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

Batch 2018 onwards

By

Board of Study MLT / MLS

Department of Academics
IK Gujral Punjab Technical University
Bachelors of Science in Medical Laboratory Science (B.Sc. MLS):
It is a Under Graduate (UG) Programme of 3 years duration (6 semesters)

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
Those candidates who have passed their Matriculation examination AND have also passed three-year Diploma in any Trade from Punjab State Board of Technical Education & Industrial Training, Chandigarh or such Examination from any other recognized State Board of Technical Education, or SantLongowal Institute of Engineering & Technology, Longowal / or / Two years’ diploma in pharmacy or medical lab technology after 10+2 recognized by any state board.
Courses & Examination Scheme:

First Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Type</th>
<th>Course Title</th>
<th>Load Allocations</th>
<th>Marks Distribution</th>
<th>Total Marks</th>
<th>Credits</th>
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*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.
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<tr>
<th>Course Code</th>
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* A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement
### Third Semester

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<td>BMLS303-18</td>
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*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement*
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<td><em><em>10 L</em> 03 T</em> 15 P**</td>
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### IK Gujral Punjab Technical University
#### B.Sc. MLS Batch 2018 onwards

#### Fifth Semester

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### Sixth Semester

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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.
First Semester
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 alleleism, 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:


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
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 MoniaCheesbrough
6. Text book of Microbiology by Prescott
7. Practical Medical Microbiology by Mackie &MacCartney Volume 1 and 2
8. Immunology by Kuby.
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 Chaterjee Shinde
7. Principal of Biochemistry by Lehninger
8. Biochemistry by Voet & Voet
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.
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.
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.
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:

Unit-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:

4. *Language through Literature* (forthcoming) ed. Dr. Gauri Mishra, Dr Ranjana Kaul, Dr Brati Biswas


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:
Course Objective

This introductory course input is intended

a. To help the students appreciate the essential complementarily 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 2018 onwards

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<tr>
<th>Course Code</th>
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<tr>
<td>HVPE101-18</td>
<td>Ability Enhancement Compulsory</td>
<td>Human Values, De-addiction</td>
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<td></td>
<td>Course (AECC)</td>
<td>and Traffic Rules</td>
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Total no. of Lectures: 28

Content for Lectures:

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

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!

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

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, Sath-astitva as comprehensive Human Goals
18. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha ) from family to world family!
   - Practice Exercises and Case Studies will be taken up in Practice Sessions.
Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

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

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


**Relevant CDs, Movies, Documentaries & Other Literature:**

1. Value Education website, [http://uhv.ac.in](http://uhv.ac.in)
2. Story of Stuff, [http://www.storyofstuff.com](http://www.storyofstuff.com)
3. Al Gore, *An Inconvenient Truth*, Paramount Classics, USA
5. IIT Delhi, *Modern Technology – the Untold Story*
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<td>Human Values, De-addiction and Traffic Rules (Lab/ Seminar)</td>
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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.
IK Gujral Punjab Technical University
B.Sc. MLS Batch 2018 onwards

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.


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:

Second Semester
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, Voges-Proskauer, Urease, Citrate, Oxidase, TSI, Nitrate reduction, Carbohydrate fermentation, Huge and leifson, Bile solubility, 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 Monia Cheesbrough
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
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 & Physiology- 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 Murgehs
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) Huge 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
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
7. Determination of Creatinine in serum or plasma
8. Determination of serum Albumin
9. Determination of Cholesterol in serum or plasma
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.
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 landuse 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)
Unit 6: Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- 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:


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.
Third Semester
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 haemotology 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 Parafol 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(IInd 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
13. Haematology (Pathophysiologival basis for clinical practice) by Stephen M. Robinson
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
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: Endocrin & 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
Aims /learning Objectives: Students will be able to know the basic concepts of Haematology & routine 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) Cyanmethahaemoglobin 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 2018 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.
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.
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
   b) Significance of air bacteriology in healthcare facilities
   c) Settle plate method
   d) Types of air sampling instruments
   e) 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 MoniaCheesbrough
6. Hospital Acquired Infections by Dr. V Muralidhar
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.
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**
Fourth Semester
Aims and Objectives: The student will study diseases associated with different body organs and systems
7. Reproductive system:- Sexually transmitted diseases, Pelvic inflammatory disease, disorder of cuvix(CIN), Disease of ovaries, ectopic pregnancy, prostatitis, Infertility
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 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
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.
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 J.B Dacie
3. Hand book of Medical Laboratory Technology(IInd 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 bernard Henary
8. Medical Laboratory Technology Methods &Interpretation(5th edition) by Ramnik Sood
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
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:
2. Medical Laboratory Sciences, Theory & Practical by A. Kolhatkar.
3. Practical Clinical Biochemistry by Harold Varley.
5. Text book of Medical Biochemistry by Chaterjee&Shinde.
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
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.
1. Estimation of Glucose in Urine and in Blood.
2. Estimation of Protein in Urine and Blood.
4. Estimation of uric acid in blood.
5. Estimation of serum bilirubin
7. Estimation of HDL Cholesterol.
9. Estimation of TG
10. Estimation of Creatinine in Blood
11. Estimation of serum calcium
12. To measure electrolytes Sodium, Potassium & Chloride.
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
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.
12. Introduction to medical mycology
13. Basic concepts about superficial and deep Mycoses
14. Taxonomy and classification and general characteristics of various medically important fungi
15. Morphological, cultural characteristics of common fungal laboratory contaminants
16. Culture media used in mycology
17. Direct microscopy in Medical mycology laboratory
18. Processing of clinical samples for diagnosis of fungal infections i.e. Skin, nail, hair, pus, sputum, CSF and other body fluids
19. Techniques used for isolation and identification of medically important fungi
20. Methods for identification of yeasts and moulds
21. 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 MoniaCheesbrough
26. Immunology by Ivan Roitt, JonathanBrostoff and David Male
27. Immunology by Kuby
28. Medical Mycology by Dr JagdishChander
IK Gujral Punjab Technical University
B.Sc. MLS Batch 2018 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), CCIEP, 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.
Fifth Semester
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
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
6. Disorder of leucocytes. a. Abnormal morphology i.e. shift to left & shift to right.
8. Physiological variations in Hb, PCV, TLC, DLC and Platelets
9. Investigations of a case suffering from bleeding disorders
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(IInd 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
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.
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
4. Patient management for clinical samples collection, collection of sample, transportation and preservation
5. Sample accountability: a. Purpose of accountability, b. Methods of accountability
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
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
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.
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
3. Gastric analysis.
5. Qualitative test for Urobilinogens, Barbiturates, T3, T4 and TSH, 17 Ketosteroids.
7. Qualitative analysis of renal calculi.
8. Chemical examination of cerebrospinal fluid.
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 (-50°C)
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
1. Estimation of Glucose tolerance test (GTT).
2. Estimation of Insulin tolerance test (ITT).
3. Determination of Uric acid in Urine.
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
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.
Annexure-III
(Medical Laboratory Management)

2. Sample accountability: a. Labeling of sample, b. Making entries in Laboratory records
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
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
Sixth Semester
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.
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
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(IInd edition) by V.H. Talib
26. Haematology (International edition)EmmanuelC.BesaHarwