

**Study Scheme & Syllabus of
Bachelor of Science in Medical Laboratory Science
(B.Sc. MLS)**

Batch 2024 onwards



By

Board of Study MLT / MLS

**Department of Academics
IK Gujral Punjab Technical University**

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

Bachelors of Science in Medical Laboratory Science (B.Sc. MLS):

It is a Under Graduate (UG) Programme of 4 years/8 Semester (Including 1 year or 2 Semesters of Internship)

Eligibility for Admission: Those candidates who have passed the 10+2 with Physics & Chemistry as compulsory subjects and either Mathematics or Biology conducted by a recognized Board / University / Council.

OR

10+2 with vocational course in Medical Laboratory Science / Medical Laboratory Technology.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

Courses & Examination Scheme:

First Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BMLS101-18	Core Theory	Essential Biology	3	1	0	40	60	100	4
BMLS102-18	Core Theory	General Microbiology	3	1	0	40	60	100	4
BMLS103-18	Core Theory	Basics of Biochemistry	3	1	0	40	60	100	4
BMLS104-18	Core Practical/Laboratory	Essential Biology-Practical	0	0	4	60	40	100	2
BMLS105-18	Core Practical/Laboratory	General Microbiology-Practical	0	0	4	60	40	100	2
BMLS106-18	Core Practical/Laboratory	Basics of Biochemistry - Practical	0	0	4	60	40	100	2
BTHU103-18	Ability Enhancement Compulsory Course (AECC)-I	English	1	0	0	40	60	100	1
BTHU104-18	Ability Enhancement Compulsory Course (AECC)	English Practical/Laboratory	0	0	2	30	20	50	1
HVPE101-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules	3	0	0	40	60	100	3
HVPE102-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules (Lab/ Seminar)	0	0	1	25	--**	25	1
BMPD102-18		Mentoring and Professional Development	0	0	1	25	--**	25	1
	TOTAL		13	03	16	460	440	900	25

*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement

**The Human Values, De-addiction and Traffic Rules (Lab/ Seminar) and Mentoring and Professional Development course will have internal evaluation only.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

Second Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BMLS201-18	Core Theory	Systemic Bacteriology	3	1	0	40	60	100	4
BMLS202-18	Core Theory	Biochemical metabolism	3	1	0	40	60	100	4
BMLS203-18	Core Theory	Human Anatomy and Physiology-I	3	1	0	40	60	100	4
BMLS204-18	Core Practical/Laboratory	Systemic Bacteriology-Practical	0	0	4	60	40	100	2
BMLS205-18	Core Practical/Laboratory	Biochemical metabolism-Practical	0	0	4	60	40	100	2
BMLS206-18	Core Practical/Laboratory	Human Anatomy and Physiology-I - Practical	0	0	4	60	40	100	2
EVS102-18	Ability Enhancement Compulsory Course (AECC) -III	Environmental Science	2	0	0	40	60	100	2
BMPD202-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		11	03	13	365	360	725	21

*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

Third Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BMLS301-18	Core Theory	Basic Hematology-& Hematological Techniques-I	3	1	0	40	60	100	4
BMLS302-18	Core Theory	Analytical Biochemistry	3	1	0	40	60	100	4
BMLS303-18	Core Theory	Human Anatomy and Physiology-II	3	1	0	40	60	100	4
BMLS304-18	Core Practical/Laboratory	Basic Hematology-& Hematological Techniques-I	0	0	4	60	40	100	2
BMLS305-18	Core Practical/Laboratory	Analytical Biochemistry -	0	0	4	60	40	100	2
BMLS306-18	Core Practical/Laboratory	Human Anatomy and Physiology-I I-Practical	0	0	4	60	40	100	2
BMLS307-18	Skill Enhancement Course-I	Applied Bacteriology	1	0	0	40	60	100	1
BMLS308-18	Skill Enhancement Course-Laboratory	Applied Bacteriology-Practical	0	0	2	30	20	50	1
BMPD302-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		10	03	15	395	380	775	21

*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

Fourth Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BMLS401-18	Core Theory	Basic Cell Pathology	3	1	0	40	60	100	4
BMLS402-18	Core Theory	Basic Hematology-II	3	1	0	40	60	100	4
BMLS403-18	Core Theory	Clinical Biochemistry-I	3	1	0	40	60	100	4
BMLS404-18	Core Practical/Laboratory	Basic Cell Pathology - Practical	0	0	4	60	40	100	2
BMLS405-18	Core Practical/Laboratory	Basic Hematology-II - Practical	0	0	4	60	40	100	2
BMLS406-18	Core Practical/Laboratory	Clinical Biochemistry-I - Practical	0	0	4	60	40	100	2
BMLS407-18	Skill Enhancement Course-II	Immunology and Mycology	1	0	0	40	60	100	1
BMLS408-18	Skill Enhancement Course- Laboratory	Immunology and Mycology- Practical	0	0	2	30	20	50	1
BMPD402-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		10	03	15	395	380	775	21

*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

Fifth Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BMLS501-18	Skill Enhancement Course-III	Applied Hematology-I	1	0	0	40	60	100	1
BMLS502-18	Skill Enhancement Course-Laboratory	Applied Hematology-I - Practical	0	0	2	30	20	50	1
BMLS503-18	Open Elective-I	Medical Lab Management	3	1	0	40	60	100	4
BMLS504-18	Elective-I	Histotechnology-I	3	1	0	40	60	100	4
BMLS505-18	Elective-II	Clinical Biochemistry-II	3	1	0	40	60	100	4
BMLS506-18	Elective-I Laboratory	Histotechnology-I - Practical	0	0	4	60	40	100	2
BMLS507-18	Elective-II Laboratory	Clinical Biochemistry-II - Practical	0	0	4	60	40	100	2
BMLS508-18	Project	Minor Project	0	0	2	Satisfactory / Un Satisfactory			2
BMPD502-18		Mentoring and Professional Development	0	0	1	25	--	25	1
TOTAL			10	03	13	335	340	675	21

*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

Sixth Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BMLS601-18	Skill Enhancement Course-IV	Applied Hematology-II	1	0	0	40	60	100	1
BMLS602-18	Skill Enhancement Course-Laboratory	Applied Hematology-II-Practical	0	0	2	30	20	50	1
BMLS603-18	Open Elective-II	Blood Banking	3	1	0	40	60	100	4
BMLS604-18	Elective-III	Parasitology and virology	3	1	0	40	60	100	4
BMLS605-18	Elective-IV	Histotechnology-II & Cytology	3	1	0	40	60	100	4
BMLS606-18	Elective-III Laboratory	Parasitology and virology - Practical	0	0	4	60	40	100	2
BMLS607-18	Elective-IV Laboratory	Histotechnology-II & Cytology - Practical	0	0	4	60	40	100	2
BMLS608-18	Project	Major Project	0	0	6	Satisfactory / Un Satisfactory			6
BMPD602-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		10	03	17	335	340	675	25

*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement

Total Marks of B.Sc. Program : 4525

Total Credit of B.Sc. Program : 134

NOTE :

ONLY FOR BOS

The course types and their number are fixed as mentioned in the scheme however respective BOS can shuffle the courses as required.

**Bachelor of Science (Medical Lab Sciences) [Semester VII-VIII]
Batch 2024 onwards**

Course Code	Course Title	Marks Distribution			Credits
		Internal	External	Total	
BMLS-701-21	Semester Internship	200	-	200	8

Course Code	Course Title	Marks Distribution			Credits
		Internal	External	Total	
BMLS-801-21	Semester Internship	200	-	200	8

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

First Semester

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS101-18-ESSENTIAL BIOLOGY

Theory

UNIT-I

Biology & Its Branches; Scientific methods in Biology; Scope of biology and career options in Medical Laboratory Sciences

UNIT-II

Structure and function of tissues - epithelial, connective, muscular and nervous

UNIT-III

Cell as a basic unit of life - discovery of cell, cell theory, cell as a self - contained unit; prokaryotic and eukaryotic cell; unicellular and multicellular organisms; Ultrastructure of prokaryotic and eukaryotic cell - cell wall, cell membrane - unit membrane concept (Fluid-Mosaic model); membrane transport; cellular movement (exocytosis, endocytosis); cell organelles and their functions- nucleus, mitochondria, plastids, endoplasmic reticulum, Golgi complex, lysosomes, microtubules, centriole, vacuole, cytoskeleton, cilia and flagella, ribosomes

UNIT-IV

Molecules of cell; inorganic and organic materials - water, salt, mineral ions, carbohydrates, lipids, amino acids, proteins, nucleotides, nucleic acids (DNA and RNA), Cell division: Binary fission, Cell cycle: Mitosis, Meiosis

Unit V

Continuity of life - heredity, variation; mendel's laws of inheritance, chromosomal basis of inheritance; other patterns of inheritance - incomplete dominance, multiple allelism, quantitative inheritance. Chromosomes - bacterial cell and eukaryotic cell; parallelism between genes and chromosomes; genome, linkage and crossing over; gene mapping; recombination; DNA as a genetic material - its structure and replication; structure of RNA and its role in protein synthesis

Suggested Readings:

1. Reece, J.B., Urry, L.A., Cain, M.L., Wasserman, S.A., Minorsky, P.V. & Jackson, R.B. (2011). Campbell Biology (9th Edition). Pearson Benjamin Cummings Publishers, San Francisco, USA.
 2. Fried, G.H. & Hademenos, G.J. (2002). Schaum's Biology. Tata McGraw Hill Publications, New Delhi.
-

MLS102-18- GENERAL MICROBIOLOGY

Theory

Aims /learning Objectives: This subject gives the general insight into history and basics of medical microbiology, imparts the knowledge about equipments used in Medical Microbiology and basic procedures done in medical microbiology laboratory i.e. microscopy, sterilization, disinfection, culture methods required to perform different microbiological tests in clinical microbiology lab and biomedical waste management.

