



PONDICHERY UNIVERSITY
Puducherry– 605 014.

**BACHELOR OF SCIENCE IN MEDICAL LABORATORY
TECHNOLOGY**
*** BSc. (MLT) ***

**BACHELOR OF SCIENCE IN MEDICAL LABORATORY
TECHNOLOGY (LATERAL ENTRY)**
BSc. MLT (L.E)

SYLLABUS AND REGULATIONS

PROPOSED FROM 2020-21

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PONDICHERRY UNIVERSITY

Puducherry

REGULATIONS OF THE UNIVERSITY

I. SHORT TITLE AND COMMENCEMENT

These regulations shall be called “**THE REGULATIONS FOR THE BACHELOR OF SCIENCE IN MEDICAL LABORATORY TECHNOLOGY / BACHELOR OF SCIENCE IN MEDICAL LABORATORY TECHNOLOGY(Lateral Entry) OF PONDICHERRY UNIVERSITY, Puducherry**”.

They shall come into force from the academic year **2020-21 Session**.

The regulation and syllabi are subject to modifications by the standing Under Graduate Board of Studies for medical laboratory technology courses from time to time.

Philosophy

Medical laboratory technology is the branch of Science which deals with the diagnostic and prognostic process of disease in living matter in its different phase of activity. The subject encompasses the study of the chemical nature of all living matter from the smallest virus and microorganisms to the most complete and highly evolved human being.

This course being Medical Laboratory Technology, involves the study of most of the basic medical subjects with more emphasis given to Clinical Pathology, Microbiology and Biochemistry. Besides the study of relationship of human being and its environment through digestion, absorption and excretion, the process by which other absorbed materials are utilized for by systematic reactions leading to growth and replenishment of tissues and the multiplication of the cell and species is also included. The metabolic breakdown of food to supply energy for all the above process. The mechanism which regulates all these process with precession by means of hormonal and neuro-regulatory stimuli.

In today's modern technology the diagnosis, treatment and prognosis of various diseases depends upon the results of investigations carried out in a Clinical laboratory. As modern medicine becomes more of a team effort, the Medical Laboratory Technologist is a crucial member and integrated part of medical team.

Keeping the above philosophy in mind, the Course is designed with the following aim and objectives.

Aim:

To provide holistic knowledge about clinical care, communication, membership of a multidisciplinary health care team, which is committed to professional excellence, social accountability, leadership quality about lifelong learning.

Objectives:

- Provide the didactic and clinical expertise necessary to acquire knowledge in clinical laboratory science and general education subjects.
- Ensure upon completion that the graduated students have the ability not only to perform all the laboratory testing procedures proficiently but also have technical expertise in evaluation of the reagents and kits for diagnostic suitability
- Make the students competent in the analysis and interpretation of various laboratory tests and also maintaining the quality control for reliability of laboratory reports.
- Produce an understanding in the student about the importance of continuing education and professional awareness.
- Provide a sense of responsibility and professionalism when interacting with patients, peers, fellow employees and other health care provider.
- Instill the importance of honesty, work ethics and professionalism in the work place.

II. REGULATIONS

1. ELIGIBILITY FOR ADMISSION:

B.Sc MLT

Candidates should have a pass in the Higher Secondary Examination (academic) conducted by the Board of Higher Secondary Examination of Tamil Nadu, or any other equivalent examination accepted by the University, thereto with a minimum of 50% marks (40% marks for SC, ST, MBC and OBC candidates) in Part-III subjects of Physics, Chemistry & Biology/Botany & Zoology or physics, foundation science and medical laboratory assistance course and should have English as one of the subjects.

B.Sc MLT (Lateral Entry)

Candidates should have a pass in 2 year Diploma in Medical Laboratory Technology from a institute recognized/ affiliated to an University or Board of Medical Education with a minimum of 50% marks (40% marks for SC, ST, MBC and OBC candidates). Students to be admitted under Lateral Entry shall be 10% over and above the sanctioned intake.

AND

Candidates should have a pass in higher secondary (10+2) with Part-III subjects of Physics, Chemistry & Biology/Botany & Zoology or Physics, Foundation science and Medical laboratory assistance course and should have English as one of the subjects

2. DURATION OF THE COURSE AND COURSE OF STUDY:

B.Sc. MLT

The period of certified study and training of the BSc(MLT) degree course shall be of Three academic years consisting of six semesters.

B.Sc. MLT (Lateral Entry)

The period of certified study and training of the BSc(MLT) (lateral entry) degree course shall be of Two academic years consisting of four semesters

3. MEDIUM OF INSTRUCTION:

English shall be the medium of instruction for all the subjects of study and for examinations of the Course.

4. MINIMUM WORKING DAYS IN AN ACADEMIC YEAR:

Each academic year shall consist of not less than 180 working days with a minimum of 90 working days per semester.

5. REGISTRATION:

A Candidate admitted into B.Sc. (MLT)/ B.Sc. MLT (Lateral Entry) Degree course in any one of the affiliated institutions of the PONDICHERRY UNIVERSITY, Puducherry shall submit the prescribed application form for registration duly filled along with prescribed fee and declaration in the format, to the Academic Officer of this University through the affiliated institution within 60 days from the cut-off date prescribed for admission.

6. ATTENDANCE REQUIRED FOR APPEARING EXAMINATION:

- a) Examination will be conducted in both theory and practical as prescribed. Candidates will be permitted to appear for the University Examinations in the subject, only if they secure not less than 80% of attendance in each subject of the respective semester / year.
- b) A student who does not meet the minimum attendance requirement in a semester or year must repeat the course along with the next batch of students.

7. CONDONATION FOR LACK OF ATTENDANCE:

Condonation of shortage of attendance in aggregate up to 10% (between 70% and 80%) in each semester may be granted by the College Academic Committee and as per the regulations of University.

8. INTERNAL ASSESSMENT:

Internal assessment will be done in each subject of study and the marks will be awarded to the candidates as detailed in the scheme of examinations. The marks awarded will be on the basis of the candidate's performance in the periodic continuous internal assessment test, assignments, class tests, laboratory work, preparation and presentation of seminars as assessed by the teachers. There will be no improvement on internal assessment and there will be no minimum prescribed marks for the Internal Assessment.

9. EXAMINATIONS:

- a) The University Examinations will be conducted in the semester pattern for all the years, each year consisting of two semesters.
- b) The particulars of subjects for various examinations and distribution of marks are detailed in the Scheme of Examination.
- c) The examination for the main subjects will be conducted by the University and the marks for the non-examination subjects will be awarded by the subject handling faculty and forwarded to University by the concerned college.

- d) The Pondicherry University Practical Examinations shall be jointly conducted by one internal and one external examiner duly appointed by the University.
- e) The faculty who had handled the subject/the faculty in-charge of the respective subject shall be the internal examiner.

10. ELIGIBILITY / MAXIMUM DURATION FOR THE AWARD OF THE DEGREE:

- a) The candidates shall be eligible for the Degree of “Bachelor of Science in Medical Laboratory Technology” / “Bachelor of Science in Medical Laboratory Technology (Lateral Entry)” when they have undergone the prescribed course of study for a period of not less than three years /two years in an institution approved by the University and have passed the prescribed examinations in all subjects.
- b) The maximum period to complete the course successfully should not exceed a period of 6 years for B.Sc. MLT and 4 years for B.Sc. MLT(lateral entry)

11. MARKS QUALIFYING FOR A PASS:

a). Candidate has to pass separately in theory + Viva voce and Practical by getting a minimum of 50% marks in the combined internal assessment and University examination. It is further subject to the condition that candidate should obtain minimum of 40% marks in University theory examination, 50% marks in University Practical.

b). Candidate should secure 50% of total marks in the test conducted by the college for the non-examination subjects.

c). If a candidate fails in *only in theory he / she need not reappear for the practical examination. If a candidate fails only in practical he/she has to reappear for both theory and practical examination. If a student absents himself / herself in either theory or practical or both. He/ she has to appear / reappear for both theory and practical.*

12. DECLARATION OF CLASS:

- A successful candidate obtaining 75% and more marks in the grand total aggregate in the first attempt shall be declared to have passed with **Distinction**.
- A successful candidate obtaining 60% and more but less than 75% of marks in the grand total aggregate shall be declared to have passed with **First Class**.
- A successful candidate obtaining 50% and more but less than 60% of marks in the grand total aggregate shall be declared to have passed with **Second Class**.
- Ranks shall be declared on the basis of the aggregate marks obtained by a candidate in the University Examination subjects of the course. Only those candidates who have passed all the subjects in all examinations in the first attempt shall be eligible for the award of **Rank**.

III.COURSE OF INSTRUCTION

B.Sc. MLT

Sl. No	Subjects	Theory (Hrs)	Department Lab (Hrs)	Clinical Lab (Hrs)	Others (Hrs)
Semester- I					
1	Communication and soft skills	60			
2	Computer Applications	30	20		
3	Anatomy	100	80		
4	Physiology	100	80		
5	Library / Self study				30
Total (500)		290	180		30
Semester - II					
1	General Biochemistry	100	30		
2	General Microbiology and Immunology	60	60	180	
3	Lab postings			140	
4	Library / Self study				30
Total (600)		160	90	320	30
Semester - III					
1	Metabolism and Molecular biology	60	60		
2	Systemic and Applied Bacteriology, Virology & Mycology	80	60	190	
3	Parasitology and Entomology	60	60		
4	Medical Law and Ethics	30			
Total (600)		230	180	190	
Semester - IV					

Sl. No	Subjects	Theory (Hrs)	Department Lab (Hrs)	Clinical Lab (Hrs)	Others (Hrs)
1	Clinical Pathology & Blood Banking	60	60	180	
2	Pharmacology	45	60		
3	Environmental Sciences	45	05		
4	Lab postings			145	
	Total (600)	150	125	325	
	Semester - V				
1	Instrumentation Enzymology & Nutrition	60	60	150	
2	Histopathology & Cytology	70	80	180	
	Total (600)	130	140	330	
	Semester - VI				
1	Clinical Biochemistry	75	60	200	
2	Preventive and social Medicine	45	50		
3	Lab postings			100	
4	Medical Laboratory Science Management	30			
5	Library / Self study				40
	Total (600)	150	110	300	40

B.Sc. MLT (Lateral Entry)

Sl. No	Subjects	Theory (Hrs)	Depart- ment Lab (Hrs)	Clinical Lab (Hrs)	Others (Hrs)
	Semester - I				
1	Metabolism and Molecular biology	60	60		
2	Systemic and Applied Bacteriology, Virology & Mycology	80	60	190	
3	Parasitology and Entomology	60	60		
4	Medical Law and Ethics	30			
	Total (600)	230	180	190	
	Semester - II				
1	Clinical Pathology & Blood Banking	60	60	180	
2	Pharmacology	45	60		
3	Environmental Sciences	45	05		
4	Lab postings			145	
	Total (600)	150	125	325	
	Semester - III				
1	Instrumentation Enzymology & Nutrition	60	60	150	
2	Histopathology & Cytology	70	80	180	
	Total (600)	130	140	330	
	Semester - IV				
1	Clinical Biochemistry	75	60	200	
2	Preventive and social Medicine	45	50		
3	Lab postings			100	

Sl. No	Subjects	Theory (Hrs)	Department Lab (Hrs)	Clinical Lab (Hrs)	Others (Hrs)
4	Medical Laboratory Science Management	30			
5	Library / Self study				40
	Total (600)	150	110	300	40

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IV. SCHEME OF EXAMINATION - B.Sc. MLT

Duration of Examination: 3 Hours

Sl. No.	Subjects	UE Max	UE Min	Viva Voce Max	Viva Voce Min	IA Max	IA Min	Total Max.	Total Min
Semester- I									
1.1.1	Anatomy Theory	80	32	20	10	25		125	63
1.1.2	Anatomy Practical	50	25	-		25		75	37
1.1.3	Physiology Theory	80	32	20	10	25		125	63
1.1.4	Physiology Practical	50	25	-		25		75	37
1.1.5	Communication and soft skills					50	25	50	25
1.1.6	Computer Applications					100	50	100	50
Semester - II									
1.2.1	General Biochemistry - Theory	75	30	-		25		100	50
1.2.2	General Microbiology and Immunology - Theory	80	32	20	10	25		125	63
1.2.3	General Microbiology and Immunology - Practical	50	25	-		25		75	37
Semester - III									
2.3.1	Metabolism and Molecular biology - Theory	80	32	20	10	25		125	63
2.3.2	Metabolism and Molecular biology-Practical	50	25	-		25		75	37
2.3.3	Systematic Bacteriology , Virology and Mycology Theory	80	32	20	10	25		125	63
2.3.4	Systematic Bacteriology , Virology and Mycology Practical	50	25	-		25		75	37
2.3.5	Medical Law And Ethics					50	25	50	25

Semester - IV									
2.4.1	Clinical Pathology & Blood Banking - Theory	80	32	20	10	25		125	63
2.4.2	Clinical Pathology & Blood Banking - Practical	50	25	-		25		75	37
2.4.3	Pharmacology Theory	80	32	20	10	25		125	63
2.4.4	Pharmacology Practical	50	25	-		25		75	37
2.3.5	Environmental Sciences	75	30	-		25		100	50
Semester - V									
3.5.1	Instrumentation, Enzymology & Nutrition - Theory	80	32	20	10	25		125	63
3.5.2	Instrumentation, Enzymology & Nutrition - Practical	50	25	-		25		75	37
3.5.3	Histopathology & Cytology - Theory	80	32	20	10	25		125	63
3.5.4	Histopathology & Cytology- Practical	50	25	-		25		75	37
Semester - VI									
3.6.1	Clinical Biochemistry - Theory	80	32	20	10	25		125	63
3.6.2	Clinical Biochemistry - Practical	50	25	-		25		75	37
3.6.3	Preventive and social Medicine - Theory	80	32	20	10	25		125	63
3.6.4	MEDICAL LABORATORY SCIENCE MANAGEMENT					50	25	50	25

