Ordinance Governing B.Sc. Medical Laboratory Technology Course

(Semester System)

Syllabus/Curriculum 2017-18

EMPOWERING PROFESSIONALS

KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH
Deemed-to-be-University

Accredited **'A' Grade** by **NAAC** (2nd Cycle)
Placed in **'A' Category** by Government of India (MHRD)

KLE Academy of Higher Education & Research

(Deemed-to-be-University)

[Declared as Deemed-to-be-University u/s 3 of the UGC Act, 1956 vide Government of India Notification No. F.9 -19/2000-U.3 (A)]

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EMPOWERING PROFESSIONALS

KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH Deemed-to-be-University

VISION

To be an outstanding KAHER of excellence ever in pursuit of newer horizons to build self reliant global citizens through assured quality educational programs.

MISSION

- To promote sustainable development of higher education consistent with statutory and regulatory requirements.
- To plan continuously provide necessary infrastructure, learning resources required for quality education and innovations.
- To stimulate to extend the frontiers of knowledge, through faculty development and continuing education programs.
- To make research a significant activity involving staff, students and society.
- To promote industry / organization, interaction/collaborations with regional/national/international bodies.
- To establish healthy systems for communication among all stakeholders for vision oriented growth.
- To fulfill the national obligation through rural health missions.

OBJECTIVES

The objectives are to realize the following at KAHER and its constituent institutions:

- To implement effectively the programs through creativity and innovation in teaching, learning and evaluation.
- To make existing programs more careers oriented through effective system of review and redesign of curriculum.
- To impart spirit of enquiry and scientific temperament among students through research oriented activities.
- To enhance reading and learning capabilities among faculty and students and inculcate sense of life long learning.
- To promulgate process for effective, continuous, objective oriented student performance evaluation.
- To ordinate periodic performance evaluation of the faculty.
- To incorporate themes to build values, Civic responsibilities & sense of national integrity.
- To ensure that the academic, career and personal counseling are in-built into the system of curriculum delivery.
- To strengthen, develop and implement staff and student welfare programs.
- To adopt and implement principles of participation, transparency and accountability in governance of academic and administrative activities.
- To constantly display sensitivity and respond to changing educational, social, and community demands.
- To promote public-private partnership.

INSIGNIA

The Emblem of the **KAHER** is a Philosophical statement in Symbolic.

The Emblem…

A close look at the emblem unveils a pillar, a symbol of the "KAHER of Excellence" built on strong values & principles.

The Palm and the Seven Stars…

The Palm is the palm of the teacher- the hand that acts, promises & guides the students to reach for the Seven Stars…

The Seven Stars signify the 'Saptarishi Dnyanamandal", the Great Bear-a constellation made of Seven Stars in the sky, each signifying a particular Domain. Our culture says: The true objective of human birth is to master these Knowledge Domains.

The Seven Stars also represent the Saptarishis, the founders of KLE Society whose selfless service and intense desire for "Dnyana Dasoha" laid the foundation for creating the knowledge called KLE Society.

Hence another significance of the raised palm is our tribute to these great Souls for making this KAHER a possibility.

Empowering Professionals…

'Empowering Professionals', inscription at the base of the Emblem conveys that out Organization with its strength, maturity and wisdom forever strive to empower the student community to become globally competent professionals. It has been a guiding force for many student generations in the past, and will continue to inspire many forth coming generations.

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Ref. No. KAHER/AC/18-19/D-909 (5) Dated : 26-11-2017

NOTIFICATION

Sub : Ordinance governing the syllabus/curriculum for B.Sc. Medical Laboratory Degree Course (Semester System)

Ref : Minutes of the meeting of the Academic Council of the University held on 15-11-2017

In exercise of the powers conferred under Rule A-04(i) of the Memorandum of Association of the KAHER, the Academic Council of the KAHER is pleased to approve the Ordinance governing the syllabus/curriculum for B.Sc. MLT Degree Course (Semester System) in its meeting held on 15-11-2017.

The Ordinance shall be effective for the students admitted to B.Sc. MLT Degree Course under the Faculty of Medicine in the constituent college of the KAHER viz. Jawaharlal Nehru Medical College, Belagavi from the academic session 2017-18 onwards.

By Order

REGISTRAR

To
The Dean
Faculty of Medicine,
J.N. Medical College, Belagavi.

CC to:
1. The Secretary, University Grants Commission, New Delhi,
2. The PA to Hon. Chancellor, KAHER, Belagavi.
3. The Special Officer to Hon. Vice- Chancellor, KAHER, Belagavi.
4. All Officers of the University- Academic Affairs/ Allied Course/ Examination Branch.

CONTENTS

B.Sc. Medical Laboratory TECHNOLOGY

PREAMBLE

The B.Sc. Medical laboratory Technology Course is of **3 years** duration aimed at training students in the laboratory aspects of medical care with a good scientific foundation. These students will be in a position to competently assist in the Biochemistry, Pathology, Microbiology laboratories & Blood bank in all types of Health care delivery systems. Along with the basic knowledge and advanced training in the latest technologies in laboratories and Blood bank, these graduates will play an important role in determining the quality of health care provided.

OBJECTIVE

The objective is to impart the basic knowledge & technical skills of Biochemistry, Pathology, Microbiology & Blood Bank and its application in the health care delivery system.

I. ELIGIBILITY FOR ADMISSION

A candidate seeking admission to the Bachelor of Science – Medical Laboratory Technology Course shall have passed:

1) The two year Pre-University examination or equivalent as recognized by KAHER with Physics, Chemistry and Biology as principal subjects of study.

OR

2) Pre Degree Course from a recognized university (two years after ten years of schooling) with Physics, Chemistry and Biology as principal subjects of study.

OR

3) Any equivalent examination recognized by KAHER for the above purpose with Physics, Chemistry and Biology as principal subjects of study.

OR

4) Pre university vocational course from an approved Board with laboratory technology as vocational subject.

II. DURATION OF COURSE

The duration of the Course shall be for period of three years including six months compulsory training in sixth semester.

III. MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

IV. SCHEME OF EXAMINATION

There shall be six examinations during the course, each at the end of the first, second, third, fourth, fifth and sixth semester.

V. ATTENDANCE

Every candidate shall attend at least 80% of the total number of classes conducted in a calendar year from date of commencement of the term to the last working day as notified by the University in each of the subjects prescribed for that year separately in Theory and Practical. Only such candidates are eligible to appear for the University examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A Candidate lacking in prescribed percentage of attendance in any one or more subjects either in Theory or Practical in the first appearance will not be eligible to appear the University Examination either in one or more subjects. Failed candidates should have attended at least 80% of the total number of classes conducted in that term in individual subjects separately in Theory and Practical to become eligible to appear for the University Examination in that subject in the supplementary or subsequent Examination. However, this is not applicable in case of carryover subjects.

FIRST SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA +Viva Voce	Total
1	BMLS01	Paper 1	Human Anatomy	60 + 20 + 20	100
2	BMLS02	Paper 2 Section A	Human Physiology	30 + 10 + 10	50
		Section B	Basics of Biochemistry	30 + 10 + 10	50
3	BMLS03	Paper 3 Section A	Pathology-Basic Haematology	30 + 10 + 10	50
		Section B	Microbiology	30 + 10 + 10	50
4	ELS01	Paper 4 Electives	English	80 + 20	100
Grand Total					**400**

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BMLS04	Practical 1	Human Anatomy	80 + 20	100
6	BMLS05	Practical 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	BMLS06	Practical 3A	Hematology & Clinical Pathology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					**300**

Semester I

PAPER I : Human Anatomy BMLS01 **Theory 25 Hours**

The human body as a whole:

Definitions, Subdivisions of Anatomy, Terms of location and position, Fundamental Planes, Vertebrate structure of man, Organization of the Body cells and Tissues.

Locomotion and support:

The Skeletal system: Types of bones, structure and growth of bones, Divisions of the skeleton, Appendicular skeleton, Axial skeleton, name of all the bones and their parts, joint- classification, types of movements with examples.

Anatomy of the Nervous System:

Central nervous system: Brain and Spinal cord, functions, meninges.

The Brain- Brief structure of Hind Brain, Midbrain and Forebrain, Location, gross features, parts, functional areas, cerebral bood circulation and coverings, Functions of peripheral nervous system, Organization and Structure of Typical Spinal Nerve Spinal Cord: Gross features, extent, blood supply and coverings, reflex- arc. Applied Anatomy of spinal cord and brain.

Anatomy of circulatory system:

Heart: Size, location, external features, chambers, pericardium and valves, Blood supply and Nerve supply.

Right and Left Atrium: Structural features, venous area, septum and appendages, structural features inflow and outflow characteristics.

The study of blood vessels, General plan of circulation, pulmonary and systemic circulation.

Names of arteries and veins and their positions, general plan of lymphatic system. Coronary Circulation, Lymphatic drainage of heart in brief Applied aspects of heart and pericardium.

Anatomy of the Respiratory system:

Organization of Respiratory System,Gross structure and interior of Nose, Nasal cavity, Para nasal air sinuses,

Gross structure and interior of Pharynx, Larynx, trachea, bronchial tree, Pleura

Gross structure and Histology of Lungs, Pulmonary Circulation, Pulmonary Arteries, Pulmonary Veins and Bronchial Arteries.

Nerve Supply of Respiratory System and Applied aspect of Respiratory System.

Type of questions and distribution of marks for Theory examination in each subject in First Semester.

Sr. No.	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Hand Book of General Anatomy	B.D.Chaurasia	C.B.S.Publishers, New Delhi
3. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi
4. Clinically Oriented Anatomy	Keith L. Moore	Williams and Wilkins, Baltimore
5. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg

PRACTICAL

Practical 20 Hours

Anatomy

1. General Histology Slides:
   - Epithelial Tissue,
   - Connective Tissue,
   - Hyaline Cartilage,
   - Fibro Cartilage,
   - Elastic Cartilage,
   - T.S. & L.S. of Bone,
   - Blood Vessels,
   - Tonsil,
   - Spleen,
   - Thymus,
   - Lymph node,
   - Skeletal and Cardiac Muscle
   - Peripheral Nerve and Optic Nerve
2. Systemic Histology Slides:
   - RS -Lungs and Trachea
   - Cerebrum
3. Demonstration of all bones - Showing parts, joints,
4. X-rays of all normal bones and joints.
5. Demonstration of heart and normal angiograms.