- 1. Introduction to Medical Microbiology:** Definition - History - Host-Microbe relationship.
- 2. Safety Measures in clinical microbiology**
- 3. Glassware used in Clinical Microbiology Laboratory:** Introduction - Care and handling of glassware - Cleaning of glassware
- 4. Equipments used in clinical Microbiology Laboratory:** Introduction - Care and maintenance
- 5. Microscopy:** Introduction and history, Types of microscope, (a) Light microscope (b) DGI(c) Fluorescent (d) Phase contrast (e) Electron microscope: Transmission, Scanning, Principles and operational mechanisms of various types of microscopes
- 6. Sterilization:** Definition, Types and principles of Sterilization, method (a) Heat (dry heat, moist heat with special Reference to autoclave (b) Radiation (c) Filtration, Efficiency testing to various sterilizers
- 7. 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 disinfectant, Testing efficiency of various
- 8. Biomedical waste management in a Microbiology lab:** Types of the waste generated – Segregation – Treatment – Disposal.
- 9. General characteristics & classification of Microbes : (Bacteria & fungi):** Classification of microbes with special reference to prokaryotes & eukaryotes, Morphological classification of bacteria, Bacterial anatomy (Bacterial cell structures)
- 10. Growth and Nutrition of Microbes:** General nutritional & other requirements of the bacteria, Classification of bacteria on the basis of their nutritional requirements, Physical conditions required for growth, Normal growth cycle of bacteria (growth Curve), Types of microbial cultures: Synchronous, Static, continuous culture
- 11. Culture media:** Introduction, Classification of culture media (Example & Uses) solid media, liquid media, semisolid, Media,, routine/synthetic/defined media, basal media, enriched , enrichment, Selective, differential media, sugar fermentation media, transport media, preservation media and anaerobic culture media.
- 12. Aerobic & anaerobic culture methods:** Concepts, Methods Used for aerobic cultures, Methods Used for anaerobic cultures

Suggested Readings:

1. Practical Medical Microbiology by Mackie and MacCartney
2. Text book of Microbiology by Ananthanereyan
3. Medical Microbiology by Paniker & Satish Gupte
4. Medical laboratory Technology vol. I, II, III by Mukherjee
5. District Laboratory Practice in tropical countries Vol II Microbiology by Monia Cheesbrough
6. Text book of Microbiology by Prescott
7. Practical Medical Microbiology by Mackie & MacCartney Volume 1 and 2
8. Immunology by Kuby.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS103-18- BASICS OF BIOCHEMISTRY

Theory

Aims /learning Objectives: The main objective of the subject is to impart the knowledge of apparatus, units, equipments, volumetric analysis in the laboratory of clinical Biochemistry.

1. **Introduction to Medical lab Technology.** (a) Role of Medical lab Technologist, (b) Ethics and responsibility, (c) Safety measures (d) First aid.
2. **Cleaning and care of general laboratory glass ware and equipments.** (a) Steps involved in cleaning soda lime glass (b) Steps involved in cleaning borosil glass. (c) Preparation of chromic acid solution. (d) Storage.
3. **Distilled water.** (a) Method of preparation of distilled water (b) Type of water distillation plants (c) Storage of distilled water
4. **Units of Measurement.** (a) S.I unit and CGS units (b) Conversion (c) Strength, molecular weight, equivalent weight (d) Normality, Molarity, Molality (e) Numericals.
5. **Calibration of volumetric apparatus** (a) Flask (b) Pipettes (c) Burettes (d) Cylinders
6. **Analytical balance** (a) Principle (b) Working (c) Maintenance
7. **Concept of pH** (a) Definition (b) Henderson Hasselbatch equation (c) Pka value (d) pH indicator (e) Methods of measurement of pH (i) pH paper (ii) pH meter (iii) Principle, working, maintenance and calibration of pH meter
8. **Volumetric analysis** (a) Normal and molar solutions (b) Standard solutions (c) Preparation of reagents (d) Storage of chemicals

Suggested Readings

1. Text book of Medical Laboratory Technology by P. B. Godker
2. Medical Laboratory Technology by KL Mukherjee volume III
3. Practical Clinical Biochemistry by Harold Varley
4. Principal of Biochemistry by M. A. Siddiqi
5. Instrumental Analysis by Chatwal Anand
6. Text book of Medical Biochemistry by ChaterjeeShinde
7. Principal of Biochemistry by Lehninger
8. Biochemistry by Voet&Voet
9. Biochemistry by Stryer Punjab Technical Univer

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards
BMLS104-18- ESSENTIAL BIOLOGY- PRACTICAL

1. Study of Mitosis and Meiosis through animal cells (Grasshopper).
2. Study of osmosis and diffusion.
3. Study of Epithelial, Muscle, Nerve and mammalian blood cells through permanent or temporary cells.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards
BMLS105-18- GENERAL MICROBIOLOGY-PRACTICAL

Aims /learning Objectives: Students are able to classify, identify, use of instruments, sterilization, cultural requirements and to perform different microbiological tests in clinical microbiology lab.

1. To prepare cleaning agents & to study the technique for cleaning & sterilization of glassware.
2. To demonstrate the working & handling of Compound microscope.
3. To demonstrate the method of sterilization by autoclave, hot air oven.
4. To demonstrate the method of sterilization of media/solution by filtration.
5. To prepare working dilution of commonly used disinfectants.
6. To demonstrate the different morphological types of bacteria.
7. Preparation of culture media from each type.
8. To demonstrate aerobic culture and anaerobic culture.
9. To demonstrate biomedical waste segregation.
10. To plot growth curve of bacteria.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards
BMLS106-18- BASICS OF BIOCHEMISTRY-PRACTICAL

Aims /learning Objectives: The main objective of the subject is to impart the knowledge of apparatus, units, equipments, volumetric analysis in the laboratory of clinical biochemistry

1. Cleaning of the laboratory glass ware.
2. Preparation of distilled water
3. Principle, working and maintenance of pH meter.
4. To prepare 0.1 N NaoH solution.
5. To prepare 0.2N HCl solution.
6. To prepare 0.1 molar H₂SO₄
7. To prepare 0.2 Molar Sodium carbonate solution.

BTHU103-18 English

Course Outcomes:

- The objective of this course is to introduce students to the theory, fundamentals and tools of communication.
- To help the students become the independent users of English language.
- To develop in them vital communication skills which are integral to their personal, social and professional interactions.
- The syllabus shall address the issues relating to the Language of communication.
- Students will become proficient in professional communication such as interviews, group discussions, office environments, important reading skills as well as writing skills such as report writing, note taking etc.

The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

Detailed Contents:

Unit1- 1 (Introduction)

- Theory of Communication
- Types and modes of Communication

Unit- 2 (Language of Communication)

- Verbal and Non-verbal
- (Spoken and Written)
- Personal, Social and Business
- Barriers and Strategies
- Intra-personal, Inter-personal and Group communication

Unit-3 (Reading and Understanding)

- Close Reading
- Comprehension
- Summary Paraphrasing
- Analysis and Interpretation
- Translation(from Hindi/Punjabi to English and vice-versa)
- Literary/Knowledge Texts

Unit-4 (Writing Skills)

- Documenting
- Report Writing
- Making notes
- Letter writing

Recommended Readings:

1. *Fluency in English* - Part II, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. *Language, Literature and Creativity*, Orient Blackswan, 2013.

IK Gujral Punjab Technical University

B.Sc. MLS Batch 2024 onwards

4. *Language through Literature* (forthcoming) ed. Dr. Gauri Mishra, Dr Ranjana Kaul, Dr Brati Biswas
5. *On Writing Well*. William Zinsser. Harper Resource Book. 2001
6. *Study Writing*. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.

BTHU104-18 English Practical/Laboratory

Course Outcomes:

- The objective of this course is to introduce students to the theory, fundamentals and tools of communication.
- To help the students become the independent users of English language.
- To develop in them vital communication skills which are integral to personal, social and professional interactions.
- The syllabus shall address the issues relating to the Language of communication.
- Students will become proficient in professional communication such as interviews, group discussions and business office environments, important reading skills as well as writing skills such as report writing, note taking etc.

The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

Interactive practice sessions in Language Lab on Oral Communication

- Listening Comprehension
- Self Introduction, Group Discussion and Role Play
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations
- Monologue
- Effective Communication/ Mis- Communication
- Public Speaking

Recommended Readings:

1. *Fluency in English* - Part II, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. *Practical English Usage*. Michael Swan. OUP. 1995.
4. *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
5. *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

HVPE101-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules
------------	---	--

Course Objective

This introductory course input is intended

- a. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- b. To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.
- c. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction with Nature.

Thus, this course is intended to provide a much needed orientational input in Value Education to the young enquiring minds.

Course Methodology

- The methodology of this course is universally adaptable, involving a systematic and rational study of the human being vis-à-vis the rest of existence.
- It is free from any dogma or value prescriptions.
- It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as proposal and the students are facilitated to verify it in their own right based on their Natural Acceptance and Experiential Validation.
- This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and within the student himself/herself finally.
- This self-exploration also enables them to evaluate their pre-conditionings and present beliefs.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

HVPE101-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules
------------	--	--

Total no. of Lectures: 28 [L-T-P: 3-0-0]

Content for Lectures:

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

[6]

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

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

[6]

7. Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’
8. Understanding the needs of Self (‘I’) and ‘Body’ - *Sukh* and *Suvidha*
9. Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of ‘I’ and harmony in ‘I’
11. Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure *Sanyam* and *Swasthya*
- Practice Exercises and Case Studies will be taken up in Practice Sessions.

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

[6]

13. Understanding harmony in the Family- the basic unit of human interaction
14. 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
15. Understanding the meaning of *Vishwas*; Difference between intention and competence
16. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
17. Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals
18. Visualizing a universal harmonious order in society- Undivided Society (*Akhand Samaj*), Universal Order (*Sarvabhaum Vyavastha*)- from family to world family!
- Practice Exercises and Case Studies will be taken up in Practice Sessions.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

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

[4]

19. Understanding the harmony in the Nature
20. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
21. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
22. Holistic perception of harmony at all levels of existence
- Practice Exercises and Case Studies will be taken up in Practice Sessions.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

[6]

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

Text Book

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

Reference 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.

