



Anjuman Khairul Islam's

# **POONA COLLEGE**

## **of Arts, Science & Commerce**

**Camp, Pune – 411001 (Maharashtra)**

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### **SYLLABUS**

## **Bachelor of Vocation**

### **Medical Laboratory Technology**

### **(B.Voc. MLT)**

**Under**

**UGC's National Skill Qualification**

**Framework (NSQF)**

**EFFECTIVE FROM – 2020-21**

**DURATION – 3 YEAR (6 SEMESTERS)**

**SYLLABUS FOR: I - VI SEMESTERS**

## **PROGRAM OUTCOMES:**

- Perform routine clinical laboratory procedures within acceptable quality control parameters in Hematology, Chemistry, Immunohematology, and Microbiology under the general supervision of a Clinical Laboratory Scientist or Pathologist.
- Demonstrate technical skills, social behavior, and professional awareness incumbent upon a laboratory technician.
- Apply systematized problem solving techniques to identify and correct procedural errors, identify instrument malfunctions and seek proper supervisory assistance, and verify the accuracy of laboratory results obtained.
- Operate and maintain laboratory equipment, utilizing appropriate quality control and safety procedures.
- Recognize and participate in activities which will provide current knowledge and upgrading of skills in laboratory medicine.

## **COURSE RELEVANCE:**

The medical sector in India is going through a boom phase. B. Voc in Medical Lab Technology is being one of such important course under the medical sector. With the growing complexity of the course, the scope of this course had expanded over the years. Medical lab technology in India has a whole variety of fields.

The medical treatment starts only after the diagnosis of the disease and diagnose, doctors need various kinds of analysis through tests. On the basis of the outcome of these tests, they treat and give advice for prevention. This is where the crucial role of Medical Laboratory Technology comes in picture.

Medical lab technicians can find employment in hospitals, medical pathology labs, research labs, urologist office, private laboratory, blood donor centers, Healthcare center or clinics and pharmaceuticals. One can also work as a freelancer as well as a Phlebotomist and have great earnings. Medical lab technicians can also find jobs in research facilities, crime laboratories, universities, pharmaceutical companies and military.

## **TOTAL DURATION OF COURSE: 3 Years**

- ✓ **After completion of Year - 1 Diploma is awarded.**
- ✓ **After completion of Year - 2 Advance Diploma is awarded.**
- ✓ **After completion of Year - 3 B. VOC Degree is awarded.**

## **Eligibility and Admission**

I: Students already acquired NSQF certification Level 4 in a particular industry sector and opted admission in the skill-based courses under NSQF in the institutions recognized under Community Colleges / B. Voc Degree programme / Deen Dayal Upadhyay KAUSHAL Kendras in same trade with job role for which he /she was previously certified at school level.

II: Students who have acquired NSQF Certification Level 4 but may like to change their trade and may enter into skill-based courses in a different trade.

III: Students who have passed 10+2 examination (Regular or Vocational) from a recognized board.

## **Duration and Structure of Programme**

The B. Voc (Travel, Tourism and Hospitality Management) Semester pattern with credit system) degree programme shall be of 3 years duration divided into three parts, Part I, Part II and Part III and 6 semesters. (At each part there will be 14 courses of 60 credits (1200 marks). Each part would comprise of two semesters each with 4 subjects of 3 credits each for general components and 3 subjects for skilling component. The B. Voc (Travel, Tourism and Hospitality Management) degree examination Part I, II and III in aggregate shall be of 180 credits (72 General and 108 Skilling) for 3600 marks. The contents of the courses are subject to change keeping in mind the industry requirements on timely basis.

## **Scheme of Examination**

The assessment will be based on 50:50 ratio of continuous internal assessment (CIA) and semester end examination (SEE). Separate and independent passing in CIA and SEE will be mandatory. In case of failure in CIA of a particular course, students will have to appear for the same CIA, at his/her own responsibility in the next academic year, when the same course is offered during regular academic session. However, in case of failure in SEE in particular course(s), exam will be conducted in immediate subsequent semester. In case a student fails in certain course(s) in a particular semester and the same course(s) are modified/ revised/ removed from the curriculum in due course, the student will have to appear as per the newly framed curriculum and/or pattern in subsequent semester, at his/her own responsibility.

## **Continuous Internal Assessment (CIA)**

There will be 50 marks for Continuous Internal Assessment. Distribution of 50 marks will be as follows -20 marks for assignments, 10 marks for seminar presentation / tutorials and 20 marks for class tests. The setting of the question papers and the assessment will be done by the concerned teacher.

## **Semester End Examination (SEE)**

The semester end theory examination for each theory course will be of 50 marks. The total marks shall be 100 for 3 credit theory courses (50 marks semester end exam + 50 marks CIA).

## **Earning Credits:**

At the end of every semester, a letter grade will be awarded in each course for which a student had registered. A student's performance will be measured by the number of credits that he/she earned by the weighted Grade Point Average (GPA). The SGPA (Semester Grade Point Average) will be awarded after completion of respective semester and the CGPA (Cumulative Grade Point Average) will be awarded at the respective exit point.

## **Standards of Passing**

Int Passing Marks (30%)	Ext Passing Marks (30%)	Total Passing Marks (40%)
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## **Grading System**

- One Credit would mean equivalent of 15 periods of 60 minutes each, for theory, workshops/labs and tutorials
- For internship/field work, the credit weightage for equivalent hours shall be 50% of that for lectures/workshops
- For self-learning, based on e-content or otherwise, the credit weightage for equivalent hours of study should be 50% or less of that for lectures/workshops
- The award of 'Certificate' / 'Diploma' / 'Advanced Diploma' / Degree to the successful learners in both skills and general education components of the curriculum may be done.
- Grade points are based on the total number of marks obtained by him / her in all heads of the examination of the course. The grade points and their equivalent range of marks are shown in Table-I

**Table I: Grades and Grade Points**

Grade	Grade Point
O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Above Average)	6
C (Average)	5
P (Pass)	4
F(Fail)	00
Ab (Absent)	00

- A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.
- Non-appearance in any examination / assessment shall be treated as the students have secured zero marks in that subject examination / assessment.

- A student with F grade will be considered as “failed” in the concerned course and he / she has to clear the course by appearing in the next successive semester examinations. There will be no revaluation or recounting under this system.
- Every student shall be awarded grade points out of maximum 10 points in each subject (based on 10-point scale). Based on the grade points obtained in each subject, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and CGPA will be given at respective exit point.

### **Computation of SGPA and CGPA**

Following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) may be adopted:

- The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the course components taken by a student and the sum of the number of credits of all the courses undergone by a student in a semester, i.e.

$$\text{SGPA (Si)} = \frac{\sum(\text{Ci} \times \text{Gi})}{\sum \text{Ci}}$$

where ‘Ci’ is the number of credits of the ith course component and ‘Gi’ is the grade point scored by the student in the ith course component.

- The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

- $\text{CGPA} = \frac{\sum(\text{Ci} \times \text{Si})}{\sum \text{Ci}}$

where ‘Si’ is the SGPA of the ith semester and Ci is the total number of credits in that semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Credits for each of the years are as follows

<b>NSQF Level</b>	<b>Skill Component Credits</b>	<b>General Education Credits</b>	<b>Normal calendar duration</b>	<b>Exit Points / Awards</b>
<b>Year 3</b>	36	24	Six Semesters	B.Voc.
<b>Year 2</b>	36	24	Four semesters	Advanced Diploma
<b>Year 1</b>	36	24	Two semesters	Diploma
<b>TOTAL</b>	108	72		

### **Departmental Committee**

The Departmental Committee of Poona college (DC) of the Centre will monitor the smooth functioning of the programme.

### **Results Grievances / Redressal Committee**

Grievances / redressal committee will be constituted in the department to resolve all grievances relating to the evaluation. The committee shall consist of Principal, Vice Principal, Head of the department, the concerned teacher of a particular course and senior faculty member of Concerned Department. The decision of Grievances / redressal committee will have to be approved by Department committee.

# First Year Syllabus for B.Voc. Medical Lab Technology

Structure For Semester I										
Sr. No.	Course Code	Course Name	Teaching Scheme (Hrs/Week)		Examination Scheme and Marks			Credits		
			THR	PRA	CIA	SEE	TOTAL	THR	PRA	TOTAL
1	MLT-111 (T)	Human Anatomy-I	03	-	50	50	100	03	-	03
2	MLT-112 (T)	Human Physiology-I	03	-	50	50	100	03	-	03
3	MLT-113(T)	Biochemistry-I	03	-	50	50	100	03	-	03
4	MLT-114 (T)	Functional English	03	-	50	50	100	03	-	03
5	MLT-115 (P)	Practical's in Human Anatomy-I	-	04	50	50	100	-	04	04
6	MLT-116 (P)	Practical's in Fundamentals of Computer	-	04	50	50	100	-	04	04
7	MLT-117 (OJT)	Practical's in Human Physiology-I	-	04	50	50	100	-	04	04
8	MLT-118 (OJT)	Practical's Biochemistry-I	-	04	50	50	100	-	04	04
9	MLT-119 (OJT)	Visit to any Medical Research Institute	-	-	25	25	50	-	02	02
<b>TOTAL</b>			<b>12</b>	<b>16</b>	<b>425</b>	<b>425</b>	<b>850</b>	<b>12</b>	<b>18</b>	<b>30</b>
Structure For Semester II										
Sr. No.	Course Code	Course Name	Teaching Scheme (Hrs/Week)		Examination Scheme and Marks			Credits		
			THR	PRA	CIA	SEE	TOTAL	THR	PRA	TOTAL
1	MLT-121 (T)	Human Anatomy-II	03	-	50	50	100	03	-	03
2	MLT-122 (T)	Human Physiology-II	03	-	50	50	100	03	-	03
3	MLT-123 (T)	Biochemistry –II	03	-	50	50	100	03	-	03
4	MLT-124 (T)	Personal Enhancement	03	-	50	50	100	03	-	03
5	MLT-125 (P)	Practical's in Anatomy-II	-	04	50	50	100	-	04	04
6	MLT-126 (OJT)	Practical's in Human Physiology-II	-	04	50	50	100	-	04	04
7	MLT-127 (OJT)	Practical's in Biochemistry-II	-	04	50	50	100	-	04	04
8	MLT-128 (OJT)	Project	-	04	50	50	100	-	04	04
9	MLT-129 (OJT)	Internship	-	-	25	25	50	-	02	02
<b>TOTAL</b>			<b>12</b>	<b>16</b>	<b>425</b>	<b>425</b>	<b>850</b>	<b>12</b>	<b>18</b>	<b>30</b>

## Second Year Syllabus for B.Voc. Medical Lab Technology

<b>Structure For Semester III</b>										
Sr. No.	Course Code	Course Name	Teaching Scheme (Hrs/Week)		Examination Scheme and Marks			Credits		
			THR	PRA	CIA	SEE	TOTAL	THR	PRA	TOTAL
1	MLT-231(T)	Pathology - I	03	-	50	50	100	03	-	03
2	MLT-232(T)	Clinical Haematology-I	03	-	50	50	100	03	-	03
3	MLT-233(T)	Microbiology-I	03	-	50	50	100	03	-	03
4	MLT-234(T)	Histopathology & Histotechniques-I	03	-	50	50	100	03	-	03
5	MLT-235(OJT)	Practical's Clinical Haematology-I	-	04	50	50	100	-	04	04
6	MLT-236(OJT)	Practical's in Microbiology I	-	04	50	50	100	-	04	04
7	MLT-237(OJT)	Practical's in Histopathology & Histotechniques-I	-	04	50	50	100	-	04	04
8	MLT-238(OJT)	Project	-	04	50	50	100	-	04	04
9	MLT-239(OJT)	Internship	-	-	25	25	50	-	02	02
<b>TOTAL</b>			<b>12</b>	<b>16</b>	<b>425</b>	<b>425</b>	<b>850</b>	<b>12</b>	<b>18</b>	<b>30</b>
<b>Structure For Semester IV</b>										
Sr. No.	Course Code	Course Name	Teaching Scheme (Hrs/Week)		Examination Scheme and Marks			Credits		
			THR	PRA	CIA	SEE	TOTAL	THR	PRA	TOTAL
1	MLT-241(T)	Pathology-II	03	-	50	50	100	03	-	03
2	MLT-242(T)	Clinical Haematology-II	03	-	50	50	100	03	-	03
3	MLT-243(T)	Microbiology-II	03	-	50	50	100	03	-	03
4	MLT-244(T)	Histopathology & Histotechniques-II	03	-	50	50	100	03	-	03
5	MLT-245(OJT)	Practical's in Clinical Haematology-II	-	04	50	50	100	-	04	04
6	MLT-246(OJT)	Practical's in Microbiology –II	-	04	50	50	100	-	04	04
7	MLT-247(OJT)	Practical's in Histopathology & Histotechniques-II	-	04	50	50	100	-	04	04
8	MLT-248(OJT)	Project	-	04	50	50	100	-	04	04
9	MLT-249(OJT)	Internship	-	-	25	25	50	-	02	02
<b>TOTAL</b>			<b>12</b>	<b>16</b>	<b>425</b>	<b>425</b>	<b>850</b>	<b>12</b>	<b>18</b>	<b>30</b>