6. Demonstration of Brain
7. Demonstration of different parts of respiratory system and normal X-rays

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical 1	80	20	100

Scheme of Exam for Practicals:

Practical Histology	Spotters:	10 X 2 Marks =	20 marks
Gross Anatomy	Discussion:	2 X 20 Marks =	40 marks
	Spotters:	10 X 2 Marks =	20 marks
IA Marks			20 marks
	Total:		**100 Marks**

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Hand Book of General Anatomy	B.D.Chaurasia	C.B.S.Publishers, New Delhi
3. Text book of Histology - A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon, Hariyana
4. Practical manual of Histology for Medical students	Neelkanth Kote	Jaypee Brothers, Medical Publishers, Delhi.

Semester I

PAPER 2 : Section A - Human Physiology **Theory 35 Hours**

General Physiology: Structure of Cell membrane and Cell Organelles, Intercellular junctions, Classification of Body fluid compartments & composition, Homeostasis, Transport across cell membrane -Definition and Classification

Nerve Muscle Physiology: Definition of Resting Membrane Potential, Action Potential - Phases & ionic basis, Classification and structure of Nervous Tissue, Structure, Classification and Properties of Skeletal Muscle, Neuromuscular Junction - Definition, Structure and Mechanism of neuromuscular transmission, Myasthenia gravis, Excitation Contraction Coupling.

Blood: Composition and functions of blood and plasma proteins
Red Blood Cells: Morphology & functions, Erythropoiesis, types & functions of hemoglobin, Definition and Classification of Anemia & Jaundice. White blood cells: Morphology, functions Definition of Leucopoiesis, Immunity - definition, and classification, Platelets and Blood Coagulation: Morphology & functions of platelets, Mechanism of Hemostasis, Anticoagulants, Bleeding disorders. Blood Groups: Classification of Blood Groups, ABO and Rh blood group systems, uses of blood grouping test and Cross matching, Blood Transfusion and its hazards.

Central Nervous System:
Organization of CNS: Introduction, Structure of neuron, Properties of nerve fiber, Axonal Transport, Classification of nerve fibers.

Synapse, Receptor & Reflex: Definition of synapse, receptor & reflex, Classification of Synapse, Structure & properties of synapse, Classification of receptor, adaptation, properties of receptor, Components of reflex arc, classification of reflex.

The sensory system: Overview of sensory system, Structure of Spinal Cord, Ascending tracts - Anterior Column, Lateral Column and Posterior Column Tract - Course, termination and function

The motor system : Overview of motor system, cortical motor areas, pyramidal and extra pyramidal, tract- Course, termination and function, Upper & Lower Motor Neuron, Lumbar Puncture.

Functions of Various parts of Brain:Cerebellum, Basal ganglia, Hypothalamus, Thalamus, Autonomic Nervous System

Temperature Regulation: Normal temperature of body, Regulation of body temperature & Fever

Special Senses:

Vision: Structure of Eye, Functions of rods and cones, accommodation, visual pathway, near, distant & colour vision, light & dark adaptation, Refractory errors of eye & correction.

Hearing: Structure and functions of external, middle and inner ear, Mechanism & Tests of Hearing

Taste, Olfaction and Skin: Taste buds, papillae's, taste pathway, Olfactory mucosa, Olfactory Pathway, Adaptation of smell, unique features of olfaction, structure & functions of skin.

Scheme of examination

Theory Total 50 marks **Duration 90 minutes**

Sr. No.	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2	Short Essay Question	3	2	2 X 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing Company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K. Choudhari	New Central Books, Calcutta
4	Textbook of Physiology	Arthur C. Guyton	Prism Publishers, Bangalore
5	Practical Physiology	Prof. A. K.Jain	Arya Publication

Practical 1 : Section A - Physiology **Practical 30 Hours**

1) Study of Microscope and its use
2) Collection of Blood and study of Haemocytometer
3) Haemoglobinometry
4) White Blood Cell count
5) Red Blood Cell count
6) Determination of Blood Groups
7) Leishman's staining and Differential WBC Count
8) Determination of Bleeding Time
9) Determination of Clotting

Practical	**Total 50 marks**
Major	-25 marks
Minor	-15 marks
Internal Assesment	-10 marks
Total	**-50 marks**

Semester I

PAPER 2 : Section B: Basics of Biochemistry **Theory 35 Hours**

1. **Introduction to Medical lab Technology:**
   (a) Role of Medical lab Technologist (b) Ethics, Responsibility (c) Safety measures
   (d) First aid (e) Cleaning and care of general laboratory glass ware and equipment.
2. **Introduction to Apparatus- Chemical Balance:** Different types, Principles and applications.
3. **Units of Measurements:** Concepts of Molecular weight, Atomic weight, Normality, Molarity, Standards, Atomic structure, Valence, Acids, Bases, Salts & indicators
4. **Concepts of pH:** Concepts of Acid Base reaction and hydrogen ion concentration. Definition of pH, buffer & pH meter
5. **Chemistry of Carbohydrates:**
   a. Definition, Classification and biological importance.
   b. Monosaccharaides, Oligosaccharides, Disaccharides & Polysaccharides:
6. **Chemistry of Lipids:**
   a. Definition, Classification and biological importance.
   b. Simple lipids: Triacylglycerol and waxes-composition and functions.
   c. Compound lipids : Phospholipids, Sphingolipids, Glycolipid and Lipoproteins : Composition and functions.
   d. Derived lipids: Fatty acids-saturated & unsaturated. Steroids and their properties.
7. **Chemistry of Proteins:**
   a. Amino acids: Classification, properties, side chains of amino acids.
   b. Protein: Definitions, Classifications and functions.
   c. Peptides: Biologically active peptides
   d. Overview of Structural organization of proteins.
   e. Denaturation of proteins and denaturating agents
8. **Chemistry of Nucleic acids:**
   a) DNA Structure and function
   b) RNA: Types, Structure (only t RNA) and Functions.

Scheme of examination

Theory Total- 30 Marks **Duration: 90 minutes**

Sr. No.	Question	Question asked	Question to attempt	Marks	Maximum Marks	Viva	IA	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2	Short Essay Question	3	2	2 X 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Sl. No.	Name of the Books & Title	Author	Publisher's Name, Place of Publication
1	Test Book of Bio Chemistry for Medical Students	Vasudevan (DM), & Sree Kumari (S)	Jaypee Brothers, New Delhi.
2	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009. India)
3	Clinical Chemistry	Varley	William Heinemann Medical Books Ltd & Inter Science Book. Inc. New York.
4	Clinical Chemistry	TEITZ	W.B. Saunders Company Harcourt (India) Private Limited New Delhi-110048.

PAPER 2 : Section B - Biochemistry Practicals **Practical 30 Hours**

1. Introduction to apparatus, Instruments and use of Chemical Balance.
2. Maintenance of Laboratory Glassware and apparatus.
3. Reactions of Carbohydrates (Glucose, fructose, maltose, lactose, sucrose and starch)
4. Reactions of Proteins (Albumin and Casein)
5. Colour reactions of Proteins
6. Identification of Unknown Carbohydrates and proteins

Scheme of Examination

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Qualitative Analysis: Identification of Unknown Carbohydrate or protein	1	1 x 25	25 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Color reactions of proteins (any one)	1	1 x 15	15 Marks

Practical Marks **40 Marks**
IA Marks: **10 Marks**
Grand Total **50 Marks**

Semester I

PAPER 3 : Section A - Pathology **Theory 25 Hours**

Basic Haematology

- Introduction to Haematology: (a) Definition (b) Importance (c) Important equipment used.
- Laboratory organization and safety measures in haemotology Laboratory
- Introduction to blood, its composition, function and normal cellular components.
- Collection and preservation of blood sample for various haematological investigations
- Normal Values in Hematology
- Preparation of blood Films- Types. Methods of preparation (Thick and thin smear/film)
- Definition, principles & procedure, Normal values, Clinical significance, errors involved, means to minimize errors for the following:
  1. Haemoglobinometry, PCV, Red Cell Indices
  2. Total leucocytes count (TLC)
  3. Differential leucocytes count (DLC), Absolute Eosinophil count, Reticulocyte count and Platelet Count.
  4. Erythrocyte Sedimentation Rate (ESR)
  5. Blood Grouping
- Staining techniques in Haematology (Romanowsky's stains) :Principle, composition, preparation of staining reagents and procedure of the following
  1. Giemsa stain
  2. Leishman stain
  3. Wright's stain
  4. Field's stain
- Bone Marrow: Techniques of aspiration, Preparation and Staining of films, Bone Marrow Biopsy.

Scheme of Examination

Type of questions and distribution of marks for Theory examination in each subject in First Semester.

Duration 90 minutes

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad

Practical 3 : Section A - Pathology **Practical 30 Hours**

Basic Haematology

1. Hb Estimation-Sahli's method & Cyanmethhaemoglobin method
2. RBC Count
3. Retic Count
4. Preparation of blood smears and staining with Leishman stain
5. WBC Count
6. WBC -Differential Count
7. Platelet Count
8. Absolute Eosinophil Count
9. ESR- Westergreens & Wintrobe's method,
10. PCV.
11. Sickling test-Demonstration
12. Bone Marrow Smear preparation & staining procedure- Demonstration
13. Demonstration of Malarial Parasite.