IK Gujral Punjab Technical University

B.Sc. MLS Batch 2024 onwards

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

12. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.

Relevant CDs, Movies, Documentaries & Other Literature:

1. Value Education website, <http://uhv.ac.in>

2. Story of Stuff, <http://www.storyofstuff.com>

3. Al Gore, *An Inconvenient Truth*, Paramount Classics, USA

4. Charlie Chaplin, *Modern Times*, United Artists, USA

5. IIT Delhi, *Modern Technology – the Untold Story*

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

HVPE102-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules (Lab/ Seminar)
-------------------	---	--

One each seminar will be organized on Drug De-addiction and Traffic Rules. Eminent scholar and experts of the subject will be called for the Seminar at least once during the semester. It will be binding for all the students to attend the seminar.

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A **(Class Activities)**

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises
- 7* A part of above six points practicals on Fundamentals of Computers are also added as per Annexure-I

Part – B **(Outdoor Activities)**

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B

Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

Annexure-I

Fundamental of Computers.

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.

Suggested Readings:

1. **Ram, B. & Kumar, S. (2014) Computer Fundamentals: Architecture & Organization. (5th Edition). New Age International Publishers, New Delhi.**
2. **Rajaraman, V. (2013). Fundamentals of Computers. PHI Learning Pvt. Ltd., New Delhi.**
3. **Sinha, P.K. & Sinha, P. (2013) Computer Fundamentals 6th Edition. BPB Publications, New Delhi.**
4. **Goel, A. (2015). Computer Fundamentals. Dorling Kindersley Pvt. Ltd. New Delhi.**

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

Second Semester

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards
BMLS201-18- Systemic Bacteriology
THEORY

Aims and Objectives: This subject will give information about the different types of bacterial culture procedures, staining procedures and Biochemical tests used for identification of bacteria. The students will learn the morphology cultural characteristics, biochemical characteristics & laboratory diagnosis of various bacteria.

1. Bacterial culture a. Instruments used to seed culture media b. Culture procedures - seeding a plate
2. Staining techniques in bacteriology Principle, procedures, significance and interpretation of the following staining techniques: Simple staining, Gram stain, Ziehl –Neelsen staining, Albert’s stain, Capsule staining.
3. Principle, procedures and interpretation of the following biochemical tests for identification of different bacteria: Catalase, Coagulase, Indole, Methyl Red, VogesProskauer, Urease, Citrate, Oxidase, TSI, Nitrate reduction, Carbohydrate fermentation, H₂ S production, Demonstration of motility
4. Various characteristics (morphological, cultural and biochemical), pathogenesis and laboratory diagnosis of the following bacteria a) Staphylococcus b) Streptococcus c) Pneumococcus d) Neisseria gonorrhoeae and Neisseria meningitis e) Haemophilis f) Corynebacterium g) Enterobacteriaceae: Escherichia coli, Klebsiella, Proteus , Salmonella, Shigella h) Vibrio i) Clostridium j) Mycobacterium tuberculosis complex, Atypical Mycobacteria and M. leprae k) Spirochetes – Treponema, Borrellia and leptospira l) Bordetella and brucella m) Mycoplasma and Ureaplasma

Suggested Readings:

1. Practical Medical Microbiology by Mackie &MacCartney Volume 1 and
2. Text book of Microbiology by Ananthanereyan
3. Medical Microbiology by Paniker&Satish Gupte
4. Medical laboratory Technology vol.I ,II, III by Mukherjee
5. Medical Laboratory manual for tropical countries Vol II Microbiology by MoniaCheesbrough

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards
BMLS202-18- Biochemical Metabolism
THEORY

Aims and Objectives: This subject shall give information about all the major metabolic pathways occurring in our body. The students will learn the details about metabolism of carbohydrates, proteins, lipids, nucleic acids, enzymes & the deficiency diseases related to them.

1. Carbohydrate Metabolism a) Introduction, Importance and Classification b) Digestion and Absorption d) Metabolism: - Glycolysis, Citric acid cycle, Gluconeogenesis Glycogenolysis, Glycogenesis e) Disorders of carbohydrate metabolism.
2. Protein Metabolism a) Introduction, Importance and classification b) Important properties of proteins c) Digestion & absorption of Proteins d) Metabolism of proteins e) Disorders of protein metabolism and Urea Cycle
3. Lipid a) Introduction & Classification b) Digestion & absorption of fats c) Lipoproteins f) Fatty acid biosynthesis & fatty acid oxidation
4. Nucleic Acid a) Introduction b) Functions of Nucleic acid c) Functions of energy carriers
5. Enzymes a) Introduction, Importance & Classification b) Properties of enzymes c) Mechanism of enzyme action d) Factors affecting enzyme action e) Enzyme kinetics & enzyme inhibitors

Suggested Readings:

1. Practical Clinical Biochemistry by Harold Varley
2. Text book of Medical Laboratory Technology by P. B. Godker
3. Medical Laboratory Technology by Mukherjee
4. Principal of Biochemistry by M. A. Siddiqi
5. Instrumental Analysis by Chatwal Anand
6. Text book of Medical Biochemistry by ChaterjeeShinde
7. Principal of Biochemistry by Lehninger
8. Biochemistry by Voet&Voet
9. Biochemistry by Stryer

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards
BMLS203-18- HUMAN ANATOMY AND PHYSIOLOGY- I
Theory

Aims /learning Objectives: Students will be able to learn the terminology of the subject and basic knowledge of cells, tissues, blood and to understand anatomy and physiology of human body. This subject will develop an understanding of the structure and function of organs and organ systems in normal human body.

1. **Introduction to human Anatomy and Physiology.**
2. **Cell and cell organelles.** (a) Structure and classification (b) Function (c) Cell division (Mitosis and Meiosis)
3. **Tissues** (a) Definition (b) Classification with structure and Functions. (i) Epithelial tissues (ii) Connective tissues (iii) Muscular tissues (iv) Nervous tissue
4. **Blood.** (a) Composition and function of blood
5. **Muscular skeletal system** (a) Introduction (b) Classification (c) Structure and function of skeletal system, muscles and joints. (d) various movements of body.
6. **Respiratory system** (a) Introduction (b) Structure (c) Function (d) Mechanism of breathing and respiration (e) Various terms involved in respiratory System. (i) Vital capacity. (ii) Total Volume. (iii) Reserve volume. (iv) Total lung capacity.
7. **Cardiovascular system.** (a) Anatomy and physiology of heart (b) Blood circulation. (c) Arteries and veins. (d) Conductive system of heart. (e) Cardiac cycle. (f) Introduction to ECG.
8. **Lymphatic system.** (a) Introduction. (b) Structure and function (i) Lymph nodes. (ii) Spleen. (iii)Thymus gland, Tonsils
9. **Structure and function of sense organs.** (a) Eye. (b) Ear. (c) Nose. (d) Tongue.

Suggested Readings:

1. Anatomy &nPhysiology- Ross and Wilson
2. Anatomy and Physiology: Understanding the Human Body by Clark
3. Anatomy and Physiology for nurses by Evelyn Pearce
4. Anatomy and Physiology for nurses by Sears
5. Anatomy and Physiology for nurses by Pearson
6. Anatomy and Physiology by N Murgesh

IK Gujral Punjab Technical University

B.Sc. MLS Batch 2024 onwards

BMLS204-18- Systematic Bacteriology

Practical

1. Bacterial culture techniques (preparation of media and isolation of microbes)
2. Staining techniques (a) Gram stain (b) Albert stain (c) Z-N staining (d) Capsule staining
3. To prepare the reagent and demonstrate following biochemical tests with positive and negative control bacteria: (a) Catalase (b) Coagulase (c) Indole (d) Methyl Red (MR) (e) VogesProskauer (VP) (f) Urease (g) Citrate (h) Oxidase (i) TSI (j) Nitrate reduction (k) Carbohydrate fermentation (l) Hufe and leifson (m) Bile solubility (n) H₂S production (o)
4. Collection and transport of various clinical samples.
5. To demonstrate various characteristics (morphological, cultural and biochemical) of bacteria commonly isolated from clinical samples i.e. Staphylococcus, Escherichia coli, Klebsiella, Proteus, Mycobacterium tuberculosis, Pseudomonas

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards
BMLS205-18- Biochemical Metabolism
Practical

1. To determine the presence of carbohydrates by Molish test.
2. To determine the presence of reducing sugar by Fehling solutions
3. To determine the presence of reducing sugar by Benedicts method.
4. To determine starch by Iodine test.
5. Determination of Glucose in serum & plasma by Folin& Wu method
6. Determination of Urea in serum, plasma & urine.
7. Determination of Creatinine in serum or plasma
8. Determination of serum Albumin
9. Determination of Cholesterol in serum or plasma

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards
BMLS206-18- HUMAN ANATOMY AND PHYSIOLOGY-I-
PRACTICAL

Aims /learning Objectives: Students will be able to learn the terminology of the subject and basic knowledge of cells, tissues, blood and to understand anatomy and physiology of human body.

1. Demonstration of human cell from slides/charts.
2. Demonstration of cell division i.e. mitosis and Meiosis from permanent mounted slides.
3. Demonstration of various tissues from permanent slides. (i) Epithelial tissue (ii) Connective tissue. (iii) Muscular tissue (iv) Nervous tissue
4. Demonstration of individual bone.
5. Demonstration of respiratory system from chart.
6. Pear expiratory flow rate (PEFr)
7. Demonstration of cardiovascular system form chart.
8. Electro cardio gram (ECG)
9. Demonstration of eye, nose, ear and tongue from model and charts.
10. To study and count spleenocytes from mammalian spleen.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards
Ability Enhancement Compulsory Course
(EVS102-18 Environment Studies)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies;
- Scope and importance; Concept of sustainability and sustainable development.