B.Sc. MLT (Lateral Entry)

Duration of Examination: 3 Hours

Sl. No.	Subjects	UE Max	UE Min	Viva Voce Max	Viva Voce Min	IA Max	IA Min	Total Max.	Total Min
Semester - I									
1.1.1	Metabolism and Molecular biology - Theory	80	32	20	10	25		125	63
1.1.2	Metabolism and Molecular biology-Practical	50	25	-		25		75	37
1.1.3	Systematic Bacteriology , Virology and Mycology Theory	80	32	20	10	25		125	63
1.1.4	Systematic Bacteriology , Virology and Mycology Practical	50	25	-		25		75	37
1.1.5	Medical Law And Ethics					50	25	50	25
Semester - II									
1.2.1	Clinical Pathology & Blood Banking - Theory	80	32	20	10	25		125	63
1.2.2	Clinical Pathology & Blood Banking - Practical	50	25	-		25		75	37
1.2.3	Pharmacology Theory	80	32	20	10	25		125	63
1.2.4	Pharmacology Practical	50	25	-		25		75	37
1.2.5	Environmental Sciences	75	30	-		25		100	50
Semester - III									
2.3.1	Instrumentation, Enzymology & Nutrition - Theory	80	32	20	10	25		125	63
2.3.2	Instrumentation, Enzymology & Nutrition - Practical	50	25	-		25		75	37

2.3.3	Histopathology & Cytology - Theory	80	32	20	10	25		125	63
2.3.4	Histopathology & Cytology- Practical	50	25	-		25		75	37
	Semester - IV								
2.4.1	Clinical Biochemistry - Theory	80	32	20	10	25		125	63
2.4.2	Clinical Biochemistry - Practical	50	25	-		25		75	37
2.4.3	Preventive and social Medicine - Theory	80	32	20	10	25		125	63
2.4.4	Medical Laboratory Science Management					50	25	50	25

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NORMS FOR CONDUCT OF COURSE

INFRASTRUCTURE :

CLASS ROOMS	:	3 Nos
OFFICE ROOM	:	1 No
AUDIO VISUAL ROOM	:	1 Nos
BIOCHEMISTRY LABORATORY	:	1 No
MICROBIOLOGY LABORATORY	:	1 No
PATHOLOGY LABORATORY	:	1 No
INSTRUMENTATION ROOM	:	1 No
OHP	:	3 Nos
LCD PROJECTOR	:	1 Nos

The college should be affiliated to a hospital laboratory or clinical laboratory where all the equipments mentioned below are available.

INSTRUMENTS / EQUIPMENTS

Pathology Laboratory

1. Microtome
2. Microscope
3. Floatation water bath
4. Hot air oven
5. Weighing balance
6. Automatic knife sharpener
7. Counting chambers
8. Incubator
9. Centrifuge
10. Refrigerator
11. Cell counter*
12. Blood component separator*
13. Freezing microtome*
14. Automatic tissue processor*
15. ELISA reader*
16. ELISA plate washer*

Microbiology Laboratory

1. Autoclave
2. Hot air oven
3. Centrifuge
4. Weighing balance

5. pH Meter
6. Microscopes
7. ELISA reader*
8. ELISA plate washer*
9. Anaerobic jar*
10. Incubator
11. Laminar flow bench*
12. Bunsen burner
13. Automatic loop sterilizer
14. Refrigerator
15. Distilled water plant
16. Water bath
17. Fluorescent microscope

Biochemistry Laboratory

1. Spectrophotometer
2. Colorimeter
3. pH Meter
4. Kinetic photoelectric colorimeter
5. Electronic Weighing balance
6. Vortex mixer
7. Electrophoretic unit
8. Distilled water plant
9. Hot air oven
10. Incubator
11. Centrifuge
12. Water bath
13. Semiautoanalyser
14. Electrolyte analyser
15. Blood gas analyser*
16. Densitometer*
17. PCR machine*
18. Autoanalyser*
19. HPLC*
20. Spectrofluorimeter*
21. Coagulometer*
22. Refrigerator

* Should be available in the affiliated hospital/clinical laboratory

COMMUNICATION AND SOFT SKILLS

Placement- First Semester (B.Sc.MLT)

Time:

Theory: 60 (Hrs)

At the end of the course the student shall:

-Have gained knowledge in applying English as a language for communication.

-Have gained skill in developing good IPR and other etiquettes as applicable in the field of medical laboratory sciences.

THEORY:

UNIT - I (Foundation English)

Sl. No.	CONTENT
1	Review of Grammar
2	Remedial study of Grammar
3	Phonetics
4	Public Speaking

UNIT - II (Writing Skills)

Sl. No.	CONTENT
1	Letter writing
2	Note taking
3	Precise Writing
4	Anecdotal records
5	Diary writing
6	Writing telegrams
7	Preparing Laboratory reports
8	Resume / CV

UNIT - III (Vocabulary)

Sl. No.	CONTENT
1	Medical terminology - roots, prefixes and suffixes
2	Medical abbreviations

UNIT - IV (Communication Skills)

Sl. No.	CONTENT
1	Concepts and principles of good communication
2	Types and process of communication
3	Barriers of communication and how to over come
4	Conversations, discussions, dialogues and sort presentations

UNIT -V (Soft Skills)

Sl. No.	CONTENT
1	Team work
2	Leadership skills
3	Decision making & problems solving
4	Managing time and pressures
5	Self-Management & Attitude

TEXT BOOKS RECOMMENDED

1. Functions of English by Tickoo subramaniam
2. English for Professional Nursing by David (MT)
3. English Grammar and composition by Wren and Martin

TEACHING LEARNING ACTIVITIES

The course content in English will be covered by:

1. Lectures
2. Group Discussion

COMPUTER APPLICATIONS

Placement- First Semester (B.Sc.MLT)

Time:

Theory: 30 (Hrs)

Practical: 20 (Hrs)

At the end of the course the student shall:

- Have gained basic knowledge in the computer hardware.
- Have gained knowledge in the applications of computers in biomedical sciences.

THEORY:

UNIT - I (Introduction to Computers)

Sl. No.	CONTENT
1	Concepts of Computers
2	Hardware and software trends and technology
3	Classification of computers
4	Application of computers in Laboratories

UNIT - II (Operating System)

Sl. No.	CONTENT
1	Introduction
2	Types of operating systems
3	WINDOWS

UNIT - III (Multimedia)

Sl. No.	CONTENT
1	Types and uses
2	Computer aided teaching and testing

UNIT - IV

Sl. No.	CONTENT
1	Introduction to Internet
2	Use of Internet and e- mail
3	Statistical packages

LIST OF PRACTICAL EXERCISES:

1. Computer operating systems like MS-DOS and WINDOWS
2. Study of soft - ware packages like Chem Draw, Tinker and Microsoft package

TEACHING LEARNING ACTIVITIES

The course content in Computer Applications will be covered by:

1. Interactive Lectures
2. Lab

ANATOMY

Placement- First Semester (B.Sc.MLT)

Time:

Theory: 100 (Hrs)

Practical: 80 (Hrs)

At the end of the course the student shall have:

- Gained knowledge on the various terminologies of the subject and basic knowledge of cells, tissues, blood and to understand anatomy of human body.
- An understanding of the structure of organs and organ systems in human body

THEORY:

Sl. No.	CONTENT
1	General Anatomy: Introduction to anatomical terms and organization of the human body. Tissues - Definitions, Types, characteristics, classification, location, functions and formation.
2	Systemic Anatomy: Musculoskeletal system: Bones- types, structure, Axial & appendicular skeleton. Bone formation and growth. Joints - classification and structure. Types and structure of muscles. Movements at the joints and muscles producing movements.
3	Nervous System: Structure of Neuroglia and neurons Parts and classification a). CNS - Structure of Brain and spinal cord and their functions. b). PNS - Cranial nerves & Spinal nerves c). ANS - Sympathetic and parasympathetic
4	Cardiovascular System Circulatory system -Structure of the Heart, Structure of Blood vessels - arterial and venous system. Lymphatic system Gross and microscopic structure of lymphatic tissue
5	Respiratory System Parts, Nasal cavity and Paranasal air sinuses, trachea, Gross and microscopic structure of lungs, Diaphragm and Pleura.
6	Digestive System Parts, Structure of Tongue, Salivary glands, stomach, Intestines, Liver, Pancreas.

Sl. No.	CONTENT
7	Urinary System Parts, Structure of Kidney, Ureters, Urinary bladder and Urethra.
8	Reproductive System Parts of the system. Gross structure of both male and female reproductive organs
9	Endocrine System Gross Structure of Pituitary, Thyroid, Parathyroid, Pancreas, Adrenal glands.
10	Special Senses Structure of Skin , Eye, Nose, Tongue (Auditory and Olfactory apparatus)
11	Anatomical Techniques Embalming of human cadaver, Museum Techniques, Basic principles of Karyotyping.

LIST OF PRACTICAL EXERCISES:

1. Study of Human skeleton
2. Study of all the system with models
3. Histological study of all the systems
4. Hematoxylin and eosin staining of given paraffin section

TEXT BOOKS RECOMMENDED

Latest edition of the following books

1. Human Anatomy by Inderbir singh
2. Ross & Wilson Anatomy & Physiology in Health & illness by Waugh (A)
3. Text book of Human histology by Inderbir singh
4. Theory and Practice of Histological Techniques by Bancroft (JD)
5. Human Genetics by Gangane (SD)

TEACHING LEARNING ACTIVITIES

The course content in Anatomy will be covered by:

1. Interactive Lectures
2. Practical
3. Demonstrations
4. Seminars
5. Assignments

EXAMINATION PATTERN

		<u>Duration</u>
Theory exam: (one paper)	80 marks	3 hours
Practical exam	50 marks	3 hours
Oral exam	20 marks	
Internal assessment (Theory)	25 marks	
Internal assessment (Practical)	25 marks	

	200 marks	

The practical examination will have the following components

Identification of Gross Spotters	20 marks
Identification of Histological slides	15 marks
Routine H & E staining of paraffin section provided.	15 marks

50 marks

INSTRUCTION TO QUESTION PAPER SETTER

SECTION I 40 marks

1. Systemic Anatomy
2. Anatomical techniques

SECTION II 40 marks

1. General Anatomy
2. Systemic Anatomy

PATTERN OF QUESTION PAPER:

Section I:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2 marks)	-	5 X 2 = 10 marks

Section II:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2 marks)	-	5 X 2 = 10 marks

**MODEL QUESTION PAPER
ANATOMY**

TIME: 3 hours

MAX MARKS: 80

SECTION - I

1x 10 =10 marks

1. Mention the different parts of urinary system. Describe the features, and histology of kidney

Or

List the different parts of the digestive system. Describe the feature and histology of liver

2. Write short notes on and FIVE

5 x 4 =20 marks

- a). Stomach
- b). Trachea
- c). Pituitary gland
- d). Embalming fluid
- e). Karyotyping
- f). Hematoxylin & Eosin staining

3. Answer the following:

5 x 2 = 10 marks

- a). Parts of the stomach
- b). Name any two lymphatic organs
- c). Name any two major salivary glands
- d). Name any two organs associated with thymus
- e). what is Bony labyrinth?

SECTION - II

1x 10 =10 marks

4. Mention the organs of respiration. Explain the features and functions of lungs.

Or

List the different parts of the male reproductive system. Describe the feature and histology of testis.

5. Write short notes on any FIVE

5 x 4 = 20 marks

- a). Parts of male reproductive system.
- b). Structure of lymph node
- c). Classification of epithelium with examples
- d).Functional areas of cerebrum
- e). Uterus.
- f). Aorta

6. Answer the following:

5x2 = 10 marks

- a). Blood supply of uterus
- b).Lobes of cerebellum
- c). List the types of muscle
- d). Nerve supply of mastication
- e). Name any two long bones of upper limb

PHYSIOLOGY

Placement- First Semester (B.Sc.MLT)

Time:

Theory: 100 (Hrs)

Practical: 80 (Hrs)

At the end of the course the student shall:

-Have gained sufficient knowledge on function of organs and organ systems in normal human body.

THEORY

A brief account of function will be covered system wise. Main emphasis will be laid on the principles underlying various techniques or procedure to study functions of isolated organs and intact system/ human body.

Sl. No	CONTENT
1	BLOOD: Components, haematocrit, blood volume measurements. RBC and WBC counts, names of developmental stages of RBC, functions and fate of RBC. Basis of blood coagulation. Blood groups - ABO & Rh.
2	MUSCLE: Structure in brief, isotonic and isometric contractions, electrical and mechanical changes, energy sources of muscle contractions, motor unit.
3	GASTRO INTESTINAL TRACT: Various parts of G.I.T their function and secretion, principles of study of secretion and movements of GIT.
4	KIDNEY: Structure of Nephron, mechanism of urine formation. Clearance values of inulin, PAH and Urea.
5	ENDOCRINES: Names of endocrine glands, secretions, functions. Brief account of endocrine disorders.
6	REPRODUCTION: Reproduction cycle in female including menstrual cycle, pregnancy, parturition, lactation. Male sex hormones and spermatogenesis. Basis of contraception.
7	CARDIO VASCULAR SYSTEM: Anatomy of heart, cardiac cycle, heart sounds, definitions of cardiac output, stroke volume, principles of measurements of cardiac output. ECG- methods of recording and complexes. Normal values of blood pressure, heart rate and their regulation in brief.