Exam Pattern

I. Major Experiment: Perform any two exercises: **20 Marks**

- Hb Estimation-Sahli's method
- RBC Count
- Retic Count
- Preparation of blood smears and staining with Leishman stain- WBC - Differential count
- WBC Count
- Platelet Count
- Absolute Eosinophil Count

II. Minor Experiment: Any one examination **10 Marks**

- Reticulocyte Count
- ESR- Westergreens & Wintrobe's method,
- PCV

III. Spotters 10 Marks

IV. Internal Assessment: 10 Marks

Total: **50 Marks**

Practical Assesment

Scheme of Practical Examination for First Semester.

(Section A Pathology -50 Marks + Section B Microbiology 50 Marks)

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Scheme of Exam for Practicals:

Major Experiment : 20 Marks
Minor Experiment : 10 Marks
Spotters : 10 Marks
Internal Assessment : 10 Marks
Total **: 50 Marks**

Semester I

PAPER 3: Section B - Microbiology **Theory 25 Hours**

- **Introduction to Medical Microbiology:** - Definition - History - Host-Microbe relationship.
- **Microscopy:** - Introduction and history - Types of microscopes
  (a) Light microscope
  (b) Dark ground Microscope
  (c) Fluorescent Microscope
  (d) Phase contrast Microscope
  (e) Electron microscope:
  -Principles and operational mechanisms of various types of microscopes
- **Sterilization:** - Definition -- Types and principle of sterilization methods
- **Physical methods-** (a) Heat (dry heat, moist heat with special Reference to autoclave - their care and maintainance.) (b) Radiation (c) Filtration, Efficiency testing to various sterilizers.
- **Chemical methods**
- **Antiseptics and disinfectants:** Definition, Types and properties - Mode of action - Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, In-house preparation of alcoholic hand/skin disinfectants, Testing efficiency of various disinfectants
- Antibiotics and drug resistance
- Classification of Microbes
- Bacterial Cell Growth and Nutrition
- Overview and mechanisms of Bacterial gene transfer.
- Ubiquity of microbes.

Scheme of Examination for Theory

Type of questions and distribution of marks for Theory examination in each subject in First Semester. Section B - Microbiology - 50 marks

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

1. Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo
2. Textbook of Microbiology for MLT. Second Edition.Dr. C. P. Baveja.

Practical 3 : Section B - Microbiology **Practical 30 Hours**

- Focusing, handling and care of Microscopes
- Hanging drop
- Simple stain
- Gram stain
- ZN stain
- Sterilization and Disinfection.

Scheme of Practical Examination for First Semester : Practical Examination for First Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40 (Major 30 + Minor 10)	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Major : **30 Marks**
Gram Stain 15 Marks
ZN Stain 15 Marks

Minor : **10 Marks**
Spotter 10 Marks

IA : **10 Marks**

Total **50 Marks**

Suggested Readings:

- Practical Microbiology, Fourth Edition. C.P Baveja.

I YEAR B.Sc. MLT ENGLISH

COURSE CONTENTS:

Subsidiary subject 60 hours for 1st year marks to be sent to university before IInd year exam. Course description: It is designated to help the students to acquire a good command over English language for common and medical terminology used in medical practice.

Behavioural objectives:

Ability to speak and write proper English

Ability to read and understand English

Ability to understand and practice medical terminology.

Paragraph

Letter writing

Note making

Description

The use of paragraphs

Essay writing

Telegrams

Precise-writing and abstracting

Report writing

Medical Terminology

Use of dictionary

Scheme of examination

Theory: 80 Marks Duration: 3 hours

1) Fill in the blanks - 10 marks
2) Articles (Passage/fill in the blanks) - 10 marks
3) Tense (Sentence identification/rewriting a sentence) - 10 marks
4) Voice (Rewrite) - 10 marks
5) Speech (Rewrite) - 10 marks
6) Linkers (Paragraph) - 10 marks
7) Paragraph writing - 10 marks
8) Letter writing - 10 marks

Text Books Recommended (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name Place of Publication
1.	Sharma Strengthen your writing	V. R. Narayana	New Delhi, Orient Longman
2.	Grammer and composition	Wren and Martin	Delhi, Chand & Co.
3.	Spoken English	Shashikumar V. D'Souza P. V.	New Delhi, Tata Mergaw Hill
4.	Medical dictionary	Dorland's pocket IBH Publishing Co.	New Delhi; Oxford &

SECOND SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA +Viv Voce	Total
1	BMLS07	Paper 1	Human Anatomy	60 + 20 + 20	100
2	BMLS08	Paper 2 Section 2A	Human Physiology	30 + 10 + 10	50
		Section 2B	Basics of Biochemistry	30 + 10 + 10	50
3	BMLS09	Paper 3 Section 3A	Haematology & Clinical Pathology	30 + 10 + 10	50
		Section 3B	Microbiology	30 + 10 + 10	50
4	ELS02	Paper 4 Electives	Enviromental Studies	80 + 20	100
Grand Total					**400**

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BMLS10	Practical 1	Human Anatomy	80 + 20	100
6	BMLS11	Practical 2 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	BMLS12	Practical 3A	Hematology & Clinical Pathology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					**300**

Semester II

PAPER 1: Human Anatomy **Theory 40 Hours**

Anatomy of the Digestive System:

Components of Digestive system, Alimentary tube, Anatomy of organs of digestive tube, mouth, tongue, tooth, salivary glands, liver, Biliary apparatus, pancreas, Names and positions and brief functions - with its applied anatomy.

Anatomy of Renal System.

Organization of renal system

Kidneys: Location, gross features, relations, structure, blood supply, nerve supply, lymphatic drainage and with its applied anatomy.

Ureters and urinary bladder-Location, gross features, structure and with its applied anatomy Urethra in brief along with its applied anatomy.

Anatomy of Reproductive System.

Male Reproductive System: Testis, Duct system - with its applied anatomy.

Female Reproductive System: Uterus, Ovaries, Duct system, Accessory organs- with its applied anatomy.

Anatomy of the Endocrine System.

Name of all endocrine glands their positions, Hormones and their functions- Pituitary, Thyroid and parathyroid glands, Adrenal glands, Gonads and Endocrine part of pancreas- with its applied anatomy.

Type of questions and distribution of marks for Theory examination in each subject in Second Semester.

Sl. No.	Question	Question asked	Question to attempt	Marks	Max Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2.	Short Essay Question	7	5	5 x 5	25			
3.	Short Answers	5	5	5 x 3	15			

Suggested Readings:

	Name of the Books & Title	Author	Publisher's Name, Place of Publication
1.	Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B. D. Chaurasia	C.B.S.Publishers, New Delhi.

2. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi.
3. Clinically Oriented Anatomy	Keith L. Moore	Williams and Wilkins, Baltimore.
4. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
5. Text book of Histology - A Practical Guide	J. P. Gunasegaran	Elsevier Publication, Gurgaon, Hariyana.
6. Practical manual of Histology for Medical students	Neelkanth Kote	Jaypee Brothers, Medical Publishers, Delhi.

Practical 1: Human Anatomy **Practicals- 20 Hours**

Systemic Histology slides:

1. G.I.T - oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.
2. Kidney, ureter and urinary bladder.
3. Endocrine glands - Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
4. Uterus, Ovary, Testis.

Practical:

1) Demonstration of the digestive system organs

2) Demonstration of excretory systems organs

3) Demonstration of Male & Female reproductive organs

4) Demonstration of Endocrine glands.

Practical Assesment

Scheme of Practical Examination for Second Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Practicala 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Gross Anatomy

	Discussion 3 x 10 marks	:	30 Marks
	Spotters 10 x 2 marks	:	20 Marks
Histology			
	Spotters 15 x 2 marks	:	30 Marks
IA marks		:	20 Marks
	Total	**:**	**100 Marks**

PAPER 2 : Section A - Physiology **Theory 35 Hours**

Respiratory System

Physiological Anatomy of Respiratory System and Functions, Dead Space.

Mechanism of Respiration, Lung volume and capacities, Surfactant, definition of compliance

Transport of Oxygen, ODC Curve and **CO_2 transport.**

Regulation of Respiration - Types and functions of Respiratory Centres

Cyanosis, Dyspnea, Apnea, Hypoxia **-** definition and types.

Cardiovascular System

Physiological Anatomy of Heart

Cardiac Cycle - Definition and Phases

Cardiac Output - Definition, and factors affecting cardiac output,

Blood pressure - Definition, Determinants & Factors affecting blood pressure, regulation of blood pressure,

Defination Hypertension , Hypotention Myocardial Ischemia and Infarction.

Normal Electrocardiogram - Definition, Waves and Uses

Excretory System

Functional Anatomy: Functional anatomy of kidneys, structure of a nephron, features of renal circulation, juxtaglomerular apparatus

Mechanism of Urine formation: Glomerular Filtration - Definition, glomerular filtration rate, factors effecting GFR, Tubular reabsorption, functions of Proximal convoluted tubule, loop of Henle, distal convoluted tubule & collecting tubule.

Micturation: Muscles of the bladder, nerves of bladder, micturition reflex, & concept of Artificial Kidney

Digestive System

Functional Anatomy of GIT, composition & functions of saliva

Composition of gastric juice, mechanism of secretion & function of HCL

Composition and functions of pancreatic juice

Functions of Liver and bile Juice

Defination of Jaundice and it types

Movements of GI Tract - Deglutition, Movements of Small Intestines

Endocrines

Major Endocrine glands

- Pituitary Gland: Anterior & Posterior Pituitary Hormones and functions
- Thyroid Gland: Hormones Secreted and Functions, Goitre
- Adrenal Gland: Hormones secreted by adrenal cortex and medulla and their functions
- Pancreas: Endocrine Hormones of Pancreas and their functions, Diabetes Mellitus
- Parathyroid Gland: PTH, calcitonin and its actions

Reproductive System

Puberty: Puberty, Pubertal changes in male and female.

