](http://www.indecon.com/)
  - iii. [Www.tudyingeconomics.ac.uk/industrial-economics](http://Www.tudyingeconomics.ac.uk/industrial-economics)
  - iv. [http://en.wikipedia.org/wiki/Industrial\\_economics](http://en.wikipedia.org/wiki/Industrial_economics)
  - v. <http://encyclopedia2.thefreedictionary.com/Industrial+Economics>
  - vi. <http://studyingeconomics.ac.uk/industrial-economics/>
  - vii. [www.aiu.edu/publications/student/.../industrial%20economics.html](http://www.aiu.edu/publications/student/.../industrial%20economics.html)
  - viii. [www.investopedia.com/terms/i/industrial-organization.asp](http://www.investopedia.com/terms/i/industrial-organization.asp)

### Suggested format of Continuous assessment along with allocation of Periods

Sr.No.	Assessment Chart	Periods Alloted
1.	Tests	3
2.	Quizzes	3
3.	Presentation Seminars	3
4.	Assignments	3

**M.Com. Part I Semester II**

**Optional Paper**

**Subject Name -: Business Statistics.**

**Course Code -: 202 - B.**

<b>1.</b>	<b>Theory of Probability Distributions: Discrete and Continuous</b> 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 1.4 Numerical Problems on finding p.m.f/p.d.f, expected value and variance.	<b>10</b>
<b>2.</b>	<b>Standard Probability Distributions</b> 2.1 Binomial Distribution : p. m. f., mean and variance. 2.2 Poisson Distribution : p. m. f., mean and variance 2.3 Normal Distribution : p. m. f., mean, variance, properties 2.4 Limiting relations between these distributions 2.5 Numerical problems to calculate probabilities, mean and variance	<b>14</b>
<b>3.</b>	<b>Estimation of Parameters of Distribution</b> 3.1 Parameter and Statistic 3.2 Unbiased estimator 3.3 Confidence interval (around unbiased estimator) 3.4 Examples and Problems	<b>8</b>
<b>4.</b>	<b>Tests of Hypothesis</b> 3.1 Hypothesis, null and alternative hypothesis, two types of errors, test statistic, critical region acceptance region, level of significance, p-value 3.2 Chi square test for goodness of fit 3.3 Chi square test for independence of two attributes 3.4 Small sample Test for the mean a) One sample test b) Two sample test c) Pair t – test 3.5 Large sample tests for population mean and population proportion 3.1.1 Test for the mean a) one sample b) two samples 3.1.2 Test for the proportion a) one sample b) two samples 3.6 Numerical Problems	<b>16</b>
<b>Recommended Books :</b> 1. Schaum’s outline series of Probability By Seymour Lipschutz 2. Probability and Statistics : R Walpole, S myers and K Ye 3. Fundamentals of Mathematical Statistics :S.C. Gupta and V.K. Kapoor 4. Fundamentals of Applied Statistics : S.C. Gupta		

**M.Com. Part I Semester II**  
**Advanced Accounting and Taxation Special Paper III**  
**Subject Title -: Specialized Areas in Accounting.**  
**Course Code -: 203**

**Objective -:**

1. To develop competency of students to solve problems relating Special areas in accounting including accounting for Services Sector.
2. To understanding of Financial Reporting Practices.
3. To familiarize the student with procedure of accounting for Taxation.

UNIT	TOPIC	No. of Lectures in hours
<b>I</b>	<b>ACCOUNTING FOR CONSTRUCTION CONTRACTS:</b> Introduction - Accounting Treatment - Percentage of Completion Method, Completed Contract Method. Provision for foreseeable losses-Principles to be followed while taking credit for profit on incomplete contracts, valuation & disclosure of Work-in-progress, escalation clause, preparation of contract accounts.AS7	<b>08</b>
<b>II</b>	<b>ACCOUNTING FOR CORPORATE RESTRUTURING:</b> Amalgamation - Absorption - External reconstruction, (Advanced problems only) - Internal Reconstruction - reparation of Scheme of Internal Reconstruction.	<b>08</b>
<b>III</b>	<b>FUND BASED ACCOUNTING:</b> Introduction - Special Features of Accounting for Educational Institutions, Accounting for Government Grants as per guidance notes issued by the ICAI.	<b>08</b>
<b>IV</b>	<b>SERVICES SECTOR ACCOUNTING:</b> A. Hotel accounting - introduction - visitors' ledger. B. Hospital accounting - Introduction- capital and revenue expenditure OPD & IPD Register. C. Transport Undertaking - Introduction - preparation of final Accounts - Accounting o f Roadways Preparation of final accounts - Log Book.	<b>08</b>
<b>V</b>	<b>CORPORATE FINANCIAL REPORTING:</b> Issues and problems with reference to published financial statements of Companies. Financial Reporting in respect of Mutual Funds, Non Banking Financial Companies, Merchant Bankers, Stock Brokers	<b>08</b>
<b>VI</b>	<b>ACCOUNTING FOR CORPORATE TAXATION:</b> <b>A.</b> Accounting for Income Tax: Provision for Taxation - Advance Tax- Completion of Assessment - Corporate Dividend Tax-Tax Deducted at Source Deferred Tax as per AS.22. <b>B.</b> Accounting treatment of Excise Duty and CENVAT: Accounting at the time of payment of Excise Duty, Cenvat Credit availed and utilized for input and Final Product and Capital Goods. <b>C.</b> Accounting of State Level Value Added Tax. (VAT): VAT Credit in	<b>08</b>

	<p>case of Inputs/Supplies, Capital Goods. Accounting for Liabilities adjusted from VAT credit receivable balance- Inputs and / or Capital Goods.</p> <p><b>D.</b> Accounting under Service Tax. Basics of Service Tax-Accounting Groups and Accounting Heads-Accounting Entries at raising Invoice and receipt of payment.- Booking of expenses and making payment. (practical problems on journal entries on above transactions))</p>	
<b>TOTAL -</b>		<b>48</b>

**Notes:**

1. Theory questions will carry 20% marks.
2. Practical problems will carry 80% marks.
3. Relevant Accounting standards to be studied under each topic

**List of Books Recommended for Study :**

1. Shukla and Grewal: Advanced Accounts. (S. Chand & Co. Ltd. New Delhi)
2. Jain and Narang: Advanced Accounts.(Kalyani Publishers, Ludhiana)
3. Sr. K. Paul: Accountancy, Volume-I and II.(New Central Book Agency, Kolkata)
4. R. K. Lele and Jawaharlal: Accounting Theory (Himalaya Publishers)
5. Dr. L. S. Porwal: Accounting Theory (Tata McGraw Hill).
6. Robert Anthony, D.F.Hawkins & K.A. Merchant: Accounting Text & Cases (Tata McGrawHill).
7. Dr. S. N. Maheshwari: Corporate Accounting (Viakas Publishing House Pvt. Ltd. New Delhi)
8. Dr.Ashok Sehgal & Dr .Deepak Sehgal: Advanced Accounting (Taxmann, New Delhi).
9. Guidance Notes issued by Institute of Chartered Accountants of India. on :
  - a. Accounting for State level Value Added Tax :
  - b. Accounting for Fringe Benefits Tax :
  - c. Accounting for Corporate Dividend Tax:
  - d. Accounting Treatment for Excise Duty:
10. Taxmann’s Journal on Service Tax : Volume 10.Part 7. (2007): Accounting under Service Tax by Pravin Dhandharia
11. Relevant guidance notes issued by the ICAI.

**List of Learning Activities and Allocation of Periods**

<b>Sr. No.</b>	<b>Activities</b>	<b>Learning Hours</b>
1	Quizzes	4
2	Assignments	4
3	Class room tests	4
<b>Total</b>		<b>12 hours</b>

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**M.Com. Part I Semester II**  
**Advanced Accounting and Taxation Special Paper IV**  
**Subject Title -: Business Tax Assessment & Planning**  
**Course Code -: 204**

**Objective -:**

1. To provide understanding of Direct Taxes including Rules pertaining thereto and their application to different business situations.
2. To understand principles underlying the Service Tax.
3. To understand basic concepts of VAT, Excise Duty and Customs Duty.

UNIT	TOPIC	No. of Lectures in hours
<b>I</b>	<b>ASSESSMENT OF VARIOUS ENTITIES:</b> 1. Assessment of Companies 2. Assessment of Co-operative Societies 3. Assessment of Charitable Trusts (Theory & Problems)	<b>08</b>
<b>II</b>	<b>MISCELLENEOUS:</b> Income Tax authorities, Return of Income, Procedure for Assessment - Types of assessment, Appeals and Revision, Deduction of Tax at Source - Advance payment of Tax - Deduction and Collection of Tax At Source-Interest and penalties, Offences and Prosecutions - Refund of Tax-Transfer Pricing (Domestic & International Transactions) (Theory & simple problems on TDS, Advance Tax & Interest Calculation)	<b>08</b>
<b>III</b>	<b>TAX PLANNING:</b> Meaning of tax planning and management, tax evasion and tax avoidance-Nature and scope of tax planning and management in the corporate sector- Justification of corporate tax planning and management. Tax Planning considerations in relation to Business.(Theory)	<b>08</b>
<b>IV</b>	<b>WEALTH TAX:</b> Scheme of Wealth Tax - Incidence of Wealth Tax - Assets to be included in Net Wealth - Exempted Assets - Valuation of Assets and Wealth Tax Liability - Assessment and Penalties. (Theory & Problems)	<b>06</b>
<b>V</b>	<b>BASICS OF INDIRECT TAXES:</b>  <b>A] SERVICE TAX:</b> Service Tax: Applicability and Services covered - Valuation of taxable services for service tax- Payment of Service Tax - Registration - Furnishing of Return - Maintenance of Record - Other obligations (Theory and Problems)  <b>B] VAT:</b> The Basic concept of VAT-how VAT operates-merits & demerits of VAT-a brief overview of state level VAT in India. (VAT is not to be studied with reference to any particular State VAT Law.) (Theory Only)	<b>18</b>

	<p><b>C] EXCISE DUTY:</b> - Basics of Central Excise Duty – Conditions for imposition - Person liable - Rates of excise duty - Goods and Excisable goods - Manufacturer, Production and Manufacturer- Classification of goods. (Theory)</p> <p><b>D] CUSTOMS DUTY:</b> Introduction to Customs Duty – Valuation - Customs Procedures - Classification for Customs and Rate of Customs Duty. (Theory)</p>	
<b>TOTAL -</b>		<b>48</b>

**Notes:**

1. Amendments made prior to commencement of Academic Year in the relevant act should be considered.
2. Theory questions will carry 50% marks.
3. Problems will carry 50% marks

**Scheme of Marking for Semester II will be as under:-**

- a. Income Tax- 70 Marks
- b. Wealth Tax- 10 Marks
- c. Indirect Taxes -20 Marks
  - i- Service Tax
  - ii- VAT
  - iii- Excise Duty
  - iv- Customs Duty

**List of Books Recommended for Study:**

1. Dr. Vinod Singhania: Direct Taxes, Law and Practice, Taxman Publication, New Delhi.
2. Dr. Bhagawati Prasad: Direct Taxes
3. Girish Ahuja and Ravi Gupta: Direct Taxes, Bharat Law House, New Delhi.
4. T. N. Manoharan: Hand Book of Income Tax Laws
5. B.B. Lal & N.Vashisht: Direct Taxes (Pearson)
6. S. S. Gupta: Service Tax (Taxman Publications, New Delhi)
7. R. Mohan Lavis: Service Tax (Bharat Publishers, New Delhi)
8. V.S. Datey: Indirect Taxes, Law and Practice (Taxman Publications, New Delhi)

**List of Learning Activities and Allocation of Periods**

Sr. No.	Activities	Learning Hours
1	Quizzes	4
2	Assignments	4
3	Class room tests	4
<b>Total</b>		<b>12 hours</b>

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**M.Com. Part I Semester II**  
**Commercial Laws and Practices Special Paper III.**  
**Subject Title :- E-Security and Cyber Laws**  
**Course Code :- 205**

**Objective :-**

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 I.T. Acts.
4. To get the students acquainted with the regulatory regime in computer field/e-business.

Unit No.	Name of the Unit / Topic	Periods
1.	<p><b>Introduction to Computer crimes.</b>            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. 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>	15
2.	<p><b>E-Security</b>            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, Firewall, Antivirus Software, Digital Identity and digital Signature, Certificate Certificates. Secure Socket Layer and Secure Electronic Transaction Protocols.</p>	15
3.	<p><b>Cyber Laws ---</b> Introduction to Cyber Laws—Meaning &amp; scope of Cyber Laws, online contracts, &amp; requirements &amp; legal aspects of e-contracts ( offer and acceptance in e-form), Cyber Laws &amp; legal issues ( cyber jurisprudence, &amp; sovereignty, net neutrality, freedom of speech in cyber space, governance)            Information Technology Act – 2002 Part-I            Digital Signature-definition ,meaning, functions, 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( Ss.</p>	10
4.	<p><b>Information Technology Act – 2002 Part-II</b>            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 &amp; 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.</p>	08
	<b>Total</b>	<b>48</b>

**[Note: Recent amendments in the Acts and relevant Landmark cases decided by courts are expected to be studied]**

**Books Recommended:**

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 – B y Rohnay D. Ryder[Wadhwa, Nagpur]
7. 6.. Cyber Laws – Justice Yatindra Singh, Universal Law Publishing Co.
8. Law of Information Technology—D.P. Mittal
9. Cyber Laws—Krishnakumar
10. 9 Encyclopedia of Cyber Laws—Sujeet Kumar
11. Handbook of Cyber Laws---Vakul Sharma



**M.Com. Part I Semester II**  
**Commercial Laws and Practices Special Paper IV.**  
**Subject Title :- Law Relating to Copyright and Designs.**  
**Course Code :- 206**

**Objective :-**

1. To understand the nature and scope of Intellectual Property laws
2. To get acquainted with various provisions of Intellectual property laws
3. To make the student familiar to Intellectual Property laws and their relevance in the changing business environment.

Unit No.	Name of the Topic	Periods
1.(a)	<b>The Copyright Act, 1957:-</b> Introduction and Evolution of the Law on Copy Right – Meaning, Scope and Characteristics of Copyright – Object of Copyright – Works in which Copyright Subsists – Qualification for Copyright Subsistence – Author and Ownership of Copyright and Rights of the Owner – International Copyright (Ss – 40-43)	10
1.(b)	<b>Copyright (Procedure):-</b> 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 (Section 44 to 50-A along with rule 16 of chapter VI of Copyright Rules, 1958)	06
1.(c)	<b>Copyright (Infringement and Regulatory Authorities):-</b> Infringement of Copyright - acts which Constitute Infringement, acts not Constituting Infringement etc. (Section 51 to 53 A ) – Offence and Penalties, Copyright Societies (Functions and Rights)	08
2	<b>The Designs Act-2000: -</b> Industrial Designs: Introduction and Meaning – Registerability of a Design, who can file an Application for Registration of a Design (Section 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.	08
3	<b>The Geographical Indications of Goods (Registration and Protection), Act, 1999: -</b> Geographical Indications: Introduction, Meaning and Content – 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.	08
4	<b>Protection of Plant Varieties and Farmers Rights Act-2001:-</b> 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	08
	<b>Total Period</b>	<b>48</b>

**[Note: Recent amendments in the Acts and relevant Landmark cases decided by courts are expected to be studied]**

**Books Recommended**

1. Intellectual Property Law – P. Narayan, Eastern Law House.
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 – 7.
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 (2007)

**M.Com. Part I Semester II**  
**Advanced Cost Accounting and Cost System Special Paper III.**  
**Subject Title -: Application of Cost Accounting.**  
**Course Code -: 207**

**Objectives:**

1. To provide knowledge on advanced cost accounting practices.
2. Relevant Cost Accounting Standard are to be studied.

Unit No.	Name of the Topic	Periods
1.	<b>Cost Book Keeping and Reconciliation between Cost and Cost financial Accounts –</b> Book - keeping, Cost Ledgers, interlocking and integral Accounts. Reconciliation of Cost and Financial Accounts, Reasons, needs, Methods.	12
2.	<b>Product Life Cycle Costing:</b> Introduction, Product Life cycle, Phases and Characteristics of Product Life Cycle, Stages of Product Life Cycle, Product Life Cycle Costing Features and benefits of Product Life Cycle Costing.	12.
3.	<b>Value Chain Analysis</b> Introduction - Definition – Role of Management Accountant – Value Chain Analysis – approach for assessing competitive advantages – value chain analysis v/s conventional management accounting.	12.
4.	<b>Productivity &amp; Concept and Measurement</b> <b>i) Productivity</b> Meaning, Measurement of Material, Labour, Capital and Management Productivity. Productivity V/s Efficiency. Capacity - Theoretical, Practical and idle capacity, Capacity utilization and effect of same on cost. <b>ii) Concept and Measurement</b> Measures to improve productivity - Technical, Financial, Operational Measures. Restructuring of activities - Business Process Re-engineering elementary knowledge. Human aspect of productivity.	12.
	<b>Total</b>	<b>48</b>

**Note:** 50% Marks for Theory and 50% Marks for practical problems. Areas of Practical Problems :

1. Reconciliation of Cost and Financial Profit
2. Measurement of Productivity.

**References:**

1. Ravi Kishor: Advanced cost Accounting and cost systems, Taxman Allied services Pvt Ltd, New Delhi.
2. N.K. Prasad: Principles and Practice of Cost Accounting, Syndicate Pvt Ltd, Calcutta.
3. Prof. Subhas: Practice in Advanced costing and Management, Nirali Prakashan, Pune.
4. Ravi Kishor: Students guide to Cost Accounting, Taxman's allied services, New Delhi.
5. M. N Arora: Cost Accounting Principles and Practices, Vikas Publishing House, New Delhi.
6. S. N Maheshwari, Cost Accounting Theory and Problems, Mittal shree Mahvir Book Dept, New Delhi.
7. Website: [www.myicwai.com](http://www.myicwai.com).
8. Advanced Cost Accounting and Cost Systems -: Ravi Kishor, P.V. Ratlam, M.L. Basu

### List of Learning Activities and Allocation of Periods

<b>Sr. No.</b>	<b>Activities</b>	<b>Learning Hours</b>
1	Industrial Visits	04
2	Assignments	04
3	Class room tests	04
<b>Total</b>		<b>12 hours</b>

**M.Com. Part I, Semester II**  
**Advanced Cost Accounting and Cost System Special Paper IV.**  
**Subject Title :- Cost Control and Cost System.**  
**Course Code :- 208**

**Objectives:**

1. To equip the students for designing and implementing cost control, cost reduction programme and different cost systems.
2. Relevant Cost Accounting Standards are to be studied.

Unit No.	Name of the topic	Periods
1	<b>Marginal Costing, Cost – Volume – Profit Analysis And Differential Costing :-</b> Marginal Costing- Meaning –Concept of Variability of Cost, Contribution P/V Ratio, Break :- Even – Analysis, Margin of Safety Cost- Volume, Profit Analysis – Procedure And Practical, Application. Differential Costing, Differential Costs, Differential Cost Analysis, Features of Differential Costing, Practical Application.	12
2	<b>Pricing Decision:</b> - Introduction – Pricing of Finished Product- Theory of Price – Pricing Policy – Principles of Product of Pricing – New Product Pricing – Pareto Analysis.	10
3	<b>Cost Control and Cost Reduction :-</b> Introduction, Process of Cost Control and Cost Reduction, Cost Reduction Programme and its Implementation – Methods and Techniques <b>Costing System Design and Installation :-</b> Study of Production Process, Objective. Selection of Methods of Costing, Creating Cost Center And Cost Codes – Deciding Basis of Apportionment of Various Overheads, Deciding Methods of Absorption. Fixing Responsibility And Designing Suitable MIS. Designing And Installing Cost System In Computer Environment	20
4	<b>Value Analysis and Value Engineering :-</b> Just-In-Time [JIT], Activity Based Costing (ABC)	06

Note: 50% Marks for Theory and 50% Marks for practical Problems.

Areas of Practical Problems:

- 1) Marginal Costing- Application oriented
- 2) Pricing Decisions

Level of knowledge will be advance and Practices

**References:**

1. Ravi Kishor: Advanced cost Accounting and cost systems, Taxman Allied services Pvt Ltd, New Delhi.
2. N.K. Prasad: Principles and Practice of Cost Accounting, Syndicate Pvt Ltd, Calcutta.
3. Prof. Subhas: Practice in Advanced costing and Management, Nirali Prakashan, Pune.
4. Ravi Kishor: Students guide to Cost Accounting, Taxman's allied services, New Delhi.
5. M. N Arora: Cost Accounting Principles and Practices, Vikas Publishing House, New Delhi.
6. S. N Maheshwari, Cost Accounting Theory and Problems, Mittal shree Mahvir Book Dept, New Delhi.
7. Website: [www.myicwai.com](http://www.myicwai.com).
8. Advanced Cost Accounting and Cost Systems -: Ravi Kishor, P.V. Ratlam, M.L.Basu

### List of Learning Activities and Allocation of Periods

<b>Sr. No.</b>	<b>Activities</b>	<b>Learning Hours</b>
1	Industrial Visits	4
2	Assignments	4
3	Class room tests	4
<b>Total</b>		<b>12 hours</b>

**M.Com. Part I Semester II**  
**Co-operation and Rural Development Special Paper III.**  
**Subject Title -: International Co-operative Movement.**  
**Course Code -: 209**

**Objectives:**

1. To acquaint the students with the Co-operative Movement.
2. To develop the capability of students for knowing different types of Co-operatives.

Unit No.	Name of the Topic	Periods
1.	<b>Introduction:</b> Origin and Growth of Co-operative Movement in the World- Cooperation in the post industrial revolution of Great Britain	12
2.	<b>Co-operation in Social and Economic Systems:</b> Co-operation in Capitalistic Systems- Co-operation in Socialistic System-Cooperation in Mixed Economy- International Cooperation. The International Cooperation Alliance (ICA)	12
3.	<b>Co-operative Movement in the world:</b> Co-operative Movement in the UK,USA,USSR. China, Japan and Israel.	12
4.	<b>Role of Co-operative Movement in Global Economy:</b> Impacts, Problems and Suggestions.	12
	<b>TOTAL</b>	<b>48</b>

<b>List of Books Recommended for Study</b>
<ol style="list-style-type: none"> <li>1. G.S. Kamat: New Dimensions of Co-operative Management</li> <li>2. G.S. Kamat: Cases in Co-operative Management</li> <li>3. K.K.Taimani: Co-operative Organisation and Management</li> <li>4. I L O: Co-operative Management and Administration</li> <li>5. B.C. Mehta: Consumer Co-operation in India</li> <li>6. Prof L.P. Wakale and Dr. G.H.Barhate: Sahakari Vikas- Sheth Publishing Mumbai</li> </ol>

**M.Com. Part I Semester II**  
**Co-operation and Rural Development Special Paper IV.**  
**Subject Title :- Management of Co-operative Business**  
**Course Code :- 210**

**Objectives:**

1. To acquaint the students with the co-operative movement.
2. To develop the capability of students for knowing different types of Co-operatives.
3. To aware the role of state and central Govt. in development of co-operative sector.
4. To give basic knowledge about administration and management of Co-operatives.

Unit No.	Name of the Topic	Periods
<b>1.</b>	<b>Co-operative Business Promotion:</b> Problems of Economic and commercial viability-Services to members: Role of Co-operative department- Criteria for appraising performance of Co-operative Business: Organizational, Operational and financial-social responsibilities of Co-operative business- Industrial relation in Cooperative business.	12
<b>2.</b>	<b>Business Policies and Practices (Managerial Evaluation) in following:</b> <ol style="list-style-type: none"> <li>1. Sugar Co-operatives</li> <li>2. Dairy Co-operatives</li> <li>3. Credit Co-operatives</li> <li>4. State Co-operative Bank</li> <li>5. District Co-operative Bank</li> <li>6. Primary Agricultural Credit Societies</li> </ol>	12
<b>3.</b>	<b>Success stories of Co-operative Institutions:</b> <ul style="list-style-type: none"> <li>• Anand Dairy Co-operatives Gujrat</li> <li>• Warana Co-operatives Organization, Warnanagar</li> <li>• Shamrao Viithal Co-operative Bank.</li> <li>• Gokul Sahakari Sangh, Kolhapur</li> </ul>	12
<b>4.</b>	<b>Problems of Co-operatives:</b> <ol style="list-style-type: none"> <li>a) Sugar Industry</li> <li>b) Agricultural and Non-agriculture Credit Co-operative.</li> <li>c) Dairy Co-operative</li> <li>d) Co-operative Banking</li> </ol>	12
<b>TOTAL</b>		<b>48</b>

**List of Books Recommended for Study**

1. G.S. Kamat: New Dimensions of Co-operative Management
2. G.S. Kamat: Cases in Co-operative Management
3. K.K.Taimani: Co-operative Organisation and Management
4. I L O: Co-operative Management and Administration
5. B.C. Mehta: Consumer Co-operation in India
6. Prof L.P. Wakale and Dr. G.H.Barhate: Sahakari Vikas- Sheth Publishing Mumbai



**M.Com. Part I Semester II**  
**Business Practices and Environment Special Paper III.**  
**Subject Title :- Modern Business Practices**  
**Course Code :- 211**

**Objective:** To improve knowledge and understanding of students about chambers of commerce and trade, Associations, Public enterprises, Public utilities and Agri. business.

Unit No.	Name of the Topic	Periods
1	Organizations – Introduction, Importance, Objectives and functions of (1) Maharashtra Chamber of Commerce, Industries and Agricultural and their local branches (2) Maratha Chamber of Commerce, Industries & Agriculture (3) Indian Merchants Chamber. (4) Nagar Chamber of Commerce (Deccan) (5) Federation of Indian Chamber of Commerce and Industries (FICCI) (6) Confederation of Indian Industries (CII)	12
2	Public Enterprises and Public Utilities :- Objectives, functions and Organization of public Enterprises and Public Utilities - Management practices of Public enterprises in India - Efficiency – Autonomy and control of public Enterprises - Recent practices and policies in public Enterprises and Public Utilities- Before LPG & after LPG	12
3	Agricultural Business Practices :- Characteristics of Agricultural Business - Nature of Indian Agriculture – Government policies related to agricultural business - Problems and prospects of Agricultural Business - Agricultural Taxation policy. Agricultural products and Farms Services :- Nature and disposal of Agricultural by e-products - Farm waste - cost of recycling of farm waste.	12
4	Scheme of support for Women Entrepreneur in Maharashtra Maharashtra Rural Credit Programme: (1) Swarna Jayanti Gram <b>Swarozgar</b> Yojana (SJGSRY) (2) Swayamsidha Programe (3) Ramai Mahila Shakshamikaran (4) Rashtriya Sam Vikas Yojana ( <b>RSVY</b> ) (5) Krushi Saptak Yojana (6) Tribal Development Project (TDP) (7) Tejaswini Rural Women Empowerment Programme (8) Rajarshee Shahu Maharaj Swayamrozar Yojana. Minority Women Empowerment Programme Mahila swavalamban nidhi (MSN) Problems of Small Scale Industries.	12

**Recommended Books for study**

1. Principles of Business Organization Acharya Govekar A.R , Sheth and Co
2. Principles of Practice of Marketing Mamoria, Joshi Kitab Mahal
3. Regulated Markets W. R. Natu
4. Marketing Co-Operative Way G.S. Kamat Maharastra state Co-op Union
5. Future Trading and Control Ram Desai
6. Bombay Money Market H.T.Y.B.A Parekh
7. Commodity Marketing and P.L. Gadgil Shubhada Sarswat, Distributive Trade Punc
8. Environment & Development : China & India

**M.Com. Part I Semester II**  
**Business Practices and Environment Special Paper IV**  
**Subject Title :- Business Environment Analysis.**  
**Course Code :- 212**

<b>Unit No.</b>	<b>Name of the Topic</b>	<b>Periods</b>
1	Indian Industrial Environment - Growth of industries in public & private sectors in India, Co-operative sector in India - small and cottage industries. mergers and acquisitions. Foreign investment - Foreign Technology and MNCs Global Environment - Natural Social, Cultural, Demographic and Technological environment and its impact on World Trade.	12
2	Financial Environment of Business - Indian Money Market - Growth of capital Market in India - Financial Institutions - Role of Public, Private, and Co-operative Banks - Role of foreign banks and non Banking Institutions. Security Market :- Meaning, function, structure, constitution & management of Security Market.	12
3	Environmental Analysis- Meaning and importance - Techniques of Analysis, Verbal and Written Information, Search and scanning, Spying, Forecasting, Limitations of these techniques, Competitions analysis – Rivalry Amongst existing firms, threat of new entrants, treat of substitutes – Bargaining power of suppliers and buyers.	12
4	Selected Biography of Reliance Group of Industries Chordiya, Pravin Masale, Big Bazar founder Bhavarlal Jain	12

**Recommended books for study**

Global Economy and Business Francis Cheranilan Himalaya publishing house  
 Environment Text & Cases ( Edn 2001)  
 Business Environment Chllaaghan, ELlison Edward Arnold  
 Economic Environment SYBA K Misha, Puri Himalaya publishing house of Business  
 Indian Business trough ages FICCI Oxford University Press

**Recommended Journals/Periodicals**

1. Arth Vijnyan 2. The Economic Times 3. Economic and Political Weekly, ode: 203

**M.Com. Part I Semester II**  
**Business Administration Special Paper III.**  
**Subject Title :- Business Ethics and Professional Values**  
**Course Code :- 213**

	<b>No. of Lectures</b>	<b>Credit 04</b>
<b>Unit I Introduction</b> Nature , concept and definition of term Business Ethics , Profession and Values, Indian Ethos, Ethics and Values – Work Ethos – Importance of Human Values. Guidelines of Socio Ethical System at General Level. Meaning of Social Ethics, Issues related to Socio Ethics Factors affecting Social Ethics.	12	01
<b>Unit II –Indian Ethical Practices in</b> A ) Marketing and Advertising : B ) Copy rights and Patents C ) Employment D ) Gender Discrimination E ) Accounting Disclosures	12	01
<b>Unit III Dilemmatic situations in Professional Ethics, Code of Ethics and conduct</b> 1. Corporate Governance 2. Corporate Social Responsibility 3. Corporate Citizenship	12	01
<b>Unit- IV</b> Indian Approach to Business Ethics Gandhian Approach in Management and Trusteeship Gandhi’s Doctrine of Satya and Ahinsa , Concept , importance and relevance of trusteeship Principle in Modern Business, Emergence of new values in Indian Industries after economic reforms of 1991.	12	01
	<hr/> 48	<hr/> 04
<b>Books Recommended</b> Reference Books 1.Wg- Cdr – B.R.Chavala , Swastik Publishers . 2.Management by Values 3.S.K.Chakraborti , Oxford University Press 4FOUNDATIONS TO Managerial Work – Contribution from Indian Thought – S. K.Chakraborti , Himalaya Publications 5.A Study in Business Ethics Rituparna Raj 6.Ethics in Management S.A. Sherlekar , Himalaya Publication 7. Business Ethics and Corporate Governance S. K. Bhatia		

**M.Com. Part I Semester II**  
**Business Administration Special Paper IV.**  
**Subject Title :- Elements of Knowledge Management**  
**Course Code :- 214**

	No. of Lectures	Credit 04
<b>1. Introduction to Knowledge Management Process</b> Knowledge management :- an integrated approach Meaning knowledge management, Difference between data, information, knowledge and wisdom, Early forms of Knowledge Management and Evolution of Knowledge Management	<b>12</b>	<b>01</b>
<b>2. Organizational Learning</b> Individual learning, Team learning, Drives of organizational learning, Organizational learning frameworks, Knowledge acquisition, Information distribution, Information interpretation, Organizational memory, Unlearning, Organizational routines	<b>12</b>	<b>01</b>
<b>3. Knowledge Management Tools &amp; Change Management</b>  Organizing knowledge tools, Capturing knowledge tools Evaluating knowledge sharing knowledge, Storing and presenting knowledge, The nature of change, Personal response to change, welcome and resistance, Leadership and, Change management strategies, Gaining commitment for change, Reward and recognition. Cultural change management, Politics of change	<b>12</b>	<b>01</b>
<b>4. Knowledge Management Culture</b> Understanding of organizational culture and climate Norms, artifacts and symbols, Value, beliefs, attitudes and assumption, Typologies of organizational culture, Measuring organizational cultural creating knowledge –sharing cultural stickiness.	<b>12</b>	<b>01</b>
	<b>4</b>	<b>04</b>

**Books Recommended**

Sr.No.	Author	Title	Publisher
01	Elias Award and Hassan Gazai	Knowledge Management	Pearson
02	Arpita Gopal and Chandranii Singh	E-world Emerging Education Pvt. Ltd.	
03	Amrit Tiwan	Knowledge Management Toolkit	Pearson Education Pvt.Ltd.
04	Bukowitz W R Williams R.I.	Knowledge Management Field Work	London Pearson Education
05	Egaallo C F	Building the Knowledge Management Network	Willey Dream tech India Ltd
06	Pettigrew A , Whipp R	Change Management for Competitive Success	Infinity Books

**M.Com. Part I Semester II**  
**Advanced Banking & Finance Special Paper III**  
**Subject Title -: Banking Law & Practices**  
**Course Code -: 215**

- 1. Introduction to Prevention of Money Laundering Act, 2002 -:** **12**  
Provisions relating to: Preliminary (Section 1 and 2) Offence of money laundering (Section 3 and 4) Attachment, adjudication and confiscation (Section 5 and 11) Obligation of banking companies, financial institutions and intermediaries (Section 12 and 15) Summons, searches and seizures (Section 16 and 24) The RBI guidelines, Money Laundering Act Post 2002
- 2. Banker customer relationship -:** **12**  
Definition of a banker and a customer Banker customer relationship as debtor-creditor, agent-principal and trustee-beneficiary Features of the relationship Banker's duty of secrecy of customers' accounts: Credit Information Bureau of India limited Right of set off, Garnishee order, Law of limitation, Termination of relationship, Role of Banking Ombudsman Customer's service: Goiporia Committee Norms, Damodaran Committee Recommendations
- 3. Asset - Liability Management -:** **12**  
Definition of assets and liabilities, Asset liability mismatches on the grounds of locations, maturity, return and currency Risks while managing the assets and liabilities: Liquidity risk, Interest rate risk, Pre-mature withdrawal and pre-payment risk, Price Risk, Foreign exchange and sector based risk, Strategies to manage these risks, RBI guidelines for asset and liability management. Management of loan portfolio with special reference to Non Performing Assets (NPAs): Definition of NPA, Income Recognition and Asset Classification Norms (IRAC Norms) Strategic approach in reduction of nonperforming assets Management of investment Portfolio- Regulatory aspects, Overview of Basel I and II
- 4. Hi-tech banking and Mergers and Acquisition in banking sector -:** **12**  
Role and uses of Technology up gradation- Impact of Technology on Banks-Protecting the confidentiality and secrecy of data, Meaning of Merger and Acquisition: Recent cases of mergers and acquisition in Banking sector of India - Consolidation of Banks.