Sl. No	CONTENT
8	<p>RESPIRATION:</p> <p>Principles of respiration, respiratory muscles, lung volumes and capacities, collection and composition of inspired alveolar and expired airs. Transport of oxygen and carbon dioxide. Brief account of respiratory regulation. Definition of hypoxia, cyanosis, asphyxia. Methods of artificial respiration.</p>
9	<p>NERVE, CENTRAL NERVOUS SYSTEM:</p> <p>Structure of neuron, nerve impulse, myelinated and non-myelinated nerve. Brief account of resting membrane potential, action potential and velocity of nerve impulse. Neuro- muscle transmission. Various parts of nervous system, meninges and C.S.F. Functions of sensory and motor tracts including reflexes, cutaneous receptors, joint receptors, joint receptor sensory pathways. Ascending reticular formation, functions. Functions of cerebellum, basal ganglia, thalamus, hypothalamus and cerebrum.</p>
10	<p>AUTONOMIC NERVOUS SYSTEM:</p> <p>Divisions and functions.</p>
11	<p>SPECIAL SENSES:</p> <p>VISION: Structure of eyeball, retina, visual pathway, accommodation, visual acuity, error of refraction, color vision.</p> <p>HEARING: Brief account external, middle and inner ear, sound analysis, hearing tests.</p> <p>TASTE & SMELL: Receptors, pathways, method of transduction.</p> <p>Vestibular apparatus and functions:</p>

LIST OF PRACTICAL EXERCISES:

1. Study of appliances for amphibian practical.
2. Study of appliances for hematology practical. Making blood smear, staining and use of microscope for identifying blood leucocytes. Preparation of diluting fluids for RBC and WBC counts. Principles of haemocytometry.
3. Working principles and Recording of chest movements with stethograph, ECG, Blood pressure, radial pulse with physiograph.
4. Spirometry - recording of lung volumes and capacities. Collection of expired air in Douglas bag and measurement of volume using gas volume meter. Recording of body temperature, Benedict Roth Apparatus - its use in recording (Oxygen) consumption.
5. Identification of instruments used in study of cardio vascular system, respiratory system, nervous system and special senses.

TEXT BOOKS RECOMMENDED

Latest edition of the following books:

1. Essentials of Medical Physiology by K. Sembulingam
2. Textbook of Medical Physiology by G.K. Pal
3. Review of Medical Physiology by Ganong.
4. Samson Wrights Applied Physiology.
5. Text book of Medical Physiology by Guyton(AC)

TEACHING LEARNING ACTIVITIES

The course content in Physiology will be covered by:

1. Interactive Lectures
2. Group Discussions
3. Practical
4. Demonstrations
5. Seminars
6. Assignments

EXAMINATION PATTERN

		Duration
Theory exam: (one paper)	80 marks	3 hours
Practical exam	50 marks	3 hours
Oral exam	20 marks	
Internal assessment (Theory)	25 marks	
Internal assessment (Practical)	25 marks	

200 marks

The practical examination will have the following components

Practical Major	20 marks
Practical Minor	10 marks
Spotters	20 marks

50 marks

INSTRUCTION TO QUESTION PAPER SETTER

Distribution of course content:

Section I - Nerve, muscle, blood, kidney, GI tract, endocrines and reproduction.

Section II - Cardio vascular system, respiratory system, central nervous system and special senses.

PATTERN OF QUESTION PAPER:

Section I:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2 marks)	-	10 marks

Section II:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2 marks)	-	10 marks

MODEL QUESTION PAPER FOR B.Sc MLT

Physiology

Time: 3 hours

Max marks 80

SECTION I

1x10=10 Marks

1. List and name the hormones of anterior pituitary. Describe in brief the action of these hormones and mention the names of two disorders associated with this gland.

Or

Describe the steps of blood coagulation. Enumerate the tests done to screen bleeding disorders

2. Write short notes on any FIVE

5 x 4=20 Marks

- PAH Clearance and its significance
- Site of production and action of secretin
- Function of leucocytes
- Sarcomere
- Ovulation and its control
- Testosterone

3. Answer the following:

5x2=10 Marks

- Two temporary methods of contraception in females
- Name the organ regulating body temperature
- Name two enzymes present in pancreatic juice
- Write the secretion of Islets of the pancreas
- Name any two clotting factors

SECTION II

4.

10 x1=10 Marks

- a. Define cardiac cycle. Mention the changes occurring in the heart during a cardiac cycle. Describe the physiological basis of measurements of cardiac output.

Or

Describe the various lung volumes and capacities with the help of a spirogram

5. Write short notes on any FIVE:

5 x4 =20 Marks

- Respiratory centres.
- Pathway for pain sensation
- Use of spirometer in respiratory function
- Function of cerebellum
- Tests of hearing
- Short term regulation of Blood Pressure.

6. Answer the following:

5x2=10 Marks

- Name the place where the tricuspid valve is situated
- What is tidal volume
- Name the transmitter released at neuro muscular junction
- Receptors for hearing
- Write two functions of hypothalamus

GENERAL BIOCHEMISTRY

Placement- Second Semester (B.Sc.MLT)

Time:

Theory: 100 (Hrs)

Practical: 30 (Hrs)

At the end of the course the student shall:

-Have gained sufficient knowledge on the chemistry of biomolecules in relation to human metabolism

THEORY (ONLY)

Sl. No.	CONTENT
1	Role of medical laboratory technologists – ethics of laboratory practice. Laboratory safety – Common lab accidents their prevention and their first aid. General laboratory layout as applicable to biochemistry.
2	Laboratory glassware and its uses – Types of pipettes, Calibration of pipettes, Cleaning of glassware.
3	Preparation of solutions – Units of weights and volume, Calculation of concentration and methods of expressing concentration of solution. Types of water their properties, uses and method of production.
4	Basic and elementary concepts of chemistry and properties of carbohydrates as applicable to the human body.
5	Basic and elementary concepts of chemistry and properties of lipids as applicable to the human body
6	Basic and elementary concepts of chemistry and properties of proteins & amino acids as applicable to the human body.
7	Basic and elementary concepts of chemistry and properties of Nucleic Acids as applicable to the human body.
8	Vitamins – Fat soluble vitamins , Water soluble vitamins, Sources, Biochemical role, RDA, deficiency and toxic manifestations
9	Minerals – Calcium, Phosphorous, Iron, Copper, Zinc, Magnesium, Manganese, Iodine.
10	Definition, basic concepts of classification mechanism of action and properties of enzymes, factors influencing enzyme action, enzyme inhibition , regulation and isoenzymes

Sl. No.	CONTENT
11	Nutrition - calorie requirements , qualitative and quantitative requirements , specific dynamic action , BMR, factors influencing BMR , RQ, biological value of proteins , formulation and computation of energy requirements for a medical student , balanced and adequate diets , formulation of diets in health and diseases protein energy malnutrition , obesity , starvation , role of dietary fibre , prescription of diet for DM, renal failure, PEM, liver failure .

TEXT BOOKS RECOMMENDED

Latest edition of the following books:

1. Medical Laboratory Procedure Manual (T-M) by K.L. Mukerjee 1987, Vol.I, II & III
Tata McGraw Hill Publication.
2. Text book of Medical biochemistry by Ramakrishna.
3. Text Book Biochemistry by Vasudevan and Sree Kumari.

EXAMINATION PATTERN

Duration

Theory exam: (one paper)	75 marks	3 hours
Internal assessment (Theory)	25 marks	

	100 marks	

INSTRUCTION TO QUESTION PAPER SETTER

Distribution of course content:

Section I: Sl.No. 1 - 6 of theory portion mentioned

Section II: Sl.No. 7 - 11 of theory portion mentioned.

PATTERN OF QUESTION PAPER:

Section I:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	4 X 5 = 20 marks
Very Short answer (1 to 2 marks)	-	10 marks

Section II:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	3 X 3 = 15 marks
Very Short answer (1 to 2 marks)	-	10 marks

**MODEL QUESTION PAPER
GENERAL BIOCHEMISTRY**

TIME : 3 hours

MAX MARKS: 80

SECTION I

1. Write in detail about sources, biochemical function, RDA, and deficiency manifestation of Vitamin D. **(10 marks)**

Or

Write in detail about sources, biochemical function, RDA, and deficiency manifestation of Vitamin A.

2. Write shorts on any FIVE **(5 x 4=20)**

- a). Features of Peptide Bond
- b). Write the composition and use of Benedicts reagent
- c). Structure of DNA
- d). Cleaning of glass wares
- e). RDA
- f). Thiamine

3. Answer the following: **(5x2=10)**

- a). Name the essential fatty acids.
- b). Mention the aromatic essential amino acid
- c). Define the biological value of protein
- d). List the glass wares used in the biochemistry laboratory
- e). Mention two copper containing proteins and their function

SECTION II

4. Write in detail about sources, biochemical function, RDA, and deficiency manifestation of copper. **(10 marks)**

Or

Write in detail about sources, biochemical function, RDA, and deficiency manifestation of iron.

5. Write shorts on any FIVE **(5 x4 = 20)**

- a). BMR
- b). How blood calcium level is regulated?
- c). Factor influencing enzyme action
- d). Walds visual cycle
- e). specific dynamic action
- f). properties of proteins

6. Answer the following: **(5x2 = 10)**

- a). What is the ring structure present in cholesterol and name two compounds derived from cholesterol
- b). Two Factors influencing iron absorption
- c). Name two copper containing .
- d). what are the functions of zinc
- e). what is competitive inhibition . give example?

GENERAL MICROBIOLOGY AND IMMUNOLOGY

Placement- Second Semester (B.Sc.MLT)

Time:

Theory: 60 (Hrs)

Practical: 60 (Hrs)

Clinical: 180 (Hrs)

At the end of the course the student shall:

This subject gives a general insight into the history, basics of microbiology and imparts knowledge about equipment used in microbiology. This has been formulated to impart basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases. It will provide knowledge of serological techniques, autoimmune disorders their markers and vaccines. This course makes the students to know handling of instruments and sterilization techniques and the students will learn scientific approaches/techniques that are used to investigate various diseases.

THEORY:

UNIT - I GENERAL MICROBIOLOGY

Sl.No	CONTENT
1.	History of microbiology.
2.	Classification and nomenclature of micro-organisms.
3.	Morphology of bacteria. Staining methods
4.	Principle and uses of various microscopes.
5.	Growth and nutrition of bacteria. Culture media and culture methods-aerobic and anaerobic.
6.	Theory and practice of sterilization disinfection antisepsis and asepsis.
7.	Metabolism of bacteria.
8.	Genetics of bacteria including gene cloning and genetic engineering.
9.	Bacterial toxins.
10.	Anti-microbial agents. Antimicrobial susceptibility tests
11.	Quality control and safety in microbiology.
12.	. Identification of Bacteria by <i>biochemical tests</i> and automated systems - Advantages and methods - Bac T Alert and BACTEC systems - VITEK and Phoenix systems -RT-PCR - MALDI-TOF

13.	Sterilisation and disinfection in health care setting - Spaulding's classification -New methods of sterilisation and disinfection -Plasma sterilisation - Biomedical waste management
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UNIT - II. IMMUNOLOGY:

Sl.No	CONTENT
1.	Immunity - innate and acquired immunity, humoral and cell mediated.
2.	<i>Antigen</i>
3.	<i>Antibody</i>
4.	Antigen antibody reactions and their applications
5.	Compliment
6.	Hypersensitivity.
7.	Histocompatibility, Transplantation immunology, Autoimmunity and Tumor immunology.

LIST OF PRACTICAL EXERCISES:

1. Use and care of microscopes.
2. Measurement of microbes by micrometry.
3. Composition and preparation of stains.
4. Simple staining methods and gram stains.
5. Special staining methods – capsule, spore, acid fast, Metachromatic etc.
6. Tests for motility in bacteria.
7. Preparation of media.
8. Using of autoclave hot air oven, other common laboratory equipment etc.
9. Disinfection practices in laboratory and wards.
10. Assay for disinfection.
11. Techniques of cultivation of bacteria.
12. Isolation of bacteria from clinical specimens.
13. Biochemical testing.
14. Serological techniques .
15. Antibiotic susceptibility testing methods.
16. Methods of maintaining stock cultures.
17. Simple assays for endo-and exo-toxins.
18. Handling and care of laboratory animals.
19. Safety in microbiology.
20. Recording of laboratory data and use of computers
21. Serological tests – VDRL, Widal and other febrile agglutination tests, rose-waaler , gel precipitation tests, latex agglutination, passive haemagglutination, neutralization, enzyme-immuno assays etc.
22. skin test – tuberculin etc
23. simple assays for cell medical immunity
24. quality control methods

TEXT BOOKS RECOMMENDED

Latest edition of the following books:

1. Medical Microbiology by R. Cruickshanketal, vol.I ELBS
2. Mackie & McCarty Practical Medical Microbiology,
Edited by J.G.College et al Vol.II , Churchill , Livingstone, London.
 - a. Medical Laboratory Manual for Tropical Countries,
Volume II : Microbiology, by Monica Cheesbrough ELBS.
 - b. Baily & Scott 's Diagnostic Microbiology , Edited by
Sydney M.Finegold, C.V.Mosby Company, London.
 - c. Text book of practical Microbiology by S.C.Parija

TEACHING LEARNING ACTIVITIES

The course content will be covered by:

1. Interactive Lectures
2. Group Discussions
3. Practical
4. Demonstrations
5. Clinical lab postings
6. Seminars
7. Assignments

EXAMINATION PATTERN

		<u>Duration</u>
Theory exam: (one paper)	80 marks	3 hours
Practical exam	50 marks	3 hours
Oral exam	20 marks	
Internal assessment (Theory)	25 marks	
Internal assessment (Practical)	25 marks	

	200 marks	

The practical examination will have the following components:

Spotters	----	10 marks
Hanging drop preparation	----	10 marks
Gram stain	----	10 marks
Media preparation	----	10 marks
Serology	----	10 marks

Total		50 marks

INSTRUCTION TO QUESTION PAPER SETTER

Allocation of syllabus in the two sections and distribution of marks should be as follows:

Section - I: General microbiology (40 Marks)

1. One long answer type 1 x 10 = 10 Marks
2. Five short answer type 5 x 4 = 20 Marks
3. Very Short answer (1 to 2 marks) = 10 marks

Section - II: Immunology(20 marks) , General microbiology (20 Marks)

1. One long answer type 1 x 10 = 10 Marks
2. Five short answer type 5 x 4 = 20 Marks
3. Very Short answer(1 to 2 marks) 10 marks

MODEL QUESTION PAPER IN MICROBIOLOGY
III SEMESTER
GENERAL MICROBIOLOGY AND IMMUNOLOGY

Time: 3 hours

Max. Marks: 80

SECTION - I

1. Describe the structure and functions of bacterial cell with the help of a diagram. **(10 marks)**

Or

Classify sterilization methods and describe in detail most heat sterilization with examples.