(2 lectures)

Unit 2 : Ecosystems

- What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems :
 - a) Forest ecosystem
 - b) Grassland ecosystem
 - c) Desert ecosystem
 - d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

(6 lectures)

Unit 3 : Natural Resources : Renewable and Non---renewable Resources

- Land resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water : Use and over---exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter---state).
- Energy resources : Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

(8 lectures)

Unit 4 : Biodiversity and Conservation

- Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega---biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity : Habitat loss, poaching of wildlife, man---wildlife conflicts, biological invasions; Conservation of biodiversity : In---situ and Ex---situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

(8 lectures)

Unit 5 : Environmental Pollution

- Environmental pollution : types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Pollution case studies.

(8 lectures)

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

Unit 6 : Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
 - Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
 - Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.
- (7 lectures)

Unit 7 : Human Communities and the Environment

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management : floods, earthquake, cyclones and landslides.
- Environmental movements : Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- Visit to a local polluted site---Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems---pond, river, Delhi Ridge, etc.

(Equal to 5 lectures)

Suggested Readings:

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R.1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999.*Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll.*Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science*, 339: 36---37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams*(pp. 29---64). Zed Books.
8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971.*Fundamentals of Ecology*. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012.*Environment*. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India*. Tripathi 1992.
14. Sengupta, R. 2003. *Ecology and economics: An approach to sustainable development*. OUP.

IK Gujral Punjab Technical University

B.Sc. MLS Batch 2024 onwards

15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology: Voices from the Tropics*. John Wiley & Sons.
17. Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
18. Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
19. Wilson, E. O. 2006. *The Creation: An appeal to save life on earth*. New York: Norton.
20. World Commission on Environment and Development. 1987. *Our Common Future*. Oxford University Press.

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A **(Class Activities)**

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B **(Outdoor Activities)**

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.
3. Practical work on some topics of Environment or field visit as per Unit-8 of subject code EVS102-18.

Evaluation shall be based on rubrics for Part – A & B

Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

Third Semester

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS301-18- BASIC HAEMATOLOGY & HAEMATOLOGICAL TECHNIQUES-I

Theory

Aims /learning Objectives: The students will be made aware of the composition of blood and methods of estimating different components of blood. Students will be able to know the basic concepts of Haematology & routine clinical investigations of Haematology laboratory.

- 1. Introduction to Haematology:** (a) Definition (b) Importance (c) Important equipment used.
- 2. Laboratory organization and safety measures in haematology Laboratory**
- 3. Introduction to blood, its composition, function and normal cellular components**
- 4. Formation of cellular components of blood:** (a) Erythropoiesis (b) Leucopoiesis (c) Thrombopoiesis
- 5. Collection and preservation of blood sample for various haematological investigations**
- 6. Definition, principles & procedure, Normal values, Clinical significance, errors involved, means to minimize errors for the following:** Haemoglobinometry, Total leucocytes count (TLC), Differential leucocytes count (DLC), Erythrocyte Sedimentation Rate (ESR), Packed cell volume/ Haematocrit value, Red cell Indices (RCI), Absolute Eosinophil count, Reticulocyte count, Platelet count
- 7. Preparation of blood Films:** types. Methods of preparation (Thick and thin smear/ film)
- 8. Staining techniques in Haematology (Romanowsky's stains) :** Principle, composition, preparation of staining reagents and procedure of : Giemsa, Leishman, Wright's, Field's, JSB

Suggested Readings:

1. Text book of Medical Laboratory Technology by Paraful B. Godkar
2. Medical laboratory Technology by KL Mukherjee Volume-I
3. Haematology for students Practitioners by RamnikSood
4. Hand book of Medical Laboratory Technology(Ind edition) by V.H. Talib
5. Haematology (International edition) EmmanuelC.BesaHarwal Publisher
6. Practical Haematology by JB Dacie
7. Practical Haematology(8th edition) by Sir John
8. Clinical Haematology by Christopher A. Ludlam
9. Clinical Diagnosis & Management by Laboratory methods(20th edition) by John bernardHenary
10. Medical Laboratory Technology Methods & Interpretation(5th edition) by RamnikSood Punjab Technical University B.Sc. Medical Laboratory Sciences, Batch 2011
11. Atlas of haematology(5th edition)by G.A. McDonald
12. A Manual of Laboratory & Diagnostic Tests(6th edition)by Frances Fischbach
13. Haematology (Pathophysiological basis for clinical practice) by Stephen M. Robinson

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS302-18- Analytical Biochemistry
Theory**

Aims and Objectives: The students will learn basic principle/ mechanisms, procedures and types of various techniques commonly performed in analytical biochemistry.

- 1) Spectrophotometry and colorimetry a) Introduction b) Theory of spectrophotometry and colorimetry c) Lambert`s law and Beer`s law d) Applications of colorimetry and spectrophotometry
- 2) Photometry a) Introduction b) General principles of flame photometry c) Limitations of flame photometry d) Instrumentation e) Applications of flame photometry f) Atomic absorption spectroscopy – Principle & applications
- 3) Chromatography Introduction, definition, types of chromatography a) Paper Chromatography : Introduction, principle, types ,details for qualitative and quantitative analysis, application b) Thin layer chromatography: Introduction, experimental techniques, application of TLC, limitations, High performance thin layer chromatography c) Column chromatography: Introduction, principle column efficiency, application of column chromatography d) Gas chromatography: Introduction principle, instrumentation, application e) Ion exchange chromatography: Introduction, Definition and principle, cation and anion exchangers, application f) Gel Chromatography: Introduction Principle and method, application and advantages
- 4) Electrophoresis: Introduction, principle, Instrumentation, types of electrophoresis - paper and gel electrophoresis, application

Suggested readings:

1. Practical Clinical Biochemistry by Harold Varley
2. Text book of Medical Laboratory Technology by P. B. Godker
3. Medical Laboratory Technology by Mukherjee
4. Principal of Biochemistry by M. A. Siddiqi
5. Instrumental Analysis by Chatwal Anand
6. Text book of Medical Biochemistry by ChaterjeeShinde
7. Principal of Biochemistry by Lehninger
8. Biochemistry by Voet&Voet
9. Biochemistry by Stryer

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS303-18- Human Anatomy & Physiology - II
THEORY

Aims and Objectives: Students will be able to learn the terminology of the subject and basic knowledge of cells the structure and function of organs and organ systems and body fluids in normal human body.

1. Body fluids and their significance : Important terms , types of body fluid , total body water , avenues by which water leaves and enters body , general principles for fluid balance , cardinal principle , How body fluids maintain Homeostasis , Electrolytes & ions Function of electrolytes , How electrolyte imbalance leads to fluid imbalance

2. Digestive system: Organisation ; accessory organs ; structure & function (Mouth, Tongue, Teeth, Oesophagus , Pharynx, Stomach, Intestine, Rectum, Anus); Digestive glands; physiology of digestion of carbohydrates ,lipids & proteins

3. Liver: structure and function

4. Urinary system: Main parts , Structure & function of kidney , structure of nephron, physiology of excretion & urine formation , urine , additional excretory organs

5. Genital system: Structure of male and female reproductive system, Gametogenesis in male & female, menstrual cycle. Placenta and extra embryonic membranes.

6. Nervous system: Parts, function & structure ; brain , spinal cord , spinal & cranial nerves ; All & none principal , role of neurotransmitters in transmission of nerve impulse

7. Endocrine system: Endocrine & exocrine glands, their location, structure & functions

Suggested Readings:

1. Anatomy & Physiology- Ross and Wilson
2. Anatomy and Physiology: Understanding the Human Body by Clark
3. Human Anatomy for nurses by Pearce

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS304-18- BASIC HAEMATOLOGY & HAEMATOLOGICAL TECHNIQUES-I
PRACTICAL

Aims /learning Objectives: Students will be able to know the basic concepts of Haematology&outline clinical investigations of Haematology lab.

1. Demonstration of Equipments used in clinical Haematology. (a) Microscope (b) Blood Cell counter (DLC) (c) Sahli's apparatus (d) Calorimeter
2. Hb Estimation (a) Sahli's method (b) Cyanmethaemoglobin method (c) Oxyhaemoglobin method
3. Total leukocyte count
4. Preparation of smear and staining with Giemsa and Leishman stain.
5. Differential leucocytes count
6. Platelets count
7. Reticulocyte count
8. Absolute Eosinophil count
9. Calculation of Red cell indices (RCI)
- 10 ESR (Wintrobe and Westergren method)
11. Packed cell volume (Macro & Micro)

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS305-18- Analytical Biochemistry Lab.
(PRACTICAL)**

- a) To demonstrate the principle, working & maintenance of spectrophotometer.
- b) To demonstrate the principle, working & maintenance of colorimeter.
- c) To demonstrate the principle, working & maintenance of flame photometer.
- d) To demonstrate the principle, procedure of paper chromatography.
- e) To demonstrate the principle & procedure of Gas chromatography.
- f) To demonstrate the principle & demonstration of TLC.
- g) To demonstrate the principle & procedure of column chromatography.
- h) To demonstrate the principle & procedure of Electrophoresis.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS306-18- Human Anatomy & Physiology - II
PRACTICAL

1. To study circulatory system from charts and TS of artery and vein from permanent slides.
2. To study digestive system from charts and TS of liver, spleen and pancreas from permanent slides.
3. Study of Urinary system (charts)
4. Study of Genital system (male & female) from charts and TS of testis and ovary from permanent slides.
5. To study nervous system (From models / charts)
6. To study various body fluids.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards
BMLS307-18- Applied Bacteriology
THEORY

Aims and Objectives: The part will cover the strategy in the Laboratory diagnosis of various Infective syndromes i. e. choice of samples, collection and transportation and processing of samples for isolation of bacterial pathogen and then to put antibiotic susceptibility testing. This will also cover Bacteriological examination of water, milk, food and air and nosocomial infections.