Male Reproductive System: Male reproductive organs, Spermatogenesis, Morphology of a sperm, Semen, Factors influencing spermatogenesis, Functions of testosterone

Female Reproductive System: Female reproductive organs, Oogenesis, Ovulatory cycle with its hormonal basis, Tests for Ovulation, Menstrual cycle with its hormonal basis, Functions of Estrogen & Progesterone

Pregnancy & Lactation: Fertilization, Functions of Placenta, Hormones of Placenta, Pregnancy tests, Contraceptive methods, Milk Ejection Reflex, Composition of Milk, Advantages of breast feeding.

Scheme of Examination

Type of questions and distribution of marks for Theory examination in each subject in First Semester.

Sl. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal Assesment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A. K. Jain	Avichal Publishing Company
2	Textbook of Medical Physiology	D. Venkatesh & H. H. Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K. Choudhari	New Central Books, Calcutta.
4	Textbook of Physiology	Arthur C. Guyton	Prism Publishers, Bangalore.
5	Practical Physiology	Prof. A. K. Jain	Arya Publication.

Practical 2 : Section A-Human Physiology **Practicals 30 Hours**

1) Recording of Pulse
2) Blood Pressure Recording
3) Effect of Exercise on BP
4) Effect of Posture on BP
5) Auscultation for Heart Sounds
6) Spirometry - Description of Normal Findings
7) Electrocardiogram of a normal person - Description of ECG waves in Lead II
8) Artificial Respiration.

Practical Assesment

Practical	**Total 50 marks**
Major	-25 marks
Minor	-15 marks
Internal Assesment	-10 marks
Total	**-50 marks**

PAPER 2 : Section B - Basics of Biochemistry **Theory 35 Hours**

1. Specimen collection of blood, urine, cerebrospinal fluid and other body fluids, preservation and preparation of protein free filtrate.
2. Enzymes: definition, classification, coenzymes, factors affecting enzyme activity and inhibitors, units of measurements, isoenzymes, Diagnostic enzymology (AST, ALT ALP, LDH, CPK and Troponin).
3. Digestion and Absorption of Carbohydrates, proteins and lipids
4. Nutrition - Calorific value and nutritional importance of Carbohydrates, Lipids,Proteins and Dietary fibers. BMR & Factors affecting BMR
5. Vitamins- Sources, RDA, functions and deficiency manifestations.
6. Minerals-Calcium, Phosphorus, Iron, copper, zinc, selenium and fluoride
7. Non Protein Nitrogenous compounds-Clinical Significance of Urea, Uric acid, creatinine, acetone and HCL
8. Overview of Metabolism

   Carbohydrate Metabolism-Glycolysis, Gluconeogenesis and TCA Cycle

   Protein Metabolism- General Reactions of amino acids and Urea cycle.

Scheme of Examination

Theory total 30 Marks **Duration 90 minutes**

No.	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

1	Test Book of Bio Chemistry for Medical Students	Vasudevan (DM), & Sree Kumari (S)	Jaypee Brothers, New Delhi.
2	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009. India)
3	Clinical Chemistry	Varley	William Heinemann Medical Books Ltd & Inter Science Book.Inc. New York.
4	Clinical Chemistry	TEITZ	W.B. Saunders Company Harcourt (India) Pvt. Ltd. New Delhi-110048.

Practical 2 : Basics of Biochemistry **Practical - 30 hours**

1. Demonstration of Colorimeter, spectrophotometer, pH meter.
2. Quantitative analysis of Glucose, Urea and creatinine
3. Estimation of urine creatinine
4. Biochemically important substance- Urea, Uric acid, Creatinine, Acetone and HCL

Practical Examination-Semester II

Major Practical

Topics	No. of Questions	Number of Question and Marks	Total
Qualitative Analysis: of Glucose/ Urea/Creatinine/Estimation of Urine creatinine	1	1 x 25	25 Marks

Minor Practical

Topics	No. of Questions	Number of Question and Marks	Total
Analysis of biochemically important substances	1	1 x 15	15 Marks

Practical Marks 40 Marks
IA Marks: 10 Marks
Grand Total 50 Marks

PAPER 3 : Section A - Haematology & Clinical Pathology **Theory 25 Hours**

Hematology:

1. Bone marrow
   a. Techniques of aspiration, preparation and staining of films
   b. Bone marrow biopsy
2. Preparation of buffy coat smears
3. Laboratory tests used in the investigation of anemia's
   a. B 12 and folate assay Normal values, derangements and interpretation of results.
   b. Schilling test - Method and interpretation
   c. Serum iron and iron binding capacity and other tests for Iron deficiency anemia-Normal values, derangements and interpretation of results
4. Laboratory test used in investigation of hemolytic anemia's
   a. Osmotic fragility
   b. Investigation of G-6 PD deficiency
   c. Test for sickling
   d. Estimation on of Hb-F, Hb-A2
   e. Plasma haemoglobin and Haptoglobin, demonstration of haemosiderin in urine
   f. Haemoglobin electrophoresis
   g. Coomb's test (Direct & Indirect) - Test for auto immune hemolytic Anaemias.

Clinical Pathology

1. Urine examination
   Physical, Chemical & Microscopic
2. Semen analysis

BLOOD BANKING
(Blood transfusion and Immunohaematology).

1. Collection & processing of Blood –Donor selection, Registration, Medical history, Physical examination.
2. Collection of Blood
3. Processing of Donor Blood
4. Storage & preservation of Blood.
5. ABO Blood group System
6. R.h typing and weaker variants in R.h system
7. Subgroup and weaker various of A and B and Bombay Phenotype
8. Preparations and standardization of Anti Human globulin reagent
9. Coomb's test.
10. Blood grouping and cross-matching in blood bank.
11. Diseases transmitted by Blood and their screening - Australia Antigen and Hepatitis C. Virus (HCV), HIV, Syphilis, CMV & Malaria in Blood transfusion
12. Investigation of transfusion reaction.
13. HLA Antigens and their significance in blood transfusion.
14. Blood Components- its preparation and their use in clinical practice.
15. Haemapheresis- Apheresis using cell separators Leucapheresis, plateletpheresis, plasmapheresis Adverse effects on donors.
16. Blood Bank Administration.
17. Record keeping

Immuno - cytochemistry:

1. Introduction
2. Basic concepts of immunochemistry
3. Monoclonal antibodies and their preparations
4. Fluorescence reactions
5. PAP Technique - principle, preparation of reagents and Procedure.

Scheme of Examination

Type of questions and distribution of marks for Theory examination in each subject in Second Semester.

(Section A - Pathology - 50 marks + Section B - Microbiology - 50 marks)

No.	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad.
7.	Hematology Blood Banking & Transfusion (PB)	Dutta B. A.	CBS Publishers & Distributors Pvt. Ltd.
8.	Blood Transfusion in Clinical Practice (HB)	Kochhar P. K.	CBS Publishers & Distributors Pvt. Ltd.
9.	Transfusion Medicine, 3e (PB)	Mc Cullough	CBS Publishers & Distributors Pvt. Ltd.
10.	Practical Transfusion Medicine,4e (HB)	Murphy	CBS Publishers & Distributors Pvt. Ltd.

Practical 3 : Pathology Practicals **Practical 35 Hours**

I. HAEMATOLOGY

- Sickling test-Demonstration
- Bone Marrow Smear preparation & staining procedure- Demonstration
- Demonstration of Malarial Parasite.
- Blood grouping. , Cross matching, Blood Transfusion and immunohaematology.
- Coomb's Test (Demonstration).

II. CLINICAL PATHOLOGY

- Visit to pathology laboratory – Postings in batches - 15 days for 2 hours
- Urine examination
  - Physical
  - Chemical – Reducing substances ketone bodies, proteins and blood
  - Microscopy
  - Dipstick method – Demonstration
  - Semen Analysis Demonstration

Practical Assesment

Scheme of Practical Examination for Second Semester.

(Section A Pathology 50 Marks + Section B Microbiology -50 Marks)

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical A	40 (Major 30 + Minor10)	10	50
2	Section B	40 (Major 30 + Minor10)	10	50

Pathology Practicals

I. Major		**30 marks**
a. Urine Examination	10 marks	
b. Urine Microscopy	10 marks	
c. Blood Grouping	10 marks	
II. Minor		**10 marks**
a. Spotters	05 marks	
b. Coombs(Direct / Indirect) test Interpretation/Proceedure writing	05 marks	
IA		**10 marks**
	Total	**50 marks**

PAPER 3 : Section B - Microbiology **Theory 25 Hours**

- Culture media and different methods of cultivation.
- **Immunology**– Introduction, Specific and non-specific immunity, Antigens, Antibodies – Structure and function, Complement and antigen-antibody reaction.

Scheme of Examination

Theory 40 Marks **Duration 90 minutes**

No.	Question asked	Questions to attempt	Questions	Marks	Max. marks	Internal assessment	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

1) Ananthanarayan and Paniker'sTestbook of Microbiology. Tenth Edition. Reba Kanungo

2) Textbook of Microbiology for MLT. Second Edition.Dr.C.P.Baveja.

Practical 3 : Section B - Microbiology Practicals 25 Hours

- Biomedical waste management
- Collection of various clinical specimens .
- Serological tests
- Un-inoculated culture media and culture techniques.

Practical Exam Pattern

Major :		**-25 marks**
• Biomedical waste management	-10 marks	
• Serological tests/Inoculation techniques	-15 marks	
Minor :		**-15 marks**
• Spotters	-15 marks	
IA		**-10 marks**
	Total	**-50 marks**

ENVIRONMENTAL STUDIES

GOAL:

The students should gain knowledge to understand the multidisciplinary nature of the environment and the awareness of the eco system, which maintains the natural environment.

OBJECTIVES:

a) KNOWLEDGE

At the end of the II Phase 1st term MBBS Course the student is expected to know:

1. The natural resources like forest, water, mineral, food, energy and land.
2. Functions of the eco system.
3. Bio-diversity and its conservation.
4. Environmental pollution & its prevention.
5. Social issues.

b) SKILLS

At the end of the II Phase 1st term MBBS Course the student is expected to:

1. Visit local areas to understand and document environmental assets like river, forest, grassland, hill and mountain.
2. Visit an industrial area or agricultural area to know about local pollutants.
3. Identify common plants, insects and birds in their local areas.
4. Identify rivers, hills and mountains in their local areas.
5. To make use of the knowledge to protect natural resources.