**TOTAL 48**

**List of Books and Journals**

1. Tannan's 'Banking', Law and Practice in India Banking
2. P.N. Varshney, Banking: Law and Practice
3. Justin Paul and Padmalatha Suresh: Management of Banking and Financial Services
4. All relevant and recent Bare Acts, Indian Institute of Bankers: Laws and Practices relating to banking
5. All journals published by Indian Institute of Banking and Finance
6. Indian Banking Associations Bulletin
7. RBI Bulletin
8. Indian Institute of Banking and Finance, Principles and Practices of Banking, Macmillan Publisher India Ltd.

**M.Com. Part I Semester II**  
**Advanced Banking & Finance Special Paper IV**  
**Subject Title -: Monetary Policy**  
**Course Code -: 216**

- 1. Money supply measures -:** **10**  
Money supply measures of the Reserve Bank of India  
Concept of High powered money  
Recommendations of the Working Group on 'Money Supply :  
Analytics and methodology of compilation (Chairman : Dr. Y.V.Reddy), 1998  
□□□ Money supply and price stability.
- 2. Monetary management** **10**  
Objectives of monetary policy: Price stability, Generation of employment, Exchange Rate Stability, Balanced growth etc., conflict between objectives.
- 3. A) Instruments of monetary policy -:** **10**  
-Mechanism and effectiveness of following instruments.  
i) Quantitative Instruments: Variations in Bank Rate, Open Market Operations and Variable Reserve Ratio  
ii) Qualitative Instruments: Margin Requirements, Credit Rationing, Moral Suasion, Direct Action, Publicity  
**B) A review of monetary policy of the Reserve Bank of India in the last five Years - Recent policy changes announced by the R.B.I.**
- 4. Development and promotional role of the Reserve Bank of India in Financial Inclusion and its implications.** **10**  
1. R.B.I. and rural credit: priority sector advance, regional rural banks, development of Farm sector and non-farm sector.  
2. R.B.I. and industrial finance: establishment of institutional, lending policy for Commercial banks, coordination between term lending institutions, bridge loans, Rehabilitation of sick industrial units.  
3. R.B.I. and export credit: pre-shipment credit, post-shipment credit, measures to Promote Exports.

**TOTAL 48**

**Recommended books/ Journals**

1. Reserve Bank of India functions and working (latest edn.) R.B.I.
2. Monetary Economics for India, Dr. Narendra Jadhav
3. Central Banking for emerging market economies, A. Vasudevan
4. Monetary and Financial Sector Reforms in India: A central banker's perspective, Dr. Y.V. Reddy
5. Indian Economy: Essays on money and finance, Dr. C.Rangarajan.
6. Reserve Bank of India Bulletin
7. Annual Report on Trend and Progress of Banking in India

**M.Com. Part I Semester II**  
**Advanced Marketing Special Paper III**  
**Subject Title :- Customer Relationship Management & Retailing**  
**Course Code :- 217**

**Objectives :** To impart knowledge regarding customer relationship management, & retailing techniques, process and tools and develop an understanding of the CRM & retailing functions techniques and strategies

Unit No.	Name of Topic	Periods
1	<b>CRM An Introduction:</b> Evolution of Relationship as a Marketing tool, Emergence of CRM Practice/ Factors responsible for the growth of CRM . CRM Cycle, Importance of CRM	08
2.	<b>Emerging CRM</b> Customer Retention Management, Reasons for Customer Switching and Strategies for Retention Customer Recall Management, Customer Recall Strategies CRM a Cost benefit analysis. CRM Benefit, CRM Cost and CRM Value	08
3	<b>CRM and I.T</b> eCRM an I.T Tool, e CRM in Business, Features of e- CRM Technologies of E CRM Important CRM Softwares—Oracle, Clarify, People Soft and My Sap CRM. Applications of e CRM	08
4.	<b>Latest Development in CRM :</b> Changing Roles of CRM , Customer Experience Management, Customer Profitability, Customer Classification based on Profitability, Customer Profitability as a strategic Management Tool, Customer Profitability and company Value, Customer Experience Management and Customer Profitability Management, Customer Lifetime Value	08
5	<b>CRM Implementation Issues</b> Challenges of CRM Implementation, Essentials of CRM Principle, Customer Satisfaction, Importance of Customer Satisfaction, Customer Expectation, Customer Perception	08
6	<b>People factor in CRM—</b> Customer Centric Organisational Structure Employee Organisation Relationship Employee Customer Orientation	08
	<b>Total</b>	48

**Books Recommended**

1. Strategic Marketing Management - David Aaker
2. Customer Relationship Management – Jaddish Seth, Parvaityar, Shainesh
3. Handbook of Relationship Marketing – Jagdish Sheth, Atual Parvatiyar
4. Leading Through Relationship Marketing – Richard Batterley
5. Relationship Marketing – S. Shajahan
6. Customer Relationship Management – Jagdish Seth., Atul Parvatiyar, G. Shainesh
7. Retail Management – Gibson Vedamani
8. Channel Management & Retail Marketing – Meenal Dhotre
9. Retail Marketing Management – David Gilbert
10. Retailing Management – Swapna Pradhan
11. Retail Management – Ron Hasty & James Rear don
12. Retail Marketing Management – Swapna Pradhan

**M.Com. Part I Semester II**  
**Advanced Marketing Special Paper IV.**  
**Subject Title -: Services Marketing**  
**Course Code -: 218**

**Objective :**

To impart knowledge regarding services marketing, process and tolls and develop understanding of the services marketing functions techniques and strategies

<b>Unit No.</b>	<b>Name of Topic</b>	<b>Periods</b>
<b>1</b>	<b>Introduction:</b> Definition and character of Services. Origin of Services Marketing. Types of Services./ Classification of Services. Difference between goods and services . Reasons for growth of Service Sector	<b>08</b>
<b>2</b>	<b>Understanding Customer Needs related to services, ,</b> The Purchase Process for Services , The Service Offering , How Customers Evaluate Service Performances Understanding Customer Behaviour at Different Points in the Service Experience ,Customer Expectations in Services Customer Perceptions in Services	<b>08</b>
<b>3</b>	<b>Product Mix and Services Marketing ,</b> Price Mix and Services Marketing . Physical Distribution/ Place Mix and Services Marketing.	<b>08</b>
<b>4</b>	<b>Physical Evidence and Services Marketing ,</b> People and Services Marketing , Process and Services Marketing. Use of Marketing by service firms, Problems and Strategies in Services Marketing, The Financial and Economic Impact of Service	<b>08</b>
<b>5</b>	<b>Organising for Service Leadership --</b> Service Leadership , Inter functional Conflict , Ensuring that Service Encounters are Customer-Oriented Listening to Customers through Research	<b>08</b>
<b>6</b>	<b>CRM and Services</b> CRM practices in Indian Service Businesses: Banking and Finance: recent customer service initiatives in the Banking Industry, Customer involvement in Banking, Customer centric communication in banks. Hospitality Industry: Customer Centric initiatives by Hotels , Customer Issues in hospitality industry, Aviation Industry: Customer Service initiatives by aviation sector	<b>08</b>
<b>Total</b>		<b>48</b>

<b>Books Recommended</b>
<ol style="list-style-type: none"> <li>1. Services Marketing - Zeithaml &amp; Bitner</li> <li>2. Services Marketing: Integrating Customer Focus Across the Firm – Valarie A. Zeithaml</li> <li>3. Services Marketing - Christopher Lovelock</li> <li>4. Service Marketing - Rampal &amp; Gupta</li> <li>5. Essence of Services Marketing - Ardian Payne</li> <li>6. Services Marketing - S.M.Jha</li> <li>7. Services Marketing - Helen Woodruffe</li> </ol>



# UNIVERSITY OF PUNE

## Master of Commerce (M.Com.) Semester Pattern with Credit System Revised with effect from June 2013

### **Preamble for Choice Based Credit System**

Since liberalization the socio-political-economic scenario is changing very fast. There is a significant transformation in term educational expectation and aspiration of the learner. The educational system also is witnessing many changes and challenges due to technological growth and changes in the Government policies. Education is no longer a concern of students but it has become a matter of social and economic importance. The changes at the global level has influence the educational system, structure and expectation of the users.

University education needs to take contingency of all these changes and restructure itself to stand in a competitive dynamic environment. Professional stream of learning like Commerce have to be properly upgraded to accommodate challenges of change, expectation of employers' and to offer global opportunities to the learners. From this point of view the course structure of post-graduate programme in Commerce needs to be structured. It has to be according to expectations of the learners, employers and the society. The learning inputs have to be more update, skilled based and with appropriate applications. The course programme should consider desire aptitude, attitude and acumen of the learner.

From this point of view University of Pune has introduced Choice Base Credit System of course structure. This system shall offer a flexible user friendly, opportunity to the learner, will broader the horizon of Commerce education and will give a fair chance to every single learner to exhibit his talent, acquired skills and enhance his personality. It will further enhance his opportunity of global mobility, to acquire different knowledge inputs from different global institutes.

### **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 for seeking suitable careers in management and entrepreneurship.
- d. To study by students methods of Data collection and their interpretations.
- e. To develop among students Communication, Study and Analytical skills.

## 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. The 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:

<b>Sr. No.</b>	<b>Semester</b>	<b>Total Credits</b>
1	Semester I	16
2	Semester II	16
3	Semester III	16
4	Semester IV	16
	<b>Grand Total</b>	<b>64</b>

Four credits for project work at 4<sup>th</sup> 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 50 marks will be for Internal Assessment (attendance, home assignments, class tests, long term papers, classroom presentation and 50 marks for University Examination. Thus M.Com. degree examination, four Semesters shall be of 1600 marks and of minimum 64 credits altogether. The following shall be the course structure.

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			
Semester I	Core Compulsory	101	Management Accounting	04	04	03	50	50	100	
		102	Strategic Management	04	04	03	50	50	100	
	Core Elective/ Optional Subjects/ Special Subjects	<i>To choose any one Group of the following</i>								
		<b>Group A (Advanced Accounting &amp; Taxation)</b>								
		103	Advanced Accounting	04	04	03	50	50	100	
		104	Income Tax	04	04	03	50	50	100	
		<b>Group B (Commercial Laws &amp; Practices)</b>								
		105	Information system and E-Commerce Practices	04	04	03	50	50	100	
		106	Intellectual Property Laws	04	04	03	50	50	100	
		<b>Group C (Advanced Cost Accounting &amp; Cost system)</b>								
		107	Advanced Cost Accounting	04	04	03	50	50	100	
		108	Costing Technique and Responsibility Accounting	04	04	03	50	50	100	
		<b>Group D (Co-operation &amp; Rural Development)</b>								
		109	Co-operative Movement in India	04	04	03	50	50	100	
		110	Organization of Co-operative Business	04	04	03	50	50	100	
		<b>Group E (Business Practices &amp; Environment)</b>								
		111	Organized Trades and Markets	04	04	03	50	50	100	
		112	Business Environment and Policy	04	04	03	50	50	100	
<b>Group F (Business Administration)</b>										
113	Production and Operation Management	04	04	03	50	50	100			
114	Financial Management	04	04	03	50	50	100			
<b>Group G (Advanced Banking &amp; Finance)</b>										
115	Legal Framework of Banking	04	04	03	50	50	100			
116	Central Banking	04	04	03	50	50	100			
<b>Group H (Advanced Marketing)</b>										
117	Marketing Techniques	04	04	03	50	50	100			
118	Consumer Behaviour	04	04	03	50	50	100			

## Semester II

Semester	Subject Types	Course Code	Title of the Paper	Hrs/ Week	Credit	Exam. Hours	Maximum Marks			
Semester II	Core Compulsory	201	Financial Analysis and Control/ Principals of Financial Accounting	04	04	03	50	50	100	
		202	Industrial Economics/ Economic Environment/Business Statistics/ Quantitative application	04	04	03	50	50	100	
	Core Elective/ Optional Subjects/ Special Subjects	<b>To choose any one Group of the following</b>								
		<b>Group A (Advanced Accounting &amp; Taxation)</b>								
		203	Specialized Areas in Accounting	04	04	03	50	50	100	
		204	Business Tax Assessment & Planning	04	04	03	50	50	100	
		<b>Group B (Commercial Laws &amp; Practices)</b>								
		205	E- Security & Cyber Laws	04	04	03	50	50	100	
		206	Laws Regulating to Copyrights & Design	04	04	03	50	50	100	
		<b>Group C (Advanced Cost Accounting &amp; Cost system)</b>								
		207	Application Cost Accounting	04	04	03	50	50	100	
		208	Cost Control & Cost System	04	04	03	50	50	100	
		<b>Group D (Co-operation &amp; Rural Development)</b>								
		209	International Co-operative Movement	04	04	03	50	50	100	
		210	Management of Co-operative Business	04	04	03	50	50	100	
		<b>Group E (Business Practices &amp; Environment)</b>								
		211	Modern Business Practices	04	04	03	50	50	100	
		212	Business Environment Analysis	04	04	03	50	50	100	
		<b>Group F (Business Administration)</b>								
		213	Business Ethics and Professional Values	04	04	03	50	50	100	
214	Elements of Knowledge Management	04	04	03	50	50	100			
<b>Group G (Advanced Banking &amp; Finance)</b>										
215	Banking Law & Practices	04	04	03	50	50	100			
216	Monetary Policy	04	04	03	50	50	100			
<b>Group H (Advanced Marketing)</b>										
217	Customer Relationship Management & Retailing	04	04	03	50	50	100			
218	Services Marketing	04	04	03	50	50	100			

### Semester III

Semester	Subject Types	Course Code	Title of the Paper	Hrs/ Week	Credit	Exam. Hours	Maximum Marks			
Semester III	Core Compulsory	301	Business Finance	04	04	03	50	50	100	
		302	Research Methodology for Business	04	04	03	50	50	100	
	Core Elective/ Optional Subjects/ Special Subjects	<i>To choose any one Group of the following</i>								
		<b>Group A (Advanced Accounting &amp; Taxation)</b>								
		303	Advanced Auditing	04	04	03	50	50	100	
		304	Specialized Areas in Auditing	04	04	03	50	50	100	
		<b>Group B (Commercial Laws &amp; Practices)</b>								
		305	Laws Relating to International Business	04	04	03	50	50	100	
		306	World Trade Organization – Norms & Practices	04	04	03	50	50	100	
		<b>Group C (Advanced Cost Accounting &amp; Cost system)</b>								
		307	Cost Audit	04	04	03	50	50	100	
		308	Management Audit	04	04	03	50	50	100	
		<b>Group D (Co-operation &amp; Rural Development)</b>								
		309	Co-operative Credit System	04	04	03	50	50	100	
		310	Co-operative and Rural Banking System	04	04	03	50	50	100	
		<b>Group E (Business Practices &amp; Environment)</b>								
		311	Entrepreneurial Behaviour	04	04	03	50	50	100	
		312	Entrepreneurship Development Pattern	04	04	03	50	50	100	
		<b>Group F (Business Administration)</b>								
		313	Human Resource Management	04	04	03	50	50	100	
314	Organizational Behaviour	04	04	03	50	50	100			
<b>Group G (Advanced Banking &amp; Finance)</b>										
315	Foreign Exchange	04	04	03	50	50	100			
316	International Finance	04	04	03	50	50	100			
<b>Group H (Advanced Marketing)</b>										
317	International Marketing	04	04	03	50	50	100			
318	Marketing Research	04	04	03	50	50	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	50	50	100	
		402	A. Industrial Economic Environment Or B. Operations Research	04	04	03	50	50	100	
		<i>To choose any one Group of the following</i>								
		<b>Group A (Advanced Accounting &amp; Taxation)</b>								
		403	Recent Advances in Accounting, Taxation and Auditing	04	04	03	50	50	100	
		404	Project Work/ Case Studies	04	04	03	50	50	100	
		<b>Group B (Commercial Laws &amp; Practices)</b>								
		405	Recent Advances in Commercial Laws and Practices	04	04	03	50	50	100	
		406	Project Work/Case Studies	04	04	03	50	50	100	
		<b>Group C (Advanced Cost Accounting &amp; Cost system)</b>								
		407	Recent Advances in Cost Auditing and Cost System	04	04	03	50	50	100	
		408	Project Work/Case Studies	04	04	03	50	50	100	
		<b>Group D (Co-operation &amp; Rural Development)</b>								
		409	Recent Trade in Co-operative and Rural Development	04	04	03	50	50	100	
		410	Project Work / Case Studies	04	04	03	50	50	100	
		<b>Group E (Business Practices &amp; Environment)</b>								
		411	Recent Advances in Business Practices and Environment	04	04	03	50	50	100	
		412	Project Work/Case Studies	04	04	03	50	50	100	
		<b>Group F (Business Administration)</b>								
		413	Recent Advances in Business Administration	04	04	03	50	50	100	
	414	Project Work/Case Studies	04	04	03	50	50	100		
	<b>Group G (Advanced Banking &amp; Finance)</b>									
	415	Recent Advances in Banking and Finance	04	04	03	50	50	100		
	416	Project Work/Case Studies	04	04	03	50	50	100		
	<b>Group H (Advanced Marketing)</b>									
	417	Recent Advances in Marketing	04	04	03	50	50	100		
	418	Project Work/Case Studies	04	04	03	50	50	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 2013-14 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 50 marks and the University Examination (UE) of 50 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 50 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
Quiz / Home Assignment	10
<b>Total</b>	<b>50</b>

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.

A student cannot register for the third semester, if she/he fails to complete 50% credits of the total credits expected to be ordinarily completed within two semesters.

## 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.

<b>Division of marks</b>	<b>Marks</b>	
A. Synopsis with working bibliography (Internal Assessment) Viva Voce (Internal Assessment)	40 marks 10 marks	50 marks
B. A full project Report (Minimum 50-80 pages) (Internal & External Assessment) Viva Voce (Internal & External Assessment)	40 marks 10 marks	50 marks

As the Research Project is based on the self study done by the candidate and evaluated for 100 marks altogether, 04 credits will be awarded to a successful candidate in this subject. 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 passess in all the courses will be declared to have passed the M.Com. degree with the following honours.

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 three 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 have 16 credits.

## 12. 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 SGPA or CGPA to equivalent percentage is given by:

$$\text{Equivalent percentage marks} = \begin{cases} 10 \times \text{CGPA} & \text{if CGPA /SGPA is in [4.00, 6.00]} \\ 05 \times \text{CGPA} + 30 & \text{if CGPA /SGPA is in [6.00, 9.00]} \\ 25 \times \text{CGPA} - 150 & \text{if CGPA /SGPA is in [9.00, 10.00]} \end{cases}$$

Marks	Grade	Grade Point
100 to 75	O : Outstanding	06
74 to 65	A : Very Good	05
64 to 55	B : Good	04
54 to 50	C : Average	03
49 to 45	D : Satisfactory	02
44 to 40	E : Pass	01
39 to 0	F : Fail	00

(C) GPA	Grade
05.00 – 6.00	O
04.50 – 04.99	A
03.50 – 04.49	B
02.50 – 03.49	C
01.50 – 02.49	D
00.50 – 01.49	E
00.00 – 00.49	F

### 13. 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
<b>Total</b>	<b>60</b>

### 14. Standard of Passing.

A. 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.

### 15. Award of Class.

a. 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:-

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.

### 16. Medium of Instruction :

The use of Marathi is allowed for writing answers in the examination except for following courses:

- Management Accounting
- Financial Analysis & Control
- Business Statistics,
- Advanced Accounting and Taxation
- Advanced Cost Accounting and Cost Systems.

17. A student (Regular / External) will be admitted to Revised M. Com. Course with effect from June 2013. For the students who have completed the terms for the First Year as per Old Course will be admitted to the Second Year as per Old Course M. Com. The examination as per Old Course will be held simultaneously for three years from April / May 2014.

### 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)

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**M.Com. Part II Semester IV**  
**Compulsory Paper**  
**Subject Name -: Capital Market and Financial Services.**  
**Course Code -: 401.**  
**(w.e.f. Academic Year: 2014-15)**

**Objective:**

To enable students to acquire sound knowledge, concept and structure of capital market and financial services.

Unit No.	Topic	Periods
1	<b>Capital market:</b> Meaning, Functions, Structure, Characteristics, Participants of capital market - Capital market instruments, Equity share, Preferences shares, Debenture, Bonds - Innovative debt instruments - Forward contracts, Futures contract - Options contract, trends in capital market.	10
2	<b>Stock Market</b> <b>Stock exchange:</b> organization-membership-governing body - Bombay stock exchange, National Stock Exchange and Over the Counter Exchange of India (OTECI) 1. <b>Primary market</b> - Functions of primary market - issue mechanism, participants 2. <b>Secondary market</b> : Objectives, functions of secondary markets, stock broking, e-broking, depository system-functions and benefits stock market trading-derivatives trading	10
3	<b>Financial Services</b> Merchant banking-meaning-functions and services rendered Mutual funds: Meaning, functions-Types-Open and closed ended funds-income funds balanced fund, growth fund-index fund Portfolio management-meaning and services Credit rating-meaning and need, various credit rating agencies. Foreign Direct Investment	16
4	<b>Securities and Exchange Board of India (SEBI)</b> Background, Establishment, functions, powers, achievements and Regulatory aspects, recent changes & emerging trends.	12
	<b>Total</b>	<b>48</b>

**Recommended Books :**

1. M.Y. Khan: Indian financial system-Tata Macgraw Hill Publishing Co. Ltd.
2. Frank J.Fabozzi & Franco Modigliani : Capital markets institutions and instruments - Prentice Hall of India, New Delhi
3. Fredric Mishkin and Stanley Eakins, Financial Markets and Institutions, Pearson Prentice Hall, Boston san Francisco, New York.

**M.Com. Part II Semester IV**  
**Compulsory Paper**  
**Subject Name -: Industrial Economic Environment.**  
**Course Code -: 402-A**  
**(w.e.f. Academic Year: 2014-15)**

**Objectives:**

1. To study the basic concepts of Industrial Finance.
2. To study the effects of New Economic Policy.
3. To study the impact of Labor reforms on Industries.

Chapter No.	Particulars	Total Lectures (48)
<b>1.</b>	<b>Industrial Finance</b> 1.1 Meaning, Concept and Functions of Industrial Finance. 1.2 Internal Sources of Industrial Finance. 1.3 External Sources of Industrial Finance – Foreign Direct Investment (FDI), Foreign Institutional Investment (FII), Non Residential Indians (NRI) as a Source of Industrial Finance	<b>8</b>
<b>2.</b>	<b>Industrial Growth and Policy in India</b> 2.1 Industrial Growth in India Since 1991. 2.2 New Industrial Policy 1991. 2.3 Export and Import Policy Since 1990-91. 2.4 Multi National Corporations – Performance and Problems 2.5 Special Economic Zones (SEZ) – Progress and Problems	<b>8</b>
<b>3.</b>	<b>Effects of New Economic Policy (1991).</b> 3.1 Liberalization – Concept & its Effects on Indian Industry. 3.2 Privatization - Concept & its Effects on Indian Industry. 3.3 Globalization - Concept & its Effects on Indian Industry.	<b>8</b>
<b>4.</b>	<b>Industrialization and Environmental Issues.</b> 4.1 Industrial Development & Environmental Problems. 4.2 Major Environmental Issues in the Process of Industrialization- Social Cost & Benefits (pollution, Health issues, work management etc) 4.3 Environmental Policy and Regulations.	<b>8</b>
<b>5.</b>	<b>Information Technology (IT) Industries.</b> 5.1 Meaning and dimensions. 5.2 Major issues in Information Technology. 5.3 Growth & Present position of IT Industries in India. 5.4 Future Prospects of IT Industry.	<b>8</b>

<b>6.</b>	<b>Industrial Relations and Labour Reforms.</b> 6.1 Meaning and Causes of industrial Disputes. 6.2 Machinery for Settlement of Industrial Disputes. 6.3 Labour Policy Reforms and Its Impact on Industries.	<b>8</b>
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### Recommended Books

1. S. C. Kuchal – Industrial Economy of India.
2. D. R. Gadgil – Industrial Evolution in India, Oxford.1948
3. K. V. Sivayya and V.B.M. Das – Indian Industrial Economy, Chand and Co. Ltd. New Delhi 1999
4. S. C. Kuchal – Major Industries in India, Chaitanya Publishing House, Allahabad.
5. Francis Cherunilam – Industrial Economics – Indian Perspective, Himalaya Publishing House, Mumbai.1999
6. Wadilal Dagli – A profile of Indian Industry, Vora and Co. Mumbai.
7. Dutt and Sunderam – Indian Economy, S. Chand and Co. 2008

### Suggested format of Continuous assessment along with allocation of Periods

Sr. No.	Assessment Chart	Periods Alloted
1.	Tests	3
2.	Quizzes	3
3.	Presentation Seminars	3
4.	Assignments	3

**M.Com. Part II Semester IV**  
**Compulsory Paper**  
**Subject Name -: Operation Research.**  
**Course Code -: 402-B**  
**(w.e.f. Academic Year: 2014-15)**

**Objectives :**

- 1) To understand and master the concepts of Operations Research.
- 2) To inculcate an attitude of enquiry , logical thinking about Quantitative techniques.
- 3) To develop skills of facing real life problems using operational research techniques .
- 4) To prepare students to understand the art of applying Operational research techniques.
- 5) To gain knowledge of Operations research.

<b>Unit no.</b>	<b>Topic</b>	<b>Periods</b>
<b>1.</b>	<b>Game Theory</b> 2.1 Introduction 2.2 Characteristics of game theory 2.2 Two person zero sum game, Pay off and pay off matrix, saddle point, pure strategy, mixed strategy, value of game 2.3 Dominance Principle. 2.4 Algebraic system of solving 2X2 Game 2.5 Numerical problems	8
<b>2.</b>	<b>Linear Programming Problem (L. P. P.)</b> 3.1 Introduction, Advantages and Applications of L.P.P. 3.2 Basic Definitions and Terminology, Formulation, Canonical and Standard forms, Slack, Surplus and Artificial variables 3.3 Solution by graphical method ( for problems with two variables only), 3.3 Solution by simplex method (canonical form and two iterations only) 3.4 degenerate, alternate , unbounded and Infeasible solutions 3.5 Formation of dual of a L. P. P. 3.6 Numerical problems	14
<b>3.</b>	<b>Transportation Problem (T. P.) and Assignment Problem</b> 3.1 Definition, T.P. as L.P.P., balanced and unbalanced T. P. 2.2 Methods of finding Initial Basic Feasible Solution (I. B. F. S.) a. North – West corner method b. Matrix Minima Method	14

	<p>c. Vogel's approximation method</p> <p>3.3 Optimal solution by U-V method</p> <p>3.4 Maximization and degeneracy in T. P.</p> <p>3.5 Definition, balanced and unbalanced A.P.</p> <p>3.6 Hungarian method</p> <p>3.7 Variations of A.P (maximization and restrictions)</p> <p>3.5 Numerical Problems</p>	
<b>4.</b>	<p><b>Project Management and Sequencing</b></p> <p>4.1 Activity, Event, Loop, Network (definition and drawing)</p> <p>4.2 Critical Path Method(CPM): critical activity, critical path, float (free, independent, total) , forward pass and backward pass calculations</p> <p>4.3 Programme Evolution and Review Technique PERT) : optimistic, pessimistic, most likely time estimates, expected time estimate and its variance</p> <p>4.4 Numerical Problems</p> <p>4.5 Assumptions in sequencing model, Basic terminology, n-jobs through two machine problems.</p>	12

**Recommended Books:**

1. Operations Research : Hamdy Taha
2. Operations Research: V.K. Kapoor
3. Operations Research : Kanti Swarup, Gupta Manmohan
4. Operations Research : Varade , Joshi: Diamond publications



**M.Com. Part II Semester IV**  
**Advanced Accounting and Taxation Special Paper VII.**  
**Subject Title -: Recent Advances in Accounting, Taxation & Auditing.**  
**Course Code -: 403**  
**(w.e.f. Academic Year: 2014-15)**

**Level of Knowledge - Basic Knowledge**

**Objectives:**

1. To up-date the students with latest developments in the Subject
2. To inculcate the habit of referring to various periodicals and publications in the given subject, apart from text books and reference books
3. To develop the ability to read, understand, interpret and Summarize various articles from newspapers, journals etc.