1. Antibiotic susceptibility testing in bacteriology a. Definition of antibiotics b. Culture medium used for Antibiotic susceptibility testing c. Preparation and standardization of inoculum d. Control bacterial strains e. Choice of antibiotics f. MIC and MBC : Concepts and methods for determination g. Various methods of Antibiotic susceptibility testing with special reference to Kirby-Bauer method and Stokes method h. Tests for production of β -lactamase
2. Bacteriological examination of air
 - a. Examination of Air a) Significance of air bacteriology in healthcare facilities b) Settle plate method c) Types of air sampling instruments d) Collection processing and reporting of an air sample
4. Sterility testing of I/v fluids a. Collection, transportation and processing of I/v fluids for bacterial contamination b. Recording the result and interpretation
5. Nosocomial Infection: a) Bacteriological surveillance of hospital environment. b) Role of microbiology laboratory in control of nosocomial infections
6. Preservation methods for microbes
 - a. Basic concepts of preservation of microbes b. Why do we need to preserve bacteria c. Principle and procedures of various preservation methods with special reference to lyophilization.

Suggested Readings:

1. Practical Medical Microbiology by Mackie & MacCartney Volume 1 and 2
2. Text book of Microbiology by Ananthanereyan
3. Medical Microbiology by Paniker & Satish Gupte
4. Medical laboratory Technology vol. I, II, III by Mukherjee
5. Medical Laboratory manual for tropical countries Vol II Microbiology by Monia Cheesbrough
6. Hospital Acquired Infections by Dr. V Muralidhar

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS308-18- Applied Bacteriology
PRACTICALS**

1. Antimicrobial susceptibility testing
 - a. Introduction and terms used
 - b. Preparation and standardization of inoculum
 - c. To demonstrate reference bacterial strains
 - d. Choice of antibiotics
 - e. To determine MIC and MBC a known bacteria against a known antibiotic
 - f. To perform antibiotic susceptibility testing of clinical isolates by using a) Kirby-Bauer method b) Stokes method and
 - g. To perform any one test to demonstrate the production of β -lactamase
2. Collection, transportation and processing of : a. water, air samples for bacteriological examination
6. To demonstrate sterility testing of intravenous fluid with positive and negative controls
7. Demonstration of serotyping and bacteriocin typing
8. Demonstration of lyophilization
9. To learn 'How to dispose of bacterial cultures'

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A **(Class Activities)**

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises
- 7* A part of above six points practicals on Fundamentals of Computers-II are also added as per Annexure-II

Part – B **(Outdoor Activities)**

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B

Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

Annexure-II
Fundamentals of Computers-II

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 and introduction of various software used in Medical Education

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

Fourth Semester

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS401-18- Basic Cellular Pathology
Theory

Aims and Objectives: The student will study diseases associated with different body organs and systems

1. Alimentary System: - Diseases of mouth, Diseases of Oesophagus- Oesophageal varices.
2. Digestive System:- Gastritis, Peptic ulceration, Appendicitis microbial diseases, food poisoning, hernia, Intestinal abstrictions&malabsorbtion.
3. Accessory Digestive glands: - Salivary glands- mumps, liver – hepatitis, liver failure, cirrhosis. Pancreas- pancreatitis. Gall Bladder- Gall stones, jaundice and cardiovascular diseases.
4. Circulatory System:- Diseases of Blood vessels- Atheroma, Arteriosclerosis, heart block. Disorders of Blood Pressure-Hyper & Hypotension.
5. Respiratory System: - Upper respiratory tract infection, Bronchi, Asthma, Pneumonia, Lung abscess, Tuberculosis, Lung Collapse.
6. Urinary System: - Glomerulonephritis, Nephrotic syndrome, Renal failure, Renal calculi, Urinary obstruction, Urinary tract infection.
7. Reproductive system:- Sexually transmitted diseases, Pelvic inflammatory disease, disorder of cervix(CIN), Disease of ovaries, ectopic pregnancy, prostatitis, Infertility
8. Nervous System: - Neuronal damage, ICP, Cerebral Infarction, head injury, Alzheimer's disease, dementia.
9. Endocrine System:- Pituitary:- Hyper & Hypo secretions Thyroid: - Goiter Adrenal: - Cushing Syndrome, Addison Disease Pancreas: - Diabetes
10. Sense Organs:- Ear:- Otitis Eye: - Cataract

Suggested readings:

1. Anatomy &Physiology- Ross and Wilson
2. Human Anatomy and Physiology by Pearce
3. Di Fiore'sAtlas of Histology
4. Medical Laboratory technology-Volume III
5. Color atlas of basic Histopathology
6. Immunology-Kuby
7. Text book of Pathology
8. Clinical Pathology
9. Functional Histology
10. Text book of Histology

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS402-18- Basic Haematological Techniques – II
THEORY

Aims and Objectives: The students will learn about normal and abnormal haemoglobin and different aspects of Normal haemostatic mechanism and theories of blood coagulation. They will also learn the estimation of different parameters of coagulation studies. 1. Haemoglobin pigments and their measurement.

2. Abnormal haemoglobins, their identification and estimation.
3. Normal haemostatic mechanism and theories of blood coagulation.
4. Classification of coagulation factors.
5. Physiological properties of various coagulation factors.
6. Screening coagulation tests such as Bleeding and clotting Time, Hess test, prothrombin time(PT) and Activated Partial Thromboplastin time (APTT)

Suggested readings

1. Text book of Medical Laboratory Technology by Paraful B. Godkar
2. Practical Haematology by JB Dacie
3. Hand book of Medical Laboratory Technology(IIInd edition) by V.H. Talib
4. Haematology (International edition)EmmanuelC.BesaHarwal Publisher
5. Practical Haematology(8th edition) by Sir John
6. Clinical Haematology by Christopher A. Ludlam
7. Clinical Diagnosis &Management by Laboratory methods(20th edition) by John bernardHenary
8. Medical Laboratory Technology Methods &Interpretation(5th edition) by RamnikSood
9. Atlas of haematology(5th edition)by G.A. McDonald
10. A Manual of Laboratory & Diagnostic Tests(6th edition)by Frances Fischbach
11. Haematology(Pathophysiological basis for clinical practice(3rd edition)by Stephen M. Robinson .

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS403-18- Clinical Biochemistry – 1
Theory**

Aims and Objectives:

1. Hazards & safety measures in clinical Biochemistry laboratory.
2. Quality control and quality assurance in a clinical biochemistry laboratory
3. Laboratory organization, management and maintenance of records
4. Principles of assay procedures, 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
5. Principles, procedures for estimation & assessment of the following including Errors involved and their corrections
 - a. Sodium, Potassium and Chloride, Iodine.
 - b. Calcium, Phosphorous and Phosphates
6. Instruments for detection of Radioactivity
7. Applications of Radioisotopes in clinical biochemistry.
8. Enzyme linked immunosorbant assay

Suggested Readings:

1. Text book of Medical Laboratory Technology by P.B. Godkar.
2. Medical Laboratory Sciences, Theory & Practical by A. Kolhatkar.
3. Practical Clinical Biochemistry by Harold Varley.
4. Biochemistry, U. Satyanarayan. & U. Chakrapani.
5. Text book of Medical Biochemistry by Chaterjee&Shinde.

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS404-18- Basic Cellular Pathology
PRACTICAL**

1. To study squamous cell from cheek cells
2. To study stained slide preparation from organs of digestive system
3. Study of stained slides of liver, pancreas ,gall bladder
4. Study of various types of microscope
5. To study stained slide preparation from organs of circulatory system
6. To study stained slide preparation from organs of Respiratory system
7. To study stained slide preparation from organs of Nervous system
8. To study stained slide preparation from organs of Urinary system
9. To study stained slide preparation from organs of Endocrine system

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS405-18- Basic Haematology Techniques – II
Practical

1. To measure the levels of Methaemoglobin, Carboxy and sulphahaemoglobin
2. To determine platelet count of the given sample using phase contrast microscope.
3. To determine PT, PTI, INR and APTT of the given sample.
4. To prepare the following in laboratory a) Brain Thromboplastin, Cephalin, Thrombin, M/40 CaCl₂ and Kaolin Solution.

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS406-18- Clinical Biochemistry – 1
Practical**

1. Estimation of Glucose in Urine and in Blood.
2. Estimation of Protein in Urine and Blood.
3. Estimation of Urea in blood.
4. Estimation of uric acid in blood.
5. Estimation of serum bilirubin
6. Estimation of Total Cholesterol in blood.
7. Estimation of HDL Cholesterol.
8. Estimation of LDL Cholesterol.
9. Estimation of TG
10. Estimation of Creatinine in Blood
11. Estimation of serum calcium
12. To measure electrolytes Sodium, Potassium & Chloride.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS407-18- Immunology and Mycology
Theory

Aims and Objectives:

This section will cover the basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases. It will also cover medically important fungi, infections caused by them and their laboratory diagnosis.