COURSE CONTENTS

Theory and Field work : 50 Hours

- **Theory - 45 hours**
- **Field work - 5 hours**

1: Multi-disciplinary nature of environmental studies
Definition, scope and importance, need for public awareness. **2 hours**

2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

g) Role of an individual in conservation of natural resources.

h) Equitable use of resources for sustainable lifestyles **8 hours**

3: 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 ecosystems:-

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) **6 hours**

4: Biodiversity and its conservation **8 hours**

- Introduction - Definition : genetic, species and ecosystem diversity.
- Biogeographical classification of India.
- Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation.
- Hot-sports of biodiversity.
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

5: Environmental Pollution **8 hours**

Definition

- Cause, effects and control measures of:-

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

- 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.

6: Social Issues and the Environment **7 hours**

- From Unsustainable to Sustainable development
- Urban problems 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.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and control of Pollution) Act.
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.

7: Human Population and the Environment **6 hours**

- Population growth, variation among nations.
- Population explosion - Family Welfare Programme.
- 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.

8: Field work

- Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
- Visit to a local polluted site - Urban / Rural/ Industrial/Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

SCHEME OF EXAMINATION

A. Theory : 80 Marks

- **Long Essay 2 X 10 = 20**
- **Short Essay 8 X 5 = 40**
- **Short Answers 5 X 4 = 20**

B. Field Work: 20 Marks

Recommended Books

Sl. No.	Title	Author	Edition & Year	Publisher
1	Environmental Biology	Agarwal, K.C.	2001	Nidi Publication Ltd. Bikaner
2	The Biodiversity of India	Bharucha Erach		Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013
3	Environmental Encyclopedia	Cunningham W.P., Copper T.H., Gorhani E. & Hepworth M.T.	2001	Jaico Publication House, Mumbai.
4	Global Biodiversity Assessment	Heywood V. H. & Waston R.T.	1995	Cambridge University Press 1140p
5	Environmental Protection and Laws	Jadhav H. & Bhosale V. M.	1995	Himalaya Publishing House, Delhi 284p
6	Environmental Science Systems & Solutions	Mckinney M. L. & School R.M.	1996	

THIRD SEMESTER

Scheme of Examination:

Sr. no	Subject Code	Theory	Subjects	Theory Max. + IA +Viva Voce	Grand Total
1	BMLS13	Paper 1	Biochemistry III	60 + 20 +20	100
2	BMLS14	Paper 2	Histopathology	60 + 20 +20	100
3	BMLS15	Paper 3	Bacteriology	60 + 20 +20	100

Scheme of Examination

Sr. no	Subject Code	Practical	Subjects	Practical Max. + IA	Grand Total
4	BMLS16	Paper 4	Biochemistry III Practical	80+20	100
5	BMLS17	Paper 5	Histopathology	80+20	100
6	BMLS18	Paper 6	Bacteriology	80+20	100
7	ELS03	Elective	Communication Skills	60 + 20 +20	100

PRACTICAL ASSESMENT

Scheme of Practical Examination

Theory	Practical	IA	Grand Total
Practical paper	80	20	100

BIOCHEMISTRY

SEMESTER III

PAPER I:

Theory 45 Hours

1. Carbohydrates: Metabolism of glucose.
    a. Glycogen Metabolism
    b. Minor metabolic pathways-HMP(hexose monophosphate) Shunt pathway, Galactose and fructose Metabolism.
    d. Regulation of Blood glucose,
    e. Diabetes mellitus
    f. OGTT(oral glucose tolerance test) and other investigations & Interpretation
2. Lipid metabolism
    a. beta oxidation, de novo synthesis of fatty acids
    b. ketone body metabolism.
    c. lipoproteins and its clinical significance.
3. Plasma proteins
    a. Classification, functions & importance.
    b. Plasma protein electrophoresis: normal and abnormal pattern
4. Enzymes- Diagnostic and therapeutic application of enzymes
5. Structure of Hemoglobin and its derivatives, hemoglobionopathies (only sickle cell anemia and thalassemia).
6. Metabolism of Heme (only breakdown of heme)
7. Chromatography: Principle, types & applications, centrifuge, electrophoresis, salting in and salting out and other precipitation techniques of protein.

PAPER IV: 3rd Semester -Practicals

1. Estimation of Total protein and A/G ratio by biuret method
2. Estimation of serum bilirubin by Malloy evelyn method.
3. Preparation of Normal solutions, ,molar solutions, percent solutions and dilution techniques
4. Analysis of normal and abnormal urine.
5. Electrophoresis separation of plasma proteins(demonstration)
6. Case reports-Jaundice, OGTT and Lipoproteins
7. Estimation of blood Glucose
8. Estimation of Blood Urea
9. Estimation of Creatinine
10. Estimation of serum Albumin
11. Estimation of serum Cholesterol

SCHEME OF EXAMINATION

Semester III

Theory Total- 100 Marks **Duration: 3 Hour**

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva Voce	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

Practical Examination-Semester III

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative estimation and case reports	1	1 x 40 1x5	45 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Urine analysis/preparation of solutions	1	1 x 35	35 Marks

Practical 80 Marks

I A Marks 20Marks

Grand Total **100 Marks**

RECREOMMENDED TEXT BOOKS (Latest Edition)

Sl. No.	Name of the Books & Title	Author	Publisher's Name, Place of Publication
1	Clinical Chemistry	VARLEY	William Heinemann Medical Books Ltd & Inter Science Book. Inc. New York.
2.	Clinical Chemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
3.	Clinical Chemistry	KAPLAN	The C.V.Mosby Company, St. Louis Washington, D.C. Toronto.
4.	Text Book of Medical Biochemistry	RAMKRISHAN (S), PRASANNA (KG), RAJAN (R),	Orient Langman, Bombay
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(DM), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)
7.	Biochemistry	DAS (Debajyothi)	Academic Publishers Calcutta.
8	Biochemistry	Godkar and shivanandnaik	Manipalnaual of clinical biochemistry

PAPER II

Theory 45 Hours

Histopathology:

1. Introduction to histopathology:

a. Receiving Specimens in Laboratory

b. Grossing techniques

c. Various fixatives - Mode of action, Indications, Preparation , Basic concepts of fixation, Various types of fixatives used in a routine histopathology laboratory, Simple fixatives, Compound fixatives and Special fixatives for demonstration of various tissue elements

d. Decalcification of calcified tissue before sectioning

e. Processing of tissues for routine paraffin sections and other methods of embedding.

2. Laboratory organization

a. Reception of specimen, dispatch of reports, “Records keeping” coding the lesions of cases.

b. Follow up programme, quality control of techniques etc.

3. Instrumentation

a**)**Tissue Processor, b)Knife sharpener, c)Automatic slide stainer, d) Microtome,

e) Knives f) Freezing Microtome; Cryostat, g) Instruments for grossing h) Electric saw.

4. Frozen Section Techniques: Co2 Freezing, Cryostat and freezing microtome

5. Processing of various tissues for histological examination: Embedding – Definition, Various types of embedding media, Procedure followed by Dehydration, Clearing, Infiltration and routine timing schedule for manual or automatic tissue processing, Components & principles of various types of automatic tissue processors

6. Techniques and principles of sections cutting and routine staining (H&E) and special stains -Theory of Staining, Classifications of Dyes, Principles of Dye Chemistry, Stains and Dyes and their uses, Types of Stains, Chemical Staining Action, Mordants and Accentuators, Metachromasy, Use of Controls in Staining Procedures, Equipment and Procedure for manual Staining and Automatic Staining Technique, Mounting of Cover Slips, Labeling and Cataloguing the Slides.

7. Mounting - Techniques, various mounting media.

8. Uses of various types of microscopes and polarisers

9. Maintenance of records and filing of slides familiarization with computer.

10. Museum Technology – Preservation.

PAPER V

Histopathology Practicals:

I. Histopathology

1. Staining techniques – H & E
2. Special stains used in histopathology:
    - P.A.S
    - VG
    - Reticulin
    - MTS.
    - Alcian blue

THEORY ASSESMENT

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5 x 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT

Scheme of Practical Examination for Third Semester.

Sr. no	Theory	Practical	IA	Grand Total
1	Practical	80	20	100

Maximum Marks **80 Marks**

I. Spotters - Histopathology & Clinical Pathology – 20 marks

II. H&E Staining – 20 marks

III. Perform and Write Procedure for any one special stain – 20 marks

PAS / MTS

IV. Histopathology techniques (any Two - 20 marks

Block Cutting

Mounting

Stropping/ Honing

Embedding

Mounting block on Microtome

Trimming of Block

Internal Assessment - 20 marks

Grand Total **- 100 marks**

RECREOMMENDED TEXT BOOKS

Sl. No.	Reference of Books	Author's	Publisher Name, Place
1.	Text Book of Medical Laboratory Technology	PrafulGodkar	Bhalani Publication House Mumbai
2.	Theory and Practice of Histological Techniques	J.D. Bancroft et al	Churchill livingstone, printed in china.
3.	Hand Book of Histopathological&Histo Chemical Techniques	C.F.A Culling	Butterworth's company ltd London
4.	Laboratory Techniques in Surgical Pathology	Dr.ShameemShariff	Prism Book Pvt. Ltd. Bangaluru
5.	Practical Pathology	Dr. Ganga Pilli	Prabhu Publications, Dharwad.
6.	Techniques in Histopathology Cytopathology	SadhanaVishwakarma	Jaypee Brothers, Medical Publishers ltd.