## Third Year Syllabus for B.Voc. Medical Lab Technology

Structure For Semester V										
Sr. No.	Course Code	Course Name	Teaching Scheme (Hrs/Week)		Examination Scheme and Marks			Credits		
			THR	PRA	CIA	SEE	TOTAL	THR	PRA	TOTAL
1	MLT-351 (T)	Immunoematology & Blood Banking	03	-	50	50	100	03	-	03
2	MLT-352 (T)	Clinical Enzymology & Automation	03	-	50	50	100	03	-	03
3	MLT-353 (T)	Parasitology & Virology	03	-	50	50	100	03	-	03
4	MLT-354 (T)	Diagnostic Cytology	03	-	50	50	100	03	-	03
5	MLT-355 (OJT)	Practical's in Clinical Enzymology	-	04	50	50	100	-	04	04
6	MLT-356 (OJT)	Practical's in Parasitology & Virology	-	04	50	50	100	-	04	04
7	MLT-357 (OJT)	Practical's in Diagnostic Cytology	-	04	50	50	100	-	04	04
8	MLT-358 (OJT)	Project	-	04	50	50	100	-	04	04
9	MLT-359 (OJT)	Internship	-	-	25	25	50	-	02	02
<b>TOTAL</b>			<b>12</b>	<b>16</b>	<b>425</b>	<b>425</b>	<b>850</b>	<b>12</b>	<b>18</b>	<b>30</b>
Structure For Semester VI										
Sr. No.	Course Code	Course Name	Teaching Scheme (Hrs/Week)		Examination Scheme and Marks			Credits		
			THR	PRA	CIA	SEE	TOTAL	THR	PRA	TOTAL
1	MLT-361(T)	Clinical Immunology	03	-	50	50	100	03	-	03
2	MLT-362 (T)	Clinical Endocrinology& Toxicology	03	-	50	50	100	03	-	03
3	MLT-363 (T)	Diagnostic Molecular Biology	03	-	50	50	100	03	-	03
4	MLT-364 (T)	Professional Ethics & Values	03	-	50	50	100	03	-	03
5	MLT-365 (OJT)	Practical's in Clinical Endocrinology & Toxicology	-	04	50	50	100	-	04	04
6	MLT-366 (OJT)	Practical's in Advanced Diagnostic Techniques	-	04	50	50	100	-	04	04
7	MLT-367 (OJT)	Practical's in Diagnostic Molecular Biology	-	04	50	50	100	-	04	04
8	MLT-368 (OJT)	Project	-	04	50	50	100	-	04	04
9	MLT-369 (OJT)	Internship	-	-	25	25	50	-	02	02
<b>TOTAL</b>			<b>12</b>	<b>16</b>	<b>425</b>	<b>425</b>	<b>850</b>	<b>12</b>	<b>18</b>	<b>30</b>

**Abbreviations Used: THR- Theory, PRA- Practical, CIA- Continuous Internal Assessment, SEE- Semester End Examination, OTJ-On Job Training**



## FIRST YEAR SEMESTER I

### MLT-111 (T): HUMAN ANATOMY-I

#### Learning Objective:

The prime concern of this syllabus is to learn the terminology of the subject and basic knowledge of cells & tissues and to understand anatomy of human body. This subject will develop an understanding of the structure and function of organs and organ systems in normal human body.

#### Learning Outcome:

Students will develop a vocabulary of appropriate terminology to effectively communicate information related to anatomy and recognize the anatomical structures included in syllabus.

<b>HUMAN ANATOMY-I</b>		
<b>Course Code- MLT-111 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Introduction:</b> Terminology and General Plan of the Body, Body Parts and Areas, Terms of Location and Position, Body Cavities and Their Membranes, Dorsal cavity, Ventral cavity, Planes and Sections of body.	<b>6</b>
<b>UNIT II</b>	<b>Cells &amp; Tissues:</b> Cells: Structure, function and location, Prokaryotic and eukaryotic cells, Cell organelles, Cell division. Tissues-Classification, Microscopic Structures and functions of Primary tissues - Epithelial Tissue, Connective Tissue, Muscle Tissue, Nerve Tissue. Glands- Classification, microanatomy of serous & mucous glands with examples. Membranes –Cutaneous, Serous, Mucous & Synovial membranes. The Integumentary System: structure and function of the Skin, Subcutaneous Tissue.	<b>16</b>
<b>UNIT III</b>	<b>Musculoskeletal System:</b> Skeletal System- Basic anatomy of important Muscles and Bones Organizations of skeleton, Functions of Skeleton; Bones - definition, Classification of bones, Axial skeleton & appendicular skeleton. Muscular system – Definition, Classification of muscular tissue, Characterization of – Skeletal, Smooth & Cardiac muscles, Names, origin, insertion, nerve supply & action of Skeletal muscles of the body	<b>12</b>
<b>UNIT IV</b>	<b>Respiratory system:</b> Basic anatomy of nose, larynx, trachea, bronchi and lungs. Histology of trachea and lung.	<b>5</b>
<b>UNIT V</b>	<b>Digestive system:</b> Basic anatomy of oesophagus, stomach, small intestine, large intestine, liver, gall bladder, pancreas.	<b>6</b>

**Suggested Readings:**

1. Ross & Wilson,(2014),Anatomy & Physiology in Health & illness,11<sup>th</sup> edition, Elsevier Publications
2. Chaurasia B D, (2016), Human Anatomy, 7<sup>th</sup> edition, CBS publishers
3. Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14<sup>th</sup> edition, Wiley Publications
4. Graaff, Kent Van de and et al, Schaum's Outline of Human Anatomy and Physiology: 4<sup>th</sup> Ed. (2013), McGraw Hill Education.
5. Clark, Robert K., (2005), Anatomy and Physiology: Understanding the Human Body, Jones and Bartlett Publishers.
6. Shier David et al, (2012), Hole's Human Anatomy and Physiology, McGraw Hill Education.

**MLT-112 (T): HUMAN PHYSIOLOGY-I****Learning Objective:**

The prime concern of this syllabus is to integrate basic knowledge of cells, tissues, blood, physiological functions and diseases of system included in syllabus.

**Learning Outcome:**

This subject will develop an understanding of the function of organs and organ systems in normal human body. Students will able to explain the physiological systems of body and also understand the basis of diseases.

<b>HUMAN PHYSIOLOGY-I</b>		
<b>Course Code- MLT-112 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Cell Physiology:</b> Cell Structure, membrane, transport across cell membrane-Active & Passive, Organization of the Body, Body Composition, Body Fluid Volumes and its measurement, Diffusion, Osmosis, Tonicity, Homeostasis.	<b>8</b>
<b>UNIT II</b>	<b>Blood &amp; Lymph:</b> Blood: Properties, Composition, function, cellular component & their functions; Haematopoiesis Blood groups and Coagulation, Properties of blood; The Plasma – Composition and character, Functions of plasma proteins; The Erythrocytes – Erythropoiesis, Functions, Fragility of RBCs, Erythrocyte sedimentation rate (ESR); RBC indices - PCV, MCV, MCH,MCHC, Colour index; Haemoglobin - structure, types, compounds of haemoglobin, abnormal haemoglobin; Anaemia - Types with examples; Haemostasis - Platelets: structure and functions, Role of platelets, Blood coagulation, anticlotting mechanisms, anticoagulants; Bleeding disorders- Purpura, Hemophilia,	<b>16</b>

	Vitamin K deficiency, tests for bleeding disorders. Lymphatic system- Composition & function of lymph, lymphatic tissue, Immunity with the role of thymus.	
<b>UNIT III</b>	<b>Cardiovascular system:</b> Structure & function of Heart, Arteries, Veins and Capillaries, Cardiac cycle, Heart sounds, Heart rate, Blood pressure, Mechanism of circulation, Definition of hypertension & shock.	<b>8</b>
<b>UNIT IV</b>	<b>Respiratory system:</b> Parts of Respiratory system, Mechanism of Respiration, Pulmonary function, Pulmonary circulation, Lungs volume, Gas transport between lungs and tissues; Definition of Hypoxia, Dyspnoea, Cyanosis, Asphyxia and Obstructive airways diseases.	<b>6</b>
<b>UNIT V</b>	<b>Gastrointestinal physiology</b> Organs of Gastrointestinal tract and their structure & function, Secretion, Digestion, Absorption and Assimilation, Gastrointestinal hormones, Physiology of digestion of Carbohydrates, Proteins & Lipids, Structure & function of Liver, Spleen, Gall bladder & Pancreas, Jaundice, Cirrhosis & Pancreatitis.	<b>7</b>

**Suggested Readings:**

1. Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11<sup>th</sup> edition, Elsevier Publications
2. Sujit Chaudhury,(2011),Concise Medical Physiology,6<sup>th</sup> edition, NCBA
3. Sembulingam k,(2012),Essentials of Medical Physiology,6<sup>th</sup> edition, Jaypee Publications
4. Guyton and Hall,(2011) Textbook of Medical Physiology,12<sup>th</sup> Edition, Saunder/Elsevier
5. Gerard J. Tortora and Bryan H.Derrickson, Principles of Anatomy and Physiology, 14<sup>th</sup> Edition, Wiley Publications

## MLT-113 (T): BIOCHEMISTRY-I

### Learning Objective:

This syllabus has been formulated to impart basics knowledge of biochemistry, apparatus, units, equipment, and volumetric analysis in the Clinical Biochemistry.

### Learning Outcome:

Students will know the basics of reagent preparation, instrument handling and can perform common analytical in Clinical Biochemistry.

<b>BIOCHEMISTRY-I</b>		
<b>Course Code- MLT-113 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Introduction</b> Introduction to Clinical Biochemistry and Role of Medical Lab Technologist , Ethics, Responsibility, Safety measure and Hazards in Clinical Biochemistry lab and First aid in laboratory accidents.  Glassware's & Plastic ware's used in lab, Calibration of volumetric apparatus, Cleaning, care and maintenance	<b>7</b>
<b>UNIT II</b>	<b>Basic Laboratory Equipment</b> Principle, Working, Care & Maintenance and Calibration of Weighing balance, Hotplate, Magnetic stirrer, Centrifuges, Incubator, Hot air oven, Colorimeter, Spectrophotometer, Water distillation plant, Deionizers. Henderson-Hasselbalch equation, Method of pH measurement- pH paper & pH meter.	<b>14</b>
<b>UNIT III</b>	<b>Units &amp; Reagent Preparation</b> Preparation of solution and Reagents, Normal solution, Molar solutions, Percent solution, Buffer solution, Dilutions, w/v, v/v, Standard solution, Aqueous solutions, Concepts of acid and base  Units of measurement: SI unit, reference range, conversion factor, Units for measurement of Bio metabolite, Enzymes, Protein, Drugs, Hormones, vitamins.	<b>10</b>
<b>UNIT IV</b>	<b>Sample Collection &amp; Handling</b> Specimen collection and processing of blood, urine & CSF, Separation of Serum and Plasma, Deproteinization of sample, Handling of specimens for testing, Preservation of specimen, Transport of specimen, Factors affecting the clinical results, Effect of storage on sample.	<b>9</b>
<b>UNIT V</b>	<b>Urine Analysis</b> Physical, Chemical and Microscopic examination of urine, Bence Jones Proteinuria and its clinical significance, Qualitative test of urine for Reducing sugars, Protein,	<b>15</b>

	Ketone bodies, Bile Salt, Bile pigments, Urobilinogen, Occult blood, Uric acid, Urea and Creatinine, Quantitative estimation of 24 hrs urine for Protein and their clinical Significance.	
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**Suggested Readings:**

1. D M Vasudevan, (2011), Text book of Medical Biochemistry, 6<sup>th</sup> edition Jaypee Publishers
2. M N Chatterjea & Rana Shinde,(2012),Text book of Medical Biochemistry,8<sup>th</sup> edition, Jayppe Publications
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2<sup>nd</sup> edition, Alpha science
4. Lehninger,(2013),Principles of Biochemistry,6<sup>th</sup> edition, W H Freeman
5. U Satyanarayan,(2008), Essentials of Biochemistry,2<sup>nd</sup> edition, Standard Publishers.

## MLT-114 (T): FUNCTIONAL ENGLISH

**Learning Objective:**

The aim of Functional English course is to develop communicative skills of the learners in listening, speaking, reading and writing. The main focus is on how English is used in real-life situations. Through the items listed in the syllabus the learners are expected to develop fluency in conversation and efficiency in interactional skills. They are also expected to learn to use grammar communicatively so that they become effective and efficient communicators in English

**Learning Outcome:**

Specific learning outcomes for the functional English course include the following:

1. **Reading and listening Skills:** Students will become accomplished, active readers and listeners who are able to appreciate ambiguity and complexity and who can articulate their own interpretation with an awareness and curiosity for other's perspectives.
2. **Writing Skills:** Students will be able to write effectively for a variety of professional and social settings.
3. **Oral Communication Skills:** Students will demonstrate the skills needed to participate in conversation that builds knowledge collaboratively. They will learn to listen carefully and respectfully to other's viewpoints; articulating their own ideas and framing their own questions clearly. Students will be able to prepare, organize and deliver an engaging oral presentation.