1. History and introduction to immunology
 2. Immunity
 - a. Innate and acquired immunity including basic concepts about their mechanisms
 3. Definition, types of antigens and Determinants of antigenicity
 4. Definition, types, structure and properties of immunoglobulins
 5. Antigen-Antibody reactions a. Definition, Classification, general features and mechanisms and applications of various antigen antibody reactions
 6. Principle, procedure and applications of Complement fixation test, Immunofluorescence, ELISA, CCIEP, and RIA, SDS-PAGE and western blotting in Medical Microbiology
 7. Principle, procedure and interpretation of various serological tests *i.e.* Widal, VDRL, ASO, CRP, Brucella tube agglutination and Rose-Waaler
 8. Complement system: Definition and Basic concepts about its components and complement activation pathways
 9. Immune response: Introduction & Basic concepts of Humoral and Cellular immune responses
 10. Hypersensitivity: Definition and Types of hypersensitivity reactions
 11. Vaccines: Definition, Types, Vaccination schedule and Brief knowledge about '*Extended programme of immunization*' (EPI) in India.
 13. Introduction to medical mycology
 14. Basic concepts about superficial and deep Mycoses
 15. Taxonomy and classification and general characteristics of various medically important fungi
 16. Morphological, cultural characteristics of common fungal laboratory contaminants
 17. Culture media used in mycology

 18. Direct microscopy in Medical mycology laboratory
 19. Processing of clinical samples for diagnosis of fungal infections *i.e.* Skin, nail, hair, pus, sputum, CSF and other body fluids
 20. Techniques used for isolation and identification of medically important fungi
 21. Methods for identification of yeasts and moulds
 23. Preservation of fungal cultures
- Suggested Readings:**
21. Practical Medical Microbiology by Mackie & MacCartney Volume 1 and 2
 22. Text book of Microbiology by Ananthanereyan
 23. Medical Microbiology by Paniker & Satish Gupte
 24. Medical laboratory Technology vol. I, II, III by Mukherjee
 25. Medical Laboratory manual for tropical countries Vol II Microbiology by Monia Cheesbrough
 26. Immunology by Ivan Roitt, Jonathaan Brostoff and David Male
 27. Immunology by Kuby
 28. Medical Mycology by Dr Jagdish Chander

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS408-18- Immunology and Mycology
PRACTICAL

1. Collection of blood sample by vein puncture, separation and preservation of serum
2. Performance of Serological tests *i.e.* a. Widal, ,
b. VDRL (including Antigen Preparation), c. ASO (Antistreptolysin 'O') d. C-Reactive Protein (Latex agglutination) e. Rheumatoid factor (RF) Latex agglutination
3. Demonstration of antigen / antibody determination by Immunofluorescence, Immunodiffusion, precipitation in agarose gel(ouchterlony), CIEP, ELISA, SDSPAGE and western blotting.
4. To prepare culture media used routinely in mycology
5. To perform all the staining techniques for identification of fungi as mentioned in theory syllabus.
6. To identify given yeast culture (By performing various identification techniques studied in theory.
7. To identify given mould culture (By performing various identification techniques studied in theory.
8. To demonstrate dimorphism in fungi
9. To process clinical samples for laboratory diagnosis of fungal infections *i.e.*
 - a) Skin
 - b) Nail
 - c) Hair
 - d) Body fluids and secretions
10. To use mice for lab diagnosis of any fungal infection

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A **(Class Activities)**

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B **(Outdoor Activities)**

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B

Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

Fifth Semester

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS501-18- Applied Haematology-1
Theory

Aims and objectives: The students be made aware of Safety precautions, Quality assurance, biomedical waste management and automation in haematology. It will also cover Bone marrow examination, Red cell anomalies, Disorder of leucocytes, L.E.cell phenomenon, Investigations of a case suffering from bleeding disorders, routine examination of urine, seminal fluid and CSF.

1. Quality assurance in haematology. a. Internal and external quality control including reference preparation b. Routine quality assurance protocol c. Statistical analysis i.e. Standard deviation, Co-efficient variation, accuracy and precision
2. Safety precautions in haematology
3. Basic concepts of automation in haematology with special reference to: a. Blood cell counter b. Coagulometer
4. Bone marrow examination a. Composition and functions b. Aspiration of bone marrow (Adults and children) c. Processing of aspirated bone marrow (Preparation & staining of smear) d. Brief knowledge about examination of aspirated bone marrow (differential cell counts and cellular ratios) e. Processing and staining of trephine biopsy specimens
5. Red cell anomalies a. Morphological changes such as variation in size shape & staining character. Punjab
6. Disorder of leucocytes. a. Abnormal morphology i.e. shift to left & shift to right.
7. L.E.cell phenomenon. a. Definition of L.E.cell. b. Demonstration of L.E.cell by various methods. c. Clinical significance.
8. Physiological variations in Hb, PCV, TLC, DLC and Platelets
9. Investigations of a case suffering from bleeding disorders
10. Quantitative assay of coagulation factors a. Principle b. Procedure
11. Routine examination of urine
12. Routine examination of seminal fluid
13. Routine examination of CSF and other body fluids i.e. pleural, peritoneal and synovial fluid etc.
14. Biomedical waste management in haematology laboratory (Other than Radioactive material)

Suggested readings

1. Text book of Medical Laboratory Technology by Paraful B. Godkar
2. Practical Haematology by JB Dacie
3. Hand book of Medical Laboratory Technology(IIInd edition) by V.H. Talib
4. Haematology (International edition)Emmanuel C.BesaHarwal Publisher
5. Practical Haematology(8th edition) by Sir John
6. Clinical Haematology by Christopher A. Ludlam
7. Clinical Diagnosis &Management by Laboratory methods(20th edition) by John bernardHenary
8. Medical Laboratory Technology Methods &Interpretation(5th edition) by RamnikSood
9. Atlas of haematology(5th edition)by G.A. McDonald
10. A Manual of Laboratory & Diagnostic Tests(6th edition)by Frances Fischbach
11. Haematology (Pathophysiological basis for clinical practice) 3rd edition, by Stephen M. Robinson.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS502-18- Applied Haematology-1
Practical

1. To prepare a bone marrow smear and stain by Leishman's, May GrunwaldGiesma and Perl's stain.
2. To process a bone marrow trephine biopsy cut sections and stain with H &E, Reticulin stain and PAS staining
3. To identify morphologically the: (i) Immature Erythroid series of cells. (ii) Immature Myeloid and other WBC series of cells.
4. To study the RBCs abnormal morphological forms. (i) Variation in size, shape & Staining character (ii) Red cell inclusion.
5. Preparation of various additive reagents used in mixing experiments a. Correction studies / mixing experiments to pin point the defect in case of prolonged i. PT ii. APTT iii. Thrombin time
6. Physical, Chemical and Microscopic examination of urine
7. Cytological examination of CSF and other body fluids
8. Physical and Microscopic examination of seminal fluid including sperm count
9. Demonstration of functional aspects of blood cell counter
10. Demonstration of functional aspects of Coagulometer

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS503-18- Medical Laboratory Management
Theory**

Aims and Objectives: The students will become aware of ethics in a clinical laboratory, Good laboratory practice and Quality Management in a clinical laboratory.

1. Ethical Principles and standards for a clinical laboratory professional: a. Duty to the patient, b. Duty to colleagues and other professionals, c. Duty to the society
2. Good Laboratory Practice (GLP) Regulations and Accreditation: a. Introduction to Basics of GLP and Accreditation, b. Aims of GLP and Accreditation, c. Advantages of Accreditation, d. Brief knowledge about Nation and International Agencies for clinical laboratory accreditation
3. Awareness / Safety in a clinical laboratory: a. General safety precautions, b. HIV: pre- and Post-exposure guidelines, c. Hepatitis B &C : pre- and Post-exposure guidelines, d. Drug Resistant Tuberculosis
4. Patient management for clinical samples collection, collection of sample, transportation and preservation
5. Sample accountability: a. Purpose of accountability, b. Methods of accountability
6. Sample analysis: a. Introduction, b. Factors affecting sample analysis
7. Reporting results: a. Basic format of a test report, b. Reported reference range, c. Clinical Alerts, d. Abnormal results, e. Turnaround time, f. Results from referral laboratories, g. Release of examination results, h. Alteration in reports
8. Quality Management system: a. Introduction, b. Quality assurance, c. Quality control system, d. Internal and External quality control
9. Biomedical waste management in a clinical laboratory
10. Introduction and importance of calibration and Validation of Clinical Laboratory instruments
11. Laboratory Information system and financial Management: a. Introduction, b. Functions of a laboratory management system, c. Standards for laboratory management system, d. Introduction and awareness of financial management in a clinical laboratory
12. Ethics in Medical laboratory Practice: a. Understanding the term 'Ethics', b. Ethics in relation to the following: i. Pre-Examination procedures, ii. Examination procedures, iii. Reporting of results, iv. Preserving medical records, v. Access to Medical laboratory Records
13. Audit in a Medical Laboratory: a. Introduction and Importance, b. Responsibility, c. Planning, d. Horizontal, Vertical and Test audit, e. Frequency of audit, f. Documentation

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS504-18- HISTOTECHNOLOGY-I
Theory

Aims and Objectives: In this section students will be made aware of terminology used in histotechnology, various instruments and their maintenance and also learn the processing of various samples for histopathological investigations.

1. Introduction to histotechnology
2. Care and maintenance of laboratory equipment used in histotechnology
3. Safety measures in a histopathology laboratory
4. Basic concepts about routine methods of examination of tissues
5. Collection and transportation of specimens for histological examination
6. Basic concepts of fixation
7. Various types of fixatives used in a routine histopathology laboratory: i. Simple fixatives ii. Compound fixatives, iii. Special fixatives for demonstration of various tissue elements
8. Decalcification: a. Criteria of a good decalcification agent, b. Technique of decalcification followed with selection of tissue, fixation, decalcification, neutralization of acid and thorough washing. c. Various types of decalcifying fluids: Organic & Inorganic Acid, chelating agents, Use of Ion-exchange resins and Electrophoretic decalcification and treatment of hard tissues which are not calcified.
9. Processing of various tissues for histological examination: a. Embedding, i. Definition ii. Various types of embedding media, iii. Procedure followed by Dehydration, Clearing, Infiltration and routine timing schedule for manual or automatic tissue processing. iv. Components & principles of various types of automatic tissue processors
10. Section Cutting: a. Introduction regarding equipment used for sectioning, b. Microtome Knives, Sharpening of Microtome Knives, Honing, Stropping, various types of microtome and their applications c. Freezing Microtome and various types of Cryostats. d. Faults in paraffin section cutting with reason and remedy, spreading the sections and attachment or mounting of sections to glass slides.
11. Staining, Impregnation and Mountants: a. Theory of Staining, Classifications of Dyes, Principles of Dye Chemistry, b. Stains and Dyes and their uses, c. Types of Stains, Chemical Staining Action, Mordants and Accentuators, Metachromasy. d. Use of Controls in Staining Procedures, e. Preparation of Stains, solvents, aniline water and buffers etc., f. Commonly used mountants in histotechnology lab. g. General Staining Procedures for Paraffin Infiltrated and Embedded tissue. h. Nuclear Stains and Cytoplasmic stains, i. Equipment and Procedure for manual Staining and Automatic Staining Technique. j. Mounting of Cover Slips, Labeling and Cataloguing the Slides.
12. Routine Staining Procedures: a. Haematoxylin and Eosin Staining, various types of Haematoxylin b. Mallory's Phosphotungstic Acid Haematoxylin (PTAH)

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS505-18- CLINICAL BIOCHEMISTRY--II
Theory**

Aims and objectives:

The students will learn about the various methods of patients' sample analysis for biochemistry parameters. The students will learn how to analyze various clinical samples, for estimation of different components which are the cause of the disease or are the diagnostic/prognostic markers. This subject gives information about various clinically important enzymes & automation techniques.