2. Write short notes on any FIVE: **(5x 4 = 20)**
- (a) Conjugation
 - (b) Growth curve
 - (c) Florescent microscope
 - (d) Koch's Postulates
 - (e) Anaerobic culture
 - (f) Plasmid

3. Answer the following : **(5 X 2 = 10)**
- (a) Define indicator medium with one example
 - (b) Name two chemical disinfectant and give its uses
 - (c) Define precipitation reaction
 - (d) Give two contributions of Louis Pasteur
 - (e) Negative staining

SECTION - II

3. Define and classify hypersensitivity. Describe the mechanism of delayed hypersensitivity

Or

Describe the mechanism of cell mediated immunity. **(1x 10 = 10)**

5. Write shorts notes on any FIVE: **(5 x 4 = 20)**
- (a) ELISA
 - (b) Passive immunity
 - (c) Structure of IgG
 - (d) CFT.
 - (e) Principles and use of electron microscope
 - (f) Transport media.

6. Answer the following : **(5 x 2 = 10)**
- (a) define active immunity
 - (b) Principle of CFT
 - (c) Name any two antibiotic sensitivity tests
 - (d) Define epitope and paratope
 - (e) What are adjuvants?

METABOLISM AND MOLECULAR BIOLOGY

Placement: (B.Sc.MLT) - Third Semester
B.Sc. MLT (Lateral Entry) First Semester

Time:
Theory: 60 (Hrs)
Practical: 60 (Hrs)

At the end of the course the student shall have:

- Gained sufficient knowledge on the major metabolic pathways occurring occurring in human body
- Understood the central dogma of molecular biology and regulation of gene expression in eukaryotes.

THEORY

Sl. No.	CONTENT
1	Biological oxidation and Electron transport chain: Redox potentials, Biological oxidation, Enzymes and Coenzymes, High Energy compound, organization of electron transport chain, chemiosmotic theory, ATP synthase, inhibitors of ATP synthase.
2	Metabolism of carbohydrates - Digestion and absorption. Glycolysis, glycogenesis, glycogenolysis, TCA cycle, HMP shunt, uronic acid pathway, gluconeogenesis. Metabolism of fructose and galactose. Regulation of blood glucose. Laboratory management of inborn errors in carbohydrate metabolism
3	Metabolism of lipid - Digestion and absorption. Beta-oxidation of fatty acids, biosynthesis of fatty acids. Synthesis and breakdown of cholesterol. Metabolism of lipoprotein. Metabolism of ketone bodies. Laboratory management of inborn errors in lipid metabolism
4	Metabolism of protein and amino acid - Digestion and absorption. Oxidative and non-oxidative deamination, transamination, decarboxylation. Urea cycle, nitrogen balance. Metabolism of sulphur containing amino acids, branched chain amino acids and aromatic amino acids. Laboratory management of inborn errors in protein metabolism
5	Nucleic acid metabolism - origin of constituents in the formation of purines, pyrimidines and nucleotides, regulatory influences, breakdown of purine and pyrimidines, biochemical basis and laboratory diagnosis of gout. Purine salvage pathways, secondary hyperuricemia. Laboratory management of inborn errors in Nucleic acid metabolism
6	Deoxyribonucleic Acid: Structure and Replication Overview of the cell cycle, Watson-Crick model of DNA structure, Chromosomes, DNA replication, DNA damage and Repair mechanisms, Inhibitors of DNA replication
7	Transcription: Types of RNAs, RNA transcription and Post transcriptional processing, Reverse Transcriptase, Inhibitors.

Sl. No.	CONTENT
8	Genetic Code and Translation: Genetic Code, Protein biosynthesis, Post translational modifications, Inhibitors of Proteins synthesis
9	Regulation of gene expression: Mutations, Operon concept, Repression and Derepression, regulation of gene expression in Eukaryotes.

LIST OF PRACTICAL EXERCISES:

1. Use of Analytical balance, preparation of standard solution.
2. Reaction of monosaccharides – glucose, fructose, galactose, mannose, arabinose.
3. Reactions of disaccharides – maltose, lactose and sucrose.
4. Reactions of polysaccharides – starch and dextrans; hydrolysis of starch by acid.
5. Analysis of carbohydrate mixtures.
6. Genral reactions of amino acids.
7. Reactions of Cysteine, cystine, methionine, phenylalanine, tryptophan, tyrosine, histidine, arginine.
8. Analysis of amino acid mixtures.
9. Colour reaction of proteins.
10. Precipitation of proteins (with cations and anions, by acidic and alkaloidal reagents, by concentrated salt solutions and by alcohol
11. Action of mineral acids on albumin and globulins
12. Heat coagulation of albumin and globulins
13. Reactions of casein and gelatin

TEXT BOOKS RECOMMENDED

Latest edition of the following books:

1. Medical Laboratory Procedure Manual (T-M) by K.L. Mukerjee 1987, Vol.I, II & III Tata McGraw Hill Publication.
2. Text book of Medical biochemistry by Ramakrishna.
3. Text Book of clinical chemistry by Norbert Teitz
4. Principles and Techniques of Practical Biochemistry by Wilson and Walker
5. Clinical chemistry – Principle and techniques by RJ Henry, Harper & Row Publishers.
6. Text Book Biochemistry by Vasudevan and Sree Kumari.

EXAMINATION PATTERN

		Duration
Theory exam: (one paper)	80 marks	3 hours
Practical exam	50 marks	3 hours
Oral exam	20 marks	
Internal assessment (Theory)	25 marks	
Internal assessment (Practical)	25 marks	
	----- 200 marks -----	

The practical examination will have the following components

a) Qualitative analysis systematically for identification of substance of biochemical importance	20 marks
b) Spotters	20 marks
c) Demonstration of the presence and /or absence of nutrients in the given sample.	10 marks

	50 marks

INSTRUCTION TO QUESTION PAPER SETTER

Distribution of course content:

Section I: Sl.No.1-4 of theory portion mentioned

Section II: Sl.No. 5-9 of theory portion mentioned.

PATTERN OF QUESTION PAPER:

Section I:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2 marks)	-	10 marks

Section II:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2 marks)	-	10 marks

**MODEL QUESTION PAPER
METABOLISM AND MOLECULAR BIOLOGY**

TIME: 3 hours

MAX MARKS: 80

SECTION I

1. Define gluconeogenesis. Trace the pathway of glucose synthesis from lactate

Or

Explain beta oxidation of palmitic acid and its energetics.

1x10=marks

2. Write shorts on any FIVE

5 x4 = 20)

- a). Regulation of blood glucose
- b). Urea cycle
- c). Metabolism of sulfur containing amino acids
- d). Fatty liver
- e). Significance of HMP shunt pathway
- f). Chemiosmotic theory

3. Answer the following:

(5x2 = 10)

- a). Name any 4 products obtained from glycine
- b). Transamination
- c). Essential fatty acids
- d). Biologically important peptides
- e). Name any 4 high energy compounds

SECTION II

4. Explain double helical structure of DNA with neat diagram

Or

Translation and post translational modifications

(10 marks)

5. Write shorts on any FIVE

(5 x 4 = 20)

- a). Genetic code
- b). GOUT
- c). Regulation of eukaryotic gene expression
- d). DNA repair mechanism
- e). Transcription
- f). Mutation

6. Answer the following:

(5x2 = 10)

- a). Lac operon concept
- b). Oractic aciduria
- c). Okazaki fragments
- d). Salvage pathway
- e). Types of RNA.

SYSTEMATIC & APPLIED BACTERIOLOGY, VIROLOGY & MYCOLOGY

Placement: (B.Sc.MLT) -Third Semester
B.Sc. MLT (Lateral Entry) -First Semester

Time:
Theory: 80 (Hrs)
Practical: 60 (Hrs)
Clinical: 95 (Hrs)

At the end of the course the student shall:

-have gained knowledge about general characters of common pathogenic bacteria, fungi and viruses.

-Students would be able to identify various Bacteria, Fungi and Viruses with latest biomedical techniques and can demonstrate the diseases associated with them.

-Students would be able to understand contemporary methods and practical approaches that are used in the Microbiology laboratories for the investigation of the diseases caused by various bacterial, fungal and viral agents in human beings.

THEORY:

UNIT - I SYSTEMIC AND APPLIED BACTERIOLOGY

Theoretical instruction should include the study of pathogenic bacteria for human beings. Occurrence, epidemiology, morphology, virulence factor, pathology and laboratory diagnosis should be emphasized.

Sl.No	CONTENT
1.	Gram positive cocci - staphylococci , streptococci
2.	Gram negative cocci - Neisseria
3.	Gram positive bacilli - Corynebacterium, Mycobacterium, Actinomy Listeria, Bacillus, Clostridia.

4.	Gram negative bacilli - Enterobacteriaceae, Pseudomonas Alcaligenes, Vibrio, Aeromonas, Plesiomonas, Campylobacter, Bacteroides, Fusobacterium, Brucella, Haemophilus, Bordetella, Pasteurella, Francisella, Spirochaetes, Chlamydia, Rickettsia, Mycoplasma, L forms, etc.
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UNIT - II. VIROLOGY:

Sl.No	CONTENT
1.	General properties of viruses - structure, replication, growth Classification, identification.
2.	Common viral disease - mode of infection, spread. Laboratory Diagnosis - Polio, Influenza, Para influenza, Mumps, Measles, Rubella, Respiratory syncytial, Rhino, Rota, Hepatitis, arbo viruses prevalent in India (Dengue, West Nile, Japanese Encephalitis, KFD), Chicken pox, Adeno, Papova, Herpes, HIV, Cytomegalo viruses, etc.
3.	Elementary knowledge of viral vaccines.
4.	Bacteriophage - Phage typing.
5.	Emerging viral infections: SARS, MERS CoV, Zika, Crimean Congo hemorrhagic Fever, Nipah, Influenza viruses etc.

UNIT - III. MYCOLOGY:

Sl.No	CONTENT
1.	Fundamentals of mycology.
2.	Morphology and identification of contaminant and pathogenic fungi.
3.	Laboratory diagnosis of common superficial, subcutaneous, and deep Fungal infections of man.

LIST OF PRACTICAL EXERCISES:

1. Collection and transportation of clinical specimens.
2. Procedures and tests required in the laboratory diagnosis of the infections caused by the pathogenic bacteria listed above.
3. Examination of urine, stool, etc. for isolation and identification of pathogenic bacteria.
4. Bacteriology of food, water, milk.
5. Preparation and standardization of bacterial vaccines and antiserum.
6. Collection, transportation and preservation of specimens.
7. Isolation and identification of viruses from specimens.
8. Preparation of glassware and media for tissue culture.
9. Preparation and maintenance of tissue culture.
10. Virus isolation in tissue culture and identification.
11. Use of chick embryo – inoculation by various routes.
12. Use of laboratory animals for isolation of viruses, preparation of anti sera and complement, etc.
13. Serological tests in virology.
14. Antigen detection by various techniques.
15. Collection of specimens for fungal examination.
16. Direct KOH examination.
17. Isolation and identification of fungi from clinical specimens.

TEXT BOOKS RECOMMENDED

Latest edition of the following books:

1. Text Book of Parasitology by K.D. Chatterjee, Chatterjee Medical Publishers, Calcutta.
2. Parasitic diseases in man by Richard Knight English Language Book Society (ELBS)
3. Medical Microbiology by R. Cruickshanketal, vol.I ELBS
4. Text book of Medical Parasitology by S.C.Parija

TEACHING LEARNING ACTIVITIES

The course content will be covered by:

1. Lectures
2. Group Discussions
3. Practical
4. Demonstrations
5. Clinical lab postings
6. Seminars
7. Assignments

EXAMINATION PATTERN

		<u>Duration</u>
Theory exam: (one paper)	80 marks	3 hours
Practical exam	50 marks	3 hour
Oral exam	20 marks	
Internal assessment (Theory)	25 marks	
Internal assessment (Practical)	25 marks	

	200 marks	

The practical examination will have the following components

Spotters	10 marks
Gram stain	10 marks
Special stain	10 marks
Fungus identification	10 marks
Bacterial culture identification	10 marks

	50 marks

INSTRUCTION TO QUESTION PAPER SETTER

Allocation of syllabus in the two sections and distribution of marks should be as follows

Section-I: Systematic Bacteriology

1. One long answer $1 \times 10 = 10$ marks
2. Five short answer $5 \times 4 = 20$ marks
3. Very Short answer (1 to 2 marks) 10 marks

Section-II: Applied Bacteriology, Virology and Mycology

4. One long answer $1 \times 10 = 10$ marks
5. Five short answer $5 \times 4 = 20$ marks
6. Very Short answer (1 to 2 marks) 10 marks

Relevance of question to diseases commonly prevalent in India and to practical aspects may be kept in mind.

MODEL QUESTION PAPER
SYSTEMATIC AND APPLIED BACTERIOLOGY, VIROLOGY AND
MYCOLOGY.
IV SEMESTER

TIME: 3 HOURS.

MAX.MARKS: 80

SECTION I

1x 10=10 Marks

1. Describe the laboratory investigations for the diagnosis of a case of enteric fever.

Or

Describe the lab diagnosis of cholera.