<b>FUNCTIONAL ENGLISH</b>		
<b>Course Code- MLT-114 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Developing Conversational Ability through role play and dialogue writing (Listening and speaking skills involved)</b> a) Greetings and Introduction b) Participating in small talks- At the office, At the railway station, At the airport, At the travel agency, At the bank, At the doctor's clinic, At the hospital. c) Making enquiries	<b>14</b>

	<ul style="list-style-type: none"> <li>d) Making requests and seeking permissions</li> <li>e) Expressing gratitude and apologizing</li> <li>f) Complaining</li> <li>g) Expressing sympathy and offering condolences</li> <li>h) Congratulating people and responding to congratulations Telephone Etiquettes</li> </ul>	
<b>UNIT II</b>	<b>Functional Reading</b> <ul style="list-style-type: none"> <li>a) Reading official Letters and Profiles</li> <li>b) Reading News Reports/Newspapers</li> <li>c) Reading Online Content</li> <li>d) Reading Comprehension, Description and Narration (Objects, Places and People)</li> </ul>	<b>7</b>
<b>UNIT III</b>	<b>Writing Skills</b> <ul style="list-style-type: none"> <li>a) Letter Writing in Email format</li> <li>b) Precis of a given passage</li> <li>c) Report writing and blog writing</li> <li>d) Resume Writing</li> </ul>	<b>6</b>
<b>UNIT IV</b>	<b>Grammar and Vocabulary</b> <ul style="list-style-type: none"> <li>a) Types of Sentences</li> <li>b) Active and Passive Voice</li> <li>c) Direct and Indirect Speech</li> <li>d) Process of Word Formation</li> <li>e) Enriching Business English Vocabulary</li> </ul>	<b>10</b>
<b>UNIT V</b>	<b>Communication and Life skills:</b> <ul style="list-style-type: none"> <li>a) Non-Verbal Communication</li> <li>b) Group Discussion</li> <li>c) Interview Skills</li> <li>d) Presentation Skills</li> </ul>	<b>8</b>

**Suggested Readings:**

1. Allen and Unwin, 2004 Hamp-Lyons, Liz and Ben Heasiey. Second edition. Study Writing.
2. Bellare, Nirmala. Reading Strategies. Vols. 1 and 2. New Delhi. Oxford University Press, 1998.
3. Bhasker, W. W. S & Prabhu, N. S.: English through Reading, Vols. 1 and 2. Macmillan, 1975
4. Brown, Ralph: Making Business Writing Happen: A Simple and Effective Guide to Writing Well. Sydney:
5. Boves. Thill Business Communication Today Mcycans Hills Publication.
6. Dark Studying International Communication Sage Publication.
7. Murphy Hidderandt Thomas Effective Business Communication Mc Graw Hill.

## PRACTICAL

### MLT 115 (P): PRACTICAL'S IN HUMAN ANATOMY-I

PRACTICAL'S IN HUMAN ANATOMY-I		
Course Code- MLT- 115 (P)		(04 Credits) 4Hrs/Week
Sr. No.	Practical	Total Hrs-60
1	Microscopic studies of different types of cells & tissues.	
2	Study of Major organs of human through models/Charts.	
3	Demonstration of parts of circulatory system from models/Charts.	
4	Demonstration of parts of respiratory system from models/Charts.	
5	Demonstration of digestive system from models/Charts.	
6	Demonstration of excretory system from models/Charts.	
7	Demonstration of nervous system from models/Charts.	
8	To study structure of eye and ear	
9	Demonstration of structural differences between skeletal, smooth and cardiac muscles.	
10	Demonstration of various bones	
11	Demonstration of various joints	
12	Demonstration of various parts of male & female reproductive system from models.	

### MLT 116 (P): PRACTICAL'S IN COMPUTER FUNDAMENTALS

PRACTICAL'S IN COMPUTER FUNDAMENTALS		
Course Code- MLT 116 (P)		(04 Credits) 4Hrs/Week
Sr. No	Content	Total Hrs-60
1	<p><b>Fundamentals of computer:</b> Overview of a Computer, Functional Components of a computer (Working of each unit), Evolution Of Computers, Generations Of Computers, Classification Of Computers, Applications Of Computers</p> <p><b>Hardware:</b> Block diagram of computer, Input and Output devices, Memory and storages devices, Different ports and its uses, Different type of printers</p>	
2	<p><b>Operating system (Windows 10):</b> Windows concepts, Features, Windows Structure, Desktop, Task bar, Start Menu, My Computer, Recycle Bin, Windows Accessories, calculator, Notepad, Paint, Word pad, Character Map, Windows Explorer, Entertainment, Installation of Hardware and Software, Using scanner, system tools, communication, sharing information between computers.</p> <p><b>MS-Paint:</b> Introduction to Paint, Drawing with the help of Paint, Image Editing.</p>	
3	<p><b>Introduction To MS Office:</b> About MS Office, Why MS Office, What Are Documents and Templates</p> <p><b>MS-WORD:</b> Introduction To Document, Formatting Text, Editing Text, Creating Template, Insertion Of- Table, Image, Text Box, Cover Page, Header, Footer, Date</p>	

	<p>And Time, Page Number; Margin, Page Setup, Printing Document; Mail Merge-Creating Main Document, Data Source, Adding and Removing Fields, Bulleted and Numbered Lists, Page Formatting, Graphics, Adding tables, styles</p> <p><b>MS-PowerPoint:</b> Introduction To Slide, Inserting Slide, Navigation In Presentation, Insert-Text, Text Style, Clip Art, Table, Chart, Picture, Audio, Video; Layout, Slide Design, Master Slide; Enhancing Presentation With Multimedia Effect -Animation, Transition, Slide Show, Recording Sound Slide By Slide, Auto Content Wizard, Template, Slide View, Printing Presentation, Sharing presentation, Working with multimedia, Formatting presentation, Editing presentation.</p> <p><b>MS-Excel:</b> Introduction To Spreadsheet, Rows, Columns, Cells, Navigation, Selection of Cells, Resizing Columns, Series Fill, Working with Formulas, Formatting worksheets, Formatting Cells, Editing worksheet, Alignment, Conditional Formatting, Cell Styles, Inserting Chart, Data Sort, Filters, Functions, Pivot Table, Pivot Charts, Workgroup, Protecting Worksheet, Printing Worksheet ,Data tables, Workbook security, Translate worksheet, Adding graphics, Marcos, Templates, Themes, Styles, Data validation.</p>
4	<p><b>Introduction to Internet Intranet tools:</b> E-mail: Anatomy of e-mail, e-mail address, finding e-mail address, adding signature, attaching files, opening attachments, managing e-mail account, Web mail, and Case study: Yahoo Mail, Outlook express. FTP, ftp commands, ftp software, Telnet, using telnet, Web pages, HTML, basics of HTML, computer virus and antivirus software, Voice and Video chat, web browsers etc.</p>
5	<p><b>Online Educational Utilities:</b> Google Doc, Sheet, Google Form, Google Classroom, Online Meetings, Google Meet, Emails, Zoom App etc.</p>
6	<p><b>Audio, Video, Images, PDF and other utilities:</b> Mobile/Desktop/web applications/tools for Audio/Video/Image conversion and compressions, Conversions from PDF to Word, Word to PDF, PDF to Excel, Excel to PDF, PDF to JPG, JPG to PDF, PowerPoint to PDF, Unlock PDF. Audio/Video conversion utilities like Freemake Video Converter, VLC etc. Image conversion utilities like Adapter, DVDVideoSoft's, SendTo-Convert and web based tools etc.</p>

### Suggested Readings:

1. V.Rajaraman, 2002, Fundamentals of Computers, Third Edition, PHI, New Delhi.
2. OFFICE 2016 for Dummies by Peter Weverkar
3. Step by Step Microsoft Word 2013 by Joan Lambert and Joyce Cox
4. Ron Mansfield, Microsoft Office, BPB Publication.
5. Step by Step Microsoft OFFICE 2013
6. Computers Fundamentals and Architecture by B. Ram
7. William Stallings, Operating System, Pearson Education
8. Norton, Introduction to Computers, McGraw Hill
9. Ron Mansfield, Microsoft Office, BPB Publication

## ON JOB TRAININGS (OJT)

### MLT 117 P (OJT) : PRACTICAL'S IN HUMAN PHYSIOLOGY-I

PRACTICAL'S IN HUMAN PHYSIOLOGY		
Course Code- MLT 117 P (OJT)		(04 Credits) 4Hrs/Week
Sr. No.	Practical	Total Hrs-60
1	To measure pulse rate.	
2	To measure blood pressure.	
3	Demonstration of ECG.	
4	To perform Hemoglobin by Sahli's Method	
5	To perform Hemoglobin by CMG method. .	
6	To perform Total RBC count.	
7	To perform total leucocyte count.	
8	To perform differential leucocyte count.	
9	To perform PCV	
10	Erythrocyte Indices- MCV, MCH, MCHC.	
11	Reticulocyte Count.	
12	Absolute Eosinophil Count.	
13	Determination of ESR	

### MLT-118 P (OJT): PRACTICAL BIOCHEMISTRY-I

PRACTICAL BIOCHEMISTRY- I		
Course Code- MLT 118 P (OJT)		(04 Credits) 4Hrs/Week
Sr. No.	Practical	Total Hrs-60
1	To study general laboratory safety rules.	
2	To demonstrate glasswares, apparatus and plasticwares used in laboratory.	
3	Collection of blood sample.	
4	To separate serum and plasma from blood.	
5	Preparation of different percentage solutions & normal saline.	
6	Preparation of normal and molar solutions.(0.1 N NaOH, 0.2N HCl,0.1 M H <sub>2</sub> SO <sub>4</sub> )	
7	Standardization of NaoH.	
8	Preparation of buffer of known molarity & pH.	
9	Demonstration of photocolormeter.	
10	Demonstration of spectrophotometer.	
11	Demonstration of pH meter and measuring of pH.	
12	Deproteinization of blood sample	

## MLT 119 P (OJT): VISIT TO ANY MEDICAL RESEARCH INSTITUTE

VISIT TO ANY MEDICAL RESEARCH INSTITUTE		
<b>Course Code- MLT 119 P (OJT)</b>	Students are expected to visit at least one Medical Research Institute and give a detailed report of the same. Work carried out here should be equivalent to 30 Hrs.	<b>02 Credits (30 Hr)</b>

## FIRST YEAR SEMESTER II MLT-121 (T): HUMAN ANATOMY-II

### Learning Objective:

This syllabus is extension of the part-I. The syllabus justifiably divides the body systems into two semesters to ensure complete and comprehensive knowledge of all functionalities of the body.

### Learning Outcome:

This curriculum can stimulate the students to understand the basic anatomy of included system and the resultant unified organization thereupon.

HUMAN ANATOMY-I		
<b>Course Code- MLT-121 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Cardiovascular system</b> Basic anatomy of heart, Major arteries of heart, Major Veins of heart, Branches of aorta blood vessels, Systemic and pulmonary circulation; Histology of - Elastic Artery, Muscular Artery & Vein.	<b>6</b>
<b>UNIT II</b>	<b>The Lymphatic System</b> General consideration of Lymphatic system; Gross anatomy of - Cisterna Chyli & Thoracic Duct; Brief discussion over names of regional lymphatic's, Axillary and Inguinal lymph nodes; Histology of – Lymph Node, Spleen, Tonsil & Thymus.	<b>6</b>
<b>UNIT III</b>	<b>The Nervous System</b> Neuron; Classification of Nervous System, Central nervous system –Cerebrum, basal nuclei, Cerebellum, Brainstem, Spinal Cord; Neurohumoral transmission in the central nervous system, Peripheral nervous system -Cranial nerves, Spinal nerves, Segmental innervations of skin; Meninges; Ventricles and Cerebrospinal fluid; Blood supply of the brain; Autonomic Nervous System- Physiology and functions of the autonomic nervous system. Mechanism of	<b>12</b>

	Neurohumoral transmission in the A.N.S. Histology of - Cerebrum, Cerebellum, Spinal cord, Peripheral nerve and Ganglia. Reflex action & Electroencephalogram.	
<b>UNIT IV</b>	<b>Endocrine System</b> Anatomy of glands and endocrine system – Brief anatomy of Pituitary Gland, Thyroid Gland, Pancreas, Parathyroid Gland, Suprarenal Gland (Adrenal gland) and Pineal Gland; Histology of Endocrine Glands - Pituitary gland, Thyroid gland, Parathyroid & Suprarenal Glands.	<b>8</b>
<b>UNIT V</b>	<b>Special Senses</b> Basic anatomy of Eye, Ear and Nose.	<b>2</b>
<b>UNIT VI</b>	<b>The Urinary System</b> Gross anatomy of the Human Urinary System - Kidney, Ureter, Urinary Bladder, Male and Female Urethra; Histology of organs of urinary system - Kidney, Ureter, Urinary Bladder, Male Urethra (Penile Urethra) & Female Urethra.	<b>6</b>
<b>UNIT VII</b>	<b>The Reproductive System</b> Basic anatomy of kidney and associated organs, Male reproductive organs, Female reproductive organs Definition and general consideration; Parts of male reproductive system - Testis, accessory organs; Parts of female reproductive system -Ovary, Mammary Gland and accessory organs; Histology of –Testis, Prostate, Ovary, Uterus, Fallopian Tubes, Umbilical cord and Placenta.	<b>5</b>

**Suggested Readings:**

1. Ross & Wilson,(2014),Anatomy & Physiology in Health & Illness,11<sup>th</sup> Edition, Elsevier Publications
2. Chaurasia B D, (2016), Human Anatomy, 7<sup>th</sup> Edition, CBS publishers.
3. Gerard J. Tortora and Bryan H. Derrickson, Principles of Anatomy and Physiology,14<sup>th</sup> Edition, Wiley Publications.

**MLT-122 (T): HUMAN PHYSIOLOGY-II**

**Learning Objective:**

This subject imparts the knowledge of the structure and function of included organs and organ systems in normal human body.

**Learning Outcome:**

Students will be able to understand functioning of various systems included in syllabus as well as diseases mentioned.