THIRD SEMESTER

Scheme of Examination

PAPER III

Theory 45 Hours

Bacteriology:

Systemic bacteriology –

a. Gram Positive Cocci – Staphylococci, Streptococci and Pneumococci

b. Gram Negative Cocci – N.gonorrhoeae, N.meningitidis.

c. Gram Positive Bacilli – Corynebacterium, Clostridium

d. Gram Negative Bacilli - Enterobacteriaceae

e. Mycobacteria: M.tuberculosis, M. leprae

f. Other Gram Negative Bacteria: a) Haemophilus, b) Brucella,

g. Anaerobic Bacteria :Bacteroides,

h. Spirochetes-: Treponemapallidium

Nosocomial Infection : a) Introduction, sources and types of nosocomial infections. b) Bacteriological surveillance of hospital environment. c) Role of microbiology laboratory in control of nosocomial infections

Suggested Readings:

Ananthanarayan and Paniker'sTestbook of Microbiology.Tenth Edition. Reba Kanungo

Textbook of Microbiology for MLT.Second Edition.Dr.C.P.Baveja.

PAPER V

PRACTICAL 25 Hours

- Media preparation, pouring and inoculation
- Biochemical tests for identification of organisms
- Processing of following clinical samples for culture and identification of pathogens:
    a. Blood
    b. Throat swab
    c. Sputum

d. Pus

e. Urine

f. Stool for Salmonella, Shigella and Vibrio cholerae

g. C.S.F. and other body fluids

- Methods of disposal of bacterial cultures.

Suggested Readings:

Practical Microbiology, Fourth Edition. C.P Baveja.

SCHEME OF EXAM FOR THEORY

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	6	5X5	25			
3.	Short Answers	10	10	5 x 3	15			
Total					**60**	**20**	**20**	**100**

PRACTICAL ASSESMENT

Scheme of Practical Examination for Third Semester.

1) Spotters -20 marks

2) Media pouring - 20 marks

3) Inoculation -20 marks

4) Interpretation of biochemical reactions -20 marks

Sr. no	Practical	IA	Grand Total
1	80	20	100

Theory 30 Hours

Communication Skills

Unit-I :

- Communication, its types and significance: Communication, Process of communication its kinds, channels and role in the society.
- Methods of Communication (Oral, Written, One way, two way communication skills).
- Reading skills: - Process of reading, reading purpose, models, strategies methodologies, reading activities, structure of meaning techniques.

Unit-II

- Précis and Communication.
- Writing skills :- Elements of effective writing, writing styles, scientific and technical writing.
- Grammar: - Transformation of sentences, words used as different parts of speech, one word substitution, abbreviations, technical terms etc.

Unit-III

- Listening skills: - Process of listening, barriers to listening, effective listening skills, feedback skills.
- Speaking skills :- Speech mechanism, organs of speech, production and classification of speech sounds, phonetic transcription, skills of effective speaking components of an effective talk, oral presentation and the role of audio visual aids in it.
- Reading of text book.

Unit-IV

- Barriers of communication and technique to overcome those.
- Meaning of effective communication.
- Technical Report writing.
- Practice of writing personal resume and writing application for employment.

Theory: 80 Marks

IA: 20 Marks

FOURTH SEMESTER

Scheme of Examination

Sr. no	Subject Code	Theory	Subjects	Theory Max. + IA+ Viva Voce	Grand Total
1	BMLS19	Paper 1	Analytic Biochemistry and Clinical Biochemistry I	60 + 20 +20	100
2	BMLS20	Paper 2	Haematology & Clinical Pathology	60 + 20 +20	100
3	BMLS21	Paper 3	Virology	60 + 20 +20	100
Sr. no	**Subject Code**	**Practical**	**Subjects**	**Practical Max. + IA**	**Grand Total**
4	BMLS22	Paper 4	Analytic Biochemistry and Clinical Biochemistry I Practical	80 + 20	100
5	BMLS23	Paper 5	Haematology & Clinical Pathology	80 + 20	100
6	BMLS24	Paper 6	Virology	80 + 20	100
7	ELS04	Elective	Law- Indian Constitution	80 + 20	100

BIOCHEMISTRY

SEMESTER IV

PAPER I

Theory 45 Hours

Analytic Biochemistry & Clinical Biochemistry I

1. Photometry, Spectrophotometry- Principles, instrumentation and its application.
2. Flame photometry and atomic absorption spectrophotometer - Principle and use.
3. Acid base balance: blood buffering systems, Henderson-hasselbach Equation, respiratory and renal regulation of blood pH. Disorders of acid base balance.
4. Water and electrolyte balance and basic principles and estimation of Electrolytes. Disorders of water and electrolyte balance.
5. Organ function tests-

   a. Liver function tests and their assessment.

   b. Renal function tests and their assessment
6. Cardiac profile-biochemical markers of myocardial infraction.
7. Hazards & safety measures in clinical Biochemistry laboratory.
8. Quality control and quality assurance in a clinical biochemistry laboratory
9. Laboratory organization, management and maintenance of record
10. Principles of assay procedures for: - Normal range in blood, Serum, Plasma and Urine and reference values for: a. Glucose, b. Proteins, c. Urea , d. Uric acid, e. Creatinine, f. Bilirubin, g. Lipids

PAPER IV

Analytic Biochemistry & Clinical Biochemistry I

Practicals-25 Hours

1. Enzyme; Determination of Alkaline phosphatase, alanine transaminase (ALT), aspartate transaminase (AST), Amylase
2. Chromatographic separation of amino acids
3. Precipitation reactions of proteins
4. Case reports-

a. Liver function tests

b. Renal function tests.

c. Cardiac markers.

5. To demonstrate the principle, working & maintenance of spectrophotometer and colorimeter.

6. To demonstrate the principle, working & maintenance of flame photometer.

7. To demonstrate the principle & demonstration of TLC.

8. To demonstrate the principle & procedure of Electrophoresis.

SCHEME OF EXAMINATION

Theory Total- 100 Marks **Duration : 3 Hours**

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva Voce	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5 x 5	25				
3.	Short Answers	5	5	5 x 3	15				

Practical Examination-Semester IV

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative estimation or chromatography and case reports	1	1 x 40 1x5	45 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Precipitation reactions of proteins	1	1 x 35	35 Marks

Practical Marks 80 Marks

IA Marks: 20 Marks

Grand Total **100 Marks**

RECOMMENDED TEXT BOOKS (Latest Edition)

Sl. No.	Name of the Books & Title	Author	Publisher's Name, Place of Publication
1	Clinical Chemistry	VARLEY	William Heinemann Medical Books Ltd & Inter Science Book. Inc. New York.
2.	Clinical Chemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
3.	Clinical Chemistry	KAPLAN	The C.V.Mosby Company, St. Louis Washington, D.C. Toronto.
4.	Text Book of Medical Biochemistry	RAMKRISHAN (S), PRASANNA (KG), RAJAN (R),	Orient Langman, Bombay
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(DM), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)
7.	Biochemistry	DAS (Debajyothi)	Academic Publishers Calcutta.
8	Biochemistry	Godkar and shivanandnaik	Manipalnaual of clinical biochemistry

PAPER II

Theory 45 Hours

Haematology & Clinical Pathology

1. To measure the levels of Methaemoglobin, Carboxy and sulphahaemoglobin
2. Investigation of Haemorrhagic Disorders
    a. Mechanism of coagulation.
    b. Collection and anticoagulants used in coagulation studies
    c. Bleeding time and clotting time
    d. Other coagulation studies PT, PTI, INR and APTT
    e. Assay of clotting factors
3. Test for blood fibrinolytic activity and detection of FDP.
4. Platelet function tests, Platelet count
5. Demonstration of LE cells
6. Cytochemistry
7. Automation in haematology
8. Bone marrow examination: Composition and functions, Aspiration of bone marrow (Adults and children) , Processing of aspirated bone marrow (Preparation & staining of smear), Brief knowledge about examination of aspirated bone marrow, differential cell counts and cellular ratios), Processing and staining of trephine biopsy specimens
9. Routine examination of seminal fluid
10. Organisation and quality control in haematology laboratory Preparation of glassware and disposal of the waste in the laboratory - Biomedical waste management in haematology laboratory (Other than Radioactive material

PAPER V:

Theory 25 Hours

Practicals

HAEMATOLOGY

a. Bleeding time & Clotting

b. LE cell demonstration.

c. MPO& Sudan black stain - Demonstration

d. Platelet count

THEORY ASSESMENT

Type of questions and distribution of marks for Theory examination in each subject for Fourth semester

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5X5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT

Scheme of Practical Examination for Fourth Semester.

Sr. no	Theory	Practical	IA	Grand Total
1	Practical	80	20	100

Pathology Practicals	- 80 marks
1. Spotters	-20 marks
2. Write the procedure for Bleeding Time / Clotting Time	- 20 marks
3. Perform the procedure for platelet count	- 20 marks
4. Stain the given bone marrow aspirate smear	- 20 marks
& Write the procedure	
Internal Assessment–	-20 marks
Grand Total	**-100 marks**

RECREOMMENDED TEXT BOOKS

Sl. No.	Reference of Books	Author's	Publisher Name, Place
1.	Text Book of Medical Laboratory Technology	ParfulGodkar	Bhalani Publication House, Mumbai
2.	Todd and Sanford, clinical Diagnosis and Management by laboratory Method's	John Bernard Henry	All India Traveller Book Seller, Delhi
3.	Practical Pathology	Dr. Ganga Pilli	Prabhu Publications, Dharwad
4.	Essentials in Hematology& clinical Pathology	Dr.RamdasNayak Dr.SharadaRai	Jaypee Brother's Medical Publisher's Limited
5.	De Gnichy's clinical Hematology	Editors- Frank Firkin, C.Chesterman, P David, R Bryan	Oxford Univ. press

PAPER III

Theory 25 Hours

Virology

- **Virology**
  - General properties and classification of viruses
  - Laboratory diagnosis of viral infection
  - Viruses and diseases caused by them (Arboviruses, Enterovirus, Myxovirus, Herpes, Pox and Adenovirus)
  - Hepatitis and retroviruses
  - Immunity in viral infection and antiviral agents
  - Viral vaccines
  - Bacteriophage
  - Tissue culture
- **Equipments necessary for carrying out tissue culture studies**
  - Laminar flow equipment
  - Carbondioxide incubator
  - Inverted microscope
  - Basic procedure for preparation of glassware, Media etc for sterilization
  - Dry heat sterilization
  - Autoclaving in an atmosphere of steam
  - Chemical sterilization
  - Filter sterilization of liquid media etc
- **Derivation of culture from the tissue**
  - Enzymatic digestion of tissue using collagens, protease etc
  - Plating of cells in tissue culture media
  - Observation of cells in invertoscope
  - Subculturing and derivation of cell lines

- **Characteristics of cell lines**
    - Determination of biochemical markers in cells
    - Chromosomal and DNA content of cells
    - Immunological properties of cells
- **Preservation of immortalised cell lines.**
    - Storage in glycerol in liquid nitrogen
    - Storage in Dimethyl sulfoxide in liquid nitrogen

Suggested Readings:

Ananthanarayan and Paniker'sTestbook of Microbiology.Tenth Edition. Reba Kanungo Textbook of Microbiology for MLT.Second Edition.Dr.C.P.Baveja.