2. Write short notes on any FIVE:

5x 4=20Marks

- a). Direct demonstration of *M. tuberculosis* in sputum
- b). Isolation of pathogens from gas gangrene
- c). Preparation of high titre anti sera
- d). Coagulase test
- e). Widal Test
- f). Gram's Staining

3. Answer the following:

5 X2=10 Marks

- a. Name two gram negative cocci and disease caused by it.
- b. Name two bacteria causing food poisoning
- c. Name two bacteria causing UTI
- d. Name two congenitally transmitted diseases
- e. Name two sporulated bacteria

SECTION - II

4. Describe the investigations required for an etiological diagnosis in an outbreak of food poisoning.

1x10=10 Marks

Or

Describe the lab diagnosis on immuno prophylaxis of Rabies.

5. Write briefly on any Five:

5x4=20 Marks

- a). Use of egg in diagnosis of viral disease.
- b). Preparation of a mono layer of monkey kidney cells.
- c). Isolation of fungus in a case of dermatophytosis
- d). Bacteriological examination of water.
- e). Measles
- f). Lab diagnosis of candidial infections

6. Answer the following :

5X2=10 Marks

- (a) What is tube coagulase
- (b) Name any two anaerobic organism
- (c) Name two Dimorphic fungi
- (d) Name two DNA viruses
- (e) Name two diseases caused by Chlamydiae

PARASITOLOGY AND ENTOMOLOGY

**Placement- (B.Sc.MLT)- Third Semester
B.Sc. MLT (Lateral Entry) - First Semester**

**Time:
Theory: 60 Hrs
Practical: 60 Hrs
Clinical: 95 Hrs**

At the end of the course the student shall:

-To learn about introduction, general characteristics, life cycle and laboratory diagnosis of various medically important parasites and Insect vectors.

THEORY

UNIT - I. (PARASITOLOGY)

Sl.No	CONTENT
1.	An elementary study of the types of animal associations parasitism commensalisms and symbiosis. Types of parasites. Classification of protozoan & Helminthes
2.	An elementary knowledge of the structure like history of parasites belonging to the following genera with reference to the forms seen in human pathological material, and the methods used to identify them. i). Protozoa: Entamoeba, Dientamoeba, Iodamoeba, Embadomonas, Trichomonas, Chilomastix, Enteromonas, Trypanosomes, Leishmania, Giardia, Plasmodium, Isospora, Eimeria and Balantidium, Toxoplasma. ii). Platyhelminthes, Diphylobothrium, Sparganum, Taenia, Echinococcus, Hymenolepis, Schistosoma, Fasciola, Fasciolopsis, Clonorchis, Peragonimus. iii). Nematelminthes: Ascaris, Ancylostoma, Necator, Strongloides, Trichinella Enterobius, Trichurias, Wucherei, Brugia, Loa loa, Onchocerca, Dracunculus. More emphasis to be given to the identification of species in general marked in this way.
3.	Collection and preservation of specimens for parasitological examination, preservation of specimens of parasitic eggs and embryos, Preserving Fluids, Transport of specimens
4.	Detection of intestinal parasites: Detection and identification of amoebae and other intestinal protozoa and other parasites.
5.	Examination of Blood parasites: Thick and Thin smears for malaria and Filaria and other parasites. Concentration methods.
6.	Examination of Biopsy material and other body fluids. Brief account of spleen puncture for diagnosis of kalaazar, bone marrow biopsy, lymph node puncture and skin biopsy for parasites. Examination of vaginal swabs.

UNIT - II (ENTOMOLOGY)

Sl.No	CONTENT
1.	Role of Arthropods in the transmission of diseases.
2.	Mosquito: Morphology and Bionomics of Anophales, Culex, Aedes, and Mansonia.
3.	Mosquito - Borne diseases and their control
4.	Phlebotomus : Morphology, Life- History and control
5.	House fly:- Morphology, Life cycle, disease relationship and control
6.	Tse - Tse fly (glossina) Morphology, life - cycle and public health importance.
7.	Fleas: Morphology , Life cycle , disease transmitted and control
8.	Louse: Morphology, Life cycle, disease transmitted and control
9.	Bed Bug: Life cycle and control
10.	Ticks: Morphology, Life cycle, disease transmitted and control
11.	Sarcoptis scabiei: Morphology, life-cycle, public health importance and control
12.	Cyclops and Public Health importance

MODEL QUESTION PAPER IN MICROBIOLOGY
III SEMESTER
PARASITOLOGY AND ENTOMOLOGY

Time: 3 hours

Max. Marks: 80

SECTION - I

(1x 10 = 10)

1. Describe the pathogenesis and laboratory diagnosis of Malaria.

Or

Describe the life cycle and laboratory diagnosis of plasmodium falciparum.

2. Write short notes on any FIVE:

(5x 4= 20)

- (a) Giardia intestinals
- (b) Trichomonas vaginalis
- I NNN medium
- (d) Cultivation of Entamoeba histolytica
- (e) Culex mosquitoes
- (f) Life cycle of Hook worm

3. Answer the following :

(5 X 2 = 10)

- (a) Morphology of egg of Trichuris trichura
- (b) Cyst of Giardia lamblia
- (c) Mode of transmission of hydatid disease
- (d) What is cysticercus cellulosae
- (e) Name the definitive and intermediate host in Taenia solium

SECTION - II

4. Describe the life cycle of Echinococcus granulosus and laboratory diagnosis of hydatid cyst.

Or

Describe the life cycle and laboratory diagnosis of Wuchereria bancrofti.

(1x 10 = 10)

5. Write short notes on any FIVE

(5 x 4 = 20)

- (a) Detection of microfilaria in blood
- (b) Differences between Tick and Flea
- (c) Draw and label the parts of Cyclops
- (d) Larva migrans
- (e) General characters of Trematodes
- (f) Stool concentration Technique

6. Answer the following :

(5 X 2 = 10)

- (a) Name two diseases transmitted by ticks
- (b) Draw a Cyclops and label its parts
- (c) Differences between Culex and Anopheles mosquitoes
- (d) Write briefly about control of fleas
- (e) Define the term reservoir host with two example

MEDICAL ETHICS AND LAW

Placement- (B.Sc.MLT) - Third Semester
B.Sc. MLT (Lateral Entry)-First Semester

Time:
Theory: 30 Hrs

At the end of the course the student shall:

-To understand the gained knowledge on the basics of medical law and ethics in relation to medical laboratory sciences.

THEORY

Sl.No	CONTENT
1.	Medical ethics -Definition-Goal-scope
2	Introduction to code of conduct
3.	Basic principles of medical ethics - confidentiality
4.	Malpractice and negligence - rational and irrational drug therapy
5.	Autonomy and informed consent - right of patients
6.	Care of the terminally ill- euthanasia
7.	Organ transplantation
8.	Medico legal aspects of medical records - Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects
9.	Professional Indemnity insurance policy
10.	Development of standardized protocol to avoid near miss or sentinel events
11.	Obtaining an informed consent.
12.	Ethics in the profession of Medical Laboratory Science

Suggested readings:

1. Medical Law and Ethics by Bonnie F Fremgen
2. Medical Law and Ethics by Jonathan Herring

CLINICAL PATHOLOGY AND BLOOD BANKING

Placement- (B.Sc.MLT) - Fourth Semester

B.Sc. MLT (Lateral Entry)-Second Semester

Time:

Theory: 60 (Hrs)

Practical: 40 (Hrs)

Clinical Lab: 180 (Hrs)

At the end of the course the student shall:

- To prepare the students in basic understanding of the composition of blood, techniques and methods of estimation of different parameters including both manual and automated methods.
- Students will be able to understand blood disorders and its laboratory diagnosis.
- They are also trained to process body fluids samples like urine, semen, CSF, etc.
- The students should be competent to handle routine blood bank organization and its procedures.

THEORY:

UNIT- I

Sl.No	CONTENT
1.	General - Hematology: Origin, development, morphology, maturation, function and fate of blood cells, nomenclature of blood cells.
2.	Various methods of blood collection. Anticoagulants- mechanism and uses.
3.	Hemocytometry and RBC count and polycythemias
4.	Hemoglobinometry. Principles and various methods of quantitating Hb. Errors and quality control in various methods of Hb estimation.
5.	Abnormal hemoglobin and its investigation. Methods of identification of abnormal hemoglobins including spectroscopy, Hb electrophoresis and HPLC. Alkali denaturation test and acid elution test. Sickle cell demonstration methods.
6.	Principles and methods of determining PCV; Calculation and interpretation of red cell indices.
7.	ESR: introduction, factors affecting ESR, principles and methods of determining ESR, increasing and decreasing conditions of ESR.
8.	WBC count - Introduction, diluting fluids. Absolute eosinophil count, errors in sampling, mixing diluting and counting.
9.	Automated Blood cell counters; advantages and disadvantages, uses and principle, quality control in cell counts.
10.	Preparation, Principle and methods of staining of peripheral blood smear. Thin smear, thick smear. Buffy coat smear, wet preparation

Sl.No	CONTENT
11.	Romanowsky stains. Preparation, advantages and disadvantages. Supravital staining and reticulocyte count. Heinz bodies demonstration.
12.	Indications and techniques of bone marrow aspiration. Preparation of Bone marrow smears, Morphologic study of Marrow films and its differential count interpretation including cytochemical stains in differentiation of leukemias.
13.	Peripheral smear examination. Description of morphology of normal and abnormal red cells.
14.	Blood differential WBC counting. Recognition of abnormal cells. Various benign leucocyte reactions- leukocytosis, neutrophilia, eosinophilia, lymphocytosis, basophilia and monocytosis. Infectious mononucleosis. Leucopenias.
15.	Hematological Disorders a. Classification of Anemia: Morphological & etiological. b. Iron Deficiency Anemia: Distribution of body Iron, Iron absorption, causes of iron deficiency & laboratory diagnosis. c. Megaloblastic anemia and Perinicious anemia: causes & diagnosis. d. Hemolytic Anemia: Definition, causes, classification and laboratory diagnosis.
16.	Special investigations in anemia - Ham's test, autohemolysis test, osmotic fragility test, etc
17.	Leukemias- definition, causes, classification and diagnosis of leukemias. Total leucocyte count in leukemias. Multiple myeloma and its laboratory diagnosis.
18.	Disorders of hemostasis and screening tests for bleeding/coagulation disorders. BT, CT, prothrombin time, activated partial thromboplastin time, thrombin time and thromboplastin regeneration time.
19.	Quantitative and qualitative disorders of platelets. Platelet count. Thrombocytopenia, thrombocytosis and thrombocythemia. Platelet function test. Clot retraction test and fibrinolysis test.
20.	LE cells- definition, morphology and various methods of demonstrating LE cells. Blood parasites - demonstration in peripheral and bone marrow smears. Malaria, LD bodies, Microfilaria, etc
21.	Automation and recent advance in hematological techniques.
22.	Clinical pathology: Examination of body fluids for cell count Cerebrospinal Fluid • Collection, transport, preservation, examination, interpretation of total and differential count.
23.	Semen analysis : • Methods of collection, macroscopic and microscopic examination of semen, motility, count, other findings. • Staining and morphological studies of spermatozoa, importance & interpretation including automation technique.

Sl.No	CONTENT
24.	<p>Urine analysis :</p> <p>Collection & preservation of urine Physical, chemical and microscopic examination Examination and identification of sediment for: various cells, crystals, casts and parasites. Urine automation.</p>
25.	<p>Faeces</p> <ul style="list-style-type: none"> • Examination of motion sample for: colour, mucous, consistency, ova, Amoeba, cyst, Parasites, RBCs, etc • Detection of occult blood in stool, measurement of faecal urobilinogen & faecal fat, their importance in interpretations.
26.	<p>Blood banking:</p> <p>General introduction to blood banking. Collection and storage of Blood. Blood bags. Anticoagulant solution used in blood bank.</p>
27.	<p>Screening and selection of donors: Physical and clinical examination. Copper sulphate method for hemoglobin, screening for parasitic infections - malaria, filaria. VDRL test, antibody screening, screening for HBs Ag, HCV and HIV.</p>
28.	<p>Blood group and its inheritance. Laws of Heredity. ABO blood group system with sub groups Rh system Rh antigens & Rh antibodies. Bombay blood group. Diego and I / I system. Du Antigen and their importance. Hemolytic disease of newborn & prevention</p>
29.	<p>Other blood grouping system. MNs blood group system. Lutheran Blood group system. Kell Blood group system, Lewis Blood group system. Duffy Blood group system, Kid blood group system</p>
30.	<p>ABO grouping methods. Principle involved in various methods of blood grouping and factors influencing the results of blood grouping.</p>
31.	<p>Cross matching. Compatibility test, direct and indirect Coomb's test-principle involved and methods used.</p>
32.	<p>Blood Components</p> <p>Techniques of preparation of blood components, storage and its clinical significance. Autologous transfusion.</p>
33.	<p>Blood transfusion and its hazards. Transfusion reactions, principles and methods of investigating transfusion reactions</p>
34.	<p>Maintenance of records and auditing in blood banks.</p>
35.	<p>Quality assurance in blood banking practices.</p>

LIST OF PRACTICAL EXERCISES:

1. Collection of blood – finger prick, venous blood.
2. Preparation of anticoagulants in hematology
3. Determination of Hemoglobin.
4. RBC count.
5. Estimation of packed cell volume. Red cell indices
6. Total WBC count.
7. Absolute eosinophil count.
8. Platelet count by various methods.
9. Bleeding time and clotting time.
10. PT and APTT
11. Preparation of blood smears. Thick, thin and Buffy coat smear preparation.
12. Preparation of Leishman stain and staining of blood smears
13. Differential count of WBC
14. Osmotic fragility of RBC.
15. Reticulocyte count.
16. LE cell preparation
17. Blood bags and preparation of anticoagulant fluids in blood bank.
18. Grouping of blood.
19. Cross matching of blood samples.
20. Coomb's test.

EXT BOOKS RECOMMENDED

Latest edition of the following books:

1. Essentials of hematology by Haufbrand.
2. Practicals in Hematology by J. V. Dacie.
3. Medical Laboratory Technology by Lynch.
4. Wintrobe's clinical hematology.