**Suggested Topics/Areas covering recent developments in the subject:**

UNIT	TOPIC	No. of Lectures in hours
1	IFRS (International Financial Reporting Standards).	04
2	A Study of Managerial Discussion And Analysis as per Section 49 of Listing agreement.	02
3	Corporate Governance Compliance by Companies.	02
4	Accounting and Taxation aspects of Carbon Credit Trading.	02
5	Environmental Accounting.	02
6	Forensic Accounting.	02
7	Lean Accounting.	02
8	Responsibility Accounting.	02
9	ESO (Employee Stock Options ) Accounting.	02
10	XBRL (Extensible Business Reporting Language).	02
11	Transfer Pricing.	02
12	Accounting for KPO (Knowledge Process Outsourcing) and BPO (Business Process Outsourcing).	02
13	Accounting for NGO Grants.	02
14	Accounting for Local Self Governments.	02
15	Introduction of accrual method for Government Accounting.	02
16	Disclosures in Financial Statements- Recent Trends.	02
17	Accounting for Human resources.	02
18	Accounting for Intellectual Property Rights.	02
19	Inflation Accounting.	02
20	A Brief Study of a) Accounting for Derivatives	02

	b) Accounting for Retirement Benefits as per AS-15.	
<b>21</b>	Creative Accounting.	<b>02</b>
<b>22</b>	A brief study of provisions of proposed- i) Direct Taxes Code, ii) Goods and Services Tax, iii) Companies Act, 2013 relating to Account and Audit.	<b>02</b>
<b>23</b>	Non- Financial Reporting Requirements– i) Business Responsibility Reporting, ii) Sustainability Reporting, iii) A brief Study of National Voluntary Guidelines (NVG), iv) Report on Corporate Governance.	<b>02</b>
<b>TOTAL -</b>		<b>48</b>

**Journals suggested:-**

- A) The Accounting World :- The ICAI University Press  
 B) The Chartered Accountant :- The ICAI New Delhi  
 C) Management Accountant :- ICWA Kolkatta  
 D) Journal of Accounting & Finance :- Accounting Research Foundation Jaipur  
 E) Journal of Indian Accounting Association, Jaipur

**List of Learning Activities and allocation of periods:-**

<b>Sr. No</b>	<b>Activities</b>	<b>Learning Hours</b>
<b>1</b>	<b>Quizzes/ Seminars/Presentations</b>	<b>04</b>
<b>2</b>	<b>Assignments/ Tutorials</b>	<b>04</b>
<b>3</b>	<b>Class Room Tests</b>	<b>04</b>
	<b>Total</b>	<b>12</b>

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**M.Com. Part II Semester IV**  
**Advanced Accounting and Taxation Special Paper VIII.**  
**Subject Title -: Project Work / Case Studies.**  
**Course Code -: 404**  
**(w.e.f. Academic Year: 2014-15 Credit System)**

**Project Work in Accountancy:-**

A student can select any topic relating to principles practices and procedures of accounting auditing taxation and management accounting. Any topic from the syllabus of the papers studied at M Com. Part One or Part Two under special paper Accountancy & Taxation can be of a use. Pick up any unit studied and try to connect it to commercial word around e.g. in taxation a student has studied taxation of a company, then he can select a topic Tax Planning of a particular company or a study of taxation of an educational institute. On this line following areas have been listed out for project work in Accountancy.

**Area of Project Work in Accounting:-**

**Following is the list of topics for project work in Accounting.**

1. Financial statement Analysis of –
  - a. A Limited Company for 5 years
  - b. Five Companies of five different industries
  - c. Five companies of one industry e.g. Automobile ,Engineering, Textile
  - d. Five banks from Private sector/Co-op. sector
2. Study of Working Capital Management of a large Company.
3. Study of Budgetary Control System of four Companies
4. Study of Management Information System of four Companies.
5. Procedure of preparation of Consolidated Balance Sheet by Holding Company having two / three subsidiaries companies.
6. Valuation of Shares of 10 unlisted Companies.
7. A study of Amalgamation/Merger of procedure of two Companies(Accounting procedure)
8. A comparative study of Accounting System of Hotel industry – Five Star, Three star, large Hotel and small Hotel.
9. Comparative study of Accounting of Hospitals from Private sector, Trust and Small Hospital.
10. Study of Accounting for Grants to school, college, institute.
11. Application of Inflation Accounting to a large Company's Balance Sheet.
12. Human Resource Accounting for Software, Marketing, Consulting Company

13. Preparation of Value Added Statements of a Company and its comparison with Conventional Accounting Statement.
14. Preparation of Economic Value Added Statement of a Company and its comparison with Conventional Accounting Statement.
15. A study of Application of Accounting Standards of five Companies.
16. Audit planning of five firms of Auditors.
17. A study internal Audit system of four companies.
18. Tax Planning of 10 assesses
19. Tax Planning regarding purchase of House Property.
20. Tax planning of Partnership Firm/ Limited Company.
21. Taxation of Public Trust
22. A study of Perquisites and its impact on Taxable Income Employees from 10 different Companies.
23. A study of ten Export Oriented Units from Taxation point of view.
24. Financial viability of five Co-operative Sugar Factories.
25. Comparative Study of Taxable Income of Individuals and HUFF
26. Problem of units paying Service Tax
27. Accounting for Tour and Travel business.
28. Comparative Study of Housing Loan Schemes of Banks and Financial Institutions.
29. Comparative Study of Fees Structure of Non-grant and Grant In Aid Educational Institutions.
30. A survey of 20 shareholders regarding utility of Published Annual Accounts of Company.
31. Study of Investment Pattern of 20 Individuals from Taxation point of view.
32. Preparation of Project Report for Small Scale Industry, Hotel, Xeroxing business, Computer Institute, Hospital, Transport Business, Petrol Pump.
33. Ascertainment of Cost of Capital from Annual Accounts of five Companies.
34. A financial viability study of Sick Industrial Companies.
35. A study of Tax Audit Report of Non-Corporate and Corporate Assesses.
36. A study of Secretarial Audit Report of five companies.
37. A study of Cost Audit Report of two companies.
38. A study of Government system Audit of Commercial Undertaking / Local bodies.
39. Commentary on Public Accounts Committee of Central Government.

40. A comparative study of different Accounts Software e.g. Tally, SAP, ERP, Local Software etc.
41. Consolidation procedure of different units of an Educational Society.
42. A study of Significant Accounting Policies of different Companies from different Industries.
43. A study of Qualified Audit Reports of different Companies.
44. Comparative study of Advances of Credit Co-op. Societies and Urban Co-op Banks.
45. Preparation of Project Report of Agro based industries, Poultry Farming, Dairy business, Nursery, Horticulture farm.
46. A study of Vehicle Loan schemes of different Banks.
47. Excise Accounting at manufacturing unit.
48. A comparative study of NPA of Urban Co-op Banks
49. A study of Corporate Responsibility Statements of Annual Accounts of 10 Companies
50. A study of Cash Flow Statement from Annual Accounts of 10 Companies.
51. Accounting of Leasing and Finance Companies.
52. A study of Accounting of Electricity Company, (Tata Power, Ahmedabad Electricity Power Co. Ltd.)
53. An exemption under Income Tax Act, availed by 10 different assesses.
54. A comparative financial analysis of running of Luxury buses by private operators and State Transport Corporation.
55. Financial Analysis of Produce Exchanges at Taluka Level.
56. Comparative study of Annual Report of 3 Co-op Banks for the year ending 2008 - 09.
57. Comparative study of Annual Report of 3 Limited companies for the year 2008-09
58. Various Accounting Policies followed by Financial Institutions.
59. Impact of IRAC Norms of financial position of any co-operative bank over last 3 years.
60. Audit classification of a Credit Co-op. Society for last 2 years.
61. Determination of Taxable Income of a Charitable Hospital as per Section 11,12,12A & 35 of I.T. ACT.. Act. 1961.
62. Accounting Standards, their application by the limited company to its annual accounts.
63. Comparative study of effect of Depreciation Allowance on Book Profit & taxable profits of a limited company for 3 years including carried forward and set-off.
64. Analysis of any three recent cases decided by High Court.

65. Study of fraud cases detected by application of S.A.P.
66. Comparative study of Financial Statements of Educational Institutions for 2 years.
67. A study on E filing of Tax Returns- Income Tax, VAT, Service Tax etc.
68. A study of Computerized Accounting system in any business unit



**M.Com. Part II Semester IV**  
**Commercial Laws and Practices Special Paper VII.**  
**Subject Title :- Recent Advances in Commercial Laws & Practices**  
**Course Code :- 405**  
**(w.e.f. Academic Year: 2014-15)**

**Objective:**

To acquaint the students with the Knowledge about recent changes / developments in commercial laws.

Unit No.	Topic	Periods
1)	<p><b>Competition Act, 2002:</b>            Definitions, Prohibition of certain agreements, Prohibition of abuse of dominant position, Regulation of combinations (Ss. 3 to 6),            Competition Commission of India. (Ss. 7 to 13)            Establishment, Composition, Selection Committee for Chairperson and Members of Committee, Term of Office, Resignation, Removal, Suspension, Restrictions on employment of Chair Person and other members, Appointment, Duties of Director General etc. (Ss. 16 to 17, 41)            Duties, Powers, Functions, Meetings and Orders of Commission (Ss. 18 to 20, 22, 31),            Acts taking place out of India (Ss. 32)            Penalties (Ss. 42 to 48)            Competition Appellate Tribunal (Ss. 53A to 53U)</p>	12
2)	<p><b>Limited Liability Partnership Act, 2008:</b>            Definitions, Nature of Limited Liability Partnership (Ss. 2 to 10).            Incorporation of Limited Liability Partnership. (Ss. 11 to 21).            Partners and their relations (Ss. 22 to 25)            Extent and Limitations of Liability of Limited Liability Partnership and Partners(Ss. 26 to 31)            Contributions and Financial Disclosures (Ss. 32 to 35)            Compromise, Arrangement and Reconstruction of Limited Liability Partnerships. (Ss. 60 to 62)            Conversion into Limited Liability Partnership (Ss. 55 to 58)            Foreign Limited Liability Partnership (Ss. 59)            Winding-up and Dissolution (Ss. 63 to 65)</p>	12
3)	<p><b>Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest Act, 2002:</b>            Definition &amp; Importance of Act, Regulation of Securitization and Reconstruction of Financial Assets of Banks &amp; Financial Institutions (Ss. 7 to 12),            Enforcement of Security Interest (Ss. 13 to 19)            Central Registry (Ss. 20 to 26)            Offences and Penalties (Ss. 27 to 30)</p>	12
4)	<p><b>The Recovery of Debts Due to Banks and Financial Institutions Act,1993:</b>            Need &amp; Object, Establishment of Tribunal and Appellate Tribunal – Jurisdiction, Powers and Authority of Tribunals-Procedure of Tribunals, Powers of Tribunals, Recovery of Debt Determined by Tribunal</p>	12
	<b>Total</b>	<b>48</b>

**Reference Books:**

1. Taxman's Corporate Law, Taxman Allied Services Pvt. Ltd., New Delhi. (Recent Edition).
2. Seth's Commentaries on Banking Regulatory Act and Allied Banking Laws, Law Publishers (India) Pvt. Ltd., Allahabad.
3. Taxman's "Banking Law and Practice in India", India Law House, New Delhi.
4. P. N. Varshney, "Banking Law and Practices", Sultan Chand & Sons, New Delhi. (2012).
5. All bare Acts of respective legislations referred in the syllabus.



**M.Com. Part II Semester IV**  
**Commercial Laws and Practices Special Paper VIII.**  
**Subject Title -: Project Work**  
**Course Code -: 406**  
**(w.e.f. Academic Year: 2014-15)**

**Objectives:**

1. To develop research attitude in the minds of students.
2. To enrich the ability of research work among students.

**Introduction and Objective:**

As a partial fulfillment of University of Pune requirement for M.Com programme students have to undergo in-plant training of 6 weeks in an organization of repute assigned by the institute or accessible to student. The objective of this activity is to test student's ability to apply theoretical knowledge to practical business situation.

In the light of exposure to different functional areas and research methodology at M.Com Part-I curriculum the students have to collect the data relevant to their topic or problem, analyze the same methodologically, make intelligent observations and offer some practical suggestions. In order to complete the task following Report Contents and Chapter Scheme is suggested which can be adopted with or without modification.

**Report Contents :**

- A. Cover page
- B. Company Certificate
- C. Acknowledgement
- D. Declaration
- E. Executive Summary

**Tentative Chapter Scheme:**

- Chapter 1. Introduction to Study
- Chapter 2. Company Profile
- Chapter 3. Objective of Study
- Chapter 4. Review of literature
- Chapter 5. Research Methodology
- Chapter 6. Data analysis Interpretations
- Chapter 7. Observations and Findings
- Chapter 8. Conclusions and suggestions

**M.Com. Part II Semester IV**  
**Advanced Cost Accounting and Cost System Special Paper VII.**  
**Subject Title :- Recent Advances in Cost Auditing and Cost System**  
**Course Code :- 407**  
**(w.e.f. Academic Year: 2014-15)**

**Objectives:**

To provide knowledge on recent advances in cost accounting and cost systems.

SR. NO	TOPIC	LECTURES
1.	<b>Cost Accounting Standards (CAS):-</b>	08
	❖ CAS 1 to 5 and 7 (Final) and CAS -8 TO 19. (Drafts And Amendments' Subjects to Finalization from time to time) <a href="http://www.myicwai.org">www.myicwai.org</a> & <a href="http://www.acmas.com">www.acmas.com</a> can be referred.	
2	<b>Basic Excise Audit, VAT Audit And Productive Audit.</b>	12
	❖ Generally Accepted Cost Accounting Principles. ❖ Scope, Of Excise Audit ,VAT Audit ❖ Procedure and Reports. ❖ <b>Productive Audit</b> –Meaning, Problems of Productive Audit and Means to overcome the Problems.	
3	<b>Enterprise Resource Planning (ERP)</b>	06
	❖ Introduction, Features and Benefits of ERP ❖ Reason for Implementation and E–Costing.	
4	<b>Six Sigma</b>	06
	Definitions, Importance, Scope, Benefits.	
5.	<b>Study Of Journal –Management Accountant:</b>	16
	By Reading of Journal of ICWAI-“ <u>Management Accountant</u> ” Issues From July to September (of the Respective Academic Year) and getting acquainted with recent changes and developments.	
		Total 48

**Books Recommended :-**

1. Indirect Taxes :- V.S. Datey
2. Indirect Taxes :- Ahuja.

**Journals :-**

Management Accountant - ICWAI, Publication

Cost Accounting Standards-Issued by ICWAI, Kolkatta

**M.Com. Part II Semester IV**  
**Advanced Cost Accounting and Cost System Special Paper VIII.**

**Subject Title -: Project Work / Case Studies**

**Course Code -: 408**

**(w.e.f. Academic Year: 2014-15)**

Project Work Will Carry 100 Marks. For Regular Students, Project Work Is Compulsory. The Option Of Case Studies Is Only For The Students Registered As An External Student. 'Students Are Expected To Prepare The Project Report Based On The Field Work And Survey And Studying The Current Trends Under The Guidance Of Their Guide Teacher'. They Will Have To Submit The Report On 31st March Every Year. Project Viva Voce Will Be Conducted At The End Of IV<sup>th</sup> Semester But Before Theory Examination.

**Guidelines Areas of Project Work**

**Marks: 100**

Students are required to Visit a Unit in Concerned Industry and submit their report on any of the following project topics.

1. **Marginal Costing:** Techniques Based on Annual Reports of Listed Companies .To Study the Application of Marginal Costing in Taking Managerial Decision.
2. **Budgetary Control:** Study of Procedure of Audit. A Study of Budgetary Control System Established therein and used for cost Control Purpose.
3. **VAT Audit:** Visit to any Trading Concern offices Chartered Accountant and Cost Accountant, Understanding the Actual Procedure of VAT audit, its Implication & Benefits.
4. **Excise Audit:** Study of Procedure of Audit (Eligible for Excise Audit) or Office Cost Accountant, to understand the Actual Procedure of Excise audit, its Importance and Benefits.
5. **Cost Audit:** Audit Programme Understanding the Procedure of Cost Audit, Cost Accounting Record Rules of the Respective Industry and Preparation of Cost Audit Report.
6. **Process Costing:** Visit to Sugar Industry & Understanding the Use of Process Costing Method in the factory, Cost Analysis at Each Stage in Particular and Cost Analysis in General done in the Sugar Factory.
7. **Pricing Decisions:** Visit to any Industry Understanding the different Methods and Techniques used by the Concern in pricing different Products.
8. **Cost Control and Cost Reduction:** Visit to any Manufacturing Concern and Understanding the different Methods used fruitfully by the Priority in Cost Control and Cost Reduction. **ISO-Procedure.**
9. **Contract Costing:** Visit to Any Construction / Contracting firm and Understanding Ascertainment of Contract Cost, Allocation and Apportionment of different Expenses and Apportionment of profit on Incomplete Contract.

10. Costing in Service Industry: Visit to any Hotel, Airlines, Hospitals or any other Service Industry and Understanding the Costing Methods used in the Concerned Service Industry and its Utility to Ascertain the Cost of Service Rendered as well as for controlling the Cost.
11. Recent Developments in Cost Accounting.
12. Application of Activity Based Costing.
13. Study of Job Evaluation and Merit Rating in Industrial Unit:
14. Application to Agro Based Industries i.e. fishery, dairy, poultry etc.
15. Cost Reduction Program and its Implementation:
16. Study of Costing Techniques and its use in Decision Making:
17. Application of Onion – Cash Crop, Sugarcane, Cotton, Horticulture etc.
18. Study of Various Measurement Policies (Risk Management)
19. Study of minimum wages.
20. Study of fixation or fees of Professional Courses,
21. Study of Cost Associate with Finance of Any Company
22. Study of Cost Structure of Different Companies from same Industry.

**M.Com. Part II Semester IV**  
**Co-operation and Rural Development Special Paper VII.**  
**Subject Title -: Recent Tread in Co-operative and Rural Development**  
**Course Code -: 409**  
**(w.e.f. Academic Year: 2014-15)**

**Objectives:**

1. To create awareness regarding globalization and its effects on a rural development.
2. To study and projects in the field of Co-operation and recent advances rural development.

Unit No.	Name of the Topic	Periods
1	<b>Social &amp; Economical Aspect:</b> 1.1 Theory and practice of Co-operative principles. 1.2 Issue of economic viability of Co-operative institutions. 1.3 Issue of non-viability and sick co-operative units. 1.4 Social responsibility of Co-operative institutions. 1.5 Co-operative leadership in global era.	12
2	<b>Globalization and Co-operatives :</b> 2.1 Impact of globalization on co-operative institutions. 2.2 Challenges of global competition. 2.3 Meeting the global challenges. 2.4 New management technologies. 2.5 Quality enhancement through six Sigma.	12
3	<b>Role of Self Help Groups in Rural Development</b> 3.1 Formation & Organisation 3.2 SHGs an innovation for rural development. 3.3 Micro finance and SHGs. 3.4 Development of banking habits among rural people. 3.5 Rural artisans and SHGs. 3.6 Woman empowerment through SHGs. 3.7 Marketing of SHG products 3.8 Performance.	12
4	<b>Rural distress and Government Measures.</b> 4.1 Reports of various committees regarding farmers Suicides. 4.2 Causes of Farmer's suicides. 4.3 Short and long term Governmental measures for redressing rural distress. 4.4 Self-sustaining rural development.	12
<b>TOTAL</b>		<b>48</b>

## **List of Books Recommended for Study**

### **Recommended Books, Journals & Reports**

#### **Books :**

1. Krushnaswami O.R- Co-operative Audit.
2. Krushnaswami O.R- Co-operative Accounts
3. Bedi R.D. – Theory History and Practices of Co-operations.
4. Dubhashi P.R – Principles and philosophy of co- operation.
5. Dubhashi P.R-Rural development administration in India.
6. B.K.Sinha- Indian co-operation.
7. S.k.Day- power to the people.
8. Rajeshwar – community development, Panchayat raj, sahakari samaj.
9. S.K.Goyal – co-operative farming in India.

#### **Journals:**

1. Journal of Rural Development, Hyderabad (Rajendranagar)
2. Journal of co-operative perspective, Pune
3. The Indian Journal of commerce, New Delhi
4. Journal of Sahakari Maharashtra, Pune
5. Journal of Southern Economics

**M.Com. Part II Semester IV**  
**Co-operation and Rural Development Special Paper VIII.**  
**Subject Title -: Project Work**  
**Course Code -: 410**  
**(w.e.f. Academic Year: 2014-15)**

**Objectives :**

1. To develop research attitude of the students.
2. To enrich the ability of research work among the students.

**Introduction & Objective :**

As a partial fulfillments of University of Pune requirement for M.Com Programme students have to undergo in-plant training of 6 weeks in an organization of repute assigned by the institute or accessible to student. The objective of this activity is to test students ability to apply theoretical knowledge to practical business situation.

In the light of exposure to different functional areas and research methodology at M.Com. Part-II curriculum the students have to collect the data relevant to their topic or problem, analyze the same methodologically, make intelligent observations and offer some practical suggestions. In order to complete the task following Report Contents and Chapter Scheme is suggested which can be adopted with or without modification.

**REPORT CONTENTS :**

- A. Cover Page
- B. Company Certificate
- C. Guide Certificate
- D. Acknowledgement
- E. Declaration
- F. Executive Summary

**TENTATIVE CHAPTER SCHEME :**

- CHAPTER 1. INTRODUCTION TO STUDY
- CHAPTER 2. COMPANY PROFILE
- CHAPTER 3. OBJECTIVES OF STUDY
- CHAPTER 4. REVIEW OF LITERATURE
- CHAPTER 5. RESEARCH METHODOLOGY
- CHAPTER 6. DATA ANALYSIS AND INTERPRETATIONS
- CHAPTER 7. OBSERVATIONS AND FINDINGS
- CHAPTER 8. CONCLUSIONS AND SUGGESTIONS

**M.Com. Part II Semester IV**  
**Business Practices and Environment Special Paper VII.**  
**Subject Title :- Recent Advances in Business Practices and Environment.**  
**Course Code :- 411**  
**(w.e.f. Academic Year: 2014-15)**

**Objective :-**

To provide knowledge and understanding of recent advances in Business Practices.

Unit No.	Topic	Periods
1	Industrial, investment & infrastructure policy of Maharashtra 2006 A) Thrust Areas. 1) Agro – Tourism 2) Agro processing Policy 3) Textile Policy. 4) Retail Policy. 5) Infrastructure development Policy. 6) Cluster Approach for Development.	12
2	A) Recent Scheme of Development of micro small & medium enterprises (MSME). B) Rajeev Gandhi Udyami Mitra Scheme (RGUMI).	12
3	B) Marketing Assistance. 1) Gram Udyog Vasahats. 2) Urban Haat. C) H.R. initiatives - Labour Market Information cell (LMIC) Service training institute (STI).	12
4	Environment Audit & Corporate Governance Nature - Scope & importance – Types – Limitation - Role & implication - Transparency & corporate discloser – Nominee Direct role.	12



**M.Com. Part II Semester IV**  
**Business Practices and Environment Special Paper VIII.**  
**Subject Title -: Project Report.**  
**Course Code -: 412**  
**(w.e.f. Academic Year: 2014-15)**

There will be a project work carrying 100 marks for internal students only. The students will have to select a subject from any area of the syllabi for Business- Entrepreneurship. The students will have to work under the guidance of concerned subject teacher.

The project will carry total 100 marks out of which Forty marks will be allotted for Project Report and 60 marks will be allotted for Project Viva Voce to be conducted by internal teacher and external teacher (examiner) appointed by the University.

Note: The list of suggested areas for project work will be notified in due course.

**Case Studies:**

There will be a paper of case studies for external students. The paper will be set for 80 marks- to be converted in to 100 marks. Total 20 cases will be selected from standard book for study. In the question paper 3 cases out of 20 (twenty) cases will be covered, each carrying twenty (20) marks. One unseen case also will be covered & it will carry twenty (20) marks.

Note: The paper of case studies will be offered only by external students only.

**M.Com. Part II Semester IV**  
**Business Administration Special Paper VII.**  
**Subject Title -: Recent Advances in Business Administration**  
**Course Code -: 413**  
**(w.e.f. Academic Year: 2014-15)**

**Objectives:**

1. To familiarise the students with the recent advancements in business administration
2. To develop an understanding about tools and their application in the business.

UNIT NO	CHAPTER	PERIODS
<b>UNIT- I</b>	<b>CONTEMPORARY ISSUES IN BUSINESS ADMINISTRATION</b> Change management – Concept, Significance. Managing change-Important feature Dimensions Approaches towards managing change Futuristic and strategic approach toward changing business environment	<b>12</b>
<b>UNIT-II</b>	<b>APPROACHES TO QUALITY MANAGEMENT &amp; ENTERPRISE RESOURCE PLANNING</b> K Total Quality management Six sigma Technique feature & utility Five’s system of Quality management. Concept & features of E. R. P Tools of E. R. Applying E. R. P. In business. Computers & E. R.P	<b>12</b>
<b>UNIT-III</b>	<b>CROSS- CULTURAL MANAGEMENT SYSTEM</b> Global management system- Concept, &Significance. Issues in cross cultural management. Acquisition & mergers- Role & importance Current Trends in acquisitions & mergers national & international scenario	<b>12</b>
<b>UNIT-IV</b>	<b>TURN AROUND &amp; INNOVATION MANAGEMENT</b> Concept & Significance of turnaround management, Techniques of turnaround management, Turn around management; prerequisite for success. Take over & turn around management Restructuring & Reengineering of business Concept of innovation Advantages and Significances of Innovation Key Steps in Innovation Management Role of Government and Private Institutions in promoting innovation	<b>12</b>
<b>TOTAL</b>		<b>48</b>

**M.Com. Part II Semester IV**  
**Business Administration Special Paper VIII.**

**Subject Title -: Project Work / Case Studies.**

**Course Code -: 414**

**(w.e.f. Academic Year: 2014-15)**

**Project Work for internal students(414)**

There will be a project work carrying 100 marks for internal students only. The students will have to select a subject from any area of the syllabi for Business- Administration. The students will have to work under the guidance of concerned subject teacher. The project will carry total 100 marks out of which sixty marks will be allotted for Project Report and 40 marks will be allotted for Project Viva Voce to be conducted by internal teacher and external teacher (examiner) appointed by the University.

Note: The list of suggested areas for project work will be notified in due course.

**Case Studies:**

There will be a paper of case studies for external students. The paper will be set for 80 marks- to be converted to 100 marks. Total 20 cases will be selected from standard book for study. In the question paper 3 cases out of 20 (twenty) cases will be covered, each carrying twenty (20) marks. One unseen case also will be covered & it will carry twenty (20) marks.

*Note:* The paper of case studies will be offered only by external students only.

**BUSINESS ADMINISTRATION – SUGGESTED TOPICS FOR PROJECT REPORT**

**REPORT CONTENTS:**

- 1.CoverPage
- 2.CompanyCertificate
- 3.Guide Certificate
- 4.Acknowledgement
- 5.Declaration
- 6.Executive Summary

**TENTATIVE CHAPTER SCHEM E**

CHAPTER 1. INTRODUCTION TO STUDY

CHAPTER 2. COMPANY PROFILE

CHAPTER 3. OBJECTIVES OF STUDY

CHAPTER 4. REVIEW OF LITERATURE

CHAPTER 5. RESEARCH METHODOLOGY

CHAPTER 6. DATA ANALYSIS AND INTERPRETATIONS OBSERVATIONS

CHAPTER 7. FINDINGS CONCLUSIONS AND SUGGESTIONS

## **TOPICS**

1. A empirical study on 360 degree Performance Appraisal in a Private sector organisation.
2. To study the Job Satisfaction of lower/middle/top level management in Banks/Private/Public sector.
3. To study stress management related to work of the employees from IT Sector.
4. A Study on cross cultural management issues in an multinational company.
5. To study the ERP System of a Private/Public sector organisation.
6. A comparative study of the impact of team work in two departments of an organisation.
7. To study the overcoming of negative emotions and boosting motivation of Managers in Private/Public sector organisation.
8. To study the Emotional Intelligence amongst female employees at workplace in Private/Public sector employees.
9. To study the work-life balance of employees in an organisation.
10. To study the work culture and work ethics in an organisation.
11. To study the impact of Training of employees in an Bank/Private/Public sector organisation.
12. To study the impact and Role of Job Rotation for the Positive outcome.
13. To study the Pros and Cons of VRS to employer and employes in an organisation- A case study.
14. A study on the problems involved with the resignation of an employee to both employer and employee.
15. A study on the prospects of Manpower Planning in organisation.
16. To study the awareness and utility of of HRD and HRM in an organisation.
17. A study on the problems related to job transfers of employees specially with reference to female employees.
18. An overview of ethics in Performance Appraisal in an organisation.
19. To study the HR environment of two companies.
20. To study the HR challenges in employing Generation Y.
21. To study the HR Challenges in Indian Context.
22. To study the employee retention strategies of two companies.
23. To study the impact of change management of an organisation.
24. To study the techniques of turnaround management in an organisation.
25. To study the role and impact of information technology in indigenous and multinational companies.
26. To study the financial position of a Company
27. To study the capital structure and Cost of capital of a company
28. To study the working Capital Management
29. To study the customer retention techniques adopted by Banks
30. To study the CSR practices adopted by Companies.

**M.Com. Part II Semester IV**  
**Advanced Banking & Finance Special Paper VII.**  
**Subject Title :- Recent Advances in Banking and Finance in India.**  
**Course Code :- 415**  
**(w.e.f. Academic Year: 2014-15)**

**Objectives:**

1. To enable students understand new developments in banking industry.
2. To keep the students abreast with the innovative practices introduced in day to day banking.

Unit No.	Topic	Periods
1	<p><b>Recent Developments in Banking:</b></p> <ul style="list-style-type: none"> <li>➤ Financial inclusion : Concept, Benefits, RBI guidelines, Economic Growth and financial inclusion, constraint.</li> <li>➤ Regulation with respect to management of NPAs and Maintenance of Capital adequacy.</li> <li>➤ Micro finance &amp; role of Banks.</li> <li>➤ Customer service, customer education &amp; Customer Relationship Management.</li> <li>➤ The Banking Ombudsman Scheme, 2006</li> <li>➤ Concept of CAMELS rating in banks.</li> </ul>	12
2	<p><b>Technological Developments in Banks: Delivery channels</b></p> <ul style="list-style-type: none"> <li>➤ Core Banking</li> <li>➤ Tele banking, Mobile banking,</li> <li>➤ ATMs</li> <li>➤ Internet Banking.</li> <li>➤ Electronic Funds Transfer (BCS credit-debit, SWIFT, RTGS, and NEFT)</li> </ul>	12
3	<p><b>Recent Developments in Money Market:</b></p> <ul style="list-style-type: none"> <li>➤ Call/ Notice / Term policy</li> <li>➤ Treasury Bills</li> <li>➤ Commercial paper and certificate of deposits.</li> <li>➤ Collateralized borrowing and lending obligations. (CBLD)</li> <li>➤ Money market mutual fund. (Repos)</li> <li>➤ Repurchase obligations (Market Repo &amp; Repo with RBI)</li> <li>➤ Money market derivative.</li> </ul>	12

4	<p><b>Recent Developments in Capital Market:</b></p> <ul style="list-style-type: none"> <li>➤ Recent reforms in the capital market with reference to primary market : Book building, reverse book building mechanism (75%-100%), Green shoe option, Online IPOs., Grading &amp; IPO's</li> <li>➤ Secondary market : organization, Regulation and functions of stock exchanges, listing and trading of securities, the BSE, the NSE, OTCEI, and the interconnected stock exchanges of India. The working of these stock exchanges.</li> <li>➤ Changing trends in foreign institutional investments.</li> <li>➤ Introduction of depositories and custodian,</li> <li>➤ Options and futures trading in equity derivatives market.</li> </ul>	12
	<b>Total</b>	<b>48</b>

**Recommended Books :**

1. Financial Institution and Markets - a Global Perspective - Hazel J. Johnson
2. Foreign Exchange; International Finance-Risk Management-A.V. Rajwade
3. Financial Markets and Institutions- L.M. Bhole
4. International Financial Management-Eun/Resnick
5. International Financial Management, Markets, Institutions-James C. Baker-
6. Reserve Bank of India Bulletin-
7. Annual Reports of IMF, World Bank, ADB.