<b>HUMAN PHYSIOLOGY-II</b>		
<b>Course Code- MLT-122 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<p><b>Excretory System &amp; Body Fluid Homeostasis</b>            Functional anatomy of kidney – Nephron, Juxtaglomerular apparatus, renal regulation; Glomerular filtration - filtration barrier, forces governing filtration; Tubular functions – Mechanism of tubular reabsorption, Mechanism of tubular secretion, Electrolytes: their balances and imbalances Introduction of acidosis and alkalosis; Renal function test; Excretory functions of skin; Homeostatic imbalances– Glomerular disease.</p>	<b>08</b>
<b>UNIT II</b>	<p><b>Nerve Muscle Physiology</b>            Electrical properties of cell membrane; Membrane Potential (MP): Development and maintenance of MP, Action Potential (AP); Physiology of nerves and neuromuscular junction; Neuro muscular transmission; Functional anatomy of skeletal muscle; Mechanism of muscle contraction and relaxation; isotonic &amp; isometric contraction; energy sources and metabolism; motor unit; Involuntary muscles - Cardiac and smooth muscles;            Homeostatic imbalances – Myasthenia gravis, Muscular dystrophy, Fibromyalgia; Clinical connection - Muscular Atrophy and Hypertrophy, Exercise-Induced Muscle Damage, Rigor Mortis, Electromyography, Hypotonia and Hypertonia, Anabolic Steroids.</p>	<b>10</b>
<b>UNIT III</b>	<p><b>Nervous System</b>            Functional anatomy of the nervous system – Central nervous system, peripheral nervous system, neuron and nerve, synapse; The sensory system – Cerebral cortex, sensory tracts; The motor system - Cerebral motor cortex, the descending tracts in the spinal cord; Structures associated with motor activity - Cerebellum, Basal ganglia, Thalamus, Red nucleus, Reticular formation, Muscle tone, Posture and equilibrium, ANS, Hypothalamus, Neural function, Cerebral hemispheres, electrical activities of the cerebral cortex; Clinical connection - Hydrocephalus; Homeostatic imbalances – Epilepsy, Spinal cord compression, Parkinson's disease.</p>	<b>10</b>
<b>UNIT IV</b>	<p><b>Endocrine Glands and Hormones</b>            Pituitary gland, thyroid glands, parathyroid gland, adrenal gland, thymus, pancreas; Homeostatic imbalances – Pituitary disorders, Thyroid gland disorders, Parathyroid gland disorders, Adrenal gland disorders, Pancreatic disorders.</p>	<b>10</b>
<b>UNIT V</b>	<p><b>Reproductive System</b>            Male &amp; Female reproductive organs, Sex hormones,</p>	<b>07</b>

	Secondary sexual characteristics, Puberty, Spermatogenesis, Oogenesis, Menstrual cycle, Pregnancy, Menopause, Contraceptive measures.	
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**Suggested Readings:**

1. Ross & Wilson,(2014),Anatomy & Physiology in Health & Illness,11<sup>th</sup> Edition, Elsevier Publications
2. Sujit Chaudhury,(2011),Concise Medical Physiology,6<sup>th</sup> edition, NCBA
3. Sembulingam k,(2012),Essentials of Medical Physiology,6<sup>th</sup> edition, Jaypee Publications
4. Guyton and Hall,(2011) Textbook of Medical Physiology,12<sup>th</sup> Edition, Saunder/Elsevier
5. Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14<sup>th</sup> Edition, Wiley Publications

**MLT-123 (T): BIOCHEMISTRY –II**

**Learning Objective:**

This paper is extension of MLT (T)-104 and which aims at understanding the chemical properties of the bio molecules, their functions and biomedical importance.

**Learning Outcome:**

Students will understand the Chemistry, Function, and Biological importance of Carbohydrates, Proteins, Lipids, Nucleic acids, Enzymes, Vitamins and Minerals.

<b>BIOCHEMISTRY –II</b>		
<b>Course Code- MLT-123 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Carbohydrate</b> Carbohydrates: Dietary Source, Classification, function, importance, structure; Regulation of blood glucose & its importance; Glucose tolerance test; Glycosylated Hb; Other parameters and related disorders.	<b>08</b>
<b>UNIT II</b>	<b>Amino Acids &amp; Proteins</b> Amino acids: Classification, Structure, Properties and Biological functions. Proteins: Structure (Primary, Secondary, Tertiary & Quaternary) & function of proteins. Fate of amino Acids, Formation and detoxification of ammonia; formation of urea; Formation of non-protein nitrogenous products e.g. Uric acid, creatinine; Disorders related to protein and nitrogen metabolism.	<b>10</b>
<b>UNIT III</b>	<b>Lipids</b> Lipids: Classification of lipids, Classification of fatty acids, Saturated & Unsaturated fatty acids, PUFA, MUFA & their biological functions. Lipid profile (cholesterol, triglyceride, lipoproteins, phospholipids) and its Significance in various disorders.	<b>06</b>

<b>UNIT IV</b>	<b>Nucleic acids</b> Structure, Function and types of DNA and RNA, Nucleotides, Nucleosides, Nitrogen bases, Purine, Pyrimidine and role of Nucleic acid.	<b>06</b>
<b>UNIT V</b>	<b>Enzymes</b> Definition, Classification of enzyme, Cofactor & Coenzymes, Isozymes, Concept of active sites and general mode of action of enzymes, Units for measuring Enzyme activity, Factor affecting enzyme activity, Factor responsible for abnormal enzyme secretion. Clinical enzymology - Therapeutic, diagnostic and analytical uses of enzymes with normal values of serum enzymes.	<b>10</b>
<b>UNIT VI</b>	<b>Vitamins &amp; Minerals</b> Classification, function and disease associated with vitamins; Minerals and ions: Requirement, function and biological importance of Calcium, Iron, Iodine, Zinc, Phosphorus, Copper, Sodium and Potassium	<b>5</b>

**Suggested Readings:**

1. D M Vasudevan, (2011), Text book of Medical Biochemistry, 6<sup>th</sup> Edition Jaypee Publishers.
2. M N Chatterjea & Rana Shinde, (2012), Text book of Medical Biochemistry, 8<sup>th</sup> edition, Jaypee Publications.
3. Singh & Sahni, (2008), Introductory Practical Biochemistry, 2<sup>nd</sup> Edition, Alpha science.
4. Lehninger, (2013), Principles of Biochemistry, 6<sup>th</sup> Edition, W H Freeman.
5. U Satyanarayan, (2008), Essentials of Biochemistry, 2<sup>nd</sup> Edition, Standard Publishers.

**MLT-124 (T): Personal Enhancement**

**Learning Objectives**

**Student will able to learn**

- To make the students aware about the dimensions and importance of effective personality.
- To understand personality traits and formation and vital contribution in the world of business.
- To make the students aware about the various dynamics of personal enhancement.

**Learning Outcome:**

**Student will able to**

- Develop the professional and inter-personal communications and facilitate an all-round enhancement of personality.
- Develop hard or technical skills help securing a basic position in one's life and career.

<b>MLT-124 (T): Personal Enhancement</b>		
<b>Course Code- MLT-124 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Determinants of Personal Enhancement:</b> Define Personality, Determinants of Personal Enhancement,	<b>04</b>

	Perception – Definition, Perceptual Process	
<b>UNIT II</b>	<b>Personality traits:</b> Factors of Association – Relationship, Personality Traits, Developing Effective Habits, Sigmund Freud’s Id, Ego & Super Ego	<b>04</b>
<b>UNIT III</b>	<b>Emotional Intelligence:</b> Meaning of Emotional Intelligence, Motivation, Self Awareness, The Johari Window, Self-Assessment, Self-Appraisal & Self Enhancement, Self Esteem and Maslow’s Self Esteem, Erik Erikson’s Psychosocial Development, Social Skills.	<b>05</b>
<b>UNIT IV</b>	<b>Types of Personalities:</b> Mind Mapping, Competency Mapping & 360 Degree Assessment, Types of Personalities – Introvert, Extrovert & Ambivert person	<b>07</b>
<b>UNIT V</b>	<b>Conflict: Process &amp; Resolution:</b> Empathy, Effective Communication & Its key aspects, Assertiveness, Decision making skills, Leadership & Qualities of Successful Leader	<b>05</b>
<b>UNIT VI</b>	<b>Stress Management:</b> Expectations Vs. Reality, Goals and Achievements, Exercise, Meditation, Mindfulness, Attitude to Gratitude, Stress management for one’s growth.	<b>05</b>
<b>UNIT VII</b>	<b>Interpersonal Relationship:</b> Good manners & Etiquettes, Effective Speech, Understanding Body language, projective positive body language.	<b>05</b>
<b>UNIT VIII</b>	<b>Presentation Skills:</b> Voice Modulation, Tempo, choice to dress, personal grooming, etiquette.	<b>07</b>
<b>UNIT IX</b>	<b>Personality –</b> Spiritual journey beyond management of change	<b>03</b>

**Suggested Readings:**

1. Personality Traits – 3rd Edition, Gerald Mathews, Ian G. Deary, Martha C. Whiteman – Cambridge University Press
2. The Seven Habits of Effective People – Stephen Covey
3. You Can Win – Shiv Khera
4. Business Communication & Personality Development – Biswajit Das, Ipseeta Satpathy
5. How to Talk to Anyone – Leil Lowndes

## PRACTICAL

### MLT-125 (P): Practical's in Anatomy-II (04 Credits=60 Lectures)

<b>PRACTICAL'S IN ANATOMY-II</b>		
<b>Course Code- MLT-125 (P)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	Demonstration of brief anatomy of human hearts from models/Charts.	
2	Demonstration of human arterial system from models/Charts.	
3	Demonstration of human Venous system from models/Charts	
4	Demonstration of human CNS from models/Charts.	
5	Demonstration of human PNS & ANS from models/Charts.	
6	Demonstration of Male reproductive system from models/Charts.	
7	Demonstration of Female reproductive system from models/Charts.	
8	Demonstration of human Excretory system from models/Charts.	
9	Study of brief anatomy & histology of Pituitary, Thyroid and Parathyroid gland from charts &/ slides.	
10	Study of brief anatomy & histology of Pancreas & Adrenal gland from charts & slides.	
11	To study the structure of human eye from models/Charts.	
12	To study the structure of human nose & ear from models/Charts.	

## ON JOB TRAINING

### MLT-126 P (OJT): PRACTICAL'S IN HUMAN PHYSIOLOGY-II

<b>PRACTICAL'S IN HUMAN PHYSIOLOGY-II</b>		
<b>Course Code- MLT-126 P (OJT)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	To perform Total platelet count.	
2	To perform Bleeding time.	
3	To perform Clotting time.	
4	To study about CSF examination.	
5	To study about intrauterine contraceptive devices.	
6	To demonstrate microscopic structure of bones with permanent slides.	
7	To demonstrate microscopic structure of muscles with permanent slides.	
8	To measure the body weight and height and calculate BMI of a human.	
9	Physical & Chemical examination of Urine.	
10	Microscopic examination of Urine.	
11	Physical & Chemical examination of Stool.	
12	Microscopic examination of Stool.	
13	Physical & Chemical examination of Semen	
14	Microscopic examination of semen.	

**MLT-127 P (OJT): PRACTICAL'S IN BIOCHEMISTRY-II**

<b>PRACTICAL'S IN BIOCHEMISTRY-II</b>		
<b>Course Code- MLT-127 P (OJT)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	To identify Carbohydrates from given sample by various methods.	
2	Estimation of serum glucose.	
3	To perform Protein test by various methods.	
4	To determine Protein by Biuret method.	
5	Determination Urine Sugar by Benedict's method.	
6	Protein by heat and acetic method.	
7	Determination of Bile salt, Bile pigments and Urobilinogen.	
8	Determination of Ketone bodies.	
9	Determination of various parameters of urine by uristik method.	
10	Preparation of hemolysate.	
11	Estimation of Cholesterol.	
12	Estimation of Serum Creatinine.	
13	Estimation of Chlorides.	
14	Estimation of Serum Uric acid.	

**MLT-128 P (OJT): PROJECT**

<b>PROJECT</b>		
<b>Course Code- MLT 128 P (OJT)</b>	Students are expected to perform skill based activity/practical work equivalent to 60 hours. Survey, lab work, presentation etc. may be carried out with prior permission of the faculty member. Work carried out here should be equivalent to 30 Hrs.	<b>04 Credits (60 Hrs)</b>

**MLT 129 P (OJT): INTERNSHIP**

<b>INTERNSHIP</b>		
<b>Course Code- MLT 129 P (OJT)</b>	Students are expected to work at any pathology lab and give a detailed report of the same. Work carried out here should be equivalent to 30 hours.	<b>02 Credits (30 Hrs)</b>

## SECOND YEAR SEMESTER III

### MLT-231 (T): PATHOLOGY – I

**Learning Objective:**

The curriculum of pathology aims at preparing the students in basic understanding of diseases and their pathogenesis. The syllabi of pathology compliments and supplements the necessary knowledge students have gained in Physiology.

**Learning Outcome:**

This curriculum will provide an introductory nature and build the concepts of how human system works in altered and diseased stage under the influence of various internal and external stimuli to the students.