PAPER V

Practicals 25 Hours

- **VIROLOGY:**
    - **Viral cultivation methods** - inoculation of egg, animal inoculation, tissue culture technique, CAM
    - Demonstration of CPE
    - Haemagglutination
    - Haemagglutination inhibition test
    - Viral serology - ELISA

Suggested Readings:

Practical Microbiology, Fourth Edition. C.P Baveja.

SCHEME OF EXAM FOR THEORY

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva-Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	6	5X5	25			
3.	Short Answers	10	10	5 x 3	15			
Total					**60**	**20**	**20**	**100**

PRACTICAL ASSESMENT

Scheme of Practical Examination for Fourth Semester for subject code BMLS04:

Sr. no	Practical	IA	Grand Total
1	80	20	100

1) Spotters- - 20 marks

2) ELISA - 20 marks

3) Spot tests -20 marks

4) Haemagglutination tests -20 marks

PAPER IV

Theory 45 Hours

LAW - INDIAN CONSTITUTION

I. GOAL :

The students should gain the knowledge and insight into the Indian Constitution so that they are aware of the fundamental rights and freedom bestowed through the democratic governance of our country.

II. OBJECTIVES :

A) KNOWLEDGE :

At the end of the B.Sc. 1st Year course the student is expected to know:

1) Basic knowledge of the Indian Constitution.
2) Democratic institutions created by the Constitution.
3) Special rights created by the Constitution for regional and linguistic minorities.
4) Election Commission.
5) Legislative, Executive and Judicial powers and their functions in India.

B) SKILLS:

At the end of the B.Sc. 1st Year course the student is expected to make use of knowledge:

1) To perform his / her duties towards the society judiciously and with conscious effort for self-development.
2) To utilize State policies in their future practice.

COURSE CONTENTS

Theory: **25 Hours**

Unit I
a) Meaning of term Constitution.
b) Making of the Indian Constitution - 1946 - 1949 and role played by Dr. B. R. Ambedkar.
c) Salient Features of the Constitution.
d) Preamble of the Constitution. 2 Hours

Unit II The democratic institutions created by the Constitution.

	Bicameral System of Legislature at the Centre and in the States.	
	Devolution of Powers to Panchayat Raj Institutions.	5 Hours
Unit III	Fundamental Rights and Duties - Their content and significance	5 Hours
Unit IV	Directive Principles of State policies - The need to balance Fundamental Rights with Directive Principles.	1 Hour
Unit V	Special rights created in the constitution for Dalits, Backward class, Women and Children, and the Religious and Linguistic Minorities	1 Hour
Unit VI	Doctrine of Separation of Powers - Legislative, Executive and Judicial, and their functions in India.	4 Hours
Unit VII	The Election Commission and State Public Service Commissions.	2 Hours
Unit VIII	Method of amending the Constitution.	1 Hour
Unit IX	Enforcing rights through Writs Certiorari, Mandamus, Quo warranto and Hebeas Corpus.	2 Hours
Unit X	Constitution and Sustainable Development in India.	2 Hours

Scheme of Examination

University Theory Examination at the end of fourth Semster:100 Marks

Reference Books Latest Edition :

Sl. No.	Title	Author	Publisher
1.	The Constution of - A Politico - Legal Study	J. C. Johari	Sterling Publication Pvt. Ltd.
2.	Constitution Law	J. N. Pandey	Central Law Agency
3.	The Indian Constitution	Granville Austin	Corner Stone of Nation

FIFTH SEMESTER

Scheme of Examination

Sr. no	Subject Code	Theory	Subjects	Theory Max. + IA+ Viva Voce	Grand Total
1	BMLS25	Paper 1	Clinical Biochemistry II	60 + 20 + 20	100
2	BMLS26	Paper 2	Cytology, Cytogenetics& Blood Banking	60 + 20 + 20	100
3	BMLS27	Paper 3	Parasitology and Mycology	60 + 20 + 20	100

Sr. no	Subject Code	Practical	Subjects	Practical Max. + IA	Grand Total
4	BMLS28	Paper 4	Clinical Biochemistry II	60 + 20 + 20	100
5	BMLS29	Paper 5	Cytology, Cytogenetics& Blood Banking And Practical	80 + 20	100
6	BMLS30	Paper 6	Parasitology and Mycology	80 + 20	100
7	ELS05	Elective	Fundamentals of Computers	80 + 20	100

BIOCHEMISTRY

SEMESTER V

PAPER I

Theory 45 Hours- Clinical Biochemistry II

1. Organ function test: Thyroid function test.
2. Gastric Analysis: Composition of gastric juice, concepts of free and bound acid, Fractional Test Meal.
3. Renal Calculi: Theory of formation and analysis
4. Basic principles and estimation of Blood gases and pH
5. Immunochemistry and techniques-RIA(radio immune assay) and ELISA(enzyme linked immune sorbent assay)
6. Biomedical Waste management
7. Quality control: Accuracy, Precision. Error in laboratory tests, quality control charts.
8. Laboratory Automation
9. Definition, units, measurements of radiation, uses, sources and application. Radio isotope techniques. Principles and applications of RIA(radio immune assay)
10. Role of Enzymes in Clinical Practice: Discuss the marker enzymes In myocardium, liver, & pancreas
11. Inborn errors of metabolism- PKU(phenylketonuria), alkaptonuria, albinism, MSUD(maple syrup urine disease) and galactosemia Storage disorders- von gierke's disease and niemanns- pick
12. Inorganic ions. - Calcium & phosphate metabolism
13. Introduction to Molecular Biology Techniques-Blotting Techniques, Recombinant DNA Technology and Genetic Engineering and Gene Therapy
14. Interpretation and reference values of Blood glucose, Urea, Creatinine, Uric acid, Cholesterol, Calcium, Proteins, Albumin & A/G ratio
15. Introduction to NABL accreditation process

PAPER IV

Clinical Biochemistry II

Practicals- 25 Hours

1. Standardization and Estimation of glucose, urea, creatinine, Total protein & A/G ratio and bilirubin
2. Estimation of urine creatinine.
3. Analysis of Renal calculi
4. Estimation of ALT(alanine transaminase), AST(aspartate transaminase), ALP(alkaline phosphatase), Amylase
5. Estimation of calcium
6. Estimation inorganic phosphorus
7. Screening test for IEM(inborn errors of metabolism)-DNPH and ferric chloride test.

SCHEME OF EXAMINATION

Theory Total- 100 Marks **Duration: 3 Hours**

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

Practical Examination-Semester V

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Standardisation and estimation	1	1 x 40	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Analysis of renal calculi	1	1 x 40	40 Marks

Practical Marks 80 Marks

IA Marks: 20 Marks

Grand Total **100 Marks**

RECOMMENDED TEXT BOOKS (Latest Edition)

Sl. No.	Name of the Books & Title	Author	Publisher's Name, Place of Publication
1..	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(DM), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
2.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)
3.	Biochemistry	DAS (Debajyothi)	Academic Publishers Calcutta.
4	Clinical Chemistry	VARLEY	William Heinemann Medical Books Ltd & Inter Science Book. Inc. New York.
5.	Clinical Chemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
6.	Clinical Chemistry	KAPLAN	The C.V.Mosby Company, St. Louis Washington, D.C. Toronto.
7.	Text Book of Medical Biochemistry	RAMKRISHAN (S), PRASANNA (KG), RAJAN (R),	Orient Langman, Bombay

SCHEME OF EXAM FOR THEORY

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5 x 5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL ASSESMENT

Scheme of Practical Examination for Fifth Semester.

Sr. no	Theory	Practical	IA	Grand Total
1	Practical	80	20	100

Pathology Practicals	**80 marks**
1.Spotters	20 marks
2. PAP staining	20 marks
3. MGG staining	20 marks
4. Fluid Processing	10 marks
5. Identify and write in detail morphology	10 marks
of Benign/ Malignant cells	
Internal assessment	20 marks
Grand Total	**100 marks**

PAPER II

Theory 45 Hours

Cytology &Cytogenetics

CYTOLOGY:

I 1) The study of basic concepts

2) The use of Microscope, screening techniques

3) Normal cell structure and function

4) Normal Histology and cytology of epithelial and connective tissue

II 1. Collection and Preparation of Samples

2. Fixation, fixatives

3. Staining - Principles, Preparation of reagents, techniques

a. Papanicolaou's stain

b. May - GrunwaldGiemsa stain

III **Hormone Cytology:**

- Anatomy, structure and physiology of female genital tract.

- Correlation of structure of female genital tract &ovarian hormones

- Various Cytological indices

(a) Maturation Index

(b) Karyopyknotic Index

(c) Maturation Value.

IV **Malignant Cytology of Female Genital Tract :**

Female genital tract, techniques of collection of specimen

(a) Cervical Malignancy

(b) Classification of cervical smear and characteristics of normal, inflammatory, and dysplasia (mild, moderate, severe), Ca-in-situ, sq. cell carcinoma and adenocarcinoma of cervix.