TEACHING LEARNING ACTIVITIES

The course content in hematology & blood banking will be covered by:

1. Lectures
2. Group Discussions
3. Practical
4. Demonstrations
5. Clinical lab postings
6. Blood donation camps
7. Seminars
8. Assignments

EXAMINATION PATTERN

		<u>Duration</u>
Theory exam: (one paper)	80 marks	3 hours
Practical exam	50 marks	3 hours
Oral exam	20 marks	
Internal assessment (Theory)	25 marks	
Internal assessment (Practicals)	25 marks	

200 marks

The practical examination will have the following components

1. Blood cell counts	10 marks
2. Hb estimation	5 marks
3. Blood grouping	5 marks
4. Cross matching	5 marks
5. DLC	15 marks
6. Spotters	10 marks

50 marks

INSTRUCTION TO QUESTION PAPER SETTER

Section I

Questions from syllabus covering Erythrocyte, leucocytes their abnormalities and investigation

Section II

Questions from Syllabus covering Blood banking, blood coagulation, platelets.

PATTERN OF QUESTION PAPER:

Section I:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2 marks)		10 marks

Section II:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2 marks)		10 marks

MODEL QUESTION PAPER.
CLINICAL PATHOLOGY AND BLOOD BANKING
SECTION I:

1. Describe the principles of hemoglobinometry and discuss the merits and demerits of various methods. **1x1=10 marks**

Or

Define Leukemia. Name the different types of leukemia. Add a note on total leucocyte count in leukemia.

2. Write short note on any FIVE **5 X4 = 20 marks**
- a. ESR
 - b. Osmotic fragility
 - c. Sickling test.
 - d. Myeloperoxidase staining.
 - e. Buffy coat preparation
 - f. Absolute eosinophil count (AEC)

3. Answer the following : **5 X 2 = 10 marks**
- (a) Give an example of RBC diluting fluid and give its composition.
 - (b) Name the disadvantages of Sahli's method of Hb estimation.
 - (c) What is supravital staining? Give examples.
 - (d) Write any two conditions when PCV is increased.
 - (e) Name any two types of anemia.

SECTION II

4. Describe in detail the procedure you would adopt in and cross matching and dispatching blood to patient. **1x1=10marks**

Or

Discuss the ABO system of blood grouping. Add a note on Bombay O blood group.

5. Write short note on any FIVE **5 X4 = 20 marks**
- a. Coombs test.
 - b. Bleeding time.
 - c. Platelet count.
 - d. Clot retraction test.
 - e. Different methods of Blood Grouping
 - f. Fresh frozen plasma (FFP)

6. Answer the following : **5 X 2 = 10 marks**
- a) What is prothrombin time and write the normal value?
 - b) Name two criteria which make donor unfit for blood donation.
 - c) Mention two tests in urine that will be useful in patient with mismatched blood transfusion.
 - d) Name two anticoagulants used in Blood bank.
 - e) Screening diseases before blood transfusion.

PHARMACOLOGY

Placement- (B.Sc.MLT) - Fourth Semester

B.Sc. MLT (Lateral Entry) - Second Semester

Time:

Theory: 45 (Hrs)

Practical: 60 (Hrs)

At the end of the course students shall:

- Have gained knowledge on general mechanism of drug acting on different organ systems
- Have gained the skill in handling laboratory animals.
- Have gained knowledge on mechanism of various antibiotics.

THEORY:

UNIT - I (General Pharmacology)

Sl. No.	CONTENT
1	Definitions and different branches of Pharmacology
2	Routes of drug administration
3	Absorption, Distribution, Metabolism and excretion of drugs
4	General mechanism of drug action
5	Animal used in experiments
6	Animal handling and ethics
7	Bioassay procedures (specific)
8	Instruments used in Pharmacology
9	Clinical trials - basic aspects
10	Therapeutic drug monitoring
11	General anesthetics and analgesics

Classification, Mechanism of action, Therapeutic uses and important adverse effects of the following categories of drugs.

UNIT - II (Drugs acting on Respiratory system)

Sl. No.	CONTENT
1	Bronchodilators and analeptics
2	Nasal decongestants, expectorants and antitussive agents

UNIT - III (Drugs acting on cardiovascular System)

Sl. No.	CONTENT
1	Antiarrhythmic drugs
2	Cardiotonics
3	Antianginal drugs
4	Antihypertensive drugs
5	Drugs used in atherosclerosis

UNIT - VI (Drugs acting on Blood and Blood forming organs)

Sl. No.	CONTENT
1	Haematinics
2	Coagulants
3	Anticoagulants
4	Blood and plasma volume expanders

UNIT - V Drugs acting on gastrointestinal tract and respiratory system

UNIT - VI Autocoids and chelating agents

UNIT - VII (Hormones and Hormone Antagonists)

Sl. No.	CONTENT
1	Antithyroid drugs
2	Hypoglycaemic agents
3	Sex hormones and oral contraceptives
4	Corticosteroids

UNIT - VIII (Chemotherapy)

Sl. No.	CONTENT
1	General considerations
2	Antimetabolites; sulfonamides and trimethoprim
3	Inhibitors of bacterial cell wall synthesis: penicillins, cephalosporins etc
4	Antibiotics inhibiting protein synthesis: Aminoglycosides, tetracyclines chloramphenicol and macrolide antibiotics
5	Antibiotics affecting membrane permeable
6	Antituberculosis and antileprotic drugs
7	Antifungal drugs
8	Antiviral drugs
9	Antimalarial drugs
10	Antineoplastic drugs

LIST OF PRACTICAL EXERCISES:

I Drug assays:

1. Matching assay, Cumulative assay, 1+2 assay, 2+2 assay, chemical assay including extraction procedures.
2. Identification and quantification of common poisons.
3. Data collection and tabulation procedures.

II. Pharmacodynamics

1. Study of absorption and excretion of drugs in human volunteers
2. Study of action of mydriatics, miotics on rabbit's eye
3. Study of action of local anaesthetics on laboratory animals
4. a). Study of signs and stages of anaesthesia
b). Study of the ionic action of magnesium sulphate
5. Effect of drugs on frog rectus abdominus muscle
6. Study of the effect of drugs on food intake and locomotor activity
7. Effect of drugs on isolated rat ileum
8. Study of analgesic activity of drugs on laboratory animals and human volunteers

9. Effect of drugs on isolated frog's heart
10. Evaluation of anticonvulsant activity of drugs in animals
11. Effect of drugs on ciliary movements of frog's oesophagus
12. Demonstration of effects of drugs on the blood pressure and respiration of anaesthetized dog.

TEXT BOOKS RECOMMENDED

Latest edition of the following books :

1. Fundamentals of experimental Pharmacology by Dr.M.N . Ghosh
2. Pharmacology & Pharmacotherapeutics by Satoskar(RS)
3. Essentials of Medical Pharmacology by Tripathi(KD)
4. Pharmacology by Rang (HP)

TEACHING LEARNING ACTIVITIES

The course content in Pharmacology will be covered by:

1. Interactive Lectures
2. Group Discussions
3. Practical
4. Demonstrations
5. Seminars
6. Assignments

EXAMINATION PATTERN

		<u>Duration</u>
Theory exam: (one paper)	80 marks	3 hours
Practical exam	50 marks	3 hours
Oral exam	20 marks	
Internal assessment (Theory)	25 marks	
Internal assessment (Practicals)	25 marks	

	200 marks	

The practical examination will have the following components

Spotters	10 marks
Synopsis	10 marks
Experiments	30 marks

	50 marks

INSTRUCTION TO QUESTION PAPER SETTER

SECTION I	40 marks
Syllabus covering Unit - I to V	
SECTION II	40 marks
Syllabus covering Unit - VI to X	

PATTERN OF QUESTION PAPER:

Section I:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2marks)	-	10 marks

Section II:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2 marks)	-	10 marks

**MODEL QUESTION PAPER
PHARMACOLOGY**

TIME : 3 hours

MAX MARKS: 80

SECTION - I

1. Explain the different types of experimental animal anesthesia. Add two points about the ethical aspects **1x1=10Marks**

Or

Explain the different methods of drug absorption. Write the various factors affecting the oral absorption of a drug.

2. Write short notes on any FIVE **5 x4=20 Marks**
- a). Bioassay
 - b). Antagonists
 - c). Analgesics
 - d). Phases of clinical trials
 - e). Neuromuscular blockers
 - f). Antihypertensive drugs

3. Answer the following: **5x2=10 Marks**
- a). Define the term agonist
 - b). Mention two drugs used in Malaria and Leprosy
 - c). Name an antidote for iron poisoning and organo phosphorus poisoning
 - d). Mention the therapeutic use of Antihistaminic agent
 - e). What is pharmacodynamics

SECTION - II

4. Enumerate Aminoglycoside antibiotics mention the general properties of therapeutic uses and adverse effect. **1x1=10 marks**

Or

List out the drugs useful in the treatment of Diabetes mellitus. Mention the advantage and disadvantage of oral hypoglycemic agents.

5. Write short notes on any FIVE: **5 x4=20 Marks**
- a). Sex hormones and oral contraceptives
 - b). Antiseptics and disinfectants
 - c). Anti cancer drugs
 - d). Picrotoxin
 - e). Chloramphenicol
 - f). Smooth muscle relaxants.

6. Answer the following: **5 x 2=10 Marks**
- a). Define Biotransformation
 - b). Name two different methods of drug administration
 - c). Mention two adverse effects of ACE inhibitor
 - d). Write the principle of bioassay
 - e). Define super infection

ENVIRONMENTAL STUDIES

Placement- (B.Sc.MLT) - Fourth Semester

B.Sc. MLT (Lateral Entry) - Second Semester

Time:

Theory: 45 (Hrs)

Field visit: 5 (Hrs)

At the end of the course the student shall:

- The student will be made aware of the environment in general, natural resources, ecosystems, environment and understanding and hospital environment.

THEORY:

UNIT - I

The multidisciplinary nature of environmental studies - Definition, scope and importance - Need for public awareness.

RENEWABLE AND NON - RENEWABLE RESOURCES:

Sl. No.	CONTENT
1	Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
2	Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
3	Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
4	Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
5	Energy resources: Growing energy needs, renewable and non-renewable energy resources, use of alternate energy sources, case studies.
6	Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. i. Role of an individual in conservation of natural resources. ii. Equitable use of resources for sustainable lifestyles.

UNIT - II (Ecosystems)

Concept of an ecosystem – Structure and function of an ecosystem Producers, consumers and decomposers – Energy flow in the ecosystem- Ecological succession- Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

Sl. No.	CONTENT
1	Forest ecosystem
2	Grassland ecosystem
3	Desert ecosystem
4	Aquatic ecosystems (Ponds, streams, lakes, rivers, ocean estuaries)

UNIT - III (Biodiversity and its conservation)

Sl. No.	CONTENT
1	Introduction – Definition: genetics, species and ecosystem diversity
2	Biogeographically classification of India
3	Value of Biodiversity: Consumptive use, productive use, social, ethical aesthetic and option values
4	Biodiversity at global, national and local levels
5	India as a mega- diversity nation
6	Hot-spots of biodiversity- Threats to biodiversity: habitat loss, poaching of wildlife , man wildlife conflicts
7	Endangered and endemic species of India
8	Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

UNIT - IV (Environmental Pollution)

Definition- causes, effects and control measures of:

Sl. No.	CONTENT
1	Air pollution
2	Water pollution
3	Soil pollution
4	Marine pollution
5	Noise pollution
6	Thermal pollution
7	Nuclear pollution
8	Solid waste Management: causes, effects and control measures of urban and industrial wastes - role of an individual in prevention of pollution - Pollution case studies - Disaster management: floods, earthquake, cyclone and landslides.

UNIT - V

Sl. No.	CONTENT
1	Social Issues and the Environment: From unsustainable to sustainable development - Urban problems and related to energy - Water conservation, rain water harvesting, watershed management - Resettlement and rehabilitation of people; its problems and concerns. Case studies - Environmental ethics: issues and possible solutions climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
2	Wasteland reclamation - Consumerism and waste products - Environmental Protection Act - Air (Prevention and Control of Pollution) Act - Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Issues involved in enforcement of environmental legislation - Public awareness
3	Human Population and the Environment: Population growth, variation among nations - Population explosion - Family welfare Programmes - Environment and human health- Human Rights - Value Education- HIV / AIDS - Women and Child Welfare- Role of Information Technology in Environment and Human Health - Case Studies.

FIELD WORK:

1. Visit to local area to document environmental assets- river/ forest/ grassland/ hill/ mountain
2. Visit to a local polluted site - Urban/Rural /Industrial/ Agricultural
3. Study of common plants, insects, birds
4. Study of simple ecosystems- pond, river, hill slopes, etc.

TEXT BOOKS RECOMMENDED

1. Agarwal, K.C. Environmental Science, Nidi Publishers.
2. Bharucha Erach, The Biodiversity of India, Mapin Publication.
3. Brunner RC, Hazardous waste incineration, McGraw Hill Publishers.
4. Jadhav H, Environmental Protection and Laws, Himalaya Publication.

TEACHING LEARNING ACTIVITIES

The course content in Environmental Studies will be covered by:

1. Interactive Lectures
2. Group Discussions
3. Field Visits

EXAMINATION PATTERN

			<u>Duration</u>
Theory exam: (one paper)	75 marks	3 hours	
Internal assessment	25 marks		

	100 Marks		

INSTRUMENTATION, CLINICAL ENZYMOLOGY AND NUTRITION

Placement- (B.Sc.MLT) - Fifth **Semester**

B.Sc. MLT (Lateral Entry) - Third Semester

Time:

Theory: 60 (Hrs)

Practical: 60 (Hrs)

Clinical: 150 (Hrs)

At the end of the course the student shall:

- Know the basic principles / mechanisms, procedures and various types of techniques commonly employed in analytical biochemistry.
- Know about the importance of nutrition and basic enzymology.
- Gain knowledge and skill in evaluating and interpreting, enzyme profiles in biological samples.