<b>PATHOLOGY – I</b>		
<b>Course Code- MLT-231 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Introduction to Pathology</b> Introduction & History of pathology, Subdivisions & Scope of Pathology, Basic definitions and Familiarization with the common terms used in Pathology, Causes and Mechanisms of Cell injury, Reversible and Irreversible injury, Introduction of hyperplasia, hypoplasia, hypertrophy, atrophy, metaplasia, necrosis and apoptosis; Ethical aspects of Pathology practice.	<b>04</b>
<b>UNIT II</b>	<b>Techniques for Studying Pathology</b> Basic Concepts of Microscope, Cryostat, Flow Cytometry & Polymerase Chain Reaction (PCR).	<b>07</b>
<b>UNIT III</b>	<b>Cell Structure, Injury and Cellular Adaptations</b> Cell morphology, Mitosis of resting cell and its mechanism, Correlation to Cell Structure and Function; Cell Injury: Etiology and Pathogenesis of Physical and Chemical cell injury, Morphology of cell injury; Cell death; Discussion over – Autolysis, Necrosis, Apoptosis and Gangrene.	<b>07</b>
<b>UNIT IV</b>	<b>Inflammation &amp; Healing</b> Inflammation Types, Cells and Mediators involved; Types – Acute inflammation, Pathological features, Vascular changes, Cellular events, Morphologic variants of acute Inflammation, Inflammatory cells and Mediators; Chronic Inflammation: Causes, Types, Classification – nonspecific and granulomatous with examples; Repair & Wound healing – Types by Primary and Secondary union, Factors Promoting and Delaying the process; Healing in specific site including bone healing; Tissue Renewal and Repair, Healing and Fibrosis,	<b>08</b>

	Cirrhosis, introduction of Oedema, Hyperaemia, Congestion, Haemorrhage, Haemostasis, Thrombosis, Embolism, Infarction, Shock and Hypertension.	
<b>UNIT V</b>	<b>Nutritional &amp; Infectious Diseases</b> Definition, pathogenesis & overview of modes of infections, prevention and control; Nutritional Diseases – Protein energy malnutrition – Marasmus, Kwashiorkor, and Vitamin deficiency disorders; Classification with specific examples; Disorders of Mineral metabolism such as a) Zinc, b) Calcium. Infectious Diseases – Bacterial diseases: Pyogenic, Typhoid, Diphtheria, Gram negative infection, bacillary dysentery, Rickettsia, Chlamydial infection; Viral diseases: Poliomyelitis, Herpes, Rabies, Measles, HIV infection; Fungal disease and opportunistic infections, Parasitic diseases: Malaria, Filaria, Amoebiasis, Kala-azar, Cysticercosis, Hydatid cyst.	<b>09</b>
<b>UNIT VI</b>	<b>Cancer</b> Definition, Classification, Histogenesis, Biologic behaviour; Types – Benign and Malignant, differences between carcinoma and sarcoma; Precancerous lesions – Types, examples; Carcinogenesis – Types of carcinogens- Environmental carcinogens, chemical, viral, occupational; Cellular oncogenes and prevention of cancer; Diagnostic Methods in Cancer – Exfoliative Cytology & FNAC; Tumour and host interactions – Systemic effects including Paraneoplastic syndromes, Cachexia, Tumour immunology.	<b>10</b>

**Suggested Readings:**

1. Harshmohan, (2017), Textbook of Pathology, 7<sup>th</sup> Edition, Jaypee Publications.
2. Robbins, (2012), Text book of Pathology, 3<sup>rd</sup> Edition, Elsevier Publications.

**MLT-232 (T): CLINICAL HAEMATOLOGY-I**

**Learning Objective:**

This course has been designed to understand the blood disorders, its lab diagnosis and various type of laboratory test.

**Learning Outcome:**

Students will learn the differential diagnosis and appropriate diagnostic evaluation of common hematologic abnormalities.

<b>CLINICAL HAEMATOLOGY-I</b>		
<b>Course Code- MLT-232 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Hematology</b> Composition of Blood, Formation of blood and functions of blood; Collection of blood – Different routes of blood collection, Difference between capillary and venous sample; Anticoagulants – Different types of anticoagulants, Method of preparation and uses of anticoagulants.	<b>04</b>

<b>UNIT II</b>	<b>Red Blood Cells</b> Erythropoiesis, Morphology, Cytoskeleton, Anisocytosis, Poikilocytosis, metabolism, Role of 2, 3- BPG and oxygen dissociation curve; Anaemia and its classification, Morphological and etiological, pathogenesis, laboratory investigations and management; Iron deficiency anaemia, Metabolism of iron, Pathogenesis, Laboratory investigations and Management, Principle and Procedure of special test; Megaloblastic anaemia, pernicious anaemia, pathogenesis, laboratory investigations	<b>07</b>
<b>UNIT III</b>	<b>Haemoglobin</b> Haemoglobin- Synthesis and Types, Normal and Abnormal hemoglobins; Extravascular and Intravascular hemolysis; Haemolytic anaemia, Pathogenesis and Laboratory investigations, Principle and procedure of special test, Glucose-6-Phosphate Dehydrogenase.	<b>07</b>
<b>UNIT IV</b>	<b>White Blood Cells</b> Leukopoiesis , Stages of Leukocyte Maturation, Features of Cell Identification, Leucocytosis and Leucocytopenia , Neutrophilia , Eosinophilia, Basophilia, Monocytosis, Lymphocytosis, Neutropenia, lymphopenia, Causes and Significance, Toxic granulation, Morphological alterations in neutrophil, Effect of HIV on blood cell parameter.	<b>08</b>
<b>UNIT V</b>	<b>Haemostasis and Coagulation Mechanism</b> Overview of Hemostasis and Coagulation, Stages of platelets development, Primary and Secondary hemostasis, Role of platelets, Role of coagulation factors, Coagulation inhibitory system, Fibrinolysis	<b>09</b>
<b>UNIT VI</b>	<b>Haematological Assay</b> General blood picture, Estimation of Iron, TIBC, Transferrin, Ferritin, Plasma haemoglobin, Vit.B12, Folic acid, FIGLU test, Schilling test, Parietal cell antibodies, G-6-PD, Osmotic fragility test, Heinz bodies, Perls Prussian staining, Platelet count, Platelet aggregation test, PT, INR APTT, Mixing experiments in PT and APTT, Thrombin time.	<b>10</b>

**Suggested Readings:**

1. Mukherjee .L.K (2017), Medical Laboratory Technology, Vol.1-3,3<sup>rd</sup> Edition, Tata Mcgraw Hill.
2. Sood Ramnik, (2015), Text book of Medical Laboratory Technology, 2<sup>nd</sup> Edition, Jaypee Publications.
3. Wintrobe's Clinical Haematology, (2014),13<sup>th</sup> Edition, Lippincott Williams & Wilkins.
4. De Gruchy's Clinical Haematology in Medical Practice, (2012), 6<sup>th</sup> Edition, Wiley Publications.
5. Dacie & Lewis Practical Haematology, (2011),11<sup>th</sup> Edition, Elsevier Publications.

## MLT 233 (T): MICROBIOLOGY-I

### Learning Objective:

This subject gives a general insight into the history, basics of microbiology and imparts knowledge about equipment used in microbiology. The subject will also provide the fundamental information about different culture media, sterilization methods, stains & identification of microbes.

### Learning Outcome:

This course makes the students to know handling of instruments and sterilization techniques. Also student will learn about the how to isolate, culture, stain & identify microbes by using different culture media.

<b>MICROBIOLOGY-I</b>		
<b>Course Code- MLT 233 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Introduction to Microbiology</b> Development of Microbiology as a discipline, Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Edward Jenner ; Introduction to bacterial taxonomy, Classification of Bacteria, Morphology based on Size, Shape, Arrangement, Motility, Flagella, Spores, Capsules, Cell wall, Plasma membrane, Pili, Ribosomes.	<b>04</b>
<b>UNIT II</b>	<b>Microscopy</b> Study of Compound Microscope – Magnification, Numerical aperture, Resolution and Components of microscope. Dark ground illumination, Care of microscope and Common difficulties Micrometry. Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope.	<b>07</b>
<b>UNIT III</b>	<b>Morphology &amp; Physiology of Bacteria</b> Cell size, shape and arrangement, cell-wall, Composition and Detailed structure of Gram-positive and Gram-negative cell walls, Cell Membrane: Structure, function and chemical composition of bacterial cell membranes. Cytoplasm: Ribosome, Mesosomes, Inclusion bodies, Nucleoid, Chromosome and Plasmids, Endospore: Structure & formation.	<b>07</b>
<b>UNIT IV</b>	<b>Bacteriological Media &amp; Culture Techniques</b> Introduction of culture media; Basic requirements & uses of culture media; Classification of culture media: Based on their Consistency (solid, liquid, semisolid), Based on Constituents/Ingredients (simple, complex, synthetic or defined, special), Based on Oxygen requirement (aerobic & anaerobic media); Indication of culture media; Types of Culture Methods (streak culture, stab culture, pour plate method, broth culture); Anaerobic culture methods: Displacement Method, Chemical or biological method, Reduction of Oxygen; Automated methods (Bactec- blood	<b>08</b>

	culture method).	
<b>UNIT V</b>	<b>Stains used in Microbiology</b> Introduction of stain; Importance of stain in microbiology; Types of stain in detailed giving example- Simple stain, differential stain, negative stain; Impregnation method; Special staining for certain bacteria, bacterial spores, parasites & fungi;	<b>05</b>
<b>UNIT VI</b>	<b>Methods of Identification of Bacteria</b> Brief introduction of how bacteria is identified in pure culture; Identification of the bacterium by staining reactions; Identification of the bacterium by cultural characteristics; Identification by fermentation & other biochemical properties (Sugar fermentation, Litmus milk, Indole production, Methyl Red test (MR), Voges Proskauer test (VP), Citrate utilization test, Nitrate reduction, Production of ammonia, Urease test, Triple Sugar Iron medium); Pathogenicity test into Laboratory Animals.	<b>08</b>
<b>UNIT VII</b>	<b>Sterilization Methods &amp; Microbial Waste Management</b> General safety measures used in Microbiology laboratory, Sterilization and disinfection: Various physical methods of sterilization – heat, UV radiation, ionizing radiation, filtration, characters affecting sterilization, auto clave control and sterilization indicators. Biomedical waste management in a Medical Microbiology laboratory: Types of the waste generated, Segregation, Treatment, Disposal	<b>06</b>

**Suggested Readings:**

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology 8<sup>th</sup> Edition, University Press Publication
2. Adelberg's Medical Microbiology, 26<sup>th</sup> edition. McGraw Hill Publication.
3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4<sup>th</sup> Edition. Elsevier.
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9<sup>th</sup> Edition. McGraw Hill Higher Education

**MLT-234 (T): HISTOPATHOLOGY & HISTOTECHNIQUES-I**

**Learning Objective:**

Students will learn about various histotechniques, handling and processing of tissue specimens as well as staining procedures.

**Learning Outcome:**

Students would be able to carry out tissue processing and general staining procedures.

<b>HISTOPATHOLOGY &amp; HISTOTECHNIQUES-I</b>		
<b>Course Code-</b>		<b>(03 Credits)</b>

<b>MLT-234 (T)</b>		<b>3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Introduction to Histopathology</b> Introduction of Histopathology, Cytology & Histotechniques, Laboratory organization, Care & Maintenance of equipments used in Histotechnology lab; Safety measures in histopathology lab, Reception, Recording, Labelling and transportation of tissue specimens; Basic concepts of fixation and various types of fixative used in histopathology and cytopathology.	<b>08</b>
<b>UNIT II</b>	<b>Tissue Processing</b> Tissue and its types, Location and function, Grossing of tissues, whole mount, Sections, Smears, Tissue processing and its steps, Manual and Automated method, Components & Principle of Automatic Tissue Processor; Decalcification, Decalcification methods, Types of decalcifying fluid, Processing of bones and teeth, Embedding media, its type and properties.	<b>07</b>
<b>UNIT III</b>	<b>Microtomes &amp; Section Cutting</b> Introduction; Types of Microtome – Sliding or Base Sledge Microtome, Rocking Microtome, Rotary Microtome, Freezing Microtome; Principle & Working of microtome, Maintenance of Microtome; Parts and types of Microtome knife; Sharpening and maintaining Microtome Knives – Honing, Stropping. Techniques of section cutting - Requirements, Methods of section cutting; Faults occurring during section cutting and their remedies.	<b>07</b>
<b>UNIT IV</b>	<b>Cryostat</b> Cryostat, Frozen sections of fresh, fixed and unfixed tissue, Freeze drying, Rapid frozen sections and Staining for emergency diagnosis	<b>05</b>
<b>UNIT V</b>	<b>Basic and Acid Dyes</b> Terms related to dyes- Mordant, Amphophilic, Neutrophilic, Metachromatic; Methods of staining - Acid phosphatase, Alkaline phosphatase, Azocarmine, Berlin blue, Bielschowsky's silver method, Bodian silver method, Cajal's silver stain, Chrome Hematoxylin and phloxin, Hematoxylin & Eosin, Wright's blood stain.	<b>05</b>
<b>UNIT VI</b>	<b>Staining Procedures &amp; Controls</b> Progressive, Regressive, Vital, Supravital Staining, Types of hematoxylin, Haematoxylin and Eosin staining, Use of control sections in tissue staining-Van Gieson's stain for collagen fibers, Alkaline Congo Red stain for amyloids, Periodic Acid Schiff's stain (PAS) for carbohydrates, Masson's Trichrome stain for collagens. Mounting and mounting media, advantages & disadvantages, refractive index	<b>08</b>
<b>UNIT VII</b>	<b>Collection &amp; Processing of Cytological Specimen</b> Introduction; Collection – Fine Needle Aspiration Cytology	<b>05</b>

	(FNAC); Processing - Preservation, Fixation, Preparation of Smear for Microscopic study.	
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**Suggested Readings:**

1. Bancroft's Theory and Practice of Histological Techniques, 7<sup>th</sup> Edition, Elsevier Publications.
2. Harshmohan (2017), Textbook of Pathology, 7<sup>th</sup> Edition, Jaypee Publications.
3. Godkar.B. Praful,(2016) Textbook of MLT,3<sup>rd</sup> Edition, Bhalani Publications.
4. C F A Culling,(1974),Handbook of Histopathological and Histochemical Techniques: Including Museum Techniques,3<sup>rd</sup> Edition, Butterworths Publishers.