**M.Com. Part II Semester IV**  
**Advanced Banking & Finance Special Paper VIII.**  
**Subject Title :- Project Work in Banking & Finance.**  
**Course Code :- 416**  
**(w.e.f. Academic Year: 2014-15)**

**The following are the topics suggested for Project Work:-**

1. A study of trends in mutual funds
2. Financial Inclusion & unskilled worker.
3. Rural Development & role of NABARD
4. A study of Bank portfolio
5. Banking Development Problems & Perspectives
6. Role of IT in Banking industry: constraints & challenges
7. A study of New Banking products
8. A study of Marketing of Banking products
9. A study of Companies (Amendment) Act 2013 with reference to Banking
10. Capital Adequacy Norms: constraints & challenges
11. Project Evaluation Tools & Techniques
12. Assessment of Financial Health through Ratio Analysis
13. Study of Bank Balance Sheet.
14. Study of Urban Co-Operative Bank.
15. Study of Non-Performing Assets.
16. Study of Capital adequacy of Public sector, Private sector and Co-Operative Banks.
17. Study of Foreign bank branch working in India.
18. Study of National securities depository and Demat Account.
19. Study of Social banking (Prime Minister Rozgar Yojana, Suwarna Jayanti Sahara Rozgar Yojana, The Urban Self employment programe.)
20. Study of Self help group in Maharashtra.
21. Study of Recent Mergers and acquisition in banks.
22. Study of Foreign institutional investments.
23. Study of Recent reforms in capital market.
24. Study of R.B.I. recent policy.
25. Study of Stock Exchange.
26. Study of Non-Banking Finance Companies.
27. Study of Role of N.G.O's.
28. Study of International Financial Institutions.
29. Study of International Investors.
30. Skill Development for unemployment Youth.
31. Study of Self Help Groups

**Note:**

- Clarity with respect to any topic mentioned above be given by the concerned subject teacher /guide.
- Student is required to choose one institution / scheme at a time.
- The topics mentioned are for guidelines and the concerned subject teachers have the privilege to choose and suggest any other topic other than the above

**M.Com. Part II Semester IV**  
**Advanced Marketing Special Paper VII.**  
**Subject Title -: Recent Advances in Marketing.**  
**Course Code -: 417**  
**(w.e.f. Academic Year: 2014-15)**

Sr. No.	New Syllabus	Lectures
1	<p><b>Marketing Strategy:</b>  Meaning- Definition - types of Marketing Strategies. Elements of Marketing Strategy  Process of Creating a Marketing Strategy. Global v/ s Local Marketing Strategy  Factors to be taken into account while adopting a particular Marketing Strategy.  Advertising and Media Planning</p>	12
2	<p><b>Sustainable Marketing</b>  Concept and Importance  Sustainable Marketing and Sustainable Development, Sustainable Marketing and related ethical issues, Current examples of Corporate Sustainability endeavors.</p>	08
3	<p><b>Digital Marketing</b>  Concept and Relevance of study in modern times. Search Engine Optimisation, Search Engine Marketing.  Social Media: Types of Social Media, social Media Mix, Social Media Marketing, Social Media Management , Social Media Audit  E Commerce: Credit card transactions, electronic payment system, cyber cash and smart cards.  A study of some e marketing websites: <a href="http://www.alibab.com">www.alibab.com</a>, <a href="http://www.flipkart.com">www.flipkart.com</a> and <a href="http://www.ebay.in">www.ebay.in</a></p>	14
4	<p><b>Retailing</b> – Concept, Definition and Importance .  Single Brand Retail , Concept and Definition.  Multi Brand Retail – Concept and Definition.  History of FDI in Single Brand retail in India.  History of FDI in Multi Brand Retail in India.  The pros and cons of allowing FDI in Single Brand retail in India  The pros and cons of allowing FDI in Multi Brand Retail in India  Government of India Policy on FDI in Single Brand Retail and FDI in Multi brand retail. State of Maharashtra Policy on allowing FDI in Single Brand Retail and Multi Brand Retail</p>	14
	<b>Total</b>	<b>48</b>



**Recommended Books:**

1. Integrated Marketing Communications – Kenneth Clown & Donald Bach PHI, 2002
2. Strategic Marketing Management - David Aaker
3. Marketing Strategy, 3rd Ed. - Boyd Walker, Mulli Larrech
4. Relationship Marketing -S.Shajahan
5. Customer relationship Management - Shet Parvatiyar, Shainesh
6. Retail Management – Gibson Vedamani
7. Retailing Management – Swapna Pradhan
8. Service Marketing - Rampal & Gupta
9. Essence of Services Marketing - Ardian Payne
10. Services Marketing - S.M.Jha

**M.Com. Part II Semester IV**  
**Advanced Marketing Special Paper VIII.**  
**Subject Title -: Project Work / Case Studies.**  
**Course Code -: 418**  
**(w.e.f. Academic Year: 2014-15)**

**Objectives :**

1. To develop research attitude of the students.
2. To enrich the ability of research work among the students.

**Introduction & Objective :**

In the light of exposure to different functional areas and research methodology at M.Com. Part-I curriculum the students have to collect the data relevant to their topic or problem, analyze the same methodologically, make intelligent observations and offer some practical suggestions. In order to complete the task following Report Contents and Chapter Scheme is suggested which can be adopted with or without modification.

**REPORT CONTENTS :**

- a. Cover Page
- b. Company Certificate
- c. Guide Certificate
- d. Acknowledgement
- e. Declaration
- f. Executive Summary

**TENTATIVE CHAPTER SCHEME**

CHAPTER 1. INTRODUCTION TO STUDY

CHAPTER 2. COMPANY PROFILE

CHAPTER 3. OBJECTIVES OF STUDY

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CHAPTER 5. RESEARCH METHODOLOGY

CHAPTER 6. DATA ANALYSIS AND INTERPRETATIONS

CHAPTER 7. OBSERVATIONS AND FINDINGS

CHAPTER 8. CONCLUSIONS AND SUGGESTIONS

**Note:**

- 1) **This project is strictly being undertaken under the guidance and concerned teacher:**
- 2) Topics for Project are in general and student may modify or select the related subject in consultation with the teacher.

**The Topics Suggested for Project Work :**

- 1) A study of local market
- 2) Study advertising in local newspapers or outdoor advertising
- 3) Study of consumer satisfaction
- 4) Comparative study of buyer behaviour
- 5) Study of marketing strategies
- 6) Study of marketing of banking services
- 7) A comparative study of rural marketing versus urban marketing
- 8) Study of Customer Relationship Marketing (CRM)
- 9) An Analytical study of Marketing Mix
- 10) Study Customer Satisfaction of Product and Services
- 11) Study of Recent Trends in Marketing of any product or service
- 12) Study of Online Marketing



# **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:

<b>Structure B.Sc. Botany syllabus</b>					
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
	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.

**REFERENCES:**

1. Chandurkar, P.J. (1989). Plant Anatomy. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Dutta, A.C. (2003). Botany for Degree students. Oxford University Press, New Delhi.
3. Eames, J. and Mc. Daniels (1994). An Introduction to Plant Anatomy. Tata McGraw Hill Publishing Comp., New Delhi.
4. Esau, K. (1993). Plant Anatomy. Wiley Eastern Ltd. New Delhi.
5. Esau, K. (2006). Anatomy of seed plants. John Wiley and Sons, New York.
6. Fahn, A. (1974). Plant Anatomy. Pergamum Press Oxford.
7. Gangulee, Das and Dutta (2002). College Botany. Vol. I. New Central Book Agency, Kolkata.
8. Lawrence, G.H.M. (2012). Taxonomy of vascular Plants. Scientific Publishers (India) Jodhpur.
9. Naik, V.N. (1994). Taxonomy of Angiosperms. Tata McGraw Hill Publishing Comp., New Delhi.
10. Pandey, B.P. (2007). Plant Anatomy. S. Chand and Co. Ltd. New Delhi.
11. Pandey, B.P. (2009). A Text Book of Botany- Angiosperms. S. Chand and Co. Ltd. New Delhi.
12. Radford, Albert E. (1986). Fundamentals of Plant Systematics. Publ. Harper and Row, New York.
13. Saxena, A.K. and Sarabhai, R.P. (1968). A Text Book of Botany. Vol. III. Ratan Prakashan mandir, Agra.
14. Sharma, O.P. (1993). Plant Taxonomy. 2<sup>nd</sup> Edition, McGraw Hill Education, New Delhi.
15. Singh, Gurucharan (2005). Systematics- Theory and Practice. Oxford IBH.
16. Sutaria, R.N.A. Text Book of Systematic Botany.
17. Tayal, M.S. (2012). Plant Anatomy. Rastogi Publications.

**BO 113: PRACTICALS BASED ON BO 111 & BO 112 (1.5 CREDITS)**

1. Study of Life Cycle of *Spirogyra*. 1 P
2. Study of Life Cycle of *Agaricus*. 1 P
3. Study of Life Cycle of *Riccia* 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

**REFERENCES:**

1. Bendre, Ashok and Kumar, Ashok (1993). A Text Book of Practical Botany, Rastogy Publications, Meerut.
2. Chamberlain, C.J. (1934). Gymnosperms- Structure and Evolution. Chicago.
3. Coulter, J.M. and Chamberlain, C.J. (1917). Morphology of Gymnosperms. Chicago.
4. Davis, P.H. and Heywood, V.H. (1963). Principles of Angiosperms taxonomy. Oliver and Boyd Publ. London.
5. Dutta, S.C. (1988). Systematic Botany. Wiley Eastern Ltd., New Delhi.
6. Eames, E.J. (1983). Morphology of Vascular Plants. Standard University Press.
7. Gangulee and Kar (2006). College Botany. New Central Book Agency (P.) Ltd. Kolkata.
8. Naik, V.N. (1994). Taxonomy of Angiosperms. Tata McGraw Hill Publishing Comp., New Delhi.
9. Parihar, N.S. (1976). Biology and Morphology of Pteridophytes. Central Book Depot.
10. Rashid, A. (1999). An Introduction to Pteridophyta. Vikas Publishing House Pvt. Ltd. New Delhi.
11. Sharma, O.P. (1990). Text Book of Pteridophyta. McMillan India Ltd. Delhi.
12. Singh, V. and Jain, D.K. (2010). Taxonomy of Angiosperms. Rastogy Publications, Meerut.

13. Singh, V., Pande, P.C., and Jain, D.K. (2011). A Text Book of Botany: Angiosperms. Rastogy Publications, Meerut.
14. Smith, G.M. (1955). Cryptogamic Botany Vol. II. McGraw Hill.
15. Sporne, K.R. (1986). The Morphology of Pteridophytes. Hutchinson University Library, London.
16. Sundar Rajan, S. (1999). Introduction to Pteridophyta. New Age International Publishers, New Delhi.
17. Vashishta, P.C., Sinha, A.R. and Kumar, Anil (2006). Gymnosperms. S. Chand and Comp. Ltd. New Delhi.
18. Vashista, B.R., Sinha A.K. and Kumar, A. (2008). Botany for degree students- Pteridophyta, S. Chand and Comp. Ltd. New Delhi.

**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

**REFERENCES:**

1. Buchanan, B.B, Gruissem, W. and Jones, R.L (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists Maryland, USA.
2. Cooper, G.M. and Hausman, R.E. (2007). The Cell: Molecular Approach 4<sup>th</sup> Edition, Sinauer Associates, USA.
3. David, Nelson and Cox, Michael (2007). Lehninger Principles of Biochemistry. W.H. Freeman and Company. New York.
4. Devlin, R.M. (1983). Fundamentals of Plant Physiology. Mc. Millan, New York.
5. Dutta, A.C. (2000). A Class Book of Botany. Oxford University Press, UK.
6. Hopkins, William G. (1995). Introduction to Plant Physiology. Publ. John Wiley and Sons, Inc.

7. Lewin, Benjamin (2011). Genes. X Jones and Bartlett.
8. Lincoln, Taiz and Eduardo, Zeiger (2010). Plant Physiology. 5<sup>th</sup> Edition. Sinauer Associates, Inc. Publishers. Sunderland, USA.
9. Opik, Helgi, Rolfe, Stephen A. and Willis, Arthur J. (2005). The Physiology of Flowering Plants. Cambridge University Press, UK.
10. Pal, J.K. and Ghaskadbi, Saroj (2009). Fundamentals of Molecular Biology. Oxford University Press. India.
11. Pandey, S.N. and Sinha, B.K. (2014). Plant Physiology. Vikas Publishing House Pvt. Ltd., India.
12. Salisbury, F.B. and Ross, C.B. (2005). Plant Physiology. 5<sup>th</sup> Edition. Wadsworth Publishing Co. Belmont California, USA.
13. Watson, James D., Baker, Tania; Bell, Stephen P.; Alexander Gann; Levine, Michael and Lodwick, Richard (2008). Molecular Biology of the Gene. 6<sup>th</sup> Edition, Pearson Education, Inc. and Dorling Kindersley Publishing, Inc. USA.
14. Weaver, R. (2011). Molecular Biology. 5<sup>th</sup> Edition, Publisher- McGraw Hill Science. USA.

### **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 <b>visit</b> 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 [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

<b>New Course (2019 Semester Pattern) ( 50 min /L)</b>	<b>Old Course (2013 Annual Pattern) ( 48 min /L)</b>
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.  $\text{KMnO}_4$ ) 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  $\text{CaC}_2$  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  $\text{KMnO}_4$ , ozonolysis and oxidation with hot alk.  $\text{KMnO}_4$ . [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*, 11<sup>th</sup> 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*, 4<sup>th</sup> Edition, Collier Macmillan Ltd.
-

## 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  $\Delta H$ .

#### 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  $\psi$  and  $\psi^2$ , 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)  $\text{ClF}_3$  ii)  $\text{Cl}_2\text{O}$  iii)  $\text{BrF}_5$  iv)  $\text{XeO}_3$  v)  $\text{XeOF}_4$  [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  $\text{ClF}_3$ ,  $\text{Cl}_2\text{O}$ ,  $\text{BrF}_5$ ,  $\text{XeO}_3$  and  $\text{XeOF}_4$ .

## 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*, 5<sup>th</sup> edition, Kluwer Academic publishers
  12. G D Christian -Analytical Chemistry
  13. Qualitative Organic Analysis 4<sup>th</sup> 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*, 9<sup>th</sup> 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*, 10<sup>th</sup> 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:  $\text{Cu}_2\text{O}$
- 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  $\text{FeSO}_4$  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  $\text{KMnO}_4$ .

**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  $\text{KIO}_3$  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**

*(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.

<b>Semester-I</b>			
S. N.	Paper No	Subject	Credits
1	<b>CCTP-1</b> CHP-110	Physical Chemistry-I (Fundamentals of Physical Chemistry)	4 credit (48 L + 12T)
2	<b>CCTP-2</b> CHI-130	Inorganic Chemistry-I (Molecular Symmetry and Chemistry of Main Group Elements)	4 credit (48 L + 12T)
3	<b>CCTP-3</b> CHO-150	Organic Chemistry-I (Basic Organic Chemistry)	4 credit (48 L + 12T)
4	<b>CBOP-1</b> <b>CHG-190</b>	<b>Section-I: General Chemistry-I, Theory Course (Any one option)</b> <b>Elective Option-A:</b> Introduction to Solid State of Matter <b>Elective Option-B:</b> Mathematics for Chemists <b>Elective Option-C:</b> Introduction to Chemical Biology-I	2 credit (24 L + 6T)
		<b>Section-II: General Chemistry Practical (Any one)</b> <b>Elective Option-A :</b> Inorganic Chemistry-Material Analysis, Synthesis and Applications <b>Elective Option-B : Chemical Biology Practical-I</b>	2 credit (48 L + 12T)
5	<b>CCPP-1</b> <b>CHP-107</b>	<b>Basic Practical Chemistry-I</b>	4 credit (96 L + 24T)
<b>Semester- II</b>			
6	<b>CCTP-4</b> CHP-210	Physical Chemistry - II (Molecular Spectroscopy and Nuclear Chemistry)	4 credit (48 L + 12T)
7	<b>CCTP-5</b> CHI-230	Inorganic Chemistry -II (Coordination and Bioinorganic Chemistry)	4 credit (48 L + 12T)
8	<b>CCTP-6</b> CHO-250	Organic Chemistry-II (Photochemistry, Pericyclic and Organic spectroscopy)	4 credit (48 L + 12T)
9	<b>CBOP-2</b> <b>CHG-290</b>	<b>Section-I: General Chemistry-II, Theory (Any one option)</b> <b>Elective Option-A :</b> Material Characterization Technique <b>Elective Option-B :</b> Organometallic and Inorganic Reaction Mechanism <b>Elective Option-C:</b> Introduction to Chemical Biology-II	2 credit (24 L + 6T)
		<b>Section-II: General Chemistry, Practical (Any one option)</b> <b>Elective Option-A:</b> Electroanalytical Techniques of Analysis <b>Elective Option-B: Chemical Biology Practical-II</b>	2 credit (48 L + 12T)
10	<b>CCPP-2</b> <b>CHP-227</b>	<b>Basic Practical Chemistry-II</b>	4 credit (96 L + 24T)
<b>Total Credits for First Year</b>			<b>40</b>

CCTP- Core Compulsory Theory Paper; CBOP-Choice Based Optional Paper; CCPP- Core Compulsory Practical Paper

**2) Equivalence to 2014 pattern**

<b>Course in 2014 pattern</b>	<b>Course in 2019 pattern</b>
CHP-110	<b>CCTP-1, CHP-110</b>
CHI-130	<b>CCTP-2, CHI-130</b>
CHO-150	<b>CCTP-3, CHO-150</b>
CHG-190	<b>No equivalence</b>
CHP-107	<b>No equivalence</b>
CHP-127	<b>No equivalence</b>
CHP-210	<b>CCTP-4, CHP-210</b>
CHI-230	<b>CCTP-5, CHI-230</b>
CHO-250	<b>CCTP-6, CHO-250</b>
CHG-290	<b>No equivalence</b>
CHP-247	<b>No equivalence</b>

**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  $\nabla$  and  $\nabla^2$ .

**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  $\pi$ -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 forttrat 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,  $\alpha$ -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  $\gamma$  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.;  $\text{PH}_3$ ,  $\text{SbH}_3$ ,  $\text{AsH}_3$ , 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 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> row ions and complexes, electronic spectra of Lanthanide and Actinide, spectrochemical and nephelauxetic series, charge transfer and luminescence spectra, calculations of Dq, B,  $\beta$  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, 1<sup>st</sup> and 2<sup>nd</sup> 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: CrO<sub>3</sub>, PDC, PCC, KMnO<sub>4</sub>, MnO<sub>2</sub>, Swern, SeO<sub>2</sub>, Pb(OAc)<sub>4</sub>, Pd-C, RuO<sub>4</sub>, OsO<sub>4</sub>, m-CPBA, O<sub>3</sub>, NaIO<sub>4</sub>, HIO<sub>4</sub>, TEMPO, IBX, CAN, Dess-Martin, DDQ, Ag<sub>2</sub>O

Reducing agents: Boranes and hydroboration reactions, MPV reduction and reduction with H<sub>2</sub>/Pd-C, Raney-Ni, NaBH<sub>3</sub>CN, 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  $\lambda_{\text{max}}$  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. <sup>1</sup>H-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, D<sub>2</sub>O 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 <sup>1</sup>H-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. <sup>13</sup>C-NMR****[04L]**

Basic of <sup>13</sup>C-NMR: Chemical shift and factors affecting chemical shifts in <sup>13</sup>C NMR, off resonance and proton decoupled spectra. Simple problems on <sup>13</sup>C-NMR.

**4. Mass spectrometry (MS)****[04L]**

Basic principle of MS, significance of M<sup>+</sup> (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, <sup>1</sup>H-NMR, <sup>13</sup>C-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  $\lambda_{\max}$  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 <sup>1</sup>H-NMR problems and should also be able to draw the <sup>1</sup>H-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  $^{13}\text{C}$ -NMR data to interpret the structure NMR problems and should also be able to draw the  $^1\text{H}$ -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,  $^1\text{H}$ -NMR,  $^{13}\text{C}$ -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, TiO<sub>2</sub> and Fe<sub>2</sub>O<sub>3</sub> 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

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**Elective Option-B: Chemical Mathematics**

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**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)

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**Elective Option-C: Introduction to Chemical Biology-I**

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**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 ( $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{H}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Cl}^-$ ) 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)**

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**Elective Option-A: Inorganic Material Analysis, Synthesis and Applications**

**Time allotted: One practical session of 4 hours per week for one semester**

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**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 TiO<sub>2</sub> TiCl<sub>4</sub> 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 Fe<sub>2</sub>O<sub>3</sub> nanoparticles sol-gel/coprecipitation/hydrothermal (any one method)
12. ZnO, TiO<sub>2</sub>, Fe<sub>2</sub>O<sub>3</sub> 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 TiO<sub>2</sub> photocatalysis (Ref-2)
13. Study of adsorption of phosphate ion on  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> (Ref-2)

**References:**

1. Text book of Quantitative Analysis by A.I. Vogel 3<sup>ed</sup> (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.

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**Elective Option - B: Chemical Biology-I Practical**

**Time allotted: One practical Session of 4 hours per week for one semester**

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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.

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**Elective Option - B: Organometallic and Inorganic Reaction Mechanism**

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**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](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.

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### **Elective Option– C: Introduction to Chemical Biology-II**

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#### **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)

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**Elective Option-A: Electrochemical Methods of Analysis**

**Time allotted: One practical Session of 4 hours per week for one semester**

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**Total 11 practical to be conducted**

**Part-I: Conductometry:** (Any three)

1. Hydrolysis of  $\text{NH}_4\text{Cl}$  or  $\text{CH}_3\text{COONa}$  or aniline hydrochloride.
2. Determination of  $\lambda_0$  or  $\lambda_\alpha$  and dissociation constant of acetic acid.
3. Hydrolysis of ethyl acetate by  $\text{NaOH}$ .
4. Determination of  $\Delta G$ ,  $\Delta H$ , and  $\Delta S$  of silver benzoate by conductometry.
5. Determination of critical micellar concentration (CMC) and  $\Delta G$  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  $\text{H}_2\text{O}$
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  $\text{SrTiO}_3$  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  $\text{TEAP}/\text{MeCN}$
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.

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**Elective Option-B: Chemical Biology-II Practical**

**Time allotted: One practical Session of 4 hours per week for one semester**

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**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  $\lambda$  Max of proteins
12. Detection of  $\lambda$  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  $\Pi^*$  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  $\lambda_{max}$  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  $\beta$  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,  $\text{BaCl}_2$ ,  $\text{K}_2\text{SO}_4$  and  $[\text{K}_3\text{Fe}(\text{CN})_6]$  (Ref-3)
7. Determination of Pb(II) in solution with  $\text{Na}_2\text{SO}_4$  solution and determination of solubility product of  $\text{PbSO}_4$  (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)– $\beta$ –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 ( $\chi_g$  and  $\chi_m$ ) 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.H<sub>2</sub>O 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)*

**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:**

<b>Semester- I</b>		
<b>Paper - I</b>		
<b>Course Type: Core Credit</b>		<b>Course Code: CS101</b>
<b>Course Title : Problem Solving Using Computer and 'C' Programming - I</b>		
Teaching Scheme 2 Hours / Week	No. of Credits 2	Examination Scheme IE : 15 Marks UE: 35 Marks
<b>Course Objectives</b>		
<ol style="list-style-type: none"> <li>1. To introduce the foundations of computing, programming and problem- solving using computers.</li> <li>2. To develop the ability to analyze a problem and devise an algorithm to solve it.</li> <li>3. To formulate algorithms, pseudocodes and flowcharts for arithmetic and logical problems</li> <li>4. To understand structured programming approach.</li> <li>5. To develop the basic concepts and terminology of programming in general.</li> <li>6. To implement algorithms in the 'C' language.</li> <li>7. To test, debug and execute programs.</li> </ol>		
<b>Course Outcomes:-</b> On completion of this course, students will be able to :		
<ol style="list-style-type: none"> <li>1. Explore algorithmic approaches to problem solving.</li> <li>2. Develop modular programs using control structures and arrays in 'C'.</li> </ol>		
<b>Course Contents</b>		
<b>Chapter 1</b>	<b>Problem Solving Aspects</b>	<b>5 Hours</b>
<ol style="list-style-type: none"> <li>1.1. Introduction to problem solving using computers.</li> <li>1.2. Problem solving steps.</li> <li>1.3 Algorithms-definition, characteristics , examples ,advantages and limitations.</li> <li>1.4 Flowcharts - definition, notations , examples , advantages and limitations, Comparison with algorithms.</li> <li>1.5 Pseudo codes - notations, examples, advantages and limitations.</li> <li>1.6 Programming Languages as tools, programming paradigms, types of languages</li> <li>1.7 Converting pseudo-code to programs.</li> <li>1.8 Compilation process (compilers , interpreters), linking and loading, syntax and semantic errors, testing a program</li> <li>1.9 Good Programming Practices (naming conventions , documentation, indentation).</li> </ol>		
<b>Chapter 2</b>	<b>'C' Fundamentals</b>	<b>7 Hours</b>
<ol style="list-style-type: none"> <li>2.1 History of 'C' language.</li> <li>2.2 Application areas.</li> <li>2.2 Structure of a 'C' program.</li> <li>2.3 'C' Program development life cycle.</li> </ol>		

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.		
<b>Chapter 3</b>	<b>Control Structures</b>	<b>6 Hours</b>
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).		
<b>Chapter 4</b>	<b>Functions</b>	<b>6 Hours</b>
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.		
<b>Chapter 5</b>	<b>Arrays</b>	<b>6 Hours</b>
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 )		
<b>Reference Books:</b>		
1. How to Solve it by Computer, R.G. Dromey, Pearson Education. 2. Problem Solving and Programming Concept, Maureen Sprankle, 7 <sup>th</sup> Edition, Pearson Publication.		

3. C: the Complete Reference, Schildt Herbert, 4<sup>th</sup> 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, 3<sup>rd</sup> edition, Schaum's outline Series, Tata McGraw Hill.
8. Programming in ANSI C, E. Balagurusamy, 7<sup>th</sup> Edition, McGraw Hill.



<b>Semester- I</b> <b>Paper - II</b>		
<b>Course Type: Core Credit</b>		<b>Course Code: CS102</b>
<b>Course Title : Database Management Systems</b>		
Teaching Scheme 02 Hours / Week	No. of Credits 2	Examination Scheme IE : 15 Marks UE: 35 Marks
<b>Prerequisites</b> <ul style="list-style-type: none"> <li>Basic Knowledge of file system, storing data in file system and Operations on sets</li> </ul>		
<b>Course Objectives</b> <ul style="list-style-type: none"> <li>To understand the fundamental concepts of database.</li> <li>To understand user requirements and frame it in data model.</li> <li>To understand creations, manipulation and querying of data in databases.</li> </ul>		
<b>Course Outcomes</b> On completion of the course, student will be able to– <ul style="list-style-type: none"> <li>Solve real world problems using appropriate set, function, and relational models.</li> <li>Design E-R Model for given requirements and convert the same into database tables.</li> <li>Use SQL.</li> </ul>		
Course Contents		
<b>Chapter 1</b>	<b>Introduction to DBMS</b>	<b>3 Hours</b>
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		
<b>Chapter 2</b>	<b>Conceptual Design</b>	<b>11 Hours</b>
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		

<b>Chapter 3</b>	<b>SQL</b>	<b>9 Hours</b>
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)		
<b>Chapter 4</b>	<b>Relational Database Design</b>	<b>7 Hours</b>
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		
<b>Reference Books:</b>		
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.		

<b>Chapter 3</b>	<b>Structures And Unions.</b>	<b>8 Hours</b>
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.		
<b>Chapter 4</b>	<b>File Handling</b>	<b>6 Hours</b>
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.		
<b>Chapter 5</b>	<b>Preprocessor</b>	<b>2 Hours</b>
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		
<b>Reference Books:</b>		
1. C: the Complete Reference, Schildt Herbert, 4 <sup>th</sup> 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 <sup>rd</sup> edition, Schaum's outline Series, Tata McGraw Hill. 6. Programming in ANSI C, E. Balagurusamy, 7 <sup>th</sup> Edition, McGraw Hill.		