THEORY

UNIT- I

Sl. No.	CONTENT
1	Working principles and application of photometry, spectrophotometry, fluorometry, flame photometry, atomic absorption Spectrophotometry, <i>Mass spectrophotometry, Flow cytometry, Nano drop spectrophotometry, Gel doc and Chemi doc system.</i>
2	Elementary concepts of radioactivity, radioisotopes, their application in medicines and agriculture isotopic dilution analysis, radioactivity counting techniques.
3	Working principles and Types and applications of Electrophoresis – Paper, Agarose Gel, Cellulose Acetate and PAGE. <i>Iso electric focusing capillary electrophoresis.</i> Methods for detecting and quantitating separated zones of proteins. Role of electrophoretic technique in clinical biochemistry.
4	Working Principles, types and applications of Chromotography – Paper Chromatography, TLC, Ion Exchange, Affinity Gel Filtration, Gas Chromatography and HPLC. <i>Gas and liquid chromatography.</i> Role of chromatography in clinical biochemistry.
5	Working principles, types and applications of Centrifugation.
6	Immunochemistry – Principles of immunochemistry, immunoelectrophoresis, ELISA techniques. Blotting techniques.

Sl. No.	CONTENT
7	Fundamental concepts on biophysical phenomena like osmosis, dialysis, colloidal state, viscosity, adsorption, osmotic pressure, surface tension and their application in relation to the human body.
8	Definition, basic concepts of classification mechanism of action and properties of enzymes, factors influencing enzyme action.
9	Clinical Enzymology - Enzyme units. Enzymes of clinical importance and their methods of determination in biofluids. Importance of estimation of enzyme activity in various disease states.
10	General dietary requirements of nutrients - factors affecting status, effects of poor nutrition- analytical methods and recommendations for testing and assessing nutritional deficiency - Methods for assessing concentration of vitamins in biological samples.
11	Essential trace elements and major elements in humans - general requirements for laboratory assessment of trace elements including specimen collection, handling, selection of analytical methodology and establishing quality.

LIST OF PRACTICAL EXERCISES:

1. *Verification of Beers Lamberts law*

2. Estimation of amylase

3. Estimation of creatine kinase

4. Estimation of lactate dehydrogenase

5. Estimation of Alkaline phosphatase

6. Estimation of acid phosphatase

7. Estimation of gamma glutamyl transferase

8. Estimation of serum ceruloplasmin

9. Estimation of serum calcium

10. Estimation of serum phosphorous

11. Estimation of serum iron

12. Estimation of serum sodium and potassium

13. Electrophoretic separation of hemoglobins, serum proteins, lipoproteins.

EXAMINATION PATTERN

Duration

Theory exam: (one paper)	80 marks	3 hours
Practical exam	50 marks	3 hours
Oral exam	20 marks	
Internal assessment (Theory)	25 marks	
Internal assessment (Practicals)	25 marks	

	200 marks	

The practical examination will have the following components

Spotters	10 marks
Synopsis	10 marks
Experiments	30 marks

	50 marks

INSTRUCTION TO QUESTION PAPER SETTER

SECTION I	40 marks
Syllabus covering Unit - I to V	
SECTION II	40 marks
Syllabus covering Unit - VI to XI	

PATTERN OF QUESTION PAPER:

Section I:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2marks)	-	10 marks

Section II:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2 marks)	-	10 marks

**MODEL QUESTION PAPER
CLINICAL BIO CHEMISTRY**

Time: Three Hours

Maximum: 80 marks

Section I

1. Define Electrophoresis and discuss the principle and procedure of serum protein electrophoresis. **1 X 10 = 10 Marks**

Or

Enumerate the different types of chromatography. Write in detail about principle and procedure of TLC

2. Write short notes on any five of the following: **5 X 4 = 20 Marks**

- a) SDA
- b) Monochromators
- c) Care of centrifuge
- d) Electroendosmosis
- e) Classification of enzymes
- f) Dialysis

3. Answer the following: **5 X 2 = 10 Marks**

- (a) Define Rf value
- (b) Name two iron containing enzymes
- (c) Give two biophysical applications of surface tension
- (d) Define isoenzymes
- (e) Give the principle of electrophoresis

Section II

4. Discuss the role of enzymes in the diagnosis of Myocardial infarction. **1x 10 = 10 Marks**

Or

Describe the regulation of calcium and phosphate. Discuss the estimation of serum calcium.

5. Write short notes on any FIVE **5 X 4 = 20 Marks**

- a) Factors affecting enzyme action
- b) Osmosis
- c) Principle of immunohistochemistry
- d) ELISA
- e) Atomic absorption spectrophotometry
- f) Competitive inhibition

6. Answer the following: **5 X 2 = 10 Marks**

- (a) Give two examples of coenzymes
- (b) Give two applications of HPLC
- (c) State Beers' law
- (d) PEM
- (e) Name two applications of isotopes

HISTOPATHOLOGY AND CYTOLOGY

Placement- (B.Sc.MLT) - Fifth Semester

B.Sc. MLT (Lateral Entry) - Third Semester

Time:

Theory: 70 (Hrs)

Practical: 80 (Hrs)

Clinical: 180 (Hrs)

At the end of the course the student shall:

-Students will learn about various histotechniques, at the end of the session students are able to fix, process, embed tissues and make sections for microscopic interpretation including routine and special stains in histopathology.

-They will also be competent to make routine cytological preparation along with cytological staining procedures.

THEORY:

UNIT - I

Sl.No	CONTENT
1.	Introduction to Histopathology - types of histological specimens, specimen reception, labeling and grossing techniques.
2.	Fixation - classification, mode of action, composition, Advantages and disadvantages of various fixatives, secondary fixation and Post-chromation.
3.	Decalcification - methods and types of decalcifying fluid.
4.	Tissue processing - manual and automated methods. Dehydration and clearing agents.
5.	Embedding - types, embedding techniques and other embedding media
6.	Microtomy -types of microtomes, advantages, knife types, honing and stropping. Care and maintenance of microtomes.
7.	Block trimming and section cutting - paraffin sections, cryostat and frozen sections. Errors in sectioning and remedies. Attaching blocks to carriers.
8.	Adhesives, mounting media and cover slipping.
9.	Staining theory, types of staining agents and its practical implication.
10.	H & E Staining. Types of hematoxylin and its preparation. Mordants and differentiation. Eosin stain and other counter stains used.
11.	Introduction to histochemistry and various principles of histochemistry
12.	Connective tissue stains: Demonstration of collagen, reticulin, elastin and fat.

Sl.No	CONTENT
13.	Demonstration of amyloid, glycogen and mucin.
14.	Demonstration of pigments and minerals (malarial, mercury, bile, lipofuscin, calcium, iron, copper).
15.	Demonstration of Microbial agents
16.	Demonstration of neuron, neuroglia and myelin
17.	Enzyme histochemistry and its application. Immunohistochemistry(IHC) and immunofluorescence technique - principles and methods.
18.	Microwave technology and its application in histopathology.
19.	Electron microscopy - indications and processing.
20.	Processing of eye ball.
21.	Museum techniques - preparation and arrangement of museum specimens.
22.	Cytology - introduction, definition, types of cytological specimen including imprint and squash smears preparations.
23.	Cytological fixatives, Examination of body fluids and effusions, processing and preparation of microscopic slides for cytology. Cellblock preparation and mailing of slides, cytospin technique and filters.
24.	Liquid based cytology (LBC)- principles and methods.
25.	FNAC, definition, techniques involved in preparation of smear.
26.	Staining techniques in cytology - PAP, MGG, Shorr's stain, Aceto-orcin stain.
27.	Demonstration of sex chromatin and barr bodies. Amniotic fluid study
28.	Immunocytochemistry (ICC)- basic concepts, principles and procedures.
29.	An overview of automation in histopathology/cytology.
30.	An overview of molecular techniques in histopathology/cytology.

LIST OF PRACTICALS

1. Preparation of various fixatives and Tissue fixation.
2. Tissue processing by manual method.
3. Paraffin section cutting.

4. H & E staining.
5. Histochemical stains.
6. PAP staining.

TEXT BOOKS RECOMMENDED.

1. Cellular pathology by culling.
2. Theory and practical of histological techniques by Bancroft
3. Medical laboratory technology by Lynch

TEACHING LEARNING ACTIVITIES

The course content in Histopathology & Cytology will be covered by:

1. Interactive Lectures
2. Group Discussions
3. Practical
4. Demonstrations
5. Clinical Lab Posting
6. Seminars
7. Assignments

EXAMINATION PATTERN

		<u>Duration</u>
Theory exam: (one paper)	80 marks	3 hours
Practical exam	50 marks	3 hours
Oral exam	20 marks	
Internal assessment (Theory)	25 marks	
Internal assessment (Practicals)	25 marks	

200 marks

The practical examination will have the following components

Spotters	10 marks
Paraffin section cutting in rotary microtome	15 marks
Routine H & E section of paraffin section provided.	15 marks
Any one special staining procedure.	10 marks

50 marks

INSTRUCTION TO QUESTION PAPER SETTER

Distribution of course content:

SECTION I

40 marks

Fixatives.

1. Processing including bone
2. Microtome and frozen section

SECTION II

40 marks

1. Staining procedure(routine/ special)
2. Cytological techniques

PATTERN OF QUESTION PAPER:

Section I:

Long answer question	-	1 X 10	= 10 marks
Short answer question	-	5 X 4	= 20 marks
Very Short answer (1 to 2 marks)			10 marks

Section II:

Long answer question	-	1 X 10	= 10 marks
Short answer question	-	5 X 4	= 20 marks
Very Short answer (1 to 2 marks)			10 marks

**MODEL QUESTION PAPER
HISTOPATHOLOGY AND CYTOLOGY**

Time: 3 hrs

Max marks: 80

SECTION I

1. What is an ideal fixative? Discuss the merits and demerits of formalin as fixative. **1x1=10 Marks**

Or

Name the various Hematoxylin used in histopathology. Discuss the advantages and disadvantages of Ehrlich's Hematoxylin.

2. Write short note on any FIVE

5X4=20 Marks

- a. Demonstration of fat in tissue.
- b. Decalcification of bone.
- c. Aqueous mounting media.
- d. Tissue processing.
- e. Care of microtome .
- f. Cryostat Sections.

3. Answer the following:

5X2=10 Marks

- a) Define honing and stropping.
- b) Define bewel angle.
- c) What is double embedding?
- d) Name the methods of amyloid demonstration.
- e) Naturally ripened hematoxylin.

SECTION II

4. Name the stains used in cytology and discuss in detail about PAP staining with its principle, procedure, advantages and disadvantages.

1X10 =10 Marks

Or

Discuss in detail about Amniotic fluid study .

5. Write short note on.

5 X 4=20 Marks

- a. Stains for mucin
- b. Demonstration of acid fast bacilli in tissue.
- c. Silver impregnation technique.
- d. Cytospin.
- e. Cellblock Preparation
- f. Millipore filter

6. Answer the following:

5 X 2=10 Marks

- a) What are mordants? Give example.
- b) Name two staining techniques in identifying microorganisms in tissues.
- c) Write two applications of enzyme histochemistry.
- d) Name the cytological fixatives used commonly.
- e) What is mailing of cytological slides?

CLINICAL BIOCHEMISTRY

Placement- (B.Sc.MLT) - Sixth Semester

B.Sc. MLT (Lateral Entry) - Fourth Semester

Time:

Theory: 75(Hrs)

Practical: 60 (Hrs)

Clinical: 200 (Hrs)

At the end of the course the student shall have:

- They should be adept in understanding the biochemical basis of the various diseases.
- They should have gained sufficient knowledge in carrying out routine and special investigations in the clinical biochemistry lab.
- They should know the basics principle of lab management of quality control.

THEORY

UNIT- I

Sl. No.	CONTENT
1	Basic procedure, techniques and equipment used in clinical laboratory- concepts relating to the selection of appropriate methods, supplies and reagents
2	Overview of approaches to clinical laboratory automation and its goal – general concepts used in automated instruments and specific applications of these concepts to selected instruments. Criteria to be used in evaluating and selecting appropriate laboratory instrumentation
3	Definition and concepts of reference values and related terminology – selection of individuals for determination of population based reference values – criteria for specimen collection and procedure for collecting data.
4	Analytical goals. Performance criteria for laboratory tests and quantitative means of assessing the diagnostic capabilities of tests (clinical relevance) – appropriate and optimal use of laboratory and data it generates.
5	Goals of procedures and statistical techniques utilized for selecting and evaluating analytical quality and utility of procedures monitoring – quality assurance program.
6	Overview of application of the computer in Clinical Biochemistry laboratories.
7	Specimen collection, processing and handling in clinical laboratory – sources of biological variation.
8	Current methodologies for their determination and identification in

Sl. No.	CONTENT
	amino acids and proteins in biological specimens - disease associated with alteration in or deficiencies of amino acids and proteins.
9	Overview of metabolism of carbohydrates - Methods for determining glucose, ketones, lactate, pyruvate reducing sugars and mucopolysaccharides and their clinical significance. Biochemistry, types, criteria parameters in diagnosis and prognosis of Diabetes mellitus.
10	Disorders of lipid metabolism. Lipoproteins patterns in disease - analytical methods and procedures applicable to detecting and monitoring such disorders.
11	Overview of current concepts in endocrinology, chemiluminescence assay procedure for hormones- physiological effects produced by normal and abnormal levels of various hormones. Thyroid function test and Adrenal function test.
12	Overview of Biochemical roles of major electrolytes and blood gases and their changes in pathological states - relationship between major electrolytes and acid base balance - application of physical and chemical principles to biological system - laboratory measurements of electrolytes and blood gases. Acid base balance and disorders.
13	Introduction to Molecular Biology. Recombinant DNA technology. Role of Recombinant DNA technology as diagnostic tool. Polymerase chain reaction.
14	Carcinogenesis: Overview of biochemical basis of cancer, oncogenes, tumor suppressor genes, tumor markers, biochemical mechanism of chemotherapeutic drugs.
15	Kidneys and their physiological role - laboratory tests to assess, detect and monitor renal diseases.
16	Laboratory tests and analytical methods used in identification and evaluation of hepatobiliary disorders.
17	Stomach, pancreas and intestinal tract - procedure and tests used in the diagnosis and treatment of gastro intestinal diseases.
18	Overview of porphyrins, their precursors, primary and secondary disorders of porphyrin metabolism - diagnostic laboratory methodologies including appropriate specimen collection and preservation techniques

Sl. No.	CONTENT
	related to porphyrins.
19	Overview of clinical toxicology - Screening procedures for detection of drugs. Drugs of abuse and their evaluation. Toxic metals - Lead, Mercury, Arsenic, Cadmium and Chromium- Toxicity and their evaluation
20	Introduction to Total Quality Management in clinical lab
21	Introduction to EQAS

LIST OF PRACTICAL EXERCISES:

I. Estimation of clinically relevant analytes:

Glucose

1. Estimation of plasma glucose
2. Glucose tolerance test
3. Stability check of glucose standards

Lipids

4. Estimation of serum cholesterol
5. Estimation of serum triglycerides
6. Estimation of HDL cholesterol

Liver Function Test

7. Estimation of serum bilirubin
8. Estimation of serum total protein
9. Estimation of serum albumin

Renal Function Test

10. Estimation of serum urea
11. Estimation of serum creatinine
12. Estimation of urine protein level
13. Estimation of urine protein-creatinine ratio
14. Estimation of uric acid
15. Analysis of calculi

II. Complete Urinalysis - quantitative and qualitative analysis - characteristics of normal urine - appearance - specific gravity - reaction - microscope examination - normal and abnormal constituents in urine.