**ON JOB TRAINING**

**MLT-235 P (OJT): PRACTICAL CLINICAL HAEMATOLOGY-I**

<b>PRACTICAL CLINICAL HAEMATOLOGY-I</b>		
<b>Course Code- MLT-235 P (OJT)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	Anticoagulant Vial preparation.	
2	Preparation of blood smears.	
3	To perform osmotic fragility test (OFT).	
4	Qualitative test for ABO grouping with antisera by slide method & tube method.	
5	Qualitative test for Determination of D (Rho) antigen on human R.B.C.by slide method & tube method.	
6	Preparation of bone marrow smears for microscopic examination.	
7	Determination of ESR by Westergeren's method.	
8	Demonstration of Hypochromic Microcytic slide.	
9	Determination of Glucose-6-Phosphate Dehydrogenase.	
10	Differential Leucocyte Count.	
11	Demonstration of toxic granulation of neutrophil.	
12	To perform Prothrombin Test and Calculate International normalised ratio (INR).	
13	To perform Activated Partial Thromboplastin Time (APTT) Test.	
14	To perform Sickling Test.	
15	To perform Reticulocyte Count.	
16	To perform Direct Coomb's Test.	
17	To perform Indirect Coomb's Test	
18	To perform Haemoglobin electrophoresis.	

**MLT-236 P (OJT) - PRACTICAL'S IN MICROBIOLOGY-I**

<b>PRACTICAL'S IN MICROBIOLOGY-I</b>		
<b>Course Code- MLT-236 P (OJT)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	Study of a Compound microscope.	
2	Demonstration of Glassware used in microbiology.	
3	Demonstration of Autoclave and Sterilization of glass wares.	
4	Demonstration of Hot air oven and Sterilization of glass wares.	
5	Study of autoclave, Preparation and Sterilization of Nutrient broth and agar.	
6	Subculturing of a bacterial strain in Liquid and Solid medium	
7	Study of growth of <i>E.coli</i> by a spectrophotometer.	
8	To perform Gram staining & study morphology of bacterial cells.	
9	Demonstration of Acid fast staining (Ziehl Neelsen staining)	
10	Demonstration of bacterial capsule by negative staining. ( india ink method)	
11	Demonstration of bacterial motility by hanging drop preparation	
12	Isolation of microorganism by streak method	
13	To perform following Biochemical test- a) IMVic test b) Catalase test c) Coagulase test d) Oxidase test e) Gelatin liquefaction test f) Urease tes	
14	Staining of bacterial spores.	

**MLT-237 P (OJT): PRACTICAL'S IN HISTOPATHOLOGY & HISTOTECHNIQUES-I**

<b>PRACTICAL CLINICAL HAEMATOLOGY-I</b>		
<b>Course Code- MLT-237 P (OJT)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	Demonstration of Glass wares and Equipment used in Histopathology lab.	
2	To prepare Alcohol of different concentration.	
3	To prepare Formalin from Stock solution.	
4	Preparation of Fixatives and fixation of Tissues.	
5	To sharp knife by Honing and Stropping.	
6	Grossing of Tissues.	
7	To perform Tissue processing by manual method for Staining.	
8	To perform Section Cutting of Paraffin Embedded Tissues.	
9	To fix the Smear on glass slide.	
10	To perform Hematoxylin and Eosin staining.	
11	To perform PAS staining.	
12	Mounting and preservation of slide.	

### MLT-238 P (OJT): PROJECT

PROJECT		
<b>Course Code- MLT 238 P (OJT)</b>	Students are expected to perform skill based activity/practical work equivalent to 60 hours. Survey, lab work, presentation etc. may be carried out with prior permission of the faculty member. Work carried out here should be equivalent to 30 Hrs.	<b>04 Credits (60 Hrs)</b>

### MLT 239 P (OJT): INTERNSHIP

INTERNSHIP		
<b>Course Code- MLT 239 P (OJT)</b>	Students are expected to work at any pathology lab and give a detailed report of the same. Work carried out here should be equivalent to 30 hours.	<b>02 Credits (30 Hrs)</b>

## SECOND YEAR SEMESTER IV

### MLT-241(T): PATHOLOGY-II

#### *Learning Objective:*

Student will learn about the fundamental techniques of haematology, blood banking and automation.

#### *Learning Outcome*

Students will be able to perform the various types haematological tests and able to use automated instruments.

PATHOLOGY-II		
<b>Course Code- MLT-241 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Haemoglobinometry</b> Hemoglobin: Definition, function, structure, various methods of estimation - Sahli's, CMG, oxyhemoglobin, specific gravity method etc., Clinical significance of Hb estimation, Hemocytometry: Neubour counting chamber-structural detail & application, Hb pipette, RBC and WBC pipette - structure & application. Counting of RBCs, WBCs & Platelets - Principle, requirements, specimen, procedure, calculation, precautions, normal values and clinical significance. Differential Leucocytes Count (DLC): Principle, requirements, specimen, procedure, precautions, normal values and clinical significance. Significance of complete blood count (CBC) & peripheral blood smear	<b>10</b>

<b>UNIT II</b>	<b>Red Cell Indices</b> Significance and estimation. Determination of packed cell volume (PCV) or Hematocrit (Hct) value - various methods & clinical significance. Erythrocyte Sedimentation Rate (ESR) - wintrob's, westergreen's & automated methods & clinical significance	<b>08</b>
<b>UNIT III</b>	<b>Hemostasis</b> Determination of bleeding time (BT), Clotting time (CT), prothrombin time (PT) & activated partial prothrombin time (APTT) - various methods, principle, procedure of methods & clinical significance.	<b>08</b>
<b>UNIT IV</b>	<b>Blood Group System</b> Introduction to human blood group system, ABO grouping antigens on red cell, antibodies to ABO antigens. Rh System: Rh antigens & Rh antibodies & its significances. Antisera used in ABO grouping procedures. storage & transportation of blood	<b>10</b>
<b>UNIT V</b>	<b>Automation</b> Uses, care & maintenance and calibration of Coulter counter, coagulometer, automatic ESR analyzer, urine analyzer, point of care testing. Pre and Post analytical variables, automation in hematology	<b>09</b>

### **Suggested Readings**

1. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications
2. Singh Tejinder,(2014),Atlas & Textbook of Haematology,3rd edition,Avichal Publications
3. Ochei J & Kolhatkar A(2000),Medical Laboratory Science: Theory & Practice, 3rd edition,Mcgraw Hill Education
4. Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata Mcgraw Hill
5. Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, Jaypee Publications

## MLT-242(T): CLINICAL HAEMATOLOGY-II

### Learning Objective

Understanding of the various haematological disorders.

### Learning Outcome

Students will be able to understand and differentiate between various acute and chronic haematological disorders.

CLINICAL HAEMATOLOGY-II		
Course Code- MLT-242 (T)		(03 Credits) 3Hrs/Week
Unit No	Content	Total Hrs-45
UNIT I	<b>Anaemia</b> Definition, classification, clinical features. Introduction, causes & lab. diagnosis of -Iron deficiency anemia, Megaloblastic anemia, aplastic anemia, sickle cell anemia - sickling test & thalassemia.	08
UNIT II	<b>Hemoglobinopathies</b> Qualitative and Quantitative Sickle cell anaemia, sickle cell trait, etiology, pathogenesis, clinical features, and laboratory investigations, Disease management and prognosis, Sickling test Thalassaemia, classification, etiology, pathogenesis, clinical features, laboratory investigations, haemoglobin electrophoresis	10
UNIT III	<b>Leukemia</b> Definition, classification & cause & clinical features. Introduction & laboratory diagnosis of AML, CML, ALL & CLL, its etiology, clinical features, laboratory investigations.	7
UNIT IV	<b>Blood Clotting</b> Qualitative and quantitative blood clotting disorders, hypercoagulable test, Disorders of secondary hemostasis, hemophilia and its lab diagnosis, Disseminated intravascular coagulation, thrombosis, Disorder of fibrinogen, test for bleeding & coagulation disorders.	10
UNIT V	<b>Diagnosis of Blood Parasites</b> Malaria, Trypanosomes, Filariasis, Leishmania & Preparation of lupus erythromatosus (LE) cell	10

### Suggested Readings

1. Wintrobe's Clinical Hematology, (2014), 13th edition, Lippincott Williams & Wilkins
2. De Gruchy's Clinical Haematology in Medical Practice, (2012), Sixth edition, Wiley Publications
3. Dacie & Lewis Practical hematology, (2011), 11th edition, Elsevier Publications
4. R N Makroo, (2009), Compendium of Trasfusion medicine, 2nd edition, Career Publications

## MLT-243(T): MICROBIOLOGY-II

### Learning Objective

Students will be able to understand the working protocol in microbiology laboratory.

### Learning Outcome

Students will be able to identify different bacteria and fungi in biological samples.

<b>MICROBIOLOGY-II</b>		
<b>Course Code- MLT-243 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Laboratory organization and safety measure</b> Recording of results and quality control in Medical Microbiology Lab. Occurrence of lab infections, route of infections in laboratory, safety measures precaution in use of pathogens in teaching. Sterilization techniques.	<b>05</b>
<b>UNIT II</b>	<b>Host Pathogen Interaction</b> Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections	<b>05</b>
<b>UNIT III</b>	<b>Instrumentation</b> Principle, component, working and maintenance of Autoclave, Incubator, Hot Air Oven, centrifuge, colony counter, etc. Sterilization & Disinfection: Introduction of sterilization & disinfection. Sterilization- Physical & chemical methods. Different disinfectants & their procedure of disinfection. Procedure for sterilization of glasswares, infected materials, plastic materials, culture media & solutions. Process of sterilization in autoclave & hot air oven. Concept of septic & aseptic conditions.	<b>08</b>
<b>UNIT IV</b>	<b>Microbial Specimen Handling</b> Specimen collection from patients, Specimen collection for epidemiological investigations, role of microbiology laboratory in control of nosocomial infection. Antibiotics: Definition, mechanism of action, classification and application, Culture medium used for Antibiotic susceptibility testing, Preparation and standardization of inoculums, Control bacterial strains, Description, morphology, cultural characteristics, pathogenecity, cultural characteristics, clinical features and lab diagnosis of Staphylococcus, Streptococcus, Pneumococcus, Choice of antibiotics MIC and MBC: Concepts and methods for determination Various methods of Antibiotic susceptibility	<b>14</b>

	testing with special reference to Stokes and Kirby-Bauer method	
<b>UNIT V</b>	<b>Pathogenic Bacteria &amp; Fungi</b> Description, morphology, cultural characteristics, pathogenicity, cultural characteristics, clinical features and lab diagnosis of <i>Clostridia</i> , <i>Escherichia coli</i> , <i>Salmonella</i> , <i>Shigella</i> , <i>Proteus</i> , <i>Vibrio</i> , <i>Pseudomonas</i> , <i>Spirocheates</i> , <i>Chlamydia</i> , <i>Actinomyces</i> , <i>Rickettsia</i> , <i>Yersenia</i> , <i>Brucella</i> ,. Introduction of Fungi (Mycology): Definition, general characters and classification Cutaneous mycoses, culture and laboratory test for fungi.	<b>13</b>

### Suggested Readings

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education
5. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013)
6. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
7. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
8. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education

## **MLT-244 (T): HISTOPATHOLOGY & HISTOTECHNIQUES-II**

### Learning Objective

To understand the principle and procedure of cytochemical localization of biomolecules.

### Learning Outcome

Students will be able to perform various techniques of immunohistochemistry for localization of biomolecules.

<b>HISTOPATHOLOGY &amp; HISTOTECHNIQUES-II</b>		
<b>Course Code- MLT-244 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Cytochemical Localization of Carbohydrates</b> Preparation of Schiff reagent, PAS staining, Alcian blue, localization of glycogen. Connective tissue elements, Trichrome staining, muscle fibers, elastic, reticulin fibres, collagen fibres etc	<b>07</b>

<b>UNIT II</b>	<b>Cytochemical Localization of Mineral, Lipid &amp; Enzymes</b> Demonstration and identification of minerals and pigments, removal of pigments/artifacts in tissue sections, cytochemical localization and identification of lipids, localization of enzymes, diagnostic application and the demonstration of phosphatases, dehydrogenases, oxidases and peroxidases, localization of microorganism on tissue specimens, Bacteria, AFB, Actinomyces, spirochetes, fungi	<b>10</b>
<b>UNIT III</b>	<b>Cytochemical Localization of Nucleic Acid</b> Cytochemical localization of nucleic acids, Fixation and staining of bone marrow sample, Processing and section cutting of bones, Techniques in neuropathology: Neurons staining, Myelin.	<b>10</b>
<b>UNIT IV</b>	<b>Electron microscopy</b> Principle and working, fixation, processing and staining of tissue <b>Fluorescence Microscope:</b> Principle and working	<b>08</b>
<b>UNIT V</b>	<b>Immunohistochemistry</b> Principle, types, applications, antigen retrieval, APAAP, PAP Staining.	<b>10</b>

### Suggested Readings

1. Bancroft's Theory and Practice of Histological Techniques, 7th Edition, Elsevier Publications
2. Harshmohan (2017), Textbook of Pathology, 7th edition, Jaypee Publications
3. Godkar.B. Praful, (2016) Textbook of MLT, 3rd edition, Bhalani Publications
4. C F A Culling, (1974), Handbook of Histopathological and Histochemical Techniques: Including Museum Techniques, 3rd edition, Butterworths Publishers.

## ON JOB TRAINING

### MLT-245 P (OJT): PRACTICAL'S IN CLINICAL HAEMATOLOGY-II

<b>PRACTICAL'S IN CLINICAL HAEMATOLOGY-II</b>		
<b>Course Code- MLT-245 P (OJT)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	Staining of bone marrow	
2	To perform sickling test.	
3	To determine foetal haemoglobin.	
4	To perform Heinz bodies	
5	Demonstration of leukemic slides	
6	To perform LAP scoring	
7	To determine total platelet count	
8	To perform PT	
9	To perform APTT	
10	To perform thrombin time.	