1. Automation in clinical Biochemistry
2. Method of estimation and assessment for: a. Glucose tolerance test. b. Insulin tolerance test. c. Xylose excretion test.
3. Gastric analysis.
4. Clearance test for renal function.
5. Qualitative test for Urobilinogens, Barbiturates, T3, T4 and TSH, 17 Ketosteroids.
6. Principles, clinical significance and procedures for estimation, of Acid phosphatase, Alkaline phosphatase, Lactate dehydrogenase, Aspartate transaminase, Alanine transaminase and Creatine phosphokinase.
7. Qualitative analysis of renal calculi.
8. Chemical examination of cerebrospinal fluid.

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS506-18- HISTOTECHNOLOGY-I
Practical**

1. Demonstration of instruments used for dissection
2. Use of antiseptics, disinfectants and insecticides in a tissue processing laboratory
3. Reception and labeling of histological specimens
4. Preparation of various fixatives
 - a. Helly's fluid
 - b. Zenker's fluid
 - c. Bouin's fluid
 - d. Corney's fluid
 - e. 10% Neutral formalin
 - f. Formal saline
 - g. Formal acetic acid
 - h. Pereyn's fluid
5. To perform embedding and casting of block
6. To process a bone for decalcification
7. To prepare 70% alcohol from absolute alcohol
8. Processing of tissue by manual and automated processor method
9. To demonstrate various part and types of microtome
10. To learn sharpening of microtome knife (Honing and stropping technique)
11. To perform section cutting
12. To practice attachment of tissue sections to glass slides
13. To learn using tissue floatation bath drying of sections in incubator (-560C)
14. To perform & practice the Haematoxylin and Eosin staining technique
15. To perform & practice the Mallory's Phosphotungstic Acid Haematoxylin (PTAH)
16. To learn mounting of stained smears

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS507-18- CLINICAL BIOCHEMISTRY--II
PRACTICAL**

1. Estimation of Glucose tolerance test (GTT).
2. Estimation of Insulin tolerance test (ITT).
3. Determination of Uric acid in Urine.
4. Determination of Creatinine clearance.
5. Determination of Urea clearance.
6. Determination of Serum acid phosphatase.
7. Determination of Serum Alkaline phosphatase.
8. Determination of Serum Lactate dehydrogenase.
9. Determination of T3, T4 and TSH

Suggested Readings:

1. Medical laboratory Technology by KL Mukherjee Volume-III
2. Clinical Biochemistry by Richard Luxton
3. Basic Medical Laboratory techniques by Barbara H. Estridge et.al

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

BMLS508-18- Minor Project

Candidate has to perform a project dealing with bioinformatics tools and their knowledge.

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A **(Class Activities)**

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises
7. The Medical Laboratory Management as per Annexure-III

Part – B **(Outdoor Activities)**

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B

Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

Annexure-III

(Medical Laboratory Management)

1. Clinical sample collection e.g. a. Blood, b. Urine. c. Stool examination, d. Saliva sample, e. Sputum sample, f. Semen analysis etc.
2. Sample accountability: a. Labeling of sample, b. Making entries in Laboratory records
3. Reporting results: a. Basic format of a test report, b. Release of examination results, c. Alteration in reports
4. Quality Management system: a. Internal and External quality control
5. Biomedical waste management in a clinical laboratory: a. Disposal of used samples, reagents and other biomedical waste
6. Calibration and Validation of Clinical Laboratory instruments
7. Ethics in Medical laboratory Practice: a. Ethics in relation to the following: i. Pre-Examination procedures ii. Examination procedures iii. Reporting of results iv. Preserving medical records v. Access to Medical laboratory Records
8. Audit in a Medical Laboratory: a. Documentation

Suggested Readings:

1. Medical Laboratory Management, by Sangeeta Sharma et.al, Viva Books Pvt Ltd.4737/23, Ansar Road, Daryaganj, New Delhi
2. Clinical Laboratory Management, by Lynne Shore Garcia, ISBN Number 978-1-55581-279-9

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

Sixth Semester

**JK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS601-18- Applied Haematology – II
Theory**

Aims and Objectives:

1. Definition and classification of anaemias.
2. Laboratory diagnosis of iron deficiency anaemia
3. Laboratory diagnosis of megaloblastic anaemia
4. Laboratory diagnosis of haemolytic anaemia
5. Definition, classification and laboratory diagnosis of leukaemias
6. Definition and laboratory diagnosis of Leukamoid reactions
7. Cytochemical stainings, procedure and their significance in various haemopoietic disorders.
8. Chromosomal studies in various haematological disorders and their significance.
9. Mechanism of normal fibrinolysis and Laboratory diagnosis of hyperfibrinolysis.
10. Mechanism and laboratory diagnosis of disseminated intravascular coagulation (DIC).
11. Laboratory diagnosis of Haemophilia and von-willebrand disease.
12. Laboratory diagnosis of Idiopathic thrombocytopenic purpura (ITP)
13. Platelet function tests and their interpretation.
14. Various radioactive isotopes used in haematology: a) Definition, source, half life and their application b) Units of radiation measurement *i.e* Curie, millicurie and microcurie c) What is Rad?
15. Various Apparatus used for measurement of Radiation: 1. Principle and their uses
16. Measurement of: a. Blood volume, b. Determination of Red cell volume and Plasma volume, c. Red cell life span, d. Platelet life span
17. Radiation hazards and its prevention
18. Disposal of radioactive material

Suggested readings

23. Text book of Medical Laboratory Technology by Paraful B. Godkar
24. Practical Haematology by JB Dacie
25. Hand book of Medical Laboratory Technology (2nd edition) by V.H. Talib
26. Haematology (International edition) Emmanuel C. Besa Harwal Publisher
27. Practical Haematology (8th edition) by Sir John
28. Clinical Haematology by Christopher A. Ludlam
29. Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henry
30. Medical Laboratory Technology Methods & Interpretation (5th edition) by Ramnik Sood
31. Atlas of haematology (5th edition) by G.A. McDonald
32. A Manual of Laboratory & Diagnostic Tests (6th edition) by Frances Fischbach
33. Haematology (Pathophysiological basis for clinical practice) 3rd edition, by Stephen M. Robinson .

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS602-18- Applied Haematology – II
Practical**

1. To detect whether the given specimen is G6PD deficient or normal.
2. To estimate Hb-F in a given blood sample.
3. To estimate plasma and urine Haemoglobin in the given specimens.
4. To demonstrate the presence of Hb-S by Sickling and solubility tests.
5. To test the given blood sample for its osmotic red cell fragility.
6. Cytochemical staining on the given smears such as PAS, SBB, MPO, LAP and Perl's reaction.
7. To perform various platelet function tests such as whole blood clot retraction test, prothrombin consumption index (PCI) Platelet adhesion, aggregation and PF3 availability test.

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS603-18- Blood Banking
BMLS-503**

Aims and objectives:

This subject will make students learn about blood grouping & blood transfusion. The students will learn about the concept of blood grouping, compatibility testing in blood transfusion & screening of donated blood for various infectious diseases.

1. Introduction to Blood Banking
2. History and discovery of various blood group systems
3. ABO and Rh blood group system
4. Sources of error in blood grouping and their elimination.
5. Difference between Complete and incomplete antibodies
6. Tests for secretion of A or B substance
7. Titration of various antisera
8. Precautions while procurement and storage of grouping antisera
9. Various anticoagulants used to collect blood for transfusion purposes
10. Procedure for collection of blood from a healthy donor
11. Compatibility test in blood transfusion
 - a) Collection of blood for cross matching from a blood bag
 - b) Major cross matching
 - c) Minor cross matching
 - d) Use of enzymes in blood bank specially Pepain
12. Complications and hazards of blood transfusion
13. Laboratory investigations of transfusion reactions and mismatched blood transfusion including direct and indirect Coomb's tests.
14. Preparation of various fractions of blood for transfusion and therapeutic purposes such as:
 - a) Packed red cells, washed red cells and FROZEN Red cells
 - b) Platelet Rich Plasma (PRP), Platelet concentrate and Frozen platelets.
 - c) Fresh plasma(PPP), Fresh Frozen Plasma(FFP) and cryoprecipitate
15. Brief introduction of blood substitute/artificial blood
16. Haemapheresis : pertaining to Leucocytes, platelets and plasma.
17. Quality control in blood bank

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

BMLS604-18- PARASITOLOGY AND VIROLOGY

Theory

Aim and objectives: The students will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various Medically important parasites. They also learn about diseases caused by medically important viruses, samples collection and laboratory diagnosis of some important viral infections.

1. Introduction to Medical Parasitology
2. General characteristics of protozoa and helminthes
3. Collection, Transport, processing and preservation of samples for routine parasitological investigations
4. Morphology, life cycle and lab-diagnosis of Giardia and Entamoeba
5. Morphology, life cycle and lab-diagnosis of Roundworms and Hookworms
6. Morphology, life cycle and lab-diagnosis of T. solium and T. saginata
7. Morphology, life cycle and lab-diagnosis of Malarial parasite with special refrence to P.vivax and P.falciparum
8. Laboratory diagnosis of hydrated cyst and cysticercosis
9. Concentration techniques for demonstration of Ova (Principles and applications)
10. Introduction to medical virology
11. Classification of viruses.
12. Introduction to medically important viruses
13. Collection, transportation and storage of sample for viral diagnosis
14. Staining techniques used in Virology
15. Processing of samples for viral diagnosis (Egg inoculation and tissue culture)

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS605-18- HISTOTECHNOLOGY – II & Cytology
Theory**

Aims and Objectives:

The students will learn about various staining procedures for demonstration of different substances & various cytological investigations. The students will learn about special staining procedures & handling & testing of various cytological specimens.