<b>Semester- II</b> <b>Paper - II</b>		
<b>Course Type: Core Credit</b>		<b>Course Code: CS202</b>
<b>Course Title : Relational Database Management Systems</b>		
Teaching Scheme 2 Hours / Week	No. of Credits 2	Examination Scheme IE : 15 Marks UE: 35 Marks
<b>Prerequisites</b> <ul style="list-style-type: none"> <li>• Basic Knowledge of DBMS</li> <li>• Knowledge of SQL Queries</li> <li>• Basics of relational design</li> <li>• Basics of ER model</li> </ul>		
<b>Course Objectives</b> <ul style="list-style-type: none"> <li>• To teach fundamental concepts of RDBMS (PL/PgSQL)</li> <li>• To teach database management operations</li> <li>• Be familiar with the basic issues of transaction processing and concurrency control</li> <li>• To teach data security and its importance</li> </ul>		
<b>Course Outcomes</b> On completion of the course, student will be able to– <ul style="list-style-type: none"> <li>• Design E-R Model for given requirements and convert the same into database tables.</li> <li>• Use database techniques such as SQL &amp; PL/SQL.</li> <li>• Explain transaction Management in relational database System.</li> <li>• Use advanced database Programming concepts</li> </ul>		
<b>Course Contents</b>		
<b>Chapter 1</b>	<b>Relational Database Design Using PLSQL</b>	<b>8 Hours</b>
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		



<b>Chapter 2</b>	<b>Transaction Concepts and concurrency control</b>	<b>10 hours</b>
<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>		
<b>Chapter 3</b>	<b>Database Integrity and Security Concepts</b>	<b>6 Hours</b>
<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>		
<b>Chapter 4</b>	<b>Crash Recovery</b>	<b>4 Hours</b>
<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>		
<b>Chapter 5</b>	<b>Other Databases</b>	<b>2 Hours</b>
<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., 6<sup>th</sup> 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, 4<sup>th</sup> 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;"><b>Semester- II</b> <b>Paper - III</b></p> <p style="text-align: center;"><b>Course Type: Core Credit</b> <span style="float: right;"><b>Course Code:CS203</b></span></p> <p style="text-align: center;"><b>Title : Practical Course on Advanced 'C' Programming and Relational Database Management Systems</b></p>		
Teaching Scheme 3 Hours / week	No. of Credits 1.5	Examination Scheme IE : 15 Marks UE: 35 Marks
<p><b>Course Objectives</b></p> <ul style="list-style-type: none"> <li>• To solve real world computational problems.</li> <li>• To perform operations on relational database management systems.</li> </ul>		
<p><b>Course Outcomes:-</b></p> <p>On completion of this course, students will be able to :</p> <ul style="list-style-type: none"> <li>• Write, debug and execute programs using advanced features in 'C'.</li> <li>• To use SQL &amp; PL/SQL.</li> <li>• To perform advanced database operations.</li> </ul>		
<p><b>Guidelines :</b></p> <p><b>Lab Book:</b> 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><b>Submission:</b></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><b>Assessment</b></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)*

**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
		<b>Core Compulsory Practical Paper</b>	<b>CSUP115</b>	<b>PPL and Database Technologies Practical</b>	4	30	70

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
		<b>Core Compulsory Practical Paper</b>	<b>CSUP125</b>	<b>Practical on Advanced OS &amp; Mobile Technologies</b>	4	30	70



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:**

<b>Old Subject</b>	<b>New Subject</b>
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:**

<b>Subject</b>	<b>Platform</b>
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:**

<b>Course Code:</b> CSUT111	<b>Course Name:</b> Paradigm of Programming Language	<b>Total Lectures</b> (48 Hours)
<b>Teaching Scheme :</b> 4 hrs/week	<b>Examination Scheme:</b> IA: 30 Marks UE: 70 Marks	<b>No. of Credits</b> 4
<b>Course Prerequisites:</b>	Student should have basic knowledge of: <ul style="list-style-type: none"> <li>• Procedural Language like C</li> <li>• Object-Oriented Languages (C++ and Java)</li> <li>• Concepts of Operating Systems</li> <li>• Basic Data Structures and Algorithms.</li> </ul>	
<b>Course Objectives:</b>	To Prepare student to think about programming languages analytically: <ul style="list-style-type: none"> <li>• Separate syntax from semantics</li> <li>• Compare programming language designs</li> <li>• Understand their strengths and weaknesses</li> <li>• Learn new languages more quickly</li> <li>• Understand basic language implementation techniques</li> <li>• Learn small programs in different programming Languages</li> </ul>	
<b>Chapter</b>	<b>Course Contents</b>	<b>No. of Lectures</b>
1	<b>Introduction</b> <ul style="list-style-type: none"> <li>• The Art of Language Design</li> <li>• The Programming Language Spectrum</li> <li>• Why Study Programming Languages?</li> <li>• Compilation and Interpretation</li> <li>• Programming Environments</li> </ul>	2
2	<b>Names, Scopes, and Bindings</b> <ul style="list-style-type: none"> <li>• The Notion of Binding Time</li> <li>• Object Lifetime and Storage Management</li> <li>• Static Allocation, Stack-Based Allocation, Heap-Based Allocation, Garbage Collection</li> <li>• Scope Rules</li> <li>• Static Scoping, Nested Subroutines, Declaration Order, Dynamic Scoping The meaning of Names in a Scope</li> <li>• Aliases, Overloading, Polymorphism and Related Concepts, the Binding of Referencing Environments</li> <li>• Subroutine Closures, First-Class Values and Unlimited Extent, Object Closures Macro Expansion</li> <li>•</li> </ul>	5

3	<p><b>Control Flow</b></p> <ul style="list-style-type: none"> <li>• Expression Evaluation , Precedence and Associativity, Assignments, Initialization, Ordering Within Expressions, Short-Circuit Evaluation</li> <li>• Structured and Unstructured Flow, Structured Alternatives to goto</li> <li>• Sequencing</li> <li>• Selection - Short-Circuited Conditions, Case/Switch Statements Iteration</li> <li>• Iteration - Enumeration-Controlled Loops, Combination Loops, Iterators, Logically Controlled Loops Recursion</li> <li>• Recursion - Iteration and Recursion, Applicative- and Normal-Order Evaluation</li> </ul>	5
4	<p><b>Data Types</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Primitive Data Types</li> <li>• Numeric Types : Integer, Floating point, Complex , Decimal, Boolean Types, Character Types</li> <li>• Character String Types</li> <li>• Design Issues, Strings and Their Operations, String Length Operations, Evaluation, Implementation of Character String Types</li> <li>• User defined Ordinal types Enumeration types, Designs Evaluation Subrange types, Ada's design Evaluation Implementation of user defined ordinal types</li> <li>• Array types</li> <li>• 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</li> <li>• Associative Arrays</li> <li>• Structure and operations, Implementing associative arrays,</li> <li>• Record types</li> <li>• Definitions of records, References to record fields, Operations on records, Evaluation, Implementation of Record types</li> <li>• Union Types</li> <li>• Design issues, Discriminated versus Free unions, Evaluation, Implementation of Union types</li> </ul>	8

	<ul style="list-style-type: none"> <li>• Pointer and Reference Types</li> <li>• Design issues, Pointer operations, Pointer problems, Dangling pointers, Lost heap dynamic variables, Pointers in C and C++, Reference types, Evaluation</li> <li>• Implementation of pointer and reference types - Representation of pointers and references Solution to dangling pointer problem Heap management</li> </ul>	
5	<p><b>Subprograms and Implementing Subprograms</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Fundamentals of Subprograms</li> <li>• Design Issues for subprograms</li> <li>• Local Referencing Environments</li> <li>• Parameter-Passing Methods</li> <li>• Parameters That Are</li> <li>• Subprograms</li> <li>• Overloaded Subprograms</li> <li>• Generic Subroutines, Generic Functions in C++, Generic Methods in Java</li> <li>• Design Issues for Functions</li> <li>• User-Defined Overloaded Operators</li> <li>• Coroutines</li> <li>• Implementing Subprograms</li> <li>• The General Semantics of Calls and Returns</li> <li>• Implementing “Simple” Subprograms</li> <li>• Implementing Subprograms with Stack-Dynamic Local Variables</li> <li>• Nested Subprograms</li> <li>• Blocks</li> <li>• Implementing Dynamic Scoping</li> </ul>	5
6	<p><b>Data Abstraction and Object Orientation</b></p> <ul style="list-style-type: none"> <li>• Object-Oriented Programming</li> <li>• Encapsulation and Inheritance</li> </ul> <p>Modules, Classes, Nesting (Inner Classes), Type Extensions, Extending without Inheritance</p> <ul style="list-style-type: none"> <li>• Initialization and Finalization</li> </ul> <p>Choosing a Constructor, References and Values, Execution Order, Garbage Collection</p> <ul style="list-style-type: none"> <li>• Dynamic Method Binding</li> <li>• Virtual- and Non-Virtual Methods, Abstract Classes, Member Lookup, Polymorphism, Object Closures</li> <li>• Multiple Inheritance</li> <li>• Semantic Ambiguities, Replicated Inheritance,</li> </ul>	8

	Shared Inheritance, Mix-In Inheritance	
7	<b>Concurrency</b> <ul style="list-style-type: none"> <li>• Introduction : Multiprocessor Architecture Categories of concurrency, Motivations for studying concurrency</li> <li>• Introduction to Subprogram-level, concurrency Fundamental concepts, Language Design for concurrency, Design Issues</li> <li>• Semaphores - Introduction Cooperation synchronization, Competition Synchronization, Evaluation</li> <li>• Monitors - Introduction, Cooperation synchronization, Competition Synchronization, Evaluation,</li> <li>• Message Passing Introduction- The concept of Synchronous Message Passing</li> <li>• Java Threads - The Thread class –Priorities, Competition Synchronization Cooperation Synchronization, Evaluation</li> </ul>	5
8	<b>Functional Programming in Scala</b> <ul style="list-style-type: none"> <li>• Strings</li> <li>• Numbers</li> <li>• Control Structures</li> <li>• Classes and Properties</li> <li>• Methods</li> <li>• Objects</li> <li>• Functional Programming</li> <li>• List, Array, Map, Set</li> </ul>	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

<b>Course Code:</b> CSUT112	<b>Course Name: Design and Analysis of Algorithm</b>	<b>Total Lectures (48 Hours)</b>
<b>Teaching Scheme :</b> 4 hrs/week	<b>Examination Scheme:</b> <b>IA: 30 Marks</b> <b>UE: 70 Marks</b>	<b>No. of Credits</b> <b>4</b>
<b>Course Prerequisites:</b>	<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	
<b>Course Objectives:</b>	<ul style="list-style-type: none"> <li>• To design the algorithms</li> <li>• To select the appropriate algorithm by doing necessary analysis of algorithms</li> <li>• To learn basic Algorithm Analysis techniques and understand the use of asymptotic notation</li> <li>• Understand different design strategies</li> <li>• Understand the use of data structures in improving algorithm performance</li> <li>• Understand classical problem and solutions</li> <li>• Learn a variety of useful algorithms</li> <li>• Understand classification of problems</li> <li>• To provide foundation in algorithm design and analysis</li> <li>• To develop ability to understand and design algorithms in context of space and time complexity.</li> </ul>	
<b>Chapter</b>	<b>Course Contents</b>	<b>No. of Lectures</b>
1	<b>Basics of Algorithms</b> <ul style="list-style-type: none"> <li>• Algorithm definition and characteristics</li> <li>• Space complexity</li> <li>• Time complexity, worst case-best case-average case</li> <li>• complexity, asymptotic notation</li> <li>• Recursive and non-recursive algorithms</li> <li>• Sorting algorithms (insertion sort, heap sort, bubble sort)</li> <li>• Sorting in linear time: counting sort, concept of bucket and radix sort</li> <li>• Searching algorithms: Linear, Binary</li> </ul>	8
2	<b>Divide and conquer strategy</b> <ul style="list-style-type: none"> <li>• General method, control abstraction</li> <li>• Binary search</li> <li>• Merge sort, Quick sort</li> <li>• Comparison between Traditional Method of Matrix Multiplication vs. Strassen's Matrix Multiplication</li> </ul>	5

3	<b>Greedy Method</b> <ul style="list-style-type: none"> <li>• Knapsack problem</li> <li>• Job sequencing with deadlines,</li> <li>• Minimum-cost spanning trees: Kruskal and Prim's algorithm</li> <li>• Optimal storage on tapes</li> <li>• Optimal merge patterns</li> <li>• Huffman coding</li> <li>• Shortest Path :Dijkstra's Algorithm</li> </ul>	7
4	<b>Dynamic Programming</b> <ul style="list-style-type: none"> <li>• Principle of optimality</li> <li>• Matrix chain multiplication</li> <li>• 0/1 Knapsack Problem <ul style="list-style-type: none"> <li>i)Merge &amp; Purge</li> <li>ii)Functional Method</li> </ul> </li> <li>• Bellman Ford Algorithm</li> <li>• All pairs Shortest Path Floyd- Warshall Algorithm</li> <li>• Longest common subsequence,</li> <li>• String editing, Travelling Salesperson problem</li> </ul>	10
5	<b>Decrease and Conquer</b> <ul style="list-style-type: none"> <li>• Definition of Graph Representation of Graph</li> <li>• By Constant - DFS and BFS</li> <li>• Topological sorting</li> <li>• Connected components and spanning trees</li> <li>• By Variable Size decrease Euclid's algorithm</li> <li>• Articulation Point and Bridge edge</li> </ul>	5
6	<b>Backtracking</b> <ul style="list-style-type: none"> <li>• General method</li> <li>• Fixed Tuple vs. Variable Tuple Formulation</li> <li>• n- Queen's problem</li> <li>• Graph coloring problem</li> <li>• Hamiltonian cycle</li> <li>• Sum of subsets</li> </ul>	5
7	<b>Branch and Bound</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• FIFO BB Search, LIFO Search</li> <li>• Definitions of LCBB Search</li> <li>• Bounding Function, Ranking Function</li> <li>• Traveling Salesman problem Using Variable tuple</li> </ul>	5



	<ul style="list-style-type: none"> <li>• Formulation using LCBB</li> <li>• 0/1 knapsack problem using LCBB</li> </ul>	
8	<b>Problem Classification</b> <ul style="list-style-type: none"> <li>• Nondeterministic algorithm</li> <li>• The class of P, NP, NP-hard and NP - Complete problems</li> <li>• Cook's theorem</li> </ul>	3

**References:**

<b>Sr. No.</b>	<b>Title of the Book</b>	<b>Author/s</b>	<b>Publication</b>
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

<b>Course Code:</b> CSUT113	<b>Course Name: Database Technologies</b>	<b>Total Lectures</b> <b>(48 Hours)</b>
<b>Teaching Scheme :</b> 4 hrs/week	<b>Examination Scheme:</b> <b>IA: 30 Marks</b> <b>UE: 70 Marks</b>	<b>No. of Credits</b> <b>4</b>
<b>Course Prerequisites:</b>	<ul style="list-style-type: none"> <li>• Knowledge of file system concepts</li> <li>• Strong foundation of Related database Concepts (Basic &amp; Advanced)</li> <li>• A firm foundation of any RDBMS package</li> </ul>	
<b>Course Objectives:</b>	<ul style="list-style-type: none"> <li>• Provide an overview of the concept of NoSQL technology.</li> <li>• Provide an insight to the different types of NoSQL databases</li> <li>• Make the student capable of making a choice of what database technologies to use, based on their application needs.</li> </ul>	
<b>Chapter</b>	<b>Course Contents</b>	<b>No. of Lectures</b>
1	<b>Introduction to NOSQL (Core concepts)</b>	18
	Why NoSQL	
	Aggregate Data Models	
	Data modeling details	
	Distribution Models	
	Consistency	
	Version stamps	
2	<b>Implementation with NOSQL databases</b>	14
	Key-Value Databases (Riak)	
	Document Databases (Mongodb)	
	Column-Family stores (Cassandra)	
	Graph databases (Neo4j)	
3	<b>Schema Migrations</b>	5
4	<b>Polygot Persistence (Multi model types)</b>	5
5	<b>Beyond NoSQL</b>	3
6	<b>Choosing your database</b>	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	<a href="http://nosql-database.org">http://nosql-database.org</a>		

**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.

<b>Course Code:</b> CSDT114A	<b>Course Name: Cloud Computing</b>	<b>Total Lectures</b> <b>(30 Hours)</b>
<b>Teaching Scheme :</b> 4 hrs/week	<b>Examination Scheme:</b> <b>IA: 15 Marks</b> <b>UE: 35 Marks</b>	<b>No. of Credits</b> <b>2</b>
<b>Course Prerequisites:</b>	<input type="checkbox"/> Operating System <input type="checkbox"/> Fundamentals of Computer Networks <input type="checkbox"/> Good Understanding of Object Oriented Programming Concepts	
<b>Course Objectives:</b>	<ul style="list-style-type: none"> <li>• To understand the principles and paradigm of Cloud Computing</li> <li>• To appreciate the role of Virtualization Technologies</li> <li>• Ability to design and deploy Cloud Infrastructure</li> <li>• Understand cloud security issues and solutions</li> </ul>	
<b>Chapter</b>	<b>Course Contents</b>	<b>No. of Lectures</b>
1	<b>Introduction to Cloud Computing</b> 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	<b>Abstraction and Virtualization</b> 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	<b>Programming, Environments and Applications</b> 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	<b>Security In The Cloud</b> 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**

<b>Sr. No</b>	<b>Assignment</b>
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.



<b>Course Code:</b> <b>CSDT114B</b>	<b>Course Name: Artificial Intelligence</b>	<b>Total Lectures</b> <b>(30 Hours)</b>
<b>Teaching Scheme :</b> <b>4 hrs/week</b>	<b>Examination Scheme:</b> <b>IA: 15 Marks</b> <b>UE: 35 Marks</b>	<b>No. of Credits</b> <b>02</b>
<b>Course Prerequisites:</b>	<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.	
<b>Course Objectives:</b>	<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.	
<b>Chapter</b>	<b>Course Contents</b>	<b>No. of Lectures</b>
<b>1</b>	<b>Introduction to Artificial Intelligence:</b> 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.	<b>2</b>
<b>2</b>	<b>Searching:</b> -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*.	<b>8</b>

3	<p><b>Knowledge Representation:</b></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><b>Introduction to AI with Python:</b></p> <p>Introduction to Python , why python with AI, Features of Python, Basics of Python, Python statements, Methods &amp; Functions using python, Basic and advanced modules &amp; Packages, Python Decorators and generators .Advanced Objects &amp; Data structures.</p>	6
5	<p><b>Machine Learning:</b></p> <p>Why Machine learning, Types of Machine Learning: Supervised learning- Classification &amp; Regression. Random Forest, KNN Algorithm. Unsupervised learning-Clustering &amp; 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**

<b>Sr. No.</b>	<b>Assignment</b>
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.

<b>Course Code:</b> CSDT 114C	<b>Course Name: Web Services</b>	<b>Total Lectures</b> <b>(30 Hours)</b>
<b>Teaching Scheme :</b> 4 hrs/week	<b>Examination Scheme:</b> IA: 15 Marks UE: 35 Marks	<b>No. of Credits</b> 2
<b>Course Prerequisites:</b>	<ul style="list-style-type: none"> <li>• Strong knowledge about Java programming.</li> <li>• Good Understanding of Object Oriented Programming concepts.</li> <li>• Must be familiar with XML.</li> </ul>	
<b>Course Objectives:</b>	<ul style="list-style-type: none"> <li>• To understand the details of web services technologies like WSDL,UDDI, SOAP</li> <li>• To learn how to implement and deploy web service client and server</li> <li>• To explore interoperability between different frameworks</li> <li>• To understand the concept of RESTful system.</li> </ul>	
<b>Chapter</b>	<b>Course Contents</b>	<b>No. of Lectures</b>
1	<p><b>Web Service and SOA fundamentals</b></p> <p><b>Introduction to Web Services</b> — 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><b>Web Services Architecture</b> — 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><b>SOAP: Simple Object Access Protocol</b></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><b>Unit III : Describing and Discovering Web Services</b></p> <p><b>WSDL</b> - 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><b>UDDI</b> – 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><b>Unit IV : The REST Architectural style :</b></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.

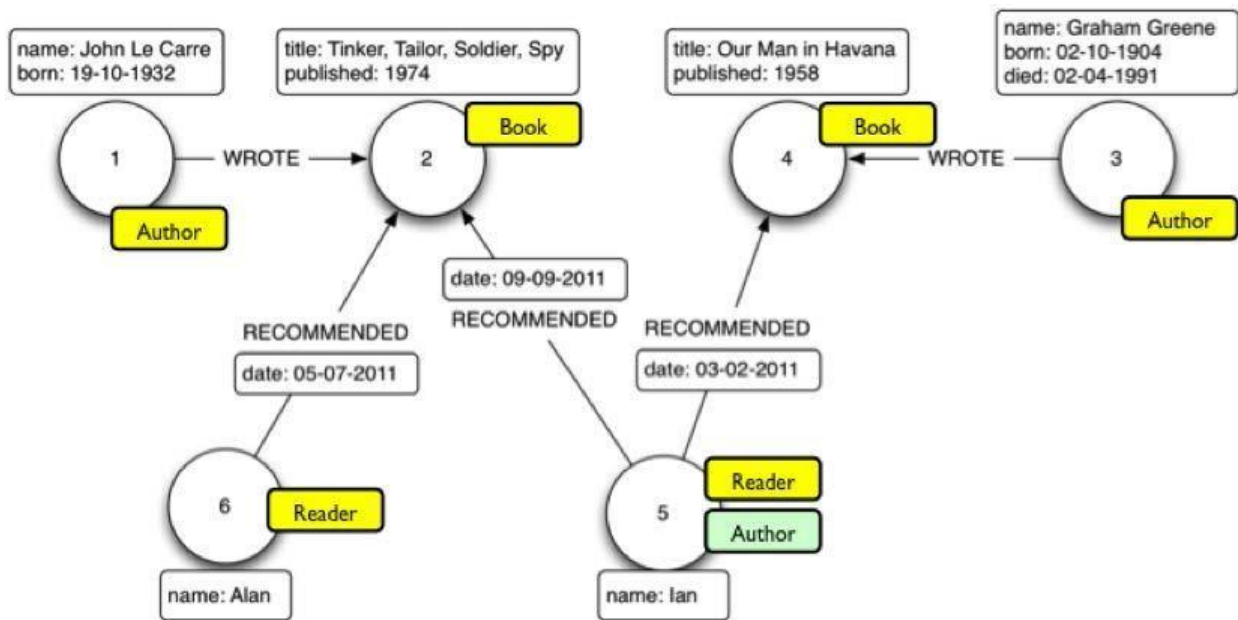
1. Find employees having designation as either 'manager' or 'floor supervisor'.
2. Find an employee whose name ends with " \_\_\_\_\_ " and print the output in json format.
3. Display the name of an employee whose salary is greater than \_\_\_\_\_ using a MongoDB cursor.
4. Sort the employees in the 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.

<b>Course Code:</b> CSUT121	<b>Course Name: Advanced Operating System</b>	<b>Total Lectures (48 Hours)</b>
<b>Teaching Scheme :</b> 4 hrs/week	<b>Examination Scheme:</b> IA: 30 Marks UE: 70 Marks	<b>No. of Credits 4</b>
<b>Course Prerequisites:</b>	<ul style="list-style-type: none"> <li>• Working knowledge of C programming.</li> <li>• Basic Computer Architecture concepts.</li> <li>• Basic algorithms and data structure concepts.</li> </ul>	
<b>Course Objectives:</b>	<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>	
<b>Chapter</b>	<b>Course Contents</b>	<b>No. of Lectures</b>
1	<b>Introduction to UNIX/LinuxKernel</b> <ul style="list-style-type: none"> <li>• System Structure, User Perspective, Assumptions about Hardware, Architecture of UNIX Operating System (TextBook-1: Chapter Topics: 1.2, 1.3, 1.5, 2.1)</li> <li>• Concepts of Linux Programming- Files and the Filesystem, Processes, Users and Groups, Permissions, Signals, Interprocess Communication (TextBook-3: Chapter 1- relevant topics)</li> </ul>	04
2	<b>File and Directory I/O</b> <ul style="list-style-type: none"> <li>• 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)</li> <li>• 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)</li> </ul>	15



3	<p><b>Process Environment, Process Control and Process Relationships</b></p> <ul style="list-style-type: none"> <li>• 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)</li> <li>• 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)</li> </ul>	15
4	<p><b>Memory Management</b></p> <ul style="list-style-type: none"> <li>• 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)</li> <li>• Swapping, Demand Paging (TextBook-1: Chapter Topics: 9.1, 9.2)</li> </ul>	06
5	<p><b>Signal Handling</b></p> <ul style="list-style-type: none"> <li>• 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)</li> </ul>	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

<b>Course Code:</b> CSUT122	<b>Course Name: Mobile Technologies</b>	<b>Total Lectures</b> <b>(48 Hours)</b>
<b>Teaching Scheme :</b> 4 hrs/week	<b>Examination Scheme:</b> <b>IA: 30 Marks</b> <b>UE: 70 Marks</b>	<b>No. of Credits</b> <b>4</b>
<b>Course Prerequisites:</b>	<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	
<b>Course Objectives:</b>	<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	
<b>Chapter</b>	<b>Course Contents</b>	<b>No. of Lectures</b>
1	<b>Introduction to Mobile Computing</b> <ul style="list-style-type: none"> <li>• Introduction and need for Mobile computing</li> <li>• Mobility and portability</li> <li>• Mobile and Wireless devices</li> <li>• Mobile Applications</li> <li>• Mobile Operating system – IOS, BlackBery, Windows phone, Plam OS, Symbian OS, PhoneGap</li> </ul>	03
2	<b>Android Fundamentals</b> <ul style="list-style-type: none"> <li>• Introduction to Android - Overview and evolution of Android , Features of Android, Android architecture</li> <li>• Components of an Android Application, Manifest file</li> <li>• Android Activity</li> <li>• Service Lifecycle</li> </ul>	07
3	<b>Android UI Design</b> <ul style="list-style-type: none"> <li>• Basic UI Designing (Form widgets ,Text Fields , Layouts ,[dip, dp, sip, sp] versus px)</li> <li>• Intent(in detail)</li> <li>• All components (e.g Button , Slider, Image view, Toast) Event Handling</li> <li>• Adapters and Widgets</li> <li>• Menu</li> </ul>	07

4	<b>Android Thread and Notification</b> <ul style="list-style-type: none"> <li>• Threads running on UI thread (runOnUiThread)</li> <li>• Worker thread</li> <li>• Handlers &amp; Runnable</li> <li>• AsyncTask (in detail)</li> <li>• Broadcast Receivers</li> <li>• Services and notifications</li> <li>• Toast</li> <li>• Alarms</li> </ul>	07
5	<b>Advanced Android Programming</b> <ul style="list-style-type: none"> <li>• Content Providers – SQLite Programming</li> <li>• JSON Parsing</li> <li>• Accessing Phone Service(Call, SMS, MMS)</li> <li>• Location based services</li> </ul>	05
6	<b>PhoneGap Programming</b> <ul style="list-style-type: none"> <li>• Why Use PhoneGap?</li> <li>• How PhoneGap Works</li> <li>• Designing for the Container</li> <li>• Writing PhoneGap Applications</li> <li>• Building PhoneGap Applications</li> <li>• PhoneGap Limitations</li> <li>• PhoneGap Plug-Ins</li> <li>• Hello, World! Program</li> <li>• PhoneGap APIs –1</li> </ul> <b>Accelerometer:</b> <ul style="list-style-type: none"> <li>• Querying Device Orientation,</li> <li>• Watching a Device’s Orientation,</li> <li>• Creating a Contact, Searching for Contacts, Cloning Contacts, Removing Contacts.</li> </ul>	12
7	<b>iOS Fundamentals</b> <ul style="list-style-type: none"> <li>• <b>Introduction</b> - What is IOS ,IOS Architecture, Frameworks, Application Life Cycle, Features</li> <li>• <b>Swift</b> - Introduction to Swift ,General Concepts of Swift</li> <li>• <b>Xcode</b> - Introduction to Xcode , Navigator, Editor Utility, Tools, Console, Document, Simulator, Instruments</li> <li>• <b>Startup</b> - Application Templates, Introduction to Storyboard , Hello World Application, How ‘Hello World’ Working, Debugging Database, Plist, Preference, Sqlite Web Service, Restful Web Service (JSON &amp; XML)</li> </ul>	08

**References:**

<b>Sr. No.</b>	<b>Title of the Book</b>	<b>Author/s</b>	<b>Publication</b>
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	

<b>Course Code:</b> CSUT123	<b>Course Name: Software Project Management</b>	<b>Total Lectures</b> <b>(48 Hours)</b>
<b>Teaching Scheme :</b> 4 hrs/week	<b>Examination Scheme:</b> <b>IA: 30 Marks</b> <b>UE: 70 Marks</b>	<b>No. of Credits</b> <b>4</b>
<b>Course Prerequisites:</b>	<input type="checkbox"/> Software Engineering <input type="checkbox"/> Basic testing concepts	
<b>Course Objectives:</b>	<ul style="list-style-type: none"> <li>• Software Metrics and Project Management covers skills that are required to ensure successful medium and large scale software projects.</li> <li>• It examines Requirements Elicitation, Project Management, Verification &amp; Validation and Management of Large Software Engineering Projects.</li> <li>• 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.</li> </ul>	
<b>Chapter</b>	<b>Course Contents</b>	<b>No. of Lectures</b>
1	<b>Introduction to Project Management</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> What is a Project?</li> <li><input type="checkbox"/> What is Project management?</li> <li><input type="checkbox"/> Project phases and project life cycle</li> <li><input type="checkbox"/> Organizational structure</li> <li><input type="checkbox"/> Qualities of Project Manager</li> <li><input type="checkbox"/> WBS</li> </ul>	4
2	<b>Project Management Components</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Project Integration Management-Project plan development and execution</li> <li><input type="checkbox"/> Change controls</li> <li><input type="checkbox"/> CCB</li> <li><input type="checkbox"/> Configuration management</li> </ul>	6
3	<b>Scope Management</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Strategic planning</li> <li><input type="checkbox"/> Scope planning, definition</li> <li><input type="checkbox"/> Verification and control</li> </ul>	4
4	<b>Time management</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Activity planning</li> <li><input type="checkbox"/> Schedule development and control</li> <li><input type="checkbox"/> GANTT Chart</li> </ul>	2
5	<b>Cost Management</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Cost estimation and Control</li> <li><input type="checkbox"/> COCOMO model</li> <li><input type="checkbox"/> BASIC COCOMO NUMERICALS</li> </ul>	2
6	<b>Quality Management</b> <ul style="list-style-type: none"> <li>• Quality planning and assurance</li> </ul>	2



7	<b>Human Resource Management</b> <ul style="list-style-type: none"> <li>• Organizational planning</li> <li>• Staff acquisition</li> </ul>	2
8	<b>Communication Management</b> <ul style="list-style-type: none"> <li>• Information distribution</li> <li>• Reporting</li> </ul>	2
9	<b>Risk Management</b> <ul style="list-style-type: none"> <li>• Risk identification</li> <li>• Quantification and control</li> </ul>	2
10	<b>Procurement Management</b> <ul style="list-style-type: none"> <li>• Solicitation management and control</li> <li>• Contract administration</li> </ul>	2
11	<b>Software Metrics</b> <ul style="list-style-type: none"> <li>• The scope of software metrics</li> <li>• Size- oriented metrics</li> <li>• Function oriented</li> <li>• Software metrics data collection</li> <li>• Analyzing software data</li> </ul>	6
12	<b>Software Reliability</b> <ul style="list-style-type: none"> <li>• Measurement and prediction</li> <li>• Resource measurement</li> <li>• Productivity, teams and tools</li> </ul>	6
13	<b>Planning a measurement program</b> <ul style="list-style-type: none"> <li>• What is metrics plan?</li> <li>• Developing goals, questions and metrics</li> <li>• Where and When: Mapping measures to activities</li> <li>• How: Measurement tools</li> <li>• Who: Measurers , analyst, tools revision plans</li> </ul>	4
14	<b>Quality Standards</b> <ul style="list-style-type: none"> <li>• CMM levels</li> <li>• KPA's</li> <li>• PSP/TSP</li> </ul>	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**

<b>Course Code:</b> <b>CSDT124B</b>	<b>Course Name: Human Computer Interaction</b>	<b>Total Lectures</b> <b>(30 Hours)</b>
<b>Teaching Scheme :</b> <b>4 hrs/week</b>	<b>Examination Scheme:</b> <b>IA: 15 Marks</b> <b>UE: 35 Marks</b>	<b>No. of Credits</b> <b>2</b>
<b>Course Prerequisites:</b>	<ul style="list-style-type: none"> <li>• Foundations of Human Computer Interaction</li> <li>• Be familiar with the design technologies for individuals and persons with disabilities</li> <li>• Be aware of mobile HCI</li> <li>• Learn the guidelines for user interface.</li> </ul>	
<b>Course Objectives:</b>	<ul style="list-style-type: none"> <li>• Design effective dialog for HCI.</li> <li>• Design effective HCI for individuals and persons with disabilities.</li> <li>• Assess the importance of user feedback.</li> <li>• Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.</li> <li>• Develop meaningful user interface.</li> </ul>	
<b>Chapter</b>	<b>Course Contents</b>	<b>No. of Lectures</b>
1	<b>FOUNDATIONS OF HCI</b> 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	<b>DESIGN &amp; SOFTWARE PROCESS</b> 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	<b>MODELS AND THEORIES</b> Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.	5
4	<b>MOBILE HCI</b> 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	<b>WEB INTERFACE DESIGN</b> Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow, Case Studies.	6
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**References:**

<b>Sr. No.</b>	<b>Title of the Book</b>	<b>Author/s</b>	<b>Publication</b>
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.
- 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.