11	To perform D-dimer test.
12	To determine fibrinogen conc.
13	General Blood smear
14	To demonstrate malarial slide
15	Demonstration of hemoparasites like trypanosomes , Filaria, Malaria

**MLT-246 P (OJT): PRACTICAL'S IN MICROBIOLOGY –II**

<b>PRACTICAL'S IN CLINICAL HAEMATOLOGY-II</b>		
<b>Course Code- MLT-246 P (OJT)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	Demonstration of Autoclave and sterilization of media	
2	Demonstration of Laminar air flow and media preparation	
3	Preparation of culture plates	
4	Demonstration of Centrifuge.	
5	Demonstration of hot air Oven and sterilization of glassware's	
6	Demonstration of Incubator and preservation of cultures	
7	Preparation of media	
8	Antibiotic sensitivity test.	
9	Microscopic examination of urine	
10	Examination of urine	
11	Examination of sputum	

**MLT-247 P (OJT): PRACTICAL'S IN HISTOPATHOLOGY &  
HISTOTECHNIQUES-II**

<b>PRACTICAL'S IN HISTOPATHOLOGY &amp; HISTOTECHNIQUES-II</b>		
<b>Course Code- MLT-247 P (OJT)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	Grossing of tissue	
2	To perform tissue processing by manual method.	
3	To perform section cutting of paraffin embedded tissue.	
4	To fix the smear on glass slide.	
5	To perform haematoxylin and eosin staining.	
6	To perform PAS staining.	
7	To perform AFB staining.	

### **MLT-248 P (OJT): PROJECT**

<b>PROJECT</b>		
<b>Course Code- MLT 248 P (OJT)</b>	Students are expected to perform skill based activity/practical work equivalent to 60 hours. Survey, lab work, presentation etc. may be carried out with prior permission of the faculty member. Work carried out here should be equivalent to 30 Hrs.	<b>04 Credits (60 Hrs)</b>

### **MLT 249 P(OJT): INTERNSHIP**

<b>INTERNSHIP</b>		
<b>Course Code- MLT 249 P (OJT)</b>	Students are expected to work at any pathology lab and give a detailed report of the same. Work carried out here should be equivalent to 30 hours.	<b>02 Credits (30 Hrs)</b>

**THIRD YEAR SEMESTER V**  
**MLT-351 (T): IMMUNOHEMATOLOGY & BLOOD BANKING**

**Learning Objective**

To understand concept of blood groups, compatibility testing and quality control involved in blood transfusion services.

**Learning Outcome**

Students will be able to understand the basics of blood banking and transfusion.

<b>IMMUNOHEMATOLOGY &amp; BLOOD BANKING</b>		
<b>Course Code- MLT-351 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Blood Group System:</b> Introduction, human blood group system, ABO grouping antigens on red cell, antibodies to ABO antigens. Rh System: Rh antigens & Rh antibodies & its significances. Antisera used in ABO grouping procedures.	<b>06</b>
<b>UNIT II</b>	<b>Blood Grouping Techniques</b> Principal of blood grouping. Forward and reverse ABO grouping & significance. Slide & tube method methods for ABO grouping. Use of gel & beads techniques in blood grouping. Du antigen - testing & significance. Haemolytic disease of newborn (HDN) – introduction & its prevention.	<b>10</b>
<b>UNIT III</b>	<b>Blood Donation</b> Blood bank organization, Introduction & types of donor, Blood donor requirements, Criteria for selection & rejection of donor. Blood Collection: Techniques of collecting blood from a donor, Blood bags & anticoagulants, Instructions given to the donor before & after blood donation. Adverse donor reactions & their remedies.	<b>10</b>
<b>UNIT IV</b>	<b>Testing of Donor Blood</b> Antibodies screening - Coomb's test, AHG reagent. Screening of transfusion transmitted infection (TTI). Bacterially contaminated blood. Storage of blood. Changes in donor blood after storage.	<b>10</b>
<b>UNIT V</b>	<b>Apheresis</b> Indications of hemapheresis, plasmapheresis, plateletspheresis, plasmapheresis Quality control of reagents, equipments, blood components used in transfusion medicine. Role of NACO, Indian Red Cross Society, DGHS and blood transfusion services.	<b>09</b>

**Suggested Readings:**

1. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications
2. Ochei J & Kolhatkar A(2000),Medical Laboratory Science: Theory & Practice, 3rd edition,Mcgraw Hill Education

3. Mukherjee .L.K(2017), Medical Laboratory Technology, Vol.1-3, 3rd edition, Tata Mcgraw Hill
4. Sood Ramnik,(2015), Text book of Medical Laboratory Technology, 2nd edition, Jaypee Publications
5. Wintrobe's Clinical Hematology,(2014), 13th edition, Lippincott Williams & Wilkins

### **MLT-352 (T): Clinical Enzymology & Automation**

**Learning Objective**

To understand comprehensive knowledge of enzymes and automation in Clinical Laboratory.

**Learning Outcome**

Student will be able to understand the function, significance & kinetics of different enzymes. Also able to differentiate between the physiological role of isozymes in different tissues.

<b>Clinical Enzymology &amp; Automation</b>		
<b>Course Code- MLT-352 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Enzymes</b> Definition, Properties, classification, concept of active sites and its general properties, Mode of action of enzymes, Lock and key hypothesis, Koshland's induced fit theory. Factor affecting enzyme activity.	<b>07</b>
<b>UNIT II</b>	<b>Coenzyme</b> Definition, classification, various functions, structure of NAD <sup>+</sup> , NADP <sup>+</sup> , FAD and FMN, PPP. Units for measuring enzyme activity, factors affecting enzyme level in serum/plasma. Clinical assay & its type, kinetic assay and end point assay for the enzymes	<b>10</b>
<b>UNIT III</b>	<b>Enzyme Kinetics</b> The Michaelis-Menten equation and its physiological significances, Enzyme Inhibition, types of inhibitors of enzyme.	<b>07</b>
<b>UNIT IV</b>	<b>Introduction to Isoenzymes</b> Unit for expression of enzyme activity. Principle of assay, procedure and clinical significance of Serum glutamate oxaloacetate transaminase (AST), Serum glutamate pyruvate transaminase (ALT), Lactate dehydrogenase, Alkaline phosphatase and Acid phosphatase,	<b>12</b>
<b>UNIT V</b>	<b>Automation</b> Basic Concepts of Automation, principle, working and maintenance of various clinical chemistry analyzers, point of care testing, Hospital Laboratory Management Learning Outcome: Students would be able to understand contemporary methods and practical approaches that are used in the clinical laboratories for the investigation of the diseased state as well as application of automation in laboratory.	<b>09</b>

### Suggested Readings

1. D M Vasudevan, (2011),Text book of Medical Biochemistry,6th edition Jaypee Publishers
2. M N Chatterjea & Rana Shinde,(2012),Text book of Medical Biochemistry,8th edition,Jaypee Publications
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science
4. Lehninger,(2013),Principles of Biochemistry,6th edition, W H Freeman
5. U Satyanarayan,(2008), Essentials of Biochemistry,2nd edition, Standard Publishers
6. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition,Elsevier Publications
7. Bishop(2013),Clinical Chemistry,7th edition, WileyPublications

## MLT-353 (T): PARASITOLOGY & VIROLOGY

### Learning Objective

To understand the general characteristics, life cycle and laboratory diagnosis of various medically important parasites.

### Learning Outcome

Students will be able to identify various viruses can diagnose several viral diseases with latest biomedical techniques

PARASITOLOGY & VIROLOGY		
Course Code- MLT-353 (T)		(03 Credits) 3Hrs/Week
Unit No	Content	Total Hrs-45
UNIT I	<b>Introduction to Parasitology</b> Description of parasitology and different fields of parasitology; Definition of parasitism, host, vectors, Host parasite relationship, Protozoa: Morphology, lifecycle, pathogenicity, clinical features, lab diagnosis, prophylaxis & treatment of <i>Entamoeba histolytica</i> , <i>Entamoeba coli</i> , <i>Giardia lamblia</i> , <i>Trichomonas vaginalis</i> , <i>Plasmodium vivax</i> , and <i>Plasmodium falciparum</i> ; Difference between <i>P. vivax</i> , <i>P. malariae</i> , <i>P. falciparum</i> and <i>P. ovale</i> . Nematodes: Morphology, lifecycle, pathogenicity, clinical features & lab diagnosis of <i>Ascaris lumbricoides</i> , <i>Trichinella spiralis</i> , <i>Trichuris trichiura</i> , <i>Enterobius vermicularis</i> , <i>Ancylostoma duodenal</i> , <i>Wucheria bancrofti</i> , <i>LoaLoa</i> , <i>Onchocerca volvulus</i> , and <i>Dracunculus medinensis</i> . Helminthes: Difference between Platyhelminthes and Nematelminthes; Morphology, lifecycle, pathogenicity, clinical feature & lab diagnosis of <i>Taenia solium</i> , <i>Taenia saginata</i> , <i>Echinococcus granulosus</i> , <i>Fasciolopsis hepatica</i> , <i>Schistosoma haematobium</i> .	15

<b>UNIT II</b>	<b>Microscopic Observation</b> Macroscopic and microscopic examination of the specimen - Pus, Urine, Stool, Sputum & throat swab; Wet and Dry Mount Techniques - Wet Mount Slide, Dry Mount Slide.	<b>09</b>
<b>UNIT III</b>	<b>Nature and Properties of Viruses</b> Virus host interaction; Virus - Morphology, Structure and Properties, Classification of DNA and RNA Virus, Viroids, Prions, Bacteriophage; Common viral diseases - HIV, Hepatitis virus, Pox virus, Poliovirus, Influenza virus, Mumps, Measles, Herpes virus, Rubella, Respiratory syncytial, Arbovirus prevalent in India, Cytomegalovirus, Prevention & treatment of viral infections.	<b>07</b>
<b>UNIT IV</b>	<b>Epidemiology of Infectious Disease:</b> Introduction; Meaning and definition of Epidemiology - Definition of Infectious Diseases, Sources and Types of Infections; Types of Diseases - Epidemic, Endemic, Pandemic, Control and prevention of diseases.	<b>06</b>
<b>UNIT V</b>	<b>Introduction to Oncogenic Viruses:</b> Types of oncogenic DNA and RNA viruses, concepts of oncogenes and proto-oncogenes, prevention & control of viral diseases, antiviral compounds and their mode of action, interferon and their mode of action, General principles of viral vaccination	<b>08</b>

### **Suggested Readings**

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013)
3. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
4. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
5. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education
6. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
7. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication

## MLT-354 (T): DIAGNOSTIC CYTOLOGY

### Learning Objective

To demonstrate the fixation and staining of cytological specimens.

### Learning Outcome

Students will be able to perform various cytological diagnostic tests.

<b>DIAGNOSTIC CYTOLOGY</b>		
<b>Course Code- MLT-354 (T)</b>		<b>(03 Credits) 3Hrs/Week</b>
<b>Unit No</b>	<b>Content</b>	<b>Total Hrs-45</b>
<b>UNIT I</b>	<b>Cytology</b> Definition and Overview of Cytology - History, Development and Scope of Cytology; Types of cytological specimen and collection. Microscopy: Light, compound, phase contrast, fluorescence.	<b>10</b>
<b>UNIT II</b>	<b>Instruments &amp; Equipment's Used In Cytology</b> Fixation and Fixatives used in cytology, Adhesive and mounting media, Cell block and cytopspin technique, Staining such as PAP, Diff-quick, MGG, H-E, Shorr staining, significance of PAP- HPV, Destaining and restaining of slides, Cover slipping.	<b>10</b>
<b>UNIT III</b>	<b>Cytological Diagnostic Tools</b> Aspiration and exfoliative cytology, Patient preparation, Sample collection, Fixation, Processing and Staining FNAC, collection, processing of sample and staining, on site quick staining procedure	<b>08</b>
<b>UNIT IV</b>	<b>Fluid Cytology</b> Pap staining, Progressive & Regressive, Hormonal cytology in different age groups, Collection and processing of sputum, BAL, CSF, Pleural, peritoneal and pericardial fluid, Gynaecologic sample	<b>07</b>
<b>UNIT V</b>	<b>Immunocytochemistry</b> Sex chromatin demonstration, Introduction of Immunocytochemistry, different markers and its applications, Automation in cytology, Liquid based preparation & automated screening device	<b>10</b>

### Suggested Readings:

1. Bibbo, (1997), Comprehensive Cytopathology, 2nd edition, Saunders Publishers
2. Koss's Diagnostic Cytology, Vol.1 & 2, (2006), 5th edition, Lippincott

## ON JOB TRAINING

### MLT-355 P (OJT): PRACTICAL'S IN CLINICAL ENZYMOLOGY

<b>PRACTICAL'S IN CLINICAL ENZYMOLOGY</b>		
<b>Course Code- MLT-355 P (OJT)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	To perform enzyme estimation of LFT	
2	To perform enzyme estimation of Cardiac profile	
3	Determination of Troponin I	
4	To perform enzyme estimation of Pancreatic disorder	
5	To perform estimation of ACP.	
6	Antenatal profile	
7	Estimation of bicarbonate	
8	Arterial blood gas analysis	
9	Determination of Calcium	
10	Creatinine and urea clearance test	