(c) Cytological screening of cervical cancer (organ screening programme, Evaluation and follow-up).

V. Respiratory tract

(a) Anatomy, Histology, Physiology and normal cytology of the respiratory tract.

(b) Collection, selection of material and making smear

(c) Cytology of Bronchogenic carcinoma

VI. Urinary tract:

a. Cytology of the urinary system

b. Collection and preparation of samples

c. Cytology of cells of urinary tract.

VII. Gastrointestinal tract:

a. Cytology of the Oesophagus and Stomach.

b. Collection and preparation of samples.

c. Characteristics of malignant cytology

VIII. Effusions &C S F

Routine examination of CSF &other body fluid's (pleural, peritoneal & synovial)

a. Collection and preparation of fluid for cytological examination

b. Cytological features of non-malignant and malignant effusions.

IX. Glandular organs:

a. Cytology of breast, thyroid, salivary glands.

b. Preparation of samples and staining : Cytological features of Malignant cells

X. Automation Cytology:

I . Flow Cytometry

1. Image Analysis

2. Principles, equipmcnts, procedure and evaluation

II. Cytospin

XI. **Cytogenetics**

I. Human genetics; an introduction to the subject

II. Terminology, classifications and nomenclature of human Chromosomes

III. Methods for Karyotypic analysis Culture of bone marrow, peripheral blood lymphocytes, solid tumours, skin fibroblast, etc.

IV. Characterisation of human chromosomes by various banding techniques.

V. Sex chromatin identification.

VI. Karyotyping and analysis of chromosomal abnormalities

VII. Common chromosomal aberrations in cancer.

PAPER V

Theory 25 Hours

Section A

Cytology&Cytogenetics

Practical

1. Papanicolaou's Stain
2. May – GrunwaldGiemsa Staining
3. Hormonal Cytology
4. Malignant Cytology
5. Fluid cytology
6. Fine Needle aspiration cytology (FNAC) – Demonstration of Benign and Malignant Cells.

PAPER III

Theory 25 Hours

Parasitology and Mycology

- **Parasitology**
  - Introduction of parasitology and classification
  - Protozoa-Entamoeba, Giardia
  - Rhizopoda
  - Mastigophora (Haemoflagellates, Intestinal and genital flagellates)
  - Sporozoa (Malarial parasite, Toxoplasma)
  - Helminthes
  - Nematodes (Ascaris,Hookworm, Whipworm, Pinworm, Strongyloides, Trichinella, Filaria worm,)
  - Cestodes (Taeniasaginata, Taeniasolium, Echinicoccus, H.nana)
- **Mycology**
  - Fungi – introduction
  - Eumycetoma
  - Dermatophytes
  - Yeasts and yeast like fungi
  - Fungi of deep mycoses

Suggested Readings:

Ananthanarayan and Paniker'sTestbook of Microbiology.Tenth Edition. Reba Kanungo

Textbook of Microbiology for MLT.Second Edition.Dr.C.P.Baveja.

PAPER V

Practical 25 Hours

Parasitology and Mycology

- Stool examination
- Stool concentration techniques
- Blood smear preparation and staining for haemoflagellates, malarial and filarial parasites
- Mycology techniques
- KOH preparation
- Lactophenol cotton blue staining
- Culture demonstration of all fungi

Suggested Readings:

Practical Microbiology, Fourth Edition. C.P Baveja.

SCHEME OF EXAM FOR THEORY

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment		Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20		100
2	Short Essay Question	7	6	5X5	25			
3.	Short Answers	10	10	5 x 3	15			

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester.

Sl. no	Practical	IA	Grand Total
1		20	100

1) Spotters -20 marks
2) Parasitology exercise - 30 marks
3) Mycology techniques -30 marks

Theory 45 Hours

Fundamentals of Computers-I

- **Introduction to computer:** introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages. **Input output devices:** input devices(keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices(monitors, pointers, plotters, screen image projector, voice response systems).

- **Processor and memory:** The Central Processing Unit (CPU), main memory. **Storage Devices:** sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices. **Introduction to MS-Word:** introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge. **Introduction to Excel:** introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs. **Introduction to power-point:** introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.

- **Introduction of Operating System:** introduction, operating system concepts, types of operating system. **Introduction to MS-DOS:** History of DOS, features of MS-DOS, MS-DOS Commands (internal and external). **Introduction of windows:** History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).

- **Computer networks:** introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network. **Internet and its Applications:** definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet. **Application of Computers in various fields:** Medical, Education, Railway, Defense, Industry, Management, Sports, Commerce, Internet. ***Introduction to installation of different software and introduction about different software related to MLS.***

Practicals:

Learning to use MS Office: MS WORD, MS EXCEL & MS PowerPoint

Practical Examination: 80 Marks

IA : 20 Marks

SIXTH SEMESTER

Scheme of Examination

Sr. no	Subject Code	Theory	Subjects	Lab work + Viva	Grand Total
1	BMLS31	Paper I	Pathology department (Lab) posting	150 +50	200
2	BMLS32	Paper II	Microbiology department (Lab) posting	150 +50	200
3	BMLS33	Paper III	Biochemistry department (Lab) posting	150 +50	200
4.	ELS06	Paper IV Electives	Human values and professional Ethics	80 +20	100

EVALUATION PROCEDURE FOR SIXTH SEMESTER (Paper I, II, III)

Scheme for evaluation in the Sixth Semester:

The departments of Pathology, Microbiology and Biochemistry shall have rotational internship posting for a duration of two months each in every department. Total duration shall be of six months. During this postings they shall be posted at various sections and shall be working on various equipments and perform all the types of tests taught to them in past five semesters.

The students in the sixth semester should maintain a Log Book exclusively meant for lab technology personnel.

At the end of every postings the HOD / Assigned Staff shall go through the Log Book and calculate the marks / grades given their by faculty incharges of various sections. The total number of marks or grades should be brought to 150 marks. The faculty in charges of various sections should allot the marks / grades based on their sincerity, punctuality, hard work, knowledge and laboratory skills.

Towards the end of the postings the HOD / assigned staff shall take the viva and access the knowledge and laboratory skills of the individuals. This assessment should be allotted marks out of 50.

Theory 45 Hours

Human Values and Professional Ethics

Unit-I

1. Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Understanding the need, basic guidelines, content and process for Value Education.
- Self Exploration–what is it?- its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration.
- Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Unit-II

2. Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - *Sukh* and *Suvidha*
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure *Sanyam* and *Swasthya* **(6 Hrs)**

Unit-III

3. Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

- Understanding harmony in the Family- the basic unit of human interaction
- Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship
- Understanding the meaning of Vishwas; Difference between intention and competence
- Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! **(6 Hrs.)**

Unit-IV

4. Understanding Harmony in the Nature and Existence - Whole existence as Co- existence

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature
- Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
- Holistic perception of harmony at all levels of existence **(4 Hrs)**

5. Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct

- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics:
- Ability to utilize the professional competence for augmenting universal human order
- Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems
- Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order:
- At the level of individual: as socially and ecologically responsible engineers, technologists and managers
- At the level of society: as mutually enriching institutions and organizations

Text Book: **(6 Hrs.)**

1. R R Gaur, R Sangal, G P Bagaria, 2009, *A Foundation Course in Value Education*.

Other Suggested Readings / Books:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
4. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
5. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
6. A.N. Tripathy, 2003, Human Values, New Age International Publishers
7. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.

8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.

9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press

10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd

11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.

12. B L Bajpai, 2004, Indian Ethos and Modern Management, New

List of Reference Books (Latest Edition)

Sl. No	Name of the Text Book	Author
1	Clinical Neuroanatomy	Snell R
2	Adams and Victor's Principles of Neurology	Ropper AH, Samuels MA, Klein JP
3	Electroencephalography	Niedermeyer E Fernando Lopes De Silva
4	Current Practice of Clinical Electroencephalography	Ebersole JS, Pedley TA
5	Clinical Electroencephalography	UK Mishra, J Kalita
6	Clinical Neurophysiology: Nerve Conduction Study, Electromyography and Evoked Potentials	UK Mishra, J Kalita
7	Clinical EMG and Nerve Conductions	Shin J Oh
8	Electrodiagnosis in Clinical Neurology	Aminoff MJ.

Internal Assessment

1. Internal Assessment will be undertaken for theory and practical periodically as per the semester system and the average marks of the tests will be calculated and reduced to 20 or 10 as applicable and the marks are to be communicated to the university.

Declaration of result

1. Criteria for pass

   a. Main subject: A Candidate is declared to have passed the examination in a subject, if he/she secures 40% of the total marks in Theory and Practical separately.

   b. Elective Subjects: The minimum marks for a pass in a elective subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.

   c. In case a candidate fails in either theory or practical, he/she has to appear for both theory and Practical in the subject in any subsequent examination and he/she must obtain the minimum for a pass in the subject (theory and practical separately)

   d. A candidate shall be declared to have passed the examination if he/she passes in all the main subjects.

   Carry over System:

   At any given point of time a candidate shall have subjects pending to clear of only previous semester in addition to the subjects of the current semester that he/she is appearing for. Example:-

   - If the candidate has not cleared semester I, he/she can appear for semester II and pending subjects of semester I simultaneously.
   - For appearing for semester III he/she should have cleared semester I and can appear for papers pending from semester II along with semester III subjects.
   - For appearing for semester IV he/she should have cleared semester II and can appear for papers pending from semester III along with semester IV subjects.

- For appearing for semester V he /she should have cleared semester III and can appear for papers pending from semester IV along with semester V subjects.
- For appearing for semester VI he/she should have cleared semester IV and can appear for papers pending from semester V along with semester VI subjects.

Examiners:

There should be minimum two examiners, one internal from the same university and one external

Examiners for the First year subjects and for Pharmacology in the second year shall have Postgraduate degree in the respective subject with 3 years teaching experience of M.Sc. (Medical) with 5 years teaching experience.