<b>Course Code:</b> CSDT124C	<b>Course Name: Soft Computing</b>	<b>Total Lectures</b> <b>(30 Hours)</b>
<b>Teaching Scheme :</b> 4 hrs/week	<b>Examination Scheme:</b> <b>IA: 15 Marks</b> <b>UE: 35 Marks</b>	<b>No. of Credits</b> <b>2</b>
<b>Course Prerequisites:</b>	<input type="checkbox"/> A strong mathematical background <input type="checkbox"/> Proficiency with algorithms <input type="checkbox"/> Critical thinking and problem solving skills	
<b>Course Objectives:</b>	<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.	
<b>Chapter</b>	<b>Course Contents</b>	<b>No. of Lectures</b>
1	<b>Introduction to Soft Computing</b> Neural Networks: Definition, Advantages, Applications, Scope. Fuzzy logic: Definition, Applications. Genetic Algorithms: Definition, Applications.	2
2	<b>Neural Network</b> 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. $\alpha$ - Least Mean Square Learning.	
3	<b>Fuzzy Set Theory</b> 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, $\lambda$ -Cuts for fuzzy Relations, Fuzzy (Rule-Based) system, Graphical technique of inference, Membership value assignment-Intuition, Inference.	9
4	<b>Genetic Algorithms</b> 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:**

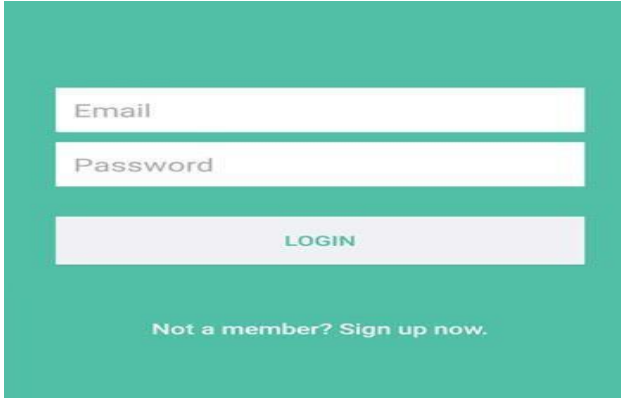
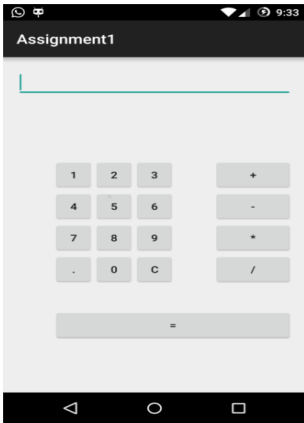
Sr. No.	Title of the Book	Author/s	Publication
1	Fuzzy Logic With Engineering Applications	Timothy Ross	Wiley Publication
2	Introduction to Soft Computing	Deepa & Shivanandan	Wiley Publication
3	Genetic Algorithms in Search, Optimization and Machine Learning	David E. Goldberg	Pearson Education
4	Fundamentals of Neural Networks – Architectures, Algorithms, And Applications	Laurene Fausett	Pearson Education
5	Neural Networks	Satish Kumar	Tata McGrawHill

## CSDP124C: Soft Computing Practical Assignment

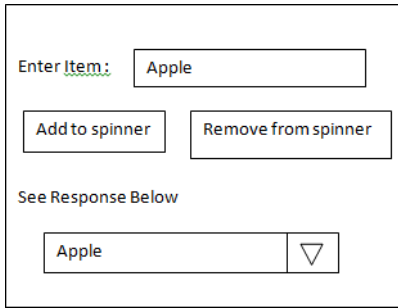
**Implement the programs in C/C++/Java/MATLAB**

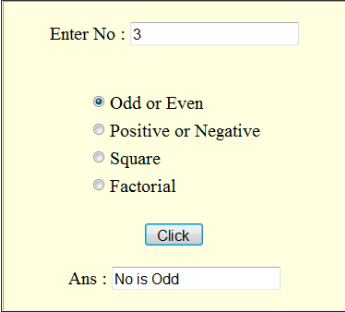
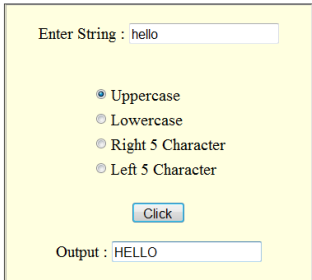
Sr. No	Assignment
1.	Write a program to implement Fuzzy Operations Union Intersection Complement Algebraic sum Algebraic product Cartesian product
2.	Write a program to implement De Morgans law.
3.	Write a program to implement Max-Min Composition and Max-Product Composition.
4.	Write a program to implement 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)*

**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)**

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**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 Kirchhoff'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)
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## Semester II

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### 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 " 3<sup>rd</sup>Edition, 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.

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**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 “ 3<sup>rd</sup>Edition, 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)
-

**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	<b>20</b>

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	<b>20</b>

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, 3<sup>rd</sup> Edition, PHI, 2002.
8. Computer programming in C, V. Rajaraman, Pearson Education, 2<sup>nd</sup> edition, 2003.
9. The C programming language, Dennis Ritchie, Pearson Education, 2<sup>nd</sup> 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, 3<sup>rd</sup> Edn, McGraw Hill.
2. Electronic Devices and Circuit Theory, Robert Boylestead, Louis Nashelsky, PHI.
3. Design with Operational Amplifiers and Linear IC, Sergio Franco, 3<sup>rd</sup> 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

## **M. Sc. Electronic Science**

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, 2<sup>nd</sup> 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, 2<sup>nd</sup> 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, 3<sup>rd</sup> Edition, 2002.
2. Principles of Electromagnetics, N. Sadiku, Oxford University Press.
3. Electromagnetics with Applications, Kraus and Fleiseh, McGraw Hill, 5<sup>th</sup> Edn, 1999.
4. Electromagnetics, J.D. Kraus, 4<sup>th</sup> 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  $\Delta x$  and  $\Delta t$ , 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:

## **M. Sc. Electronic Science**

1. Measurement Systems, Applications and Design, Ernest O. Doebelin and Dhanesh N. Manik, 5<sup>th</sup> 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

## 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.:

<b>Equivalent papers in Old course</b>	<b>Equivalent papers in Present course</b>
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. 3<sup>rd</sup> 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. 2<sup>nd</sup> 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. Moores 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**

<b>Semester I (5.5 Credits)</b>		
<b>Core Courses</b>		
<b>Subject Code</b>	<b>Subject Title</b>	<b>Number of Credits</b>
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
	<b>Total</b>	<b>5.5 Credits</b>
<b>Semester II (5.5 Credits)</b>		
<b>Core Courses</b>		
<b>Subject Code</b>	<b>Subject Title</b>	<b>Number of Credits</b>
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
	<b>Total</b>	<b>5.5 Credits</b>

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

**CC- I**

**(Lectures 36)**

<b>Topics</b>	<b>No. of Lectures</b>
<b>Credit I:</b>	
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
<b>Credit II:</b>	
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
<b>Credit I: Mineralogy</b>	
<b>A) Introduction:</b> Definition, branches and scope of mineralogy. Importance and conservation of minerals.	1
<b>B) Chemistry of Minerals</b> 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
<b>C) Formation of minerals:</b> 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
<b>D) Uses of Minerals in Industries:</b> Ceramic, Refractory, Pharmaceutical, Paint, Glass, Cement, Fertilizer, Oil Industry, Electrical and Electronics.	2
<b>E) Physical properties of minerals</b> 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
<b>F) Optical mineralogy</b> 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

<b>Credit II: Crystallography</b>	
<b>A.</b> Definition and conditions conducive for the formation of crystals.	1
<b>B.</b> Crystal morphology – faces, forms, edges, solid angles, interfacial angle and its measurement by contact Goniometer, law of constancy of interfacial angle.	2
<b>C.</b> 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
<b>D.</b> Various crystal lattices: Study of following crystallographic systems with respect to their elements of symmetry, crystallographic axes and their forms with indices. 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	12

#### **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



**GL 113: Practicals related to GL 111 and GL 112****(2 Credit)**

<b>Topics</b>	<b>No. of Practicals</b>
<b>Mineralogy</b> A) Physical properties of minerals: Colour, form, streak, luster, cleavage, fracture, hardness and specific gravity.	1
B) Identification of following <b>Megascopic minerals</b> 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) <b>Microscopic minerals:(Any 6)</b> Olivine, augite, hornblende, microcline, plagioclase, muscovite, biotite, calcite, garnet, quartz and orthoclase.	1
E) <b>Crystallography</b> 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) <b>Toposheets and study of landform models:</b> Reading of toposheets with reference to toposheet number, latitude and longitude, state/districts, scale, adjacent toposheet number and conventional signs.	1
<b>No. of Practicals</b>	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.

<b>Credit I : IGNEOUS PETROLOGY</b>	
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
<b>Credit II: GEOCHEMISTRY &amp; METAMORPHIC PETROLOGY</b>	
<b>1. INTRODUCTION TO GEOCHEMISTRY</b> a) Nucleosynthesis and Stellar Evolution Formation of elements, stability of Nucleii, structure of nucleus, isotopes, isobars, basic terms of radioactivity like $\alpha$ , $\beta$ , $\gamma$ 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 $\delta^{18}O$ , $\delta D$ , $\delta^{13}C$ , $\delta^{15}N$ . Dating of fossils using $^{14}C$ carbon dating.	1

<b>METAMORPHIC PETROLOGY</b>	
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)**

<b>Topics</b>	<b>No. of Practicals</b>
<b>A) Petrology</b> 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>B) Study of following Primary Sedimentary Structures in hand specimen with their Environmental Significance.</b> 1. Bedding 2. Cross bedding 3. Graded bedding 4. Ripple marks 5. Mud/ Sun cracks	1
<b>C) Stratigraphic correlation</b>	1
<b>D) One day Geological Fieldwork to be conducted in an area of geological interest and geological report to be submitted for the same.</b>	1
<b>No. of Practicals</b>	<b>8</b>

**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. 3<sup>rd</sup> 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.
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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.
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36. Winkler, H.G.C., (1967) Petrogenesis of Metamorphic Rocks. Narosa Publ.
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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. 2<sup>nd</sup> 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**

*(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  $n^{\text{th}}$  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**

*(Formerly University of Pune)*

**Three Year B.Sc. Degree Program in Physics**

**(Faculty of Science & Technology)**

**F.Y.B.Sc. (Physics)**

**Choice Based Credit System Syllabus**

**To be implemented from Academic Year 2019-2020**

## **Title of the Course: B.Sc. (Physics)**

### **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.

**Structure of the Course:**

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-2311	Language-I	2
				IV	Compulsory Course	PHY-241
		PHY-242	Optics			2
		PHY-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	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- 357	Physics Laboratory-3A	2
PHY- 358				Physics Laboratory-3B	2	
PHY- 359				Physics Laboratory-3C	2	
Skill Enhancement Course				PHY-3510	Maintenance and Repairing of Laboratory equipment – I	2
		PHY- 3511	Household Electrification, Maintenance and repairing - I	2		



		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	Electronics II /Advanced Electronics	2
				PHY- 366	Elective II (Select any One)	2
				PHY- 367	Physics Laboratory-4A	2
				PHY- 368	Physics Laboratory-4B	2
				PHY- 369	Project	2
		Skill Enhancement Course	PHY-3610	Maintenance and Repairing of Laboratory Equipment – II	2	
			PHY- 3611	Household Electrification, Maintenance and Repairing- II	2	

**SEMESTER-I****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, ( $Y$ ,  $\eta$ ,  $K$ ), 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, BharatiBhavan 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.
- 10.

**Course code and title: PHY-112 Physics 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-113 Physics Laboratory 1A****Practical: 10****(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 “ $\eta$ ” 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, with a total of 10 experiments.

**SEMISTER-II****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, 7<sup>th</sup> 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-122 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 magnetron  
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: Halliday Resnik and Walker, 8<sup>th</sup> 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: Brij Lal, Subramanyan, Ratan Prakashan (Revised edition, 1997).
7. Electricity and Magnetism: Khare, Shrivastav (Revised edition, 1997).



**Course code and title: PHY-123 Physics Laboratory 1B****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.**



# **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
<b>F.Y.B.Sc.</b>	<b>SEMESTER I</b>	<b>SEMESTER II</b>	
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
<b>S.Y.B.Sc.</b>	<b>SEMESTER III</b>	<b>SEMESTER IV</b>	
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
<b>T.Y.B.Sc.</b>	<b>SEMESTER V</b>	<b>SEMESTER VI</b>	
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)**

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

- 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)**

<b>No.</b>	<b>Topic &amp; Content</b>	<b>Number of lectures</b>
1.	<b>Introduction to Ecology</b> 1.1 Concepts of Ecology, Environment, Population, Community, Ecosystem, Biosphere, Autecology and synecology.	<b>(02)</b>
2.	<b>Ecosystem</b> 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.	<b>(08)</b>
3	<b>Population</b> 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 Quadrante, line and belt transect methods.	<b>(08)</b>
4.	<b>Community</b> 4.1Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Eco tone and edge effect; Ecological succession with one example.	<b>(07)</b>
5.	<b>Animal interactions</b> 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	<b>(05)</b>

### 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)**

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

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)**

<b>No.</b>	<b>Title &amp; Contents</b>	<b>Number of lectures</b>
1.	<b>Introduction:</b>	<b>(04)</b>
	1.1 Introduction cell biology,	
	1.2 Cell as basic unit of life.	
	1.3 Importance of Cell Biology and its applications in industry.	
	<b>Overview of Cells</b>	
	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)	





7.3 Peroxisomes

### Cell Division

(05)

7.1 Introduction

7.2 Cell cycle (G<sub>1</sub>, S, G<sub>2</sub>, 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 (2<sup>nd</sup> 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 (7<sup>th</sup> 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.*



# **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	<b>ZOUT 111</b> Biochemistry and Biochemical Techniques	-			-	4
2	<b>ZOUT 112</b> Cell Biology and Developmental Biology	-			-	4
3	<b>ZOUT 113</b> Genetics and English in Scientific Communication.	-			-	4
4	-	<b>ZODT 114</b> Theory.	Biostatistics/ Freshwater Zoology	2		4
		<b>ZODP 114</b> Practical	Zoology Practical Paper-I	2	-	
5	-	-			<b>ZOUP 115</b> Basic Zoology Lab-I	4
<b>Total Credit of Semester 1</b>						<b>20</b>

**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	<b>ZOUT 121</b> Molecular Biology and Bioinformatics	-			-	4
2	<b>ZOUT 122</b> Endocrinology and Parasitology	-			-	4
3	<b>ZOUT 123</b> Comparative Animal Physiology and Environmental Biology.	-			-	4
4	-	<b>ZODT 124</b> Theory. ----- <b>ZODP 124</b> Practical	Metabolic pathways / Ichthyology  <b>Zoology Practical Paper-2</b>	2  2	-	4
5	-	-			<b>ZOUP 125</b> Basic Zoology Lab-II	4
<b>Total Credit of Semester 2</b>						<b>20</b>



**M.Sc. Zoology, Part-II, Semester - III**

<b>Sr. No.</b>	<b>Core Compulsory Theory Paper (CCTP)</b>	<b>Choice Based Optional Paper (CBOP)</b>	<b>Theory/ practical</b>	<b>Credit</b>	<b>Core Compulsory Practical Paper (CCPP)</b>	<b>Credit</b>
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
<b>Total Credit of Semester 4</b>						<b>20</b>

**Equivalence of Previous Syllabus:**

<b>Old Course (2013 Pattern)</b>	<b>New Course (2019 Pattern)</b>
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**

<b>Old Course (2013 Pattern)</b>	<b>New Course (2019 Pattern)</b>
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
<b>Biochemistry:</b>		
1.	<b>Basics of chemistry-</b> Structure of atoms, molecules and chemical bonds, Normality, molarity, molality	(02L)
2.	<b>Chemistry of Water :</b> Structure of water and physicochemical properties of water, water as universal solvent, pH and Buffers, Biological Buffer System	(04L)
3.	<b>Carbohydrates:</b> Classification, basic Structures and functions, Biological Significance.	(03L)
4.	<b>Lipids:</b> Classification, structure and function and biological significance.	(03L)
5.	<b>Vitamins:</b> Classification- water-soluble and fat-soluble vitamins, Biological significance.	(02L)
6.	<b>Amino acids:</b> Classification, properties (Physical properties- Optical Isomerization, Absorption in UV light, Ionization; Chemical properties- Reactions with carboxyl group and amino group)	(02L)
7.	<b>Proteins:</b> 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.	<b>Enzymes:</b> 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)
<b>Biochemical Techniques:</b>		
1.	<b>Chromatography:</b> 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)
	<b>Developmental Biology:</b>	
1.	<b>Introduction to developmental biology:</b> Early theories of Developmental biology Concepts of Developmental biology – Growth, cell division, cell differentiation, cell communication, signalling, patterning, induction and competence.	(3L)
2.	<b>Model Organisms:</b> Invertebrate: <i>Drosophila melanogaster</i> , Pisces: Zebra Fish- <i>Danio rerio</i> , Amphibians: <i>Xenopus laevis</i> , Birds: Chicken, Mammals: Mouse.	(3L)
3.	<b>Gametogenesis:</b> Spermatogenesis: spermatogenesis, structure of sperm, regulation of sperm motility, Oogenesis: structure of ovum, previtellogenesis, vitellogenesis and post-vitellogenesis	(2L)
4.	<b>Fertilization:</b> 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 Transition, (5L)  
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*. 6<sup>th</sup> 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*. 8<sup>th</sup> 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*. 5<sup>th</sup> 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*. 8<sup>th</sup> 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*. 5<sup>th</sup> 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.

<b>Sr. No.</b>	<b>Name of the topic</b>	<b>Lectures allotted</b>
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, 3<sup>rd</sup> Edn by Strickberger, Pearson India, 2015, Paperback, 9789332555105
2. Principles of Genetics, Gardner, E.J., Peter & Simmons, M.J. and Snustad, D.P. 8<sup>th</sup> Edn. John Wiley and Sons, New York, 2006.
3. Concepts of Genetics. William S Klug and Michael R Cummings. 10<sup>th</sup> Edn. 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, 3<sup>rd</sup> Edn 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. 7<sup>th</sup> 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*. 2<sup>nd</sup> 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. 6<sup>th</sup> Edition, Washington D.C.
  23. Modern Language Association(2016)MLA Handbook. 8<sup>th</sup> 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.	<b>Introduction:</b> 1.1 Applications and Uses of Statistics 1.2 Population & sample, Different types of Sample 1.3 Exercise & Problems.	(02L)
2.	<b>Data Classification:</b> 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.	<b>Measures of central tendency:</b> 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.	<b>Measures of dispersion:</b> 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.	<b>Correlation and Regression:</b> 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.	<b>Probability and probability distribution:</b> 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 aquatic 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,

- 3<sup>rd</sup> 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; 2<sup>nd</sup> 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, 2<sup>nd</sup> edition.
  7. Freshwater invertebrates of the United States. Robert Pennak. A Wiley-Interscience Publication.
  8. Freshwater Biology. Whipple and Ward. John Wiley & Sons Inc; 2<sup>nd</sup> edition (December 1959).
  9. Freshwater Invertebrates: Ecology and General Biology. Thorp and Covich. Academic Press, 4<sup>th</sup> 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
<b>Module-I Biochemistry and Biochemical Techniques</b>		
1.	Preparation of Acid & Alkali solutions and acid-base titration ( <b>Compulsory</b> )	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 ( <b>Compulsory</b> )	1P



6	Determine the concentration of Vitamin C by titration method from various sources.	1P
7.	Estimation of Sugar (Glucose) by Folin Wu method. <b>(Compulsory)</b>	1P
8.	Isolate proteins by salting out / by adjusting isoelectric point. <b>( Compulsory)</b>	1P
9.	Estimation of protein by Biuret method method. <b>( Compulsory)</b>	1P
10	Principle and uses of different microscopes	1P
11	Principles of electrophoresis, separation of proteins using Gel electrophoresis. <b>(Compulsory)</b>	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 <b>(Compulsory)</b>	1P
14.	Enzyme isolation and purification by fractionation methods.	2P
<b>Module-II Cell Biology and Developmental Biology</b>		
1	Study of ultrastructure of cell organelles. <b>(Compulsory)</b>	1P
2	Study of different types of cells. <b>(Compulsory)</b>	1P
3	Temporary preparation of human cheek epithelial cells. <b>(Compulsory)</b>	1P
4	Study of different stages of mitosis in suitable material. <b>(Compulsory)</b>	1P
5	Study of meiosis in Grasshopper testes / Onion flower buds / <i>Aloe vera</i> with emphasis on all stages of prophase. <b>(Compulsory)</b>	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 <b>(Compulsory)</b>	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. <b>(Compulsory)</b>	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> . <b>(Compulsory)</b>	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
	<b>Module-III Genetics and English in Scientific communication</b>	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> <b>(Compulsory)</b>	1P
3	Determination of gene distances and gene order for a given three-point test cross. <b>(Compulsory)</b>	1P
4	Polytene chromosomes of <i>Drosophila or Chironomous</i> -examination of puff and bands. <b>(Compulsory)</b>	1P
5	Estimation of allelic frequencies, heterozygote frequencies in human populations. <b>(Compulsory)</b>	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 <b>(Compulsory)</b>	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 <b>(Compulsory)</b>	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 paperand writing Citations/ Bibliography <b>(Compulsory)</b>	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.	<b>DNA structure and topology</b> :-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.	<b>Physical properties of DNA:</b> T <sub>m</sub> , hypo and hyper chromicity, solubility, mutarotation and buoyancy.	(2L)
3.	<b>Genome organization:</b> 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.	<b>DNA Replication:</b> 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
<b>Endocrinology:</b>		
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.	<b>Digestion:</b> Physiology of digestion.	(03L)
2.	<b>Respiration:</b> Respiratory Surfaces: comparison of ventilation associated with gills and pulmonary respiration. Blood pigment, role in Oxygen transport. O <sub>2</sub> dissociation curves physiological and ecological significance, CO <sub>2</sub>	(04L)
3.	<b>Muscle contraction:</b> Structure (light & electron microscopic) of the skeletal muscle, proteins of the myofilaments, nature of actin-myosin interaction, sarcoplasmic reticulum and role of Ca <sup>++</sup> in contraction	(04L)
4.	<b>Osmotic regulation:</b> Concepts of osmole, osmolarity and tonicity, ionic regulation, Hyper- and hypo-osmotic regulators, ureosmotic animals.	(04L)
5.	<b>Excretion:</b> Basic processes in urine formation, renal function in animals specially the mammalian kidney, Renal pressure system, Comparative biochemistry of nitrogen excretion.	(04L)
6.	<b>Thermoregulation:</b> 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.	<b>Chemical Communication:</b> Neurosecretion, neurohemal & endocrine organs.	(03L)
8.	<b>Sense organ:</b> classification & functions (details of photoreception as a model). Reflexes, Principles of neural integration.	(04L)
<b>Environmental Biology</b>		
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"> <li>1. Steps of Glycolysis (EMP Pathway).</li> <li>2. PFK</li> <li>3. Regulation of Glycolysis.</li> <li>4. Glycogenesis, Glycogenolysis and Glyconeogenesis</li> <li>5. Inborn errors of metabolism- Von- Gerkes disease, Tarui's disease, Galactosemia, Maple syrup urine</li> </ol>	(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 ( $\omega$ )-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.( <b>Compulsory</b> )	(1P)
2.	Separation amino acids by paper chromatography	(2P)
3.	Estimation of uric acid in wall Lizard excreta/ Human blood any other suitable material.( <b>Compulsory</b> )	(1P)
4.	To find absorption spectrum of haemoglobin, BSA, Tyrosine.	(1P)
5.	Estimation of Protein by Lowry et al Method.( <b>Compulsory</b> )	(1P)
6.	Estimation of Sugar by DNSA method.	(1P)
7.	Separation of amino acids by TLC ( <b>Compulsory</b> )	(1P)
8.	Estimation of free amino acids by Ninhydrin method.( <b>Compulsory</b> )	(1P)
9.	Estimation of cholesterol.	(1P)
10.	Study $\alpha$ -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; 5<sup>th</sup> 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; 4<sup>th</sup> 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.



<b>Topic No.</b>	<b>Name of the topic</b>	<b>Lecture allotted</b>
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
<b>Module-I Molecular Biology and Bioinformatics</b>		
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

	<b>FASTA (Compulsory)</b>	
<b>6</b>	To analyse protein on native PAGE and SDS-polyacrylamide gel electrophoresis.( <b>Compulsory</b> )	<b>2P</b>
<b>7.</b>	Construction of phylogenetics tree for DNA and protein ( <b>Compulsory</b> )	<b>1P</b>
<b>8.</b>	Demonstration of DNA amplification by PCR	<b>1P</b>
	<b>Module- II Endocrinology and Parasitology</b>	<b>1P</b>
<b>1</b>	Histology of invertebrate and vertebrate neurosecretory and endocrine structures.(Compulsory)	<b>1P</b>
<b>2</b>	Blood sugar regulation in the crab- role of eye stalk. ( <b>Compulsory</b> )	<b>1P</b>
<b>3</b>	Study of retrocerebral complex of the cockroach.	<b>1P</b>
<b>4</b>	Introduction of alloxan diabetes in the mouse/ rat / human. ( <b>Compulsory</b> )	<b>1P</b>
<b>5</b>	Gonadectomy in the mouse/ rat.	<b>2P</b>
<b>6</b>	Pancreatectomy in the mouse/ rat.	<b>1P</b>
<b>7</b>	Effect of insulin on blood sugar, hepatic and muscle glycogen of the rat/human. ( <b>Compulsory</b> )	<b>1P</b>
<b>8</b>	Thyroidectomy in the rat.	<b>1P</b>
<b>9</b>	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. ( <b>Compulsory</b> ) (Specimen, Slides or charts may be used.)	<b>2P</b>
<b>10</b>	Ectoparasites&Endoparasites of wild rat, cattle, dog, chick & human including stages in excreta.	<b>2P</b>
<b>11</b>	Study of life cycle of parasitic protozoa: <i>Trypanosoma, Leishmania</i> .( <b>Compulsory</b> )	<b>1P</b>
<b>12</b>	Study of life cycle of helminth parasites: <i>Schistosoma, Echinococcus, Ancylostoma, Dracunculus</i> ( <b>Compulsory</b> )	<b>2P</b>
<b>13</b>	Study of Parasites from digestive tract of Cockroach/gut / parasites of hen. (Compulsory)	<b>1P</b>

<b>Module-III Comparative Animal physiology and Environmental Biology</b>		
<b>1</b>	Study of nitrogenous waste products of animals from different habitats. <b>(Compulsory)</b>	<b>1P</b>
<b>2</b>	Study of RBCs in different vertebrates and in different physiological conditions.	<b>1P</b>
<b>3</b>	Study of relation of Body size and oxygen consumption in aquatic animals (crab/fish). <b>(Compulsory)</b>	<b>1P</b>
<b>4</b>	Estimation of sugar in rat/crab/human blood. <b>(Compulsory)</b>	<b>1P</b>
<b>5</b>	Determination of bleeding time & clotting time of human blood. <b>(Compulsory)</b>	<b>1P</b>
<b>6</b>	Determination of the heart beat in the crab-effect of temperature & ions.	<b>1P</b>
<b>7</b>	Effect of eye stalk ablation on glucose in the haemolymph of the crab.	<b>1P</b>
<b>8</b>	A visit to aquatic ecosystem and methods for water and plankton collection. <b>(Compulsory)</b>	<b>2P</b>
<b>9</b>	Plankton identification and quantification from river / lake water samples. <b>(Compulsory)</b>	<b>2P</b>
<b>10</b>	Vegetation studies by line, quadrates and belt transect methods and their analysis.	<b>2P</b>
<b>11</b>	Preparation of media for microbial culture, Isolation and culturing of microbes from soil/water samples. <b>(Compulsory)</b>	<b>2P</b>
<b>12</b>	Water analysis for physico-chemical characteristics. <b>(Compulsory)</b>	<b>1P</b>
<b>13</b>	Physico-chemical analysis of soil. <b>(Compulsory)</b>	<b>1P</b>

*Note: Latest edition of the recommended books may also be used*

**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 2<sup>nd</sup> and 4<sup>th</sup> 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	<b>Special Course Paper (I)</b> 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	<b>Special Course Paper (I)</b> 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"> <li>g) Business Entrepreneurship</li> <li>h) Marketing Management</li> <li>i) Agricultural and Industrial Economics</li> <li>j) Defence Budgeting, Finance and Management</li> <li>k) Insurance, Transport and Tourism</li> <li>l) Computer Programming and Application</li> </ul>	
V	Core Course	Auditing & Taxation – I	PR- 354
V	Discipline Specific Elective	<p style="text-align: center;"><b>Special Course Paper (II)</b></p> <ul style="list-style-type: none"> <li>a) Business Administration</li> <li>b) Banking and Finance</li> <li>c) Business Law and practices</li> <li>d) Cooperation and Rural Development</li> <li>e) Cost and Works Accounting</li> <li>f) Business Statistics</li> <li>g) Business Entrepreneurship</li> <li>h) Marketing Management</li> <li>i) Agricultural and Industrial Economics</li> <li>j) Defence Budgeting, Finance and Management</li> <li>k) Insurance, Transport and Tourism</li> <li>l) Computer Programming and Application</li> </ul>	PR- 355
V	Discipline Specific Elective	<p style="text-align: center;"><b>Special Course Paper (III)</b></p> <ul style="list-style-type: none"> <li>a) Business Administration</li> <li>b) Banking and Finance</li> <li>c) Business Law and practices</li> <li>d) Cooperation and Rural Development</li> <li>e) Cost and Works Accounting</li> <li>f) Business Statistics</li> <li>g) Business Entrepreneurship</li> <li>h) Marketing Management</li> <li>i) Agricultural and Industrial Economics</li> <li>j) Defence Budgeting, Finance and Management</li> <li>k) Insurance, Transport and Tourism</li> <li>l) Computer Programming and Application</li> </ul>	PR- 356
VI	Core Course	Auditing & Taxation – II	PR- 364
VI	Discipline Specific Elective	<p style="text-align: center;"><b>Special Course Paper (II)</b></p> <ul style="list-style-type: none"> <li>a) Business Administration</li> <li>b) Banking and Finance</li> <li>c) Business Law and practices</li> <li>d) Cooperation and Rural Development</li> </ul>	PR- 365

		<ul style="list-style-type: none"> <li>e) Cost and Works Accounting</li> <li>f) Business Statistics</li> <li>g) Business Entrepreneurship</li> <li>h) Marketing Management</li> <li>i) Agricultural and Industrial Economics</li> <li>j) Defence Budgeting, Finance and Management</li> <li>k) Insurance, Transport and Tourism</li> <li>l) Computer Programming and Application</li> </ul>	
VI	Discipline Specific Elective	<p style="text-align: center;"><b>Special Course Paper (III)</b></p> <ul style="list-style-type: none"> <li>a) Business Administration</li> <li>b) Banking and Finance</li> <li>c) Business Law and practices</li> <li>d) Cooperation and Rural Development</li> <li>e) Cost and Works Accounting</li> <li>f) Business Statistics</li> <li>g) Business Entrepreneurship</li> <li>h) Marketing Management</li> <li>i) Agricultural and Industrial Economics</li> <li>j) Defence Budgeting, Finance and Management</li> <li>k) Insurance, Transport and Tourism</li> <li>l) Computer Programming and Application</li> </ul>	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.

$\sigma$  = 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
<b>Total No. of credits</b>							<b>132</b>

### 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
<b>Total</b>				<b>6</b>

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**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	<b>Optional Group. (A) (Any one of the Following)</b> 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	<b>Optional Group. (B) (Any one of the Following)</b> 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	<b>Any one of the following Language</b> 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	<b>Optional Group. – (A)</b> <b>(Any one of the Following)</b> 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	<b>Optional Group. (B) (Any one of the Following)</b> 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	<b>Any one of the following Language- II</b> 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	<b>Special Course Paper- I (Any One)</b> 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	<b>Special Course Paper – II (Same Special Course Offered at S.Y.B.Com)</b> 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	<b>Special Course Paper – III (Same Special Course Offered at S.Y.B.Com)</b> 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	<b>Special Course Paper – II (Same Special Course Offered at S.Y.B.Com)</b> 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	<b>Special Course Paper – III (Same Special Course Offered at S.Y.B.Com)</b>  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

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**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.