1. Cryostat sectioning, its applications in diagnostic histopathology.
2. Special Staining Procedures for detection of a. Connective tissue elements, Trichrome staining, muscle fibers, elastic, reticulinfibres, collagen fibres etc. b. Metachromatic staining such as toluidine blue on frozen sections c. Principles of metal impregnation techniques. d. Demonstration and identification of minerals and pigments, removal of pigments/artifacts in tissue sections
3. Demonstration of Proteins & nucleic acids.
4. Demonstration of Carbohydrates, lipids, fat & fat like substances.
5. Demonstration of bacteria and fungi in tissue section.
6. Tissue requiring special treatment i.e. eye ball, bone marrow, muscle biopsy, undercalcified or uncalcified bones, whole brain, whole lungs including other large organs.
7. Enzyme histochemistry : Diagnostic applications & demonstration of Phosphatases, Dehydrogenases, Oxidases & Peroxidases.
8. Vital staining.
9. Neuropathological techniques.
10. Museum techniques.
11. Aspiration cytology principles, indications & utility of the technique with special emphasis on role of cytotechnologist in FNAC clinics, fluid cytology
12. Exfoliative cytology (Papanicolaou technique for the staining of cervical smears.)
13. Introduction and importance of Autoimmune disorders, HLA typing, T & B Cells, ANA, ANCA and TMA
14. Cancer immunology.
15. Tissue typing for kidney transplant.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

BMLS606-18- PARASITOLOGY AND VIROLOGY

1. Routine stool examination for detection of intestinal parasites with concentration methods: - Saline preparation - Iodine preparation - Flootation method - Centrifugation method - Formal ether method - Zinc sulphate method
2. Identification of adult worms from models/slides: - Tapeworm - Tapeworm segments – Ascaris – Hookworms - Pinworms
3. Malarial parasite: - Preparation of thin and thick smears - Staining of smears - Examination of smears for malarial parasites(P.Vivax and P.falciparum) - Demonstration of various stages of life cycle of malarial parasites from stained slides
4. Demonstration of fertilized hen egg
5. Demonstration of various inoculation routes in fertilized hen egg
6. Inoculation of fertilized hen egg through various routes.

Suggested readings:

1. Text book of Parasitology by NC Dey
2. Text book of Parasitology by Chaterjee
3. Medical parasitology by RL Ichhpujani and Rajesh Bhatia
4. Text book of Microbiology by Ananthanereyan
5. Medical Microbiology by Paniker&Satish Gupte
6. Text book of Microbiology by DR arora
7. Basic Medical Laboratory techniques by Barbara H. Estridge et.al

**IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards**

**BMLS607-18- HISTOTECHNOLOGY – II & Cytology
Practical**

1. To cut frozen section and stain for haematoxylin and eosin, metachromatic stain toluidine blue-‘o’ and oil red ‘o’ staining for the demonstration of fat
2. To prepare schiff’s reagent in the lab and do Periodic Acid schiff’s stain on a paraffin section
3. To prepare ammonical silver bath in the laboratory and stain paraffin embedded section for the demonstration of reticulin fibers.
4. To stain a paraffin section for the demonstration of smooth muscle van gieson’s stain
5. To perform masson’s trichrome stain on a paraffin section for the demonstration of collagen, muscle fibre and other cell elements.
6. To stain the paraffin section for the demonstration for the elastic fibres(EVG).
7. To stain Decalcified paraffin embedded section for the presence of calcium salts (Von Kossa’s method).
8. To stain a paraffin section for the following mucicarmine, alsaian blue.
9. To stain a paraffin section for the demonstration of iron (perl’s stain)
10. To demonstrate the presence of bacteria and fungi in paraffin embedded sections the following staining procedures:
 - a) Gram’s staining
 - b) AFB staining (Zeil Neilson’s staining)
 - c) Grocott’s stain for fungi
 - d) Schamori’s reaction for reducing substances (melanin)
11. To stain for nucleic acid (DNA and RNA)
12. To perform Papnicolaou’s stain on cervical smear
13. To perform Guard’s staining for demonstration sex chromatin (barr bodies on a buccal smear)

Suggested readings:

1. Medical laboratory Technology by KL Mukherjee Volume-III

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A **(Class Activities)**

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B **(Outdoor Activities)**

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B

Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

IK Gujral Punjab Technical University
B.Sc. MLS Batch 2024 onwards

Annexure-IV
Blood Banking

1. To prepare Acid Citrate Dextrose (ACD) and Citrate Phosphate Dextrose (CPD) Solutions
2. Screening of blood donor: physical examination including medical history of the donor
3. Collection and preservation of blood for transfusion purpose
4. Screening of blood for Malaria, Microfilaria, HBsAg, syphilis and HIV
5. To determine the ABO & Rh grouping
 - a) Direct or preliminary grouping
 - b) Indirect or proof grouping
 - c) Rh grouping and determination of Du in case of Rh negative
6. To perform Direct and Indirect Coomb's test
7. To perform cross matching
 - a) Major cross matching
 - b) Minor cross matching
8. Preparation of various fractions of blood.

Suggested readings:

1. Practical haematology by JB Dacie
2. Transfusion Science by Over field, Hamer
3. Medical laboratory Technology by KL Mukherjee Volume-I
4. Haematology for students Practitioners by Ramnik Sood

GUIDELINES FOR INTERNSHIP TRAINING PROGRAMME

For

Final year B.Sc. MLS

1. Introduction:

During the clinical internship, MLS students will perform assigned tasks under the direction of clinical site preceptors according to their established policies and procedures. Working with the preceptor, students will develop skills in the laboratory by performing patient testing, preparing and maintaining instruments for testing, reviewing lab data and patient results, and reporting accurate results. Students will not be substituted for regular employees. Students will demonstrate entry level MLS competency by completing task checklists, submitting log summary and other assignments, and completing any testing required by clinical sites. Students will share their knowledge in weekly discussions of what has been learned at their respective sites as well as answer questions put forth by the clinical course instructor. Students will demonstrate professional attributes of the Medical Lab Scientist at all times.

2. Proceeding of Internship:

Compulsory Internship shall include rotational clinical assignments, administrative skills & a scientific project over a period of One year as per the Rules & Regulations applicable to Internees regarding attendance, attitude, performance & evaluation.

3. OBJECTIVES:

Skills based outcomes and monitor able indicators for Medical Lab. Technologist.

1. Should be able to undertake sample collection independently.
2. Assist in specialized procedures.
3. Able to do the sample processing.
4. Should be able to handle all equipment independently.
5. Should ensure protection and quality assurance
6. Undertake care and maintenance of all equipment
7. Able to evaluate samples
8. Able to identify and manage emergency situations.
9. Able to receive and document verbal, written and electronic orders in the patient's medical record.
10. Implements health and safety procedures

11. Demonstrates ability to interpret, apply and disseminate information as a member of the medical team.

12. Ensures adherence to legislation

13. Demonstrates knowledge and skills to carry out the daily/weekly Quality Control (QC) checks

4. **INTERNSHIP** – minimum 1440 hours in not less than 180 days evenly spread over TWO Semesters.

The student will have to submit Attendance certificate issued by the Authorized person/ Head of the Hospital/Department/laboratory where the student is undergoing internship at the end of each semester. (Form-1)

Students have to undertake the rotational postings during which students have to work under supervision of an experienced staff in the following areas:

Postings Duration

S. No.	Posting Area	Duration
1	Blood Bank	2 month
2	Pathology	3 month
3	Hematology	3 month
4	Microbiology	2 month
5	Biochemistry	2 Months

5. EXIT VIVA

There will be one exit Viva to be conducted at End of training and student has to score SATISFACTORY grade.

6. EVALUATION

During the rotational posting, students shall Investigate all kinds of patients & also undertake skills of maintaining administrative records & Maintenance of equipment.

The candidate shall maintain a log book (Form-2) & record all the events of the respective posting. He /She shall be closely monitored by the senior staff in charge throughout the posting & the same shall also sign in the Log book on completion of the assignment.

7. START OF INTERNSHIP PROGRAMME

The programme will commence within 15 days after the declaration of Final B.Sc result by the University. In special circumstances with the permission of the head of the institute, students can start an internship within 30 days of declaration of results.

8. LEAVE FOR INTERNS

An internee shall be entitled for maximum 12 days leave during a One Year period of internship posting.

An internee will not be permitted to avail more than 4 days leave in any department. Period of leave in excess of 4 days in a department will have to be extended in the same department. Under any circumstances this period will not be condoned by any authority.

However if any student wants to attend any state/national/international conference, workshop or seminar then maximally 6 days study leave can be granted to the students with production of the proper documents or certificate. It should not be more than 6 days in any conditions.

9. STIPULATION FOR REPEAT POSTING IN CONCERNED DISCIPLINE:

- i) Unsatisfactory performance.
- ii) Prolonged illness, Medical Certificate must be validated by a by the parent institution
- iii) Prolonged Leave due to any reasons other than illness.
- iv) Failure to submit Log book.
- v) Failure to submit attendance certificate.

10. INTERNSHIP COMPLETION CERTIFICATE

The college/institute will issue Internship completion certificate to student after completion of internship as per format provided in FORM-3.

FORM-1

ATTENDANCE CERTIFICATE

Ref. No _____

Date

This is to certify that

Mr./Ms./Mrs. _____ has satisfactory
completed _____ months of training in _____ at
_____ (Name of Hospital)

[sign] _____

Authorized person/ Head of the Hospital/Department

[sign] _____

Principal/ Head of the Institute

FORM-3

INTERNSHIP COMPLETION CERTIFICATE

Ref. No _____

Date _____

This is to certify that

Mr./Ms./Mrs. _____ has satisfactory

completed one year of Compulsory Internship for Bachelor of Science- B.Sc.

(Medical Technology-Anaesthesia & Operation Theatre Technology) at

_____ (Name of the college/institute)

[sign] _____

Department Dean /Principal