### MLT-356 P (OJT): PRACTICAL'S IN PARASITOLOGY & VIROLOGY

<b>PRACTICAL'S IN PARASITOLOGY &amp; VIROLOGY</b>		
<b>Course Code- MLT-356 P (OJT)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	Leishman staining for malarial parasites	
2	Demonstration of permanent slide of Trichuris, Ascaris and Hookworm	
3	Saline wet mount for observing ova and eggs of parasites.	
4	Iodine wet mount for observing ova and eggs of parasites.	
5	Concentration of stool samples by floatation method	
6	Zinc sulphate conc. Method for stool sample	
7	Demonstration of various parasites by permanent slides.	
8	Concentration of stool sample by sedimentation method	
9	Serological diagnosis of Leishmania	
10	Aldehyde Chopra test for Kala Azar	
11	To perform HBsAg/ Australia Ag by rapid method	
12	To perform HBsAg by ELISA	
13	To perform HIV Tridot method.	
14	To perform HIV by ELISA	
15	To perform Dengue IgG/IgM	
16	To perform TORCH profile	
17	Demonstration of PCR HBV	
18	Demonstration of PCR HIV Viral load	
19	To perform TB IgG & IgM test	
20	To perform Dengue IgG & IgM test	

## MLT-357 P (OJT): PRACTICAL'S IN DIAGNOSTIC CYTOLOGY

<b>PRACTICAL'S IN DIAGNOSTIC CYTOLOGY</b>		
<b>Course Code- MLT-357 P (OJT)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	Preparation of various cytological fixatives	
2	Preparation of various stains used in cytology	
3	Preparation of smear	
4	To perform PAP staining	
5	To perform Giemsa staining on fluid sample	
6	To prepare cell suspension	
7	Processing of various fluid samples	

## MLT-358 P (OJT): PROJECT

<b>PROJECT</b>		
<b>Course Code- MLT 358 P (OJT)</b>	Students are expected to perform skill based activity/practical work equivalent to 60 hours. Survey, lab work, presentation etc. may be carried out with prior permission of the faculty member. Work carried out here should be equivalent to 30 Hrs.	<b>04 Credits (60 Hrs)</b>

## MLT 359- (OJT): INTERNSHIP

<b>INTERNSHIP</b>		
<b>Course Code- MLT 359 P (OJT)</b>	Students are expected to work at any pathology lab and give a detailed report of the same. Work carried out here should be equivalent to 30 hours.	<b>02 Credits (30 Hrs)</b>

## THIRD YEAR SEMESTER VI

### MLT-361(T): CLINICAL IMMUNOLOGY

#### Learning Objective

To understand serological techniques, autoimmune disorders their markers and vaccines.

#### Learning Outcome

Students will be able to carry out different immunological and serological tests.

CLINICAL IMMUNOLOGY		
Course Code- MLT-361 (T)		(03 Credits) 3Hrs/Week
Unit No	Content	Total Hrs-45
UNIT I	<b>Immunodetection</b> Principle, procedure and applications of Complement fixation test, Immunofluorescence, ELISA, CCIEP, and RIA, SDS-PAGE and Western blotting	10
UNIT II	<b>Accept or Reject Responses</b> Introduction of transplant immunology, graft rejection, tissue typing for kidney and bone marrow transplant, Laboratory test for transplant.	10
UNIT III	<b>Basic Concepts of Autoimmunity</b> Brief knowledge about autoimmune diseases and its markers such parietal cell antibody, anti-sperm antibody, lupus anticoagulants, anti-mitochondrial antibody, ANA, ds DNA, HLA-B27, ASMA, anti CCP	10
UNIT IV	<b>Immunological Disorders</b> Primary and secondary immunodeficiency, SCID, AIDS, Tumour, types of tumours, Various Tumour Markers, their significance and method of estimation.	10
UNIT V	<b>Vaccines</b> Definition, Types, Vaccination schedule and Brief knowledge about 'Extended programme of immunization' (EPI) in India.	05

#### Suggested Readings

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley- Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
6. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

## MLT-362 (T): CLINICAL ENDOCRINOLOGY & TOXICOLOGY

### Learning Objective

To understand hormones secretion, function and hormonal disorders.

### Learning Outcome

Students will be able to understand function of hormones and endocrine disorders.

CLINICAL ENDOCRINOLOGY & TOXICOLOGY		
Course Code- MLT-362 (T)		(03 Credits) 3Hrs/Week
Unit No	Content	Total Hrs-45
UNIT I	<b>Hormones</b> Classification of hormones, organs of endocrine system their secretion and function, regulation of hormone secretion, Mechanism of action	10
UNIT II	<b>Thyroid Function Test</b> Thyroid hormones, biological function, hypothyroidism, hyperthyroidism, Determination of T3, T4, TSH, FT3, FT4, TBG, Disorder associated with thyroid dysfunction.	10
UNIT III	<b>Hormone Profile</b> LH, FSH, TSH, Estrogen, Progesterone, Total Testosterone, Free testosterone, DHEA-S, 17- Ketosteroids, Prolactin, their estimation and clinical significance, reference range, hypo and hyper secretion, Triple Test. Growth hormone, ACTH, Aldosterone, Cortisol their estimation and clinical significance, reference range, hypo and hyper secretion	15
UNIT IV	<b>Introduction of Toxicology</b> , Alcohol poisoning, Lead poisoning, Zinc poisoning, Mercury poisoning drugs abuse, screening procedure for drug screening, Spot tests, hair and urine test,	10

### Suggested readings:

1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition, Elsevier Publications
2. Bishop(2013),Clinical Chemistry,7th edition, Wiley Publications
3. Henry's Clinical Diagnosis and Management by Laboratory Methods,(2011),22nd edition, Elsevier
4. D M Vasudevan, (2011),Text book of Medical Biochemistry,6th edition Jaypee Publishers
5. M N Chatterjea & Rana Shinde,(2012),Text book of Medical Biochemistry,8th edition,Jaypee Publications
6. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science
7. Lehninger,(2013),Principles of Biochemistry,6th edition, W H Freeman.

## MLT-363(T): DIAGNOSTIC MOLECULAR BIOLOGY

### Learning Objective

To understand basics and techniques of molecular biology.

### Learning Outcome

Students will be able to take up future molecular biology challenges and efficiently work in diagnostic molecular setup.

DIAGNOSTIC MOLECULAR BIOLOGY		
Course Code- MLT-363 (T)		(03 Credits) 3Hrs/Week
Unit No	Content	Total Hrs-45
UNIT I	<b>Nucleic Acids</b> DNA, RNA, composition, structure, types, denaturation and renaturation of DNA, chemistry of DNA synthesis, general principles of replication, enzyme involved in DNA replication – DNA polymerases, DNA ligase, primase, telomerase and other accessory proteins	08
UNIT II	<b>Transcription</b> Basic transcription apparatus, Initiation, elongation and termination of transcription, Eukaryotic Transcription of mRNA, tRNA and rRNA, types of RNA polymerases, transcription factors Introduction of translation	10
UNIT III	<b>Nucleic Acid Amplification</b> Nucleic acid amplification testing, PCR, Principle, Types, applications, Thermal cycler, RT PCR, reverse transcriptase PCR, Nested PCR	09
UNIT IV	<b>Blotting techniques</b> Southern blotting and Western blotting. Introduction to chromosomes, its structure and disorder, Karyotyping, Chromosomal studies in hematological disorders (PBLC and Bone marrow), FISH	08
UNIT V	<b>Clinical Diagnosis of Blood Profile with Radioisotopes</b> Radioisotopes and its application in measurement of blood volume, determination of red cell volume and plasma volume, red cell life span, platelet life span, radiation hazards and its prevention disposal of radioactive material. Introduction and applications of Flow cytometry, Stem cell banking, Prenatal Diagnosis	10

### Suggested Readings:

1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition,Elsevier Publications
2. Henry's Clinical Diagnosis and Management by Laboratory Methods,(2011),22nd edition, Elsevier
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science
4. Lehninger,(2013),Principles of Biochemistry,6th edition, W H Freeman

## MLT-364 (T): PROFESSIONAL ETHICS AND VALUES

### Learning Objective:

1. To enable the students to absorb and internalize the Values and Ethical behaviour in the personal and professional lives.
2. To make student recognize the nature of the individual and the relationship between the self and the community.
3. To develop inter personal skills and be an effective goal-oriented leader
4. To create the awareness among students to follow human values.
5. To expose students to right attitudinal and behavioural aspects essential at personal and professional level.

### Learning Outcome:

1. Students would understand the core values that shape the ethical behaviour.
2. Students would aware on professional ethics and human values.
3. Students would be able to handle ethical dilemma in a better way.
4. Students would understand how to restrain themselves from unethical behaviour.
5. This course would increase sense of Social Responsibility among students.
6. It helps to understand risk and safety measures in personal and professional life.
7. Students comprehend their positive role in the technological development of the society.

PROFESSIONAL ETHICS AND VALUES		
Course Code- MLT-364 (T)		(03 Credits) 3Hrs/Week
Unit No	Content	Total Hrs-45
UNIT I	<b>Introduction to Professional Ethics</b> Meaning & Significance of Ethics, Types of Ethics – Personal & Professional Ethics, Code of Professional Ethics – Honesty, Integrity, Unity , Inclusiveness, Self-esteem and self- confidence, Work Culture, Punctuality – Time, Task and Resource management, Problem solving and decision making skills, Interpersonal and Intra personal relationship, Team work-Positive and creative thinking.	13
UNIT II	<b>Perspectives of Professional Ethics E</b> Ethics and Profession, Profession and professionalism, Professional Risks, Professional Accountabilities, Professional Success,. Issues in Professional Ethics.	12
UNIT III	Meaning & Significance of Human Values, Classification of Values, Personal, Social & Ethical Values, Rights & Duties envisioned in Indian Constitution.	10
UNIT IV	<b>Dimensions of Human Values</b> Concept of Human Rights, Environment and Ecological balance, Social Evils & their prevention.	10

### Suggested Readings

1. R. R. Gaur, R Sangal, G.P. Bagaria, *A Foundation course in Human Values and Professional Ethics*, Excel Books, New Delhi, 2010

2. B L Bajpai, *Indian Ethos and Modern Management*, New Royal Book Co. Lucknow, 2008
3. P L Dhar, RR Gaur , *Science and Humanism*, Commonwealth Publisher, 1990
4. A N Tripathy, *Human Values*, New Age International Publishers, 2003
5. Jayshree Suresh & Raghavan B S , *Human Values and Professional Ethics*, S Chand Publications.
6. Elizabeth P Tierney, *Ethics in Workplace*, Oak Tree Press.
7. Fritz Allhoff, *Business Ethics : Fairness and Justice in the workplace* – Vol. 2 of Business Ethics, Sage Publications, 2005
8. R. S. Naagarazan, *A textbook on Professional Ethics & Human Values*, New Age International Publishers, 2006
9. R Subramaniam, *Professional Ethics*, Oxford Publications, New Delhi
10. S B Gogate, *Human Values and Professional Ethics*, Vikas Publishing House Pvt. Ltd, Noida
11. Prof. D R Kiran, *Professional Ethics and Human Values*, Tata McGraw-Hill, 2013

### **ON JOB TRAINING**

#### **MLT 365 P (OJT): PRACTICAL'S IN CLINICAL ENDOCRINOLOGY & TOXICOLOGY**

<b>PRACTICAL'S IN CLINICAL ENDOCRINOLOGY &amp; TOXICOLOGY</b>		
<b>Course Code- MLT 365 P (OJT)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	To determine T3 conc. in serum sample.	
2	To determine T4 conc. in serum sample.	
3	To determine TSH conc. in serum sample.	
4	To determine LH conc. in serum sample.	
5	To determine FSH conc. in serum sample.	
6	To determine Prolactin conc. in serum sample.	
7	To determine TSH conc. in serum sample.	
8	To perform TRIPLE test.	
9	Demonstration of male and female infertility test.	
10	Beta human chorionic gonadotropin (HCG).	

**MLT 366 P (OJT): PRACTICAL'S IN ADVANCED DIAGNOSTIC  
TECHNIQUES**

<b>PRACTICAL'S IN ADVANCED DIAGNOSTIC TECHNIQUES</b>		
<b>Course Code- MLT-366 P (OJT)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	To perform separation of amino acids by paper chromatography	
2	To perform separation of amino acids by thin layer chromatography	
3	To perform separation of DNA by Agarose gel electrophoresis.	
4	Separation of protein by PAGE	
5	Separation of protein by paper electrophoresis	
6	Separation of haemoglobin	

**MLT 367 P (OJT): PRACTICAL'S IN DIAGNOSTIC MOLECULAR  
BIOLOGY**

<b>PRACTICAL'S IN DIAGNOSTIC MOLECULAR BIOLOGY</b>		
<b>Course Code- MLT-367 P (OJT)</b>		<b>(04 Credits) 4Hrs/Week</b>
<b>Sr. No.</b>	<b>Practical</b>	<b>Total Hrs-60</b>
1	Isolation of DNA	
2	Separation of DNA by Agarose gel electrophoresis	
3	Demonstration of thermal cycler and PCR.	
4	HIV test by Western Blotting	
5	To perform karyotyping	
6	Demonstration of PCR HLA B-27	
7	Demonstration of PCR HIV	
8	Demonstration of PCR MTB	

### **MLT 368 P (OJT): PROJECT**

<b>PROJECT</b>		
<b>Course Code- MLT 368 P (OJT)</b>	Students are expected to perform skill based activity/practical work equivalent to 60 hours. Survey, lab work, presentation etc. may be carried out with prior permission of the faculty member. Work carried out here should be equivalent to 30 Hrs.	<b>04 Credits (60 Hrs)</b>

### **MLT 369 P (OJT): INTERNSHIP**

<b>INTERNSHIP</b>		
<b>Course Code- MLT 369 P (OJT)</b>	Students are expected to work at any pathology lab and give a detailed report of the same. Work carried out here should be equivalent to 30 hours.	<b>02 Credits (30 Hrs)</b>