<b>Unit No.</b>	<b>Unit Title</b>	<b>Contents</b>	<b>Purposed Skills to be developed</b>
1	Accounting Concepts, Conventions and Principles and an overview of Emerging Trends in Accounting	<p><b>(A) Accounting Concepts, Conventions and Principles</b></p> <ol style="list-style-type: none"><li>1. Money Measurement</li><li>2. Business Entity</li><li>3. Dual Aspect</li><li>4. Periodicity Concept</li><li>5. Realization Concept</li><li>6. Matching Concept</li><li>7. Accrual / Cash Concept</li><li>8. Consistency Concept</li><li>9. Conservatism Principle</li><li>10. Materiality Concept</li><li>11. Going Concern Concept</li><li>12. Historical Cost Concept</li></ol> <p><b>(B) Emerging Trends in Accounting</b></p>	<ul style="list-style-type: none"><li>• Knowledge about various accounting Concepts, Conventions and Principles.</li><li>• Understanding emerging trends in accounting and its effect on accounting Practices.</li></ul>

		<ol style="list-style-type: none"> <li>1. Inflation Accounting</li> <li>2. Creative Accounting</li> <li>3. Environmental Accounting</li> <li>4. Human Resource Accounting</li> <li>5. Forensic Accounting</li> </ol>	
2	Piecemeal Distribution of Cash	<ol style="list-style-type: none"> <li>1. Surplus Capital Method only, Asset taken over by a partner,</li> <li>2. Treatment of past profits or past losses in the Balance sheet,</li> <li>3. Contingent liabilities</li> <li>4. Realization expenses/amount kept aside for expenses</li> <li>5. adjustment of actual, Treatment of secured liabilities,</li> <li>6. Treatment of preferential liabilities like Govt. dues/labour dues etc., Excluding: Insolvency of partner and Maximum Loss Method.</li> </ol>	<ul style="list-style-type: none"> <li>• Knowledge about process of dissolution of partnership firm.</li> </ul>
3	Accounts from Incomplete Records (Single Entry System)	<ol style="list-style-type: none"> <li>1. Meaning of single entry system</li> <li>2. Features of Single Entry System</li> <li>3. Conversion of Single Entry into Double Entry</li> </ol>	<ul style="list-style-type: none"> <li>• Knowledge about single entry systems.</li> <li>• Purpose and advantages of double entry system</li> <li>• Process of conversion of single entry into double entry system.</li> </ul>
4	Introduction to Goods and Services Tax laws and Accounting	<ol style="list-style-type: none"> <li>1. Constitutional Background of GST, Concepts and definition of GST.</li> <li>2. IGST, CGST and SGST</li> <li>3. Input and Output Tax credit</li> <li>4. Procedure for registration under GST</li> </ol>	<ul style="list-style-type: none"> <li>• Knowledge about conceptual framework of the GST</li> <li>• Knowledge about various components of GST.</li> <li>• Types of taxes under GST</li> <li>• Registration process under GST for business establishments.</li> </ul>

### 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.	<b>Advanced Accounting</b>	<b>S. N. Maheshwari</b>		
6.	<b>GST Law and Analysis with Conceptual Procedures</b>	<b>Bimal Jain and Isha Bansal (Set of 4 Volumes)</b>	Pooja Law Publishing Company	New Delhi
7.	<b>Guidance Note on GST by ICAI</b>	--	The Institute of Chartered Accountants of India	New Delhi

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**Revised syllabi (2019Pattern) for three years F.Y. B. Com. Degree course (CBCS)**

**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

<b>Unit No.</b>	<b>Unit Title</b>	<b>Contents</b>	<b>Purpose &amp; skills to be developed</b>
1	<b>Introduction and Basic Concepts</b>	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"> <li>• To make the students aware of concepts in micro economics</li> <li>• To help the students understand the difference between micro and macro economics</li> <li>• To make the students understand economic and non-economic goals of firms.</li> </ul> <p><b>Skills :</b> Analyze and think critically, develop writing skills</p>
2	<b>Consumer Behavior</b>	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"> <li>• To help the students understand the concept of utility</li> <li>• To impart knowledge of cardinal and ordinal approach</li> <li>• To make them understand the concept of consumer surplus</li> </ul> <p><b>Skills:</b> Understanding complex theories and concepts Geometrical skills, mathematical aptitude, writing skills</p>

		Analysis- Concept, Characteristics, Consumer Equilibrium	
3.	<b>Demand and Supply Analysis</b>	3.1 Concept of Demand 3.2 Determinants of Demand 3.3 Law of Demand 3.4 Elasticity of Demand 3.4.1 Price Elasticity of Demand - Meaning, Types, Measurement, Uses and Significance 3.4.2 Income Elasticity of Demand-Meaning and Types 3.4.3 Cross Elasticity of Demand-Meaning and Types 3.5 Supply : Concept, Determinants and Law of Supply 3.6 Equilibrium of Demand and Supply for Price Determination	<ul style="list-style-type: none"> <li>• To understand the concept of demand and elasticity of demand</li> <li>• To impart knowledge of law of supply and the determinants of law of supply</li> <li>• To help the students understand price determination in varied demand and supply condition</li> </ul> <p><b>Skills imparted:</b> Applying mathematical and statistical analysis methods extracting information, drawing conclusions</p>
4.	<b>Production Analysis</b>	4.1 Concept of Production Function 4.2 Total, Average and Marginal Production 4.3 Law of Variable Proportions 4.4 Law of Returns to Scale 4.5 Economies and Diseconomies of Scale- Internal and External	<ul style="list-style-type: none"> <li>• To help the students understand the relation between revenue concepts</li> <li>• To understand theories of production function</li> <li>• To make students know about economies and diseconomies of scale</li> </ul> <p><b>Skills:</b> 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"> <li>• Open book discussion</li> <li>• Case studies</li> <li>• Problem solving based learning</li> </ul>	You tube lectures on micro and macro economics	<ul style="list-style-type: none"> <li>• Functional relations</li> <li>• Goals of firms</li> </ul>	<ul style="list-style-type: none"> <li>• Students will understand basic concepts of micro economics,</li> <li>• Will be able to analyze and interpret</li> </ul>
1.	12	<ul style="list-style-type: none"> <li>• Digital lectures</li> <li>• Jigsaw reading</li> </ul>	You tube lectures	Types of utility	<ul style="list-style-type: none"> <li>• Will know cardinal and ordinal approach</li> <li>• Will understand the concept of consumer surplus</li> </ul>
2.	12	<ul style="list-style-type: none"> <li>• Game oriented classes</li> <li>• Pair learning</li> <li>• Group discussion</li> </ul>	<ul style="list-style-type: none"> <li>• Films</li> <li>• You tube lectures</li> </ul>	Type of goods and elasticity of demand	<ul style="list-style-type: none"> <li>• Will understand the concept of demand and elasticity of demand</li> <li>• Will understand the concept of supply</li> <li>• Able to interpret equilibrium in the market</li> </ul>
3.	12.	<ul style="list-style-type: none"> <li>• Group discussion</li> <li>• Teacher driven power point presentation</li> <li>• Games and simulation</li> </ul>	<ul style="list-style-type: none"> <li>• You tube lectures</li> <li>• Online PPTs</li> </ul>	Effect of economies of scale on industries (with example of an industry)	<ul style="list-style-type: none"> <li>• Will understand revenue concept</li> <li>• Will know economies and diseconomies of scale</li> </ul>

## 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.	<a href="https://mitpress.mit.edu/books/lectures-microeconomics">https://mitpress.mit.edu/books/lectures-microeconomics</a>	<a href="https://www.economicsnetwork.ac.uk/teaching/Video%20and%20Audio%20Lectures/Principles%20of%20Microeconomics">https://www.economicsnetwork.ac.uk/teaching/Video%20and%20Audio%20Lectures/Principles%20of%20Microeconomics</a>	<a href="https://www.youtube.com/redirect?q=http%3A%2F%2Fwww.thateconstutor.com&amp;v=Zre4tp90Aog&amp;redir_token=6U11cd7zsOZt8fGKACK3B5JHJNh8MTU1NzkyNzkzMUAxNTU3ODQxNTMx&amp;event=video_description">https://www.youtube.com/redirect?q=http%3A%2F%2Fwww.thateconstutor.com&amp;v=Zre4tp90Aog&amp;redir_token=6U11cd7zsOZt8fGKACK3B5JHJNh8MTU1NzkyNzkzMUAxNTU3ODQxNTMx&amp;event=video_description</a>	<a href="https://ctaar.rutgers.edu/gag/ppc2_files/ppc2.ppt">https://ctaar.rutgers.edu/gag/ppc2_files/ppc2.ppt</a>	<a href="http://scholar.google.co.in/scholar?q=articles+on+microeconomics&amp;hl=en&amp;as_sdt=0&amp;as_vis=1&amp;oi=scholar">http://scholar.google.co.in/scholar?q=articles+on+microeconomics&amp;hl=en&amp;as_sdt=0&amp;as_vis=1&amp;oi=scholar</a>
2.	<a href="https://www.amazon.com/Lectures-Microeconomics-Questions-Approach-Press/dp/0262038188">https://www.amazon.com/Lectures-Microeconomics-Questions-Approach-Press/dp/0262038188</a>	<a href="https://nptel.ac.in/courses/109104125/">https://nptel.ac.in/courses/109104125/</a>	<a href="https://www.youtube.com/watch?v=ewPNugIqCUM">https://www.youtube.com/watch?v=ewPNugIqCUM</a>	<a href="https://www.slideshare.net/tribhuwan64/presentation-on-importance-of-microeconomics">https://www.slideshare.net/tribhuwan64/presentation-on-importance-of-microeconomics</a>	<a href="http://theconversation.com/global/topics/microeconomics-3328">http://theconversation.com/global/topics/microeconomics-3328</a>

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**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

<b>Unit No.</b>	<b>Unit Title</b>	<b>Contents</b>	<b>Purpose/Skills to be developed</b>
1	<b>Interest and Annuity</b>	<p><b>Interest:</b> Concept of Present value and Future value, Simple interest, Compound interest, Nominal and Effective rate of interest, Examples and Problems</p> <p><b>Annuity:</b> 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"> <li>1. To understand the concept of Simple interest, compound interest, effect of compounding.</li> <li>2. To understand the concept of Annuity and its applications for EMIs and Amortization Schedule.</li> </ol>
2	<b>Shares and Mutual Funds</b>	<p><b>Shares:</b> Concept of share, face value, market value, dividend, brokerage, equity shares, preferential shares, bonus shares. Examples and Problems</p> <p><b>Mutual Funds:</b> 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"> <li>1. To understand the concept of shares and mutual funds.</li> <li>2. To understand contribution of shares and mutual funds in systematic investment plans</li> <li>3. To solve problems related to shares and mutual funds</li> </ol>
3	<b>Population and Sample</b>	<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"> <li>1. Collection of data</li> <li>2. Analyzing and interpreting data.</li> <li>3. Knowing different method of sampling</li> </ol>

4	<b>Measures of Central Tendency and Measures of Dispersion</b>	<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"> <li>1. To classify and represent data in tabular and graphical form.</li> <li>2. To compute various measures of central tendency and measures of dispersion.</li> </ol>
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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:**

<b>Sr. No.</b>	<b>Title of the Book</b>	<b>Author/s</b>	<b>Publication</b>	<b>Place</b>
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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**Revised syllabi (2019Pattern) for three years F.Y. B. Com. Degree course (CBCS)**

**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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**Revised syllabi (2019Pattern) for three years F.Y. B. Com. Degree course (CBCS)**

**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**

<b>Unit No.</b>	<b>Unit Title</b>	<b>Contents</b>	<b>Purpose Skills to be developed</b>
<b>1</b>	Concept of Modern Office	<ol style="list-style-type: none"><li>a. Modern Office :- Definition, Characteristics, importance and functions</li><li>b. Office environment:- Meaning and Importance</li><li>c. Office Location :- Meaning, Principles and factors affecting Office location</li><li>d. Office Layout :- Meaning, Principles and factors affecting Office Layout</li></ol>	<ol style="list-style-type: none"><li>1. Conceptual Clarity on the meaning of a modern office</li><li>2. Developing understanding on the internal and external factors of an office environment</li><li>3. Developing analytical and technical skills to contribute towards planning office location and layout</li></ol>
<b>2</b>	Office Organisation and Management	<ol style="list-style-type: none"><li>a. Office Organisation : Definition, Importance, Principles and Types of Organisation</li><li>b. Office Management:- Definition, Functions</li><li>c. Scientific Office Management :- Meaning, Aims, Techniques of Scientific Office Management and Steps for installation of Scientific Office Management</li></ol>	<ol style="list-style-type: none"><li>1. Conceptual clarity on the meaning of Scientific office management</li><li>2. Development of understanding in various techniques for scientific management</li></ol>

3	Office Records Management	a. Office Records Management -Definition, Objectives, Scope of Records Management, Significance, Principles of Records management. b. Digitalization of records:- Advantages and Problems of Digitalization c. Form Design:- Objectives, types of forms, Significance, Principles of form designing d. Office Manual – Definition, Contents Types , benefits and limitations	1. Introduction to concept of digitalization of records 2. Technical skills and critical analysis skills for designing of various office documents for effective records creation and maintenance
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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# Revised syllabi (2019Pattern) for three years F.Y. B. Com. Degree course (CBCS)

## 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.	<b>Evolution of Banking</b>	<ul style="list-style-type: none"><li>• Meaning, Definition and Origin of 'Bank'</li><li>• Evolution of Banking in Europe and Asia</li><li>• Evolution of Banking in India</li><li>• Structure of Indian Banking System</li></ul>	<ul style="list-style-type: none"><li>• Knowledge of evolution of banking.</li><li>• Understanding structure of Indian Banking</li></ul>
2.	<b>Functions of Bank</b>	<p><b>Primary Functions:</b></p> <ul style="list-style-type: none"><li>○ <b>Accepting Deposits:</b><ul style="list-style-type: none"><li>i. Demand Deposits - Current Deposit and Savings Deposits;</li><li>ii. Time Deposits - Fixed Deposit and Recurring Flexi Deposits (Auto Sweep)</li></ul></li><li>○ <b>Granting Loans and Advances-</b><ul style="list-style-type: none"><li>i. Short Term Loan- Overdraft Facility, Cash Credit Facility, Purchasing and Discounting of Bills,</li><li>ii. Term Loan</li></ul></li></ul>	<ul style="list-style-type: none"><li>• Understanding primary and secondary functions of a bank.</li><li>• Understanding the concepts related to lending and ratios.</li></ul>

		<p><b>Secondary Functions:</b></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"> <li>• 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</li> </ul>	
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<p>3.</p>	<p><b>Procedure for Opening and Operating of Deposit Account</b></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><b>Types of Account Holders</b></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"> <li>• Understanding the process of opening and operating procedure of bank accounts.</li> <li>• Understanding various types of bank accounts holders</li> </ul>
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4	<b>Methods of Remittance</b>	<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"> <li>Understanding various methods of remittance.</li> </ul>
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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"> <li>Knowledge of evolution of banking.</li> <li>Understanding structure of Indian Banking</li> </ul>
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"> <li>Understanding primary and secondary functions of a bank.</li> <li>Understanding the concepts related to lending and ratios.</li> </ul>

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"> <li>• Understanding the process of opening and operating procedure of bank accounts.</li> <li>• Understanding various types of bank accounts holders</li> </ul>
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"> <li>• Understanding various methods of remittance.</li> </ul>

#### 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., (4<sup>th</sup> Edition, 2017), 'Banking and Insurance', Himalaya Publishing House.
5. Gopinath M. N., (1<sup>st</sup> Edition, 2008), 'Banking Principles and Operations', Snow White Publications Pvt. Ltd, Mumbai
6. Gordon E. & Natarajan K., 'Banking - Theory, Law and Practice', (21<sup>st</sup> Revised Edition), Himalaya Publishing House.
7. Joshi Vasant & Joshi Vinay, (3<sup>rd</sup> Edition), 'Managing Indian Banks', Sage Publication, New Delhi.
8. Varshney P.N. (12<sup>th</sup> Edition, 2003), 'Banking - Law and Practice', Sultan Chand & Co. New Delhi
9. Kothari V., (26<sup>th</sup> Edition) 'Tanna's Banking Law & Practice in India,' Lexis Nexis Publication.

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# Revised syllabi (2019Pattern) for three years F.Y. B. Com. Degree course (CBCS)

## 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.	<b>Development of Defense Organization after Independence</b> 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"><li>• Understanding defence organization after independence.</li><li>• Understanding the principles of Defense organization</li></ul>
2.	<b>Elements of Defense Organization in India.</b> 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"><li>• Understanding the elements of defense organization in India.</li></ul>

	2.4 National Security Council.			
<b>3.</b>	<b>Defense Structure of Indian Armed Forces</b> 3.1 Chief of Staff Committee. 3.2 Organization of Army, Naval & Air Headquarters. 3.3 Organization of Army, Naval & Air Commands.	<b>12</b>	Lecture,PPT, Group Discussion, Library Work,	<ul style="list-style-type: none"> <li>Understanding the defense structure of Indian Armed Forces</li> </ul>
<b>4.</b>	<b>Para Military Forces of Defense</b> 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.	<b>12</b>	Lecture,PPT, Group Discussion, Library Work, Assignment	<ul style="list-style-type: none"> <li>Understanding the paramilitary force of defense.</li> </ul>
	<b>Total</b>	<b>48</b>		

#### 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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# Revised Syllabi (2019 Pattern) for three years B.Com Degree Course (CBCS)

## 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 <b>International Co-operative Alliance (ICA)</b> 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	<b>History of Co-operative Movement in India</b>	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"> <li>i. To understand the development of Co-operative Movement in India</li> <li>ii. To understand Sir Fedrick Nicholson Report and Maclagen Committee Report To understand eminent supporters and their contribution in Co-operative Movement of India</li> </ul>
3	<b>Development of Co-operative Movement in India in post Independent Era</b>	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"> <li>i. To understand the Contribution of Co-operative Leaders in India</li> <li>ii. To understand the Gorewala Committee Report, Vaidyanathan Commiittee Report</li> <li>iii. To understand Current scenario of Co-operative Movement in India</li> </ul>
4	<b>Government and Co-operative Movement</b>	Role of Central Government , Role of State Government Co-operative Vs Capitalism & Communism	<ul style="list-style-type: none"> <li>i. To understand the role of Government in Co-operative Movement</li> <li>ii. To understand Co-operative Vs Capitalism &amp; Communism</li> </ul>

### 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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# Revised Syllabi (2019 Pattern) for three years B.Com Degree Course (CBCS)

## 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>

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# 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

<b>4</b>	<b>E- Payment and Electronic Data Inter exchange</b>	<p>A. <b><u>E- Payment</u></b> : 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. <b><u>Electronic Data Inter exchange</u></b>: 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"> <li>1. Practical Oriented Skills on E-commerce</li> <li>2. Conceptual Clarity on Online Payment Process</li> <li>3. Conceptual Clarity on EDI and Electronic</li> </ol>
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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

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# 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.	<b>Introduction to Insurance</b> 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"><li>• Understanding the concept of insurance</li></ul>
2.	<b>Life Insurance</b> 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"><li>• Understanding the concept of life insurance.</li></ul>

<b>3.</b>	<b>Fire Insurance</b> 3.1 Meaning and Features 3.2 Nature of Fire Insurance Contract 3.3 Types of Fire Insurance Policies	<b>08</b>	Lecture,PPT, Group Discussion, Library Work,	<ul style="list-style-type: none"> <li>Understanding the concept of fire insurance</li> </ul>
<b>4.</b>	<b>Marine Insurance</b> 4.1 Meaning and Features 4.2 Marine Insurance Contract 4.3 Types of Marine Insurance Policies	<b>08</b>	Lecture,PPT, Group Discussion, Library Work, Assignment	<ul style="list-style-type: none"> <li>Understanding the concept of marine insurance</li> </ul>
	<b>Total</b>	<b>48</b>		

### 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

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# 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 &amp; 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"> <li>i. Meaning and Definition of Place Mix</li> <li>ii. Importance</li> <li>iii. Types of Distribution Channels – consumer goods and Industrial Goods</li> <li>iv. Factors Influencing selection of Channels</li> </ul> <p>4.2 Promotion Mix</p> <ul style="list-style-type: none"> <li>4.2.1 Meaning of Promotion Mix</li> <li>4.2.2 Elements of Promotion Mix- Personal Selling, Public Relation and Sales Promotion</li> <li>4.2.3 Factors Affecting Market Promotion Mix</li> <li>4.2.4 Promotion Techniques or Methods</li> </ul>	Students will develop the skills of promoting a product along with gaining knowledge about the distribution channels.
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## Teaching Methodology

<b>Topic No.</b>	<b>Total Lectures</b>	<b>Innovative Methods to be used</b>	<b>Film shows and AV Applications</b>	<b>Expected Outcome</b>
<b>1</b>	<b>14</b>	Power Point Presentation, Survey Analysis	Short Film AV Application	Student will get acquainted with the basics of marketing field.
<b>2</b>	<b>07</b>	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.
<b>3</b>	<b>14</b>	Conceptual Learning Group Discussion	AV Application	Students will develop the skills of Pricing the product along with gaining knowledge on Product Mix
<b>4</b>	<b>13</b>	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

<b>Sr. No.</b>	<b>Title of the Book</b>	<b>Author/s</b>	<b>Publication</b>	<b>Place</b>
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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# Revised syllabi (2019 Pattern) for three years B.com Degree course (CBCS)

## 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	<b>Consumer Protection - An Overview</b>	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	<b>Consumer Education and Awareness</b>	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.	<b>Consumer Protection Law in India *</b>	Consumer Protection Movement in India <b>Consumer Protection Act 1986-</b> 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.	<b>E -Commerce and consumer Protection</b>	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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## Revised syllabi (2019 Pattern) for three years B.com Degree course (CBCS)

### 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	<b>Business Environment</b>	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	<b>Environment Issues</b>	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

<b>3</b>	<b>Problems of growth</b>	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
<b>4</b>	<b>The Entrepreneur</b>	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 Intrapreneur	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

<b>Topic No.</b>	<b>Total Lectures</b>	<b>Innovative Methods to be used</b>	<b>Film Shows and A.V. Application</b>	<b>Project</b>	<b>Expected Outcome</b>
<b>1</b>	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
<b>2</b>	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
<b>3</b>	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
<b>4</b>	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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# Revised syllabi (2019 Pattern) for three years B.com Degree course (CBCS)

## 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	<ul style="list-style-type: none"><li>▪ Conceptual Understanding on the various forms of Business Organization,</li></ul>
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	<ol style="list-style-type: none"><li>1. Overview of the emerging types of business models</li></ol>

3	<b>Industrial Policies and Recent Programmes for Start ups in India</b>	<ol style="list-style-type: none"> <li>1. Overview of recent Industrial Policies in India – New Industrial Policy 1991, EXIM Policy , India New Foreign Trade Policy 2015 – 2020 , FDI Policy</li> <li>2. Overview of : <ol style="list-style-type: none"> <li>a. Start up India</li> <li>b. Atal Innovation Mission (AIM)</li> <li>c. Make in India</li> <li>d. Digital India</li> <li>e. Support To Training And Employment Programme For Women (STEP)</li> <li>f. <b>Trade-Related Entrepreneurship Assistance And Development (TREAD)</b></li> <li>g. <b>Pradhan Mantri Kaushal Vikas Yojana (PMKVY)</b></li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>4. Overview of the various policies supporting business in India</li> <li>5. Awareness on the recent programmes to promote and support for business</li> </ol>
4	<b>Emerging Trends in Service Sector</b>	<p>Overview of Recent trends –</p> <ol style="list-style-type: none"> <li>1. Banking Sector - Internet and Mobile Banking</li> <li>2. Indian Post Payments Bank</li> <li>3. Insurance Sector –Malhotra Committee Report</li> <li>4. Logistics</li> <li>5. BPO, KPO , TPO , and LPO</li> <li>6. New trends in Tourism- Religious, Rural, &amp; Medical tourism</li> </ol>	<ol style="list-style-type: none"> <li>4. Awareness of Recent Trends in the Service Sector</li> </ol>

## 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	<a href="https://www.india.gov.in/my-government/schemes">https://www.india.gov.in/my-government/schemes</a>	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 <b>Pradhan Mantri Kaushal Vikas Yojana (PMKVY)</b>
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>

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# 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"><li>1. Types of Accounting Software</li><li>2. Use of Accounting Software</li><li>3. Installation of Accounting Software</li><li>4. Advantages and disadvantages of Accounting Software</li></ol> <p>Voucher entry and Report Generation including GST transactions</p>	<ul style="list-style-type: none"><li>• Students are expected to acquaint themselves with Computerised accounting, its application and utility.</li></ul>

2	<b>Final Accounts of Charitable Trust (Clubs, Hospitals, Libraries etc.)</b>	<ol style="list-style-type: none"> <li>1. Meaning and Characteristics</li> <li>2. Accounting Records</li> <li>3. Income and Expenditure Account</li> <li>4. Receipt and Payment Account</li> <li>5. Balance Sheet and Adjustments</li> </ol>	<ul style="list-style-type: none"> <li>• Understanding the accounting process of accounting of charitable trusts</li> <li>• Recording basic accounting transactions and prepare annual financial statements; and</li> <li>• Analyzing , interpreting and communicating the information contained in basic financial statements and explain the limitations of such statements</li> </ul>
3	<b>Valuation of Intangibles</b>	<ol style="list-style-type: none"> <li>1. Valuation of Goodwill (Problem)</li> <li>2. Valuation of Brands</li> <li>3. Valuation of Patents, Copyright and Trademark etc.</li> </ol>	<ul style="list-style-type: none"> <li>• Learning the concept of intangible assets and the methods of their valuation.</li> </ul>
4	<b>Accounting for Leases</b>	<ol style="list-style-type: none"> <li>1. Types of Lease (Finance Lease and Operating Lease)</li> <li>2. Finance Lease (Hire Purchase and installment) (Theory)</li> <li>3. Operating Lease</li> <li>4. Royalty,</li> <li>5. Minimum Rent,</li> <li>6. Short Workings,</li> <li>7. Recoupment Of Short Working,</li> <li>8. Lapse of Short Working</li> </ol> <p>Journal Entries and Ledger Accounts in the Books of Landlord and Lessee</p>	<ul style="list-style-type: none"> <li>• Understanding the process and methods of leasing.</li> </ul>

Teaching methodology

<b>Topic No.</b>	<b>Total Lectures</b>	<b>Innovative methods to be used</b>	<b>Film shows and AV Applications</b>	<b>Project</b>	<b>Expected Outcome</b>
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

<b>Sr. No.</b>	<b>Title of the Book</b>	<b>Author/s</b>	<b>Publication</b>	<b>Place</b>
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**

<b>Topic</b>	<b>Mode of Practical</b>
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	<b>Cost and Revenue</b>	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"><li>• To understand the concept and types of cost</li><li>• To make the students know about short run and long run cost concepts</li><li>• To impart knowledge about types of revenue</li></ul> Skills: Interpretation of cost curves, integrate cost and revenue concepts, draw inferences

2	<b>Pricing Under Perfect Market Conditions</b>	<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"> <li>• To help the students understand the concept of pure and perfect competition</li> <li>• To impart knowledge about equilibrium of firm and industry in short and long run.</li> </ul> <p>Skills: Understanding, writing skills, critical thinking</p>
3.	<b>Pricing Under Imperfect Market Conditions</b>	<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"> <li>• To develop ability to understand the market structures under imperfect competition</li> <li>• Ability to compare perfect and imperfect competition</li> </ul> <p>Skills: Understand complex relations, problem solving skill, analytical skill</p>
4	<b>Factor Pricing</b>	<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"> <li>• To understand the theory of marginal productivity</li> <li>• To understand the concept and theories in factor pricing</li> </ul> <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"> <li>• Open book discussion,</li> <li>• Case studies</li> </ul>	<ul style="list-style-type: none"> <li>• You tube lectures</li> <li>• Online PPTs</li> </ul>	<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"> <li>• Will understand the concept and types of cost</li> <li>• Students will know about short run and long run cost concepts</li> <li>• Students will have knowledge about types of revenue</li> </ul>
2	8	<p>Digital lectures</p> <p>Interactive lectures</p>	<ul style="list-style-type: none"> <li>• You tube lectures</li> <li>• Online PPTs</li> </ul>	<p>Application of perfect competition markets in the markets like that of agricultural products, dairy products etc</p>	<ul style="list-style-type: none"> <li>• Students will understand the concept of pure and perfect competition</li> <li>• Students will know about the equilibrium of firm and industry in short and long run.</li> </ul>

3	14	<ul style="list-style-type: none"> <li>• Game oriented classes</li> <li>• Dramatization</li> <li>• Group discussion</li> </ul>	<ul style="list-style-type: none"> <li>• You tube lectures</li> <li>• Online PPTs</li> </ul>	<ul style="list-style-type: none"> <li>• Study of price and output trends in oligopoly markets</li> <li>• Price and non price competition in monopolistic competition</li> </ul>	<ul style="list-style-type: none"> <li>• Will develop ability to understand the market structures under imperfect competition</li> <li>• Will be able to compare perfect and imperfect competition</li> </ul>
4	18	<ul style="list-style-type: none"> <li>• Group discussion</li> <li>• Teacher driven power point presentation</li> </ul>	<ul style="list-style-type: none"> <li>• You tube lectures</li> <li>• Online PPTs</li> </ul>	<ul style="list-style-type: none"> <li>• Application of backward bending supply curve of labor in the market</li> <li>• Study of application of theories of factor pricing</li> </ul>	<ul style="list-style-type: none"> <li>• Will understand the theory of marginal productivity.</li> <li>• Will understand the concept and theories in factor pricing</li> </ul>

## References

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	<b>Advanced Economic Theory, Microeconomic Analysis</b>	<b>Ahuja H.L</b>	<b>S.Chand and Company</b>	<b>New Delhi</b>
2.	<b>Price Theory and Applications</b>	<b>Jack Hirshlifer</b>	<b>Prentice Hall of India, Pvt. Ltd</b>	<b>New Delhi</b>
3.	<b>Microeconomics,</b>	<b>Paul A. Samuelson and William D. Nordhaus</b>	<b>McGrawhill International Ed</b>	<b>New York</b>
4.	<b>First Principles of Economics,</b>	<b>Richard G. Lipsey, Colin Harbury:</b>	<b>Gerorge Weidenfeld and Nicolon Ltd,</b>	<b>London</b>
5.	<b>Consumer Behaviour and Managerial Decision Making,</b>	<b>Frank R. Kardes: Pearson,</b>	<b>Prentice Hall,</b>	<b>New Delhi</b>
6.	<b>, Microeconomics</b>	<b>R. Glenn Hubbard, Anthony Patrick O.</b>	<b>Pearson, Prentice Hall,</b>	<b>New Delhi</b>

		<b>Brien</b>		
<b>7.</b>	<b>Microeconomics: Principles, Application and Tools</b>	<b>O'Sullivan, Sheffrin, Perez</b>	<b>Pearson, Prentice Hall,</b>	<b>New Delhi</b>
<b>8.</b>	<b>Priniples of Economics</b>	<b>Karl E. Case, Ray C.Fair,</b>	<b>Pearson,Prentice Hall</b>	<b>New Delhi</b>