III. Estimation of blood gas analysis and electrolytes.

IV. Qualitative screening tests of toxic substances like carbon monoxide, phenol, organophosphates, heavy metals, methanol, phenol, salicylates, and cyanides.

V. Assay of hormones like T3, T4, insulin TSH by radio-immunoassay procedures, ELISA procedures.

VI. PREPARATION OF LJ Chart.

VII. Calculation of precision accuracy and CV.

TEXT BOOKS RECOMMENDED

Latest edition of the following books:

1. Medical Laboratory procedures Manual (T-M) by K.L. Mukherjee, Vol.I, II and III.
2. A manual of laboratory Diagnostic tests Fischback
3. Practical clinical Biochemistry. Harold Varley
4. Tietz's Text book of clinical chemistry - by N. Tietz Latest edition W.E. Saunders company.
5. Clinical chemistry - Theory, Analysis, Correlation by Kaplan.
6. Principles and Techniques of biochemistry and Molecular Biology by Keith Wilson & Walker
7. Lippincott's illustrated reviews Biochemistry by Pamela C. Champe
8. Text book of Biochemistry by D.M. Vasudevan and Sreekumari
9. Todd-Sanford Clinical Diagnosis by Laboratory Methods

TEACHING LEARNING ACTIVITIES

The course content in clinical biochemistry will be covered by:

1. Interactive Lectures
2. Group Discussions
3. Practical
4. Demonstrations
5. Clinical Lab Postings
6. Seminars
7. Assignments

EXAMINATION PATTERN

		Duration
Theory exam: (one paper)	80 marks	3 hours
Practical exam	50 marks	3 hour
Oral exam	20 marks	
Internal assessment (Theory)	25 marks	
Internal assessment (Practicals)	25 marks	

	200 marks	

The practical examination will have the following components

Quantitative determination of blood Constituents	20 marks
Preparation of standard graph Colorimetrically	10 marks
Qualitative analysis of urine Sample	10marks
Interpretation Spotters	10 marks
	—————
	50 marks

INSTRUCTION TO QUESTION PAPER SETTER

Distribution of course content:

Section I - Descriptive questions covering syllabus in unit 1 to 10

Section II - Descriptive questions covering syllabus in unit 11 to 19

PATTERN OF QUESTION PAPER:

Section I:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2 marks)		10 marks

Section II:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2 marks)		10 marks

**MODEL QUESTION PAPER
CLINICAL BIO CHEMISTRY**

Time: Three Hours

Maximum: 80 marks

Section I

1 X 10 = 10 Marks

1. Discuss role of computer in clinical biochemistry laboratory.

Or

Discuss quality control management in clinical lab

2. Write short notes on any five of the following:

5 X 4 = 20 Marks

- g) Reference values
- h) Lipid profile in MI
- i) Serum transaminases
- j) Identification of amino acidurias
- k) Ketone body metabolism in Diabetes mellitus
- l) Accuracy & Precision

3. Answer the following:

5 X 2 = 10 Marks

- (f) Name any two non protein nitrogenous compounds
- (g) Give the normal range for serum proteins
- (h) Name two iron containing compounds
- (i) Name two conditions where ketonuria is present
- (j) Give the principle of electrophoresis

Section II

1 X 10 = 10 marks

4. Discuss in detail thyroid function tests. Add a note Hyperthyroidism.

Or

Enumerate the tests to evaluate renal function

5 X 4 = 20 marks

5. Write short notes on any FIVE

- a) Renal clearance
- b) Van den Bergh test
- c) Urine screening tests for drugs of abuse
- d) Bence - Jones proteins and its clinical importance
- e) Regulation of serum calcium
- f) Respiratory acidosis

6. Answer the following:

5 X 2 = 10 Marks

- (a) List the body buffer systems
- (b) Name two anticoagulants used in clinical biochemistry
- (c) List few blood parameters estimated for assessing liver function
- (d) Give two applications of recombinant DNA technology
- (e) Define urea clearance

PREVENTIVE AND SOCIAL MEDICINE

Placement- (B.Sc.MLT) - Sixth Semester

B.Sc. MLT (Lateral Entry) - Fourth Semester

Time:

Theory: 45 Hrs

Practical: 50 Hrs

At the end of the course the student shall:

- Know the health policies, plans and national health programs.
- Have gained knowledge on the concept of community health, primary health care
- Appreciate the role of the health team.
- Gained knowledge on the functioning of laboratories at PHC and CHC.

THEORY:

UNIT - I

Sl. No.	CONTENT
1	Natural History of Disease Determinants of health, multi- factorial causation of disease host, agent and environment relationship primary, secondary and tertiary levels of prevention with examples related to few diseases of national importance.
2	Mode of transmission of disease Air - borne, vector and vehicle transmission. Methods of control with examples for control of each mode.
3	Disinfection Disinfection of the infective materials received in the Laboratory by using the appropriate disinfection methods, at the health centre level.

UNIT - II

Sl. No.	CONTENT
1	Health services Brief description of organization of health services at the centre and state levels.
2	Primary Health Care - Definition, components and principles of primary health care. Health for All indicators.
3	Primary Health Centre The functions, staffing pattern and the role of laboratory technicians in primary Health Centre.

Sl. No.	CONTENT
	Laboratory tests for use in Health Centre(See annexure for description)
4	<p>National Programmes of Health and disease eradication/control</p> <p>A) Health Programmes:</p> <ul style="list-style-type: none"> - Family Welfare Programme - National Programme for water supply and sanitation -Nutritional Programmes -Immunisation programmes Expanded programme of Immunization and universal immunization programme. <p>B) Disease Eradication programme : Leprosy & Guinea worm</p> <p>C) Disease control programmes: Tuberculosis, Malaria, Filaria, S.T.D., Goitre, Cholera and other diarrhoeal diseases and National Programme for prevention of blindness including trachoma.</p>

UNIT - III

Sl. No.	CONTENT
1	<p>Demography & Population control</p> <ul style="list-style-type: none"> - The factors influencing population growth, death rate, birth rate and methods of contraception.
2	<p>Biostatistics</p> <ul style="list-style-type: none"> - Application of statistical principles in biology - Presentation of data, calculation of mean, median and mode, range and standard deviation and their significance. - Significance of 'T' test, χ^2 values

UNIT - IV

Sl. No.	CONTENT
1	<p>Environmental sanitation:</p> <ul style="list-style-type: none"> - Methods of water purification and disinfection, collection of water samples, their transport and bacteriological analysis. - Methods of excreta disposal.
2	<p>Waste disposal - infectious and non-infectious. Concepts, principles and methods at different levels</p>

UNIT - V

Sl. No.	CONTENT
1	Health education - definition, principles, objectives, purpose, types and AV aids.
2	Communication - definition, process and types Behavioral change communication. IEC (Information education and communication): aims, scope, concept and approaches.
3	First aid - Definition, Principles, Golden rules and bandages. First for fracture, bleeding, drowning, Convulsions, Foreign Bodies, poisoning, Shock. Cardio Pulmonary Resuscitation.
4	Role and skill of health professional in Health Education; Inter personal relationship: co-ordination and co-operation in health education with other members of the health team.

UNIT - VI

Sl. No.	CONTENT
1	Care of patients with communication diseases. Isolation methods. Standard safety measures (Universal precautions). Role and skill of Health professional in management of patients with communicable diseases.

UNIT - VII

Sl. No.	CONTENT
1	Family Welfare - Definition, Objectives of Family Planning. Types - Temporary and Permanent methods. Follow up of contraceptives methods. Family planning counseling.

ANNEXURE

ESSENTIAL LABORATORY TESTS FOR USE IN HEALTH CENTRE

ESSENTIAL TESTS METHOD

BLOOD

Haemoglobin	Comparator
White cell count	Counting chamber
Examination of a film for differential count	Leishman stain
Erythrocyte sedimentation rate	Westergren method
Parasites	Direct and Romanowsky stained preparations.

URINE

Protein	Sulphosalicylic acid method
Glucose	Benedict's method
Sediment for cells, casts, parasites	Direct microscopy

SPUTUM

M. Tuberculosis	Ziehl Neelsen stain
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STOOLS

Protozoa and ova	Direct saline and iodine preparation
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SKIN SMEAR FOR ACID FAST B

Ziehl Neelsen stain

TEXT BOOKS RECOMMENDED

Latest edition of the following books:

1. Text book preventive & social medicine – by J.E. Park
2. Manual for laboratory technician – 1985. DGHS, Ministry of health, Govt. of India.

TEACHING LEARNING ACTIVITIES

The course content in Community Medicine will be covered by:

1. Interactive Lectures
2. Group Discussions
3. Practical
4. Demonstrations
5. Field Visits
6. Seminars
7. Assignments

EXAMINATION PATTERN

		<u>Duration</u>
Theory exam: (one paper)	75 marks	3 hours
Internal assessment (Theory)	25 marks	

	100 marks	

PATTERN OF QUESTION PAPER:

Section I:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2 marks)		10 marks

Section II:

Long answer question	-	1 X 10 = 10 marks
Short answer question	-	5 X 4 = 20 marks
Very Short answer (1 to 2 marks)		10 marks

MODEL QUESTION PAPER.
PREVENTIVE AND SOCIAL MEDICINE

Time : 3 hours

Max. Marks : 80

Answer the two sections separately

SECTION - I

1. Describe briefly the terms host, agent and environment. Explain how a disease is caused. **1x1=10 Marks**

Or

How will you prevent tuberculosis applying the levels of prevention?

2. Write short notes on any Five **5x4=20 Marks**
- a). The National Programmes to prevent Anaemia
 - b). Write the formulae to calculate Mean, Median and mode for unclassified data
 - c). Sanitary well
 - d). Quarantine
 - e). Oral Contraceptives
 - f). Multi drug therapy for leprosy (MDT)

3. Answer the following : **5X2=10 Marks**
- (a) Name any two permanent methods of contraception
 - (b) List the determinants of health
 - (c) Name two lab diagnosis malaria parasite
 - (d) Mention two components of PHC
 - (e) Define incubation period

SECTION - II

4. List the Laboratory tests available in a Primary health Centre for Leprosy patients. How are the results of slit skin smear examination interpreted? How are these tests useful in the implementation of national leprosy Eradication Programme? **1x1=10Marks**

Or

Explain the laboratory test Leishman stain and Ziehl Neelson stain.

5. Write briefly on any FIVE **5x4=20 Marks**
- a) Disinfection/sterilization procedures practiced at PHC
 - b) List the components of Primary health care
 - c) National Immunization Schedule
 - d) Methods of presentation of statistical data
 - e) Rehabilitation Services
 - f) Management of needle pricks injury.
6. Answer the following : **5X2=10 Marks**
- a) Define mean and mode
 - b) Name any two chemical disinfectant used in water purification
 - c) Write any two nutritional programme implemented in India
 - d) List any two methods of presenting statistical datas
 - e) List ant two methods of disposal of excreta

MEDICAL LABORATORY MANAGEMENT SCIENCES

Placement- (B.Sc.MLT)- Sixth **Semester**
B.Sc. MLT (Lateral Entry) - Fourth Semester

Time:
Theory: 30(Hrs)

At the end of the course the student shall:

-Have gained knowledge on the principles of management in respect of clinical laboratory sciences.

THEORY:

1. Ethical Principles and standards for a clinical laboratory professional
1.1 Duty to the patient
1.2 Duty to colleagues and other professionals
1.3 Duty to the society
2. Good Laboratory Practice (GLP) Regulations and Accreditation
2.1 Introduction to Basics of GLP and Accreditation
2.2 Aims of GLP and Accreditation
2.3 Advantages of Accreditation
2.4 Brief knowledge about National and International Agencies for clinical laboratory accreditation
3. Awareness / Safety in a clinical laboratory
3.1 General safety precautions
3.2 HIV: pre- and post-exposure guidelines
3.3 Hepatitis B & C: pre- and post-exposure guidelines
3.4 Drug Resistant Tuberculosis
4. Patient management for clinical samples collection, transportation and preservation
5. Sample accountability
5.1 Purpose of accountability
5.2 Methods of accountability
6. Sample analysis
6.1 Introduction
6.2 Factors affecting sample analysis
7. Reporting results
8. Introduction to LIMS