**Suggested References**  
**Web Reference**

Sr. No	Lectures	Films	PPTs	Articles
1	<a href="https://www.youtube.com/watch?v=oA8kL7OD74o">https://www.youtube.com/watch?v=oA8kL7OD74o</a>	<a href="https://www.economicsonline.co.uk/Business_economics/Perfect_competition.html">https://www.economicsonline.co.uk/Business_economics/Perfect_competition.html</a>	<a href="https://www.slideshare.net/zeeshanyounas35/perfect-and-imperfect-market-competition-76374490">https://www.slideshare.net/zeeshanyounas35/perfect-and-imperfect-market-competition-76374490</a>	<a href="http://www.scielo.br/scielo.php?script=sci_arttext&amp;pid=S1413-70542016000300337">http://www.scielo.br/scielo.php?script=sci_arttext&amp;pid=S1413-70542016000300337</a>
2	<a href="https://www.economicshelp.org/blog/311/markets/monopolistic-competition/">https://www.economicshelp.org/blog/311/markets/monopolistic-competition/</a>	<a href="https://www.youtube.com/watch?v=TTJ4kFX6uRM">https://www.youtube.com/watch?v=TTJ4kFX6uRM</a>	<a href="https://slideplayer.com/slide/6410262/">https://slideplayer.com/slide/6410262/</a>	<a href="http://www.economicdiscussion.net/price/factor-pricing-concept-and-theories/3875">http://www.economicdiscussion.net/price/factor-pricing-concept-and-theories/3875</a>
3	<a href="http://www.economicdiscussion.net/price/factor-pricing-concept-and-theories/3875">http://www.economicdiscussion.net/price/factor-pricing-concept-and-theories/3875</a>	<a href="https://www.youtube.com/watch?v=66fKCrsl_e_8">https://www.youtube.com/watch?v=66fKCrsl_e_8</a> <a href="https://www.youtube.com/watch?v=qXmGnQ0WzPM">https://www.youtube.com/watch?v=qXmGnQ0WzPM</a>	<a href="http://delhi.gov.in/wps/wcm/connect/40fd320047adb2d2aa2fff3f47d42062/economics-Rands.pps?MOD=AJPERES&amp;lmod=-277090329">http://delhi.gov.in/wps/wcm/connect/40fd320047adb2d2aa2fff3f47d42062/economics-Rands.pps?MOD=AJPERES&amp;lmod=-277090329</a>	<a href="https://www.investopedia.com/ask/answers/032515/what-difference-between-perfect-and-imperfect-competition.asp">https://www.investopedia.com/ask/answers/032515/what-difference-between-perfect-and-imperfect-competition.asp</a>

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## 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	<b>Matrices and Determinants (up to order 3 only)</b>	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"><li>1. To understand the concept of matrices and determinants.</li><li>2. To understand the application of determinant in solving linear equations</li><li>3. To understand applications of matrices and determinants in business and economics.</li></ol>
2	<b>Linear Programming Problems (LPP) (for two variables only)</b>	Definition and terms in a LPP, formulation of LPP, Solution by Graphical method, Examples and Problems	<ol style="list-style-type: none"><li>1. To understand the concept of LPP and its application in business and decision making.</li><li>2. To understand graphical method to solve business optimization problems with two variables.</li></ol>
3	<b>Correlation and Regression</b>	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"><li>1. To use correlation for knowing the relationship between two variables.</li><li>2. To use regression for prediction</li></ol>

4	<b>Index numbers</b>	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"> <li>1. To know different types index numbers and problems in their construction.</li> <li>2. To know the applications of various index numbers.</li> </ol>
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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:**

<b>Sr. No.</b>	<b>Title of the Book</b>	<b>Author/s</b>	<b>Publication</b>	<b>Place</b>
1.	<b>Practical Business Mathematics</b>	<b>S. A. Bari</b>	<b>New Literature Publishing Company</b>	<b>New Delhi</b>
2.	<b>Mathematics for Commerce</b>	<b>K. Selvakumar</b>	<b>Notion Press</b>	<b>Chennai</b>
3.	<b>Business Mathematics with Applications</b>	<b>Dinesh Khattar &amp; S. R. Arora</b>	<b>S. Chand Publishing</b>	<b>New Delhi</b>
4.	<b>Business Mathematics and Statistics</b>	<b>N.G. Das &amp; Dr. J.K. Das</b>	<b>McFraw Hill</b>	<b>New Delhi</b>
5.	<b>Fundamentals of Business Mathematics</b>	<b>M. K. Bhowal</b>	<b>Asian Books Pvt. Ltd</b>	<b>New Delhi</b>
6.	<b>Operations Research</b>	<b>P. K. Gupta &amp; D. S. Hira</b>	<b>S. Chand Publishing</b>	<b>New Delhi</b>
7.	<b>Mathematics for Economics and Finance: Methods and Modeling</b>	<b>Martin Anthony and Norman Biggs</b>	<b>Cambridge University Press</b>	<b>Cambridge</b>
8.	<b>Financial Mathematics and Its Applications</b>	<b>Ahmad Nazri Wahidudin</b>	<b>Ventus Publishing ApS</b>	<b>Denmark</b>
9.	<b>Fundamentals of Mathematical Statistics</b>	<b>Gupta S. C. and Kapoor V. K.,</b>	<b>Sultan Chand and Sons</b>	<b>23, Daryaganj, New Delhi 110002</b>
10.	<b>Statistical Methods</b>	<b>Gupta S. P.:</b>	<b>Sultan Chand and Sons</b>	<b>23, Daryaganj, New Delhi 110002</b>
11.	<b>Applied Statistics</b>	<b>Mukhopadhyaya Parimal</b>	<b>New Central Book Agency Pvt. Ltd.</b>	<b>Calcutta.</b>
12.	<b>Fundamentals of Statistics</b>	<b>Goon A. M., Gupta, M. K. and Dasgupta, B.</b>	<b>World Press</b>	<b>Calcutta.</b>



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](http://www.freestatistics.tk)(National Statistical Agencies)
2. [www.psychstat.smsu.edu/sbk00.htm](http://www.psychstat.smsu.edu/sbk00.htm)(Onlinebook)
3. [www.bmj.bmjournals.com/collections/statsbk/index.shtml](http://www.bmj.bmjournals.com/collections/statsbk/index.shtml)
4. [www.statweb.calpoly.edu/bchance/stat-stuff.html](http://www.statweb.calpoly.edu/bchance/stat-stuff.html)
5. [www.amstat.org/publications/jse/jse-data-archive.html](http://www.amstat.org/publications/jse/jse-data-archive.html)(International journal on teaching and learning of statistics)
6. [www.amstat.org/publications/chance](http://www.amstat.org/publications/chance)(Chancemagazine)
7. [www.statsci.org/datasets.html](http://www.statsci.org/datasets.html)(Datasets)
8. [www.math.uah.edu/stat](http://www.math.uah.edu/stat)(Virtual laboratories in Statistics)
9. [www.amstat.org/publications/stats](http://www.amstat.org/publications/stats)(STATS : the magazine for students of Statistics)
10. [www.stat.ucla.edu/cases](http://www.stat.ucla.edu/cases)(Case studies in Statistics).
11. [www.statsoft.com](http://www.statsoft.com)
12. [www.statistics.com](http://www.statistics.com)
13. [www.indiastat.com](http://www.indiastat.com)
14. [www.unstat.un.org](http://www.unstat.un.org)
15. [www.stat.stanford.edu](http://www.stat.stanford.edu)
16. [www.statpages.net](http://www.statpages.net)
17. [www.wto.org](http://www.wto.org)
18. [www.censusindia.gov.in](http://www.censusindia.gov.in)
19. [www.mospi.nic.in](http://www.mospi.nic.in)
20. [www.statisticsofindia.in](http://www.statisticsofindia.in)

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# **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

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## 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"><li>a. Qualities of office manager, skills of office manager - Interpersonal skills, Presentation skills, thinking and Negotiation skills ,Duties and Responsibilities of office manager</li><li>b. Goal Setting:- Concept, Importance of goals, SMART( Specific, Measurable, Achievable, Realistic and Time Bound)</li><li>c. Time Management :-Meaning, Techniques, Principles and Significance</li></ol>	<ol style="list-style-type: none"><li>1. Developing the necessary set of managerial skills</li><li>2. Developing Goal setting and Time management skills in all areas of life</li></ol>
2	Management Reporting (Office Reports)	<ol style="list-style-type: none"><li>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 reports</li><li>b. Office Communication :- Meaning, Significance, Barriers and Recent trends in Communication such as</li></ol>	<ol style="list-style-type: none"><li>1. Enhancing the communication skills</li><li>2. Developing report writing skills for formal reporting</li><li>3. Usability of latest Communication Media</li></ol>

		E-mail, Video Conferencing, Tele- Conferencing, Internet, Intranet , WWW, etc.,	
<b>3</b>	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"> <li>1. Conceptual Clarity on the concept of need and importance of work measurement</li> <li>2. Developing Technical and analytical skills for performance measurement.</li> <li>3. Skills to develop ideal standards at work place.</li> </ol>
<b>4</b>	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"> <li>1. Enhancement of Technical knowledge and developing technical skills to adapt to the technical advancements</li> <li>2. Critical thinking skills and technical skills to overcome the problem of choice among options</li> </ol>

### Teaching Methodology

<b>Topic No.</b>	<b>Total Lectures</b>	<b>Innovative methods to be used</b>	<b>Film shows and AV Applications</b>	<b>Project</b>	<b>Expected Outcome</b>
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**

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**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**

<b>Unit No.</b>	<b>Topics</b>	<b>No. of Lectures</b>	<b>Teaching Method</b>
<b>1.</b>	<b>Lending Principles and Balance Sheet of a Bank</b>  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.	<b>10</b>	Lecture, Expert Lecture, PPT/ Poster Presentation, Group Discussion, Library / Home, Assignment, Visit to a bank
<b>2.</b>	<b>Negotiable Instruments</b> 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	<b>12</b>	Lecture, PPT/ Poster Presentation, Group Discussion, Library /Home Assignment, Visit to a bank

3.	<b>Endorsement</b> Definition and meaning of Endorsement Types of Endorsement- Blank, Full or Special, Restrictive, Partial, Conditional, Sans Recourse, Facultative. Effects of Endorsement.	08	Lecture, PPT/ Poster Presentation, Group Discussion, Library /Home Assignment, Visit to a bank
4.	<b>Technology in Banking</b> 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	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, (4<sup>th</sup> Edition, 2017), ‘Banking and Insurance’, Himalaya Publication House.
5. Gopinath M. N., (1<sup>st</sup> Edition, 2008) ‘Banking Principles and Operations’, Snow White Publications Pvt. Ltd, Mumbai.
6. Gordon E. & Natarajan K., (21<sup>st</sup> 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)**

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**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.

<b>Unit No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Method</b>
<b>1.</b>	<b>Indian Intelligence Services</b> 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.	<b>12</b>	Lecture, PPT, Group Discussion, Library Work, Assignment
<b>2.</b>	<b>Evolution of War Techniques</b> 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	<b>12</b>	Lecture, PPT, Group Discussion, Library Work, Study Visit

<b>3.</b>	<b>Economic Warfare</b> 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.	<b>12</b>	Lecture,PPT, Group Discussion, Library Work,
<b>4.</b>	<b>Economic Constraints on Indian Internal Security</b> 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.	<b>12</b>	Lecture,PPT, Group Discussion, Library Work, Assignment
	<b>Total</b>	<b>48</b>	

### 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	<b>Impact of Liberalization ,Privatization and Globalization on Co-operative movement</b>	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	<b>Co-operative Education and Training:.</b>	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

<b>Unit No</b>	<b>Unit Title</b>	<b>Content</b>	<b>Purpose Skills to be developed</b>
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"> <li>i. Open book discussion</li> <li>ii. Case studies</li> <li>iii. Group discussion</li> </ul>	<ul style="list-style-type: none"> <li>i. You tube lectures on different types of business organization.</li> </ul>	<ul style="list-style-type: none"> <li>i. Study of comparative merits and demerit of different business organisation</li> </ul>	<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"> <li>i. Case Studies</li> <li>ii. Group discussion</li> <li>iii. Pair learning</li> </ul>	<ul style="list-style-type: none"> <li>i. You tube lectures on PEs and MNCs.</li> <li>ii. Films</li> </ul>	<ul style="list-style-type: none"> <li>i. Study of role of MNCs.</li> <li>ii. Study of problem of PEs.</li> </ul>	<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"> <li>i. Case Studies</li> <li>ii. Group discussion.</li> <li>iii. Game oriented Classes.</li> </ul>	<ul style="list-style-type: none"> <li>i. Films.</li> <li>ii. You tube lectures</li> </ul>	<ul style="list-style-type: none"> <li>i. Study of pricing policy followed by a firm in your area.</li> </ul>	<p>Awareness of students about various pricing practices</p>
4	14	<ul style="list-style-type: none"> <li>i. Case Studies</li> <li>ii. Open book discussion</li> <li>iii. Group discussion.</li> </ul>	<ul style="list-style-type: none"> <li>i. You tube lectures</li> <li>ii. Films</li> </ul>	<ul style="list-style-type: none"> <li>i. Study of method of capital budgeting.</li> </ul>	<p>Students should realize the importance of the different methods of Capital Budgeting and investment as a tool of profit management</p>

## References

<b>Sr. No.</b>	<b>Title of the Book</b>	<b>Author/s</b>	<b>Publication</b>	<b>Place</b>
<b>1.</b>	Managerial Economics- Economic Tools for Todays Decision Makers,	Keat Paul G. and Philip K.Y. Young	Prentice Hall	Prentice Hall, New Jersey
<b>2.</b>	Managerial Economics,	D.N.Dwivedi D.N	Vikas Publishing House	Delhi
<b>3.</b>	Managerial Economics in a Global Economy	Salvatore D.	8th Edition, Oxford University Press.	
<b>4.</b>	Managerial Economics,	Sumitra Paul,	Macmillan 2008	
<b>5.</b>	P.L.Mehatha, Managerial	Managerial Economics	8th Ed. S.Chand Publishing	Economics, 8th Ed. S.Chand Publishing
<b>6.</b>	D.M.Mithani,	Managerial Economics-2008	Himalaya Publishing House	Mumbai
<b>7.</b>	Shankaran S.	Managerial Economics	Margham Publications,	Madras
<b>8.</b>	Thomas Christopher R. and Charles, Maurice S.,	Managerial Economics	McGraw Hill Irwin,	Boston

### **Suggested references Web reference**

<https://nptel.ac.in/courses/110101005/2>

<https://nptel.ac.in/downloads/110101005/>

<http://cec.nic.in/Pages/Home.aspx>

<http://en.wikipedia.org/wiki/Economics>

<http://www.investopedia.com/university/economics/#axzz1XwhFTmtm>

<http://www.tutor2u.net/blog/index.php/economics/>

<http://www.economicshelp.org/>

<https://www.intelligenteconomist.com/economics-blogs/>

<https://www.coursera.org/courses?query=managerial%20economics>

<https://www.edx.org/course/introduction-to-managerial-economics-0>

<https://www.mooc-list.com/tags/managerial-economics>

<https://online.stmary.edu/mba/courses/managerial-economics>

<https://www.tru.ca/distance/courses/econ3041.html>

<https://www.euomba.org/managerial-economics/>

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**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**

<b>Unit No.</b>	<b>Unit Title</b>	<b>Contents</b>	<b>Skills to be developed</b>
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.

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## **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**

<b>Unit No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Method</b>
<b>1.</b>	<b>Introduction to Transport</b> 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	<b>12</b>	Lecture, PPT, Group Discussion, Library Work, Assignment

<p><b>2.</b></p>	<p><b>Road Transport</b></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><b>12</b></p>	<p>Lecture, PPT, Group Discussion, Library Work, Assignment</p>
<p><b>3.</b></p>	<p><b>Railway Transport</b></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><b>12</b></p>	<p>Lecture, PPT, Group Discussion, Library Work, Assignment</p>
<p><b>4.</b></p>	<p><b>Water and Air Transport</b></p> <p><b>4.1 Water Transport:</b></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><b>12</b></p>	<p>Lecture, PPT, Group Discussion, Library Work, Assignment</p>

	4.1.4 Limitations of Water Transport		
	<b>4.2 Air Transport:</b>		
	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		
	<b>Total</b>	<b>48</b>	

### 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](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](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](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](https://www.epw.in/system/files/pdf/1956_8/16/progress_of_indian_railways.pdf)
13. [https://www.cs.mcgill.ca/~rwest/wikispeedia/wpcd/wp/r/Rail\\_transport\\_in\\_India.htm](https://www.cs.mcgill.ca/~rwest/wikispeedia/wpcd/wp/r/Rail_transport_in_India.htm)[https://www.cs.mcgill.ca/~rwest/wikispeedia/wpcd/wp/r/Rail transport in Indi](https://www.cs.mcgill.ca/~rwest/wikispeedia/wpcd/wp/r/Rail_transport_in_India.htm)

**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.

<b>UNIT NO.</b>	<b>UNIT TITLE</b>	<b>CONTENTS</b>	<b>PURPOSE SKILLS TO BE DEVELOPED</b>
<b>1</b>	<b>Salesmanship</b>	<b>1.1</b> Meaning and Definition of Salesmanship <b>1.2</b> Features of Salesmanship <b>1.3</b> Scope of Salesmanship <b>1.4</b> Modern Concept of Salesmanship <b>1.5</b> Utility of Salesmanship <b>1.6</b> Elements of Salesmanship <b>1.7</b> Salesmanship : Arts or Science	Students will get the knowledge of Salesmanship and various approaches.

		<p><b>1.8</b> Salesmanship – a Profession</p> <p><b>1.9</b> Qualities of Salesman</p>	
<b>2</b>	<b>Process of Selling</b>	<p><b>2.1</b> Psychology of Salesmanship – Attracting Attention, Awakening Interest, Creating Desire and Action</p> <p><b>2.2</b> Stages in Process of Selling –</p> <ul style="list-style-type: none"> <li>(i) Pre-Sale Preparations</li> <li>(ii) Prospecting</li> <li>(iii) Pre-Approach</li> <li>(iv) Approach</li> <li>(v) Sales Presentation</li> <li>(vi) Handling of Objections</li> <li>(vii) Close</li> <li>(viii) After Sales Follow-up</li> </ul>	Techniques of salesmanship skills will be developed.
<b>3</b>	<b>Rural Marketing</b>	<p><b>3.1</b> Rural Marketing</p> <ul style="list-style-type: none"> <li>3.1.1 Introduction</li> <li>3.1.2 Definition of Rural Marketing</li> <li>3.1.3 Features of Rural Marketing</li> <li>3.1.4 Importance of Rural Marketing</li> <li>3.1.5 Present Scenario of Rural Market</li> <li>3.1.6 Challenges and Opportunities in Rural Marketing</li> </ul>	Awareness and importance of Rural Marketing amongst students.
<b>4</b>	<b>Recent Trends in Marketing</b>	<p><b>4.1</b> Digital Marketing</p> <p><b>4.2</b> Green Marketing</p> <p><b>4.3</b> Niche Marketing</p> <p><b>4.4</b> E-marketing</p> <p><b>4.5</b> Social Media Marketing- Challenges and Opportunities</p>	Skills of Modern Marketing will be developed.

## Teaching Methodology

<b>Topic No.</b>	<b>Total Lectures</b>	<b>Innovative Methods to be used</b>	<b>Film shows and AV Applications</b>	<b>Project</b>	<b>Expected Outcome</b>
<b>1</b>	<b>14</b>	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.
<b>2</b>	<b>14</b>	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.
<b>3</b>	<b>12</b>	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.
<b>4</b>	<b>08</b>	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

<b>Subject</b>	<b>Internal Evaluation</b>	<b>External Evaluation</b>	<b>Suggested Add on Course</b>
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

<b>Sr. No.</b>	<b>Title of the Book</b>	<b>Author/s</b>	<b>Publication</b>	<b>Place</b>
1	Marketing Management	Philip Kotler	Pearson Publication	
2	Marketing Management	Rajan Saxena	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	

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**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.

<b>Unit No</b>	<b>Unit Title</b>	<b>Contents</b>	<b>Purpose Skills to be developed</b>
1	<b>Business Ethics</b>	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	<b>Corporate Social Responsibility</b>	<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"> <li>a. Social welfare,</li> <li>b. Healthcare,</li> <li>c. Education and</li> <li>d. Infrastructure</li> </ul>	<p>Understanding the scope CSR and it's scope</p> <p>2. To know the global trends</p>
3.	<b>Corporate Governance and Business ethics</b>	<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"> <li>a. Accounting,</li> <li>b. Social Media,</li> <li>c. IT,</li> <li>d. Marketing and Advertisement</li> <li>e. Harassments and discrimination at workplace</li> </ul>	<p>Acquaint the students with corporate governance and global business ethics.</p>

4.	<b>Sustainable Development and Ethics</b>	<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

<b>Sr. No.</b>	<b>Title of the Book</b>	<b>Author/s</b>	<b>Publication</b>	<b>Place</b>
1.	<b>Ethics in Management</b>	<b>S.A. Sherlekar ,</b>	<b>Himalaya Publication</b>	<b>New Delhi</b>
2.	<b>Business Ethics and corporate Governance</b>	<b>S S Khanka</b>	<b>S. Chand Publication</b>	<b>Mumbai</b>
3.	<b>Business Ethics and Corporate Governance</b>	<b>S. K. Bhatia</b>	<b>Deep and Deep sons</b>	<b>New Delhi</b>
4.	<b>Corporate Governance : Principle, Policies and Practices</b>	<b>Bob Tricker</b>	<b>Oxford University Press</b>	<b>New Delhi</b>
5.	<b>Management by Values</b>	<b>S.K.Chakraborti ,</b>	<b>Oxford University Press</b>	<b>Mumbai</b>
6.	<b>Business Ethics And Corporate Governance</b>	<b>A. C. Fernando</b>	<b>Dorling Kindersly</b>	<b>Mumbai</b>
7.	<b>E Commerce - A Study in Business Ethics</b>	<b>Rituparna Raj</b>	<b>Himalaya Publication</b>	<b>New Delhi</b>
8.	<b>E-Commerce and It' Applications</b>	<b>Dr. U. S. Pandey, Rahul Srivastava and Saurabh Shukla.</b>	<b>S. Chand &amp; Company,</b>	<b>New Delhi</b>
9.	<b>The sustainable development goals</b>	<b>United Nations</b>	<b>United Nations Publication</b>	<b>UN</b>

10.	<b>Atlas of Sustainable Development Goals 2017: from World Development Indicators</b>	<b>World Bank</b>	<b>World Bank Publication</b>	-
11.	<b>Business Ethics And Corporate Governance</b>	<b>A. C. Fernando</b>	<b>Dorling Kindersly</b>	<b>Mumbai</b>
12.	<b>The age of sustainable development goals</b>	<b>Jeffery D Saches and Ki Moon Ban</b>	<b>Columbia University Press</b>	- -

#### **Suggested References -Web Reference**

<b>Sr. No</b>	
1	<a href="http://www.mca.gov.in/MinistryV2/csrdatasummary.html">http://www.mca.gov.in/MinistryV2/csrdatasummary.html</a>
2	<a href="http://Csr.gov.in">Csr.gov.in</a>
3	<a href="https://www.acclimited.com/sustainable/corporate-social-responsibility">https://www.acclimited.com/sustainable/corporate-social-responsibility</a>
4	<a href="https://www.youtube.com/watch?v=FN0kRR98518">https://www.youtube.com/watch?v=FN0kRR98518</a>
5	<a href="https://sustainabledevelopment.un.org/?menu=1300">https://sustainabledevelopment.un.org/?menu=1300</a>
6	<a href="https://www.toppr.com/guides/business-communication-and-ethics/business-ethics/meaning-and-ethical-principles-in-business/">https://www.toppr.com/guides/business-communication-and-ethics/business-ethics/meaning-and-ethical-principles-in-business/</a>

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## 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	<b>Entrepreneurial Behaviour</b>	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	<b>Entrepreneurship</b>	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	<b>Institutions working for promoting entrepreneurship</b>	<ol style="list-style-type: none"><li>1) Entrepreneurship Development Institute of India (EDII)</li><li>2) Maharashtra Centre for Entrepreneurship Development (MCED)</li><li>3) District Industries Centre ( DIC)</li><li>4) Maharashtra Chamber of Commerce, Industries and Agriculture(MCCIA)</li><li>5) Role of local NGO in promoting Entrepreneurship</li></ol>	Gaining knowledge of various institutions promoting entrepreneurship Skill-Acquaintance with these institutions



<b>4</b>	<b>Study of entrepreneurs</b>	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
<b>1</b>	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
<b>2</b>	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
<b>3</b>	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
<b>4</b>	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	<b>Entrepreneurship</b>	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"><li>1. Conceptual Understanding on Entrepreneurship ,</li><li>2. Motivate the students develop Entrepreneurship Skills</li><li>3. Develop Innovative entrepreneurial ideas</li></ol>

2	<b>E-Commerce</b>	<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"> <li>1. Understanding e- Commerce and its future prospectus</li> <li>2. Awareness on the various forms of e-commerce</li> </ol>
3	<b>Retailing</b>	<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"> <li>1. Introduction to the Recent trend in Retailing</li> <li>2. To develop conceptual understating on Digital Retailing</li> </ol>
4	<b>Management and Administration</b>	<ol style="list-style-type: none"> <li>a) Management: Concept and Features</li> <li>b) Administration: Concept and Features</li> <li>c) Difference between and Management and Administration</li> <li>d) Scope of Management</li> </ol>	<ol style="list-style-type: none"> <li>1. Conceptual understating on Management and Administration</li> </ol>

## 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 Leraning
- 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, 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 12<sup>th</sup> std.
- Three Years Diploma after S.S.C. i.e. 10<sup>th</sup> 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
<b>Total</b>		<b>67</b>	<b>15</b>	<b>26</b>	<b>12</b>	<b>2</b>	<b>10</b>	<b>67+15+26+12+2+10=132</b>

### 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	
<b>OR</b>				
CA-304	PHP	EC	3	
CA-305	Big data	EC	3	
<b>OR</b>				
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	
<b>CA-404</b>	<b>NODE JS</b>	<b>EC</b>	<b>3</b>	
<b>OR</b>				
<b>CA-404</b>	<b>Advance PHP</b>	<b>EC</b>	<b>3</b>	
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.

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# 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	<b>1. Concept of Communication and Introduction to Communication</b>  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	<b>Methods and types of Communication</b>  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.	<b>Business Correspondence</b>  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.	<b>Analysis of different Media of Communication</b>  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><b>Nature of management</b></p> <p>Meaning , importance , functions ,types            Management as an art ,science and social system            Universality of concept of management            and organization</p>	<b>12</b>
2	<p><b>Evolution of management thoughts</b></p> <p>Concept of managerial thoughts            Contribution of Taylor, Mayo and Fayol and Drucker and            Indian Management Ethos</p>	<b>12</b>
3.	<p><b>Major managerial Functions</b></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>	<b>12</b>
4.	<p><b>Recent trends in Management</b></p> <p>Management of change , Mgt of crises ,TQM ,stress            management            (Principles ,concepts merits )</p>	<b>12</b>

## References

<b>Sr. No.</b>	<b>Title of the Book</b>	<b>Author/s</b>	<b>Publication</b>
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	<b>Introduction to C language</b> 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	<b>Managing I/O operations</b> 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	<b>Decision Making and looping</b> 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	<b>Programs through conditional and looping statements</b> 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	<b>Arrays and Strings</b> 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	<b>Functions</b> 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	<b>7 Introduction to pointer</b> 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	<b>8 Structures</b> 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>	

<b>3</b>	<b>3</b>	<b>Relational Model</b> 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	<b>8</b>
<b>4</b>	<b>4</b>	<b>SQL (Structured Query Language)</b> 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	<b>12</b>
<b>5</b>	<b>5</b>	<b>Relational Database Design</b> 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	<b>8</b>

**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	<b>Concept of statistics.</b>  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	<b>Measures of central tendency and dispersion</b>  Criteria for good measures of central tendency, Arithmetic mean, Median and Mode for grouped and ungrouped data, combined mean.	12
3.	<b>Measures of Dispersion :</b>  Concept of dispersion , Absolute and relative measure of dispersion, Range, Variance, Standard deviation, Coefficient of variation, Quartile Deviation , Coefficient of Quartile deviation.	12
4	<b>Correlation and Regression( for ungrouped data )</b>  Concept of correlation, positive & negative correlation, Karl Pearson's Coefficient of correlation, meaning of regression, Two regression equations, Regression coefficients and properties.	12

## References

<b>Sr. No.</b>	<b>Title of the Book</b>	<b>Author/s</b>	<b>Publication</b>
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	<b>Introduction to Organizational Behavior</b>	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	<b>Introduction to HRM</b>	<b>Introduction to HRM-</b> 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	<b>Procurement</b>	<b>HRP-</b> Concept, Definition, Merits & Demerits, process , influencing factors of HRP <b>Recruitment-</b> Concept, Definition, sources of recruitment and their utility in identifying vacancies, methods, E-recruitment, <b>Selection-</b> 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	<b>Training &amp; Development</b>	<b>Training &amp; Development-</b> 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
<b>One project Report : 5 Marks</b> <b>One assignment : 5 marks</b> <b>One Case Study Solution Report : 5 marks</b> <b>Internal Examination : 15 marks</b>	<b>25% MCQ</b> <b>Short notes 35%</b> <b>Long answers 40%</b>
<b>30</b>	<b>70</b>

### Suggested references

<b>Sr. No.</b>	<b>Title of the Book</b>	<b>Author/s</b>	<b>Publication</b>	<b>Place</b>
<b>1</b>	Human Resources Management.	-L.M. Prasad	<b>Sultan and Chand Publishing Company</b>	<b>New Delhi</b>
<b>2</b>	Human Resources Management.	K. Ashwathappa –	<b>Tata McGraw Hill</b>	<b>New Delhi</b>
<b>3</b>	Personnel Management.	C. B. Mamoria		
<b>4</b>	Organizational Behavior Text, Cases and Games	- K. Aswathappa,	<b>Tata McGraw Hill</b>	<b>New Delhi</b>
<b>5</b>	Organizational Behavior -	L.M. Prasad	<b>Sultan and Chand Publishing Company</b>	<b>New Delhi</b>

**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

<b>Unit No.</b>	<b>Unit Title</b>	<b>Contents</b>	<b>Purpose and Skills to be developed</b>
<b>1</b>	<b>Financial Accounting-</b>	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
<b>2</b>	<b>Accounting Transactions and Final Accounts</b>	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
<b>3.</b>	<b>Bank Reconciliation Statements</b>	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

	<b>Computerized Accounting</b>	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		
	<b>30</b>	<b>70</b>	

### 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

<b>Unit No.</b>	<b>Topic</b>	<b>No. of Lecture</b>
1	<b>1. Ratio, Proportion and Percentage:</b> Ratio – Definition, Continued Ratio, Inverse Ration, Proportion, Continued Proportion, Direct Proportion, Inverse Proportion, Variation, Inverse Variation, Joint Variation, Percentage, computation of Percentage.	8
2	<b>2. Profit and Loss: -</b> 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><b>3. Interest and Annuity: -</b> 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><b>Shares and Mutual Funds:-</b> 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><b>4. Matrices and Determinant: -</b> 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><b>5. Linear Programming Problem (LPP)</b> Concept of LPP, Formulation of LPP and solution of LPP by graphical method.</p> <p><b>Transportation Problem (T.P.):-</b></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
<b>Total</b>		<b>48</b>

**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.	<b>Introduction To RDBMS</b>	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.	<b>PL-SQL</b>	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.	<b>Transaction Management</b>	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	<b>Concurrency Control &amp; Recovery System</b>	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:**

<b>Sr. No.</b>	<b>Title of the Book</b>	<b>Author/s</b>	<b>Publication</b>	<b>Place</b>
<b>1</b>	Database Management System	Bipin Desai	Galgotia Publications	New Delhi
<b>2</b>	SQL/PLSQL the programming language of oracle	Ivan Bayross	BPB Publications	New Delhi
<b>3</b>	An Introduction to Database Systems Eighth Edition	C. J.Date, A.Kannan, S.Swamynathan	Pearson Publications	North America
<b>4</b>	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.

<b>Unit No</b>	<b>Topic</b>	<b>No. of Lecture</b>
1	<b>1. Introduction</b> 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	<b>2. Web Design</b> 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

<b>3</b>	<b>3. HTML</b> 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	<b>12</b>
<b>4</b>	<b>4. Style sheets</b> 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	<b>10</b>
<b>5</b>	<b>5. JavaScript</b> 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	<b>12</b>
<b>Total</b>		<b>48</b>



**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](http://www.w3schools.com)
2. [www.tutorialspoint.com](http://www.tutorialspoint.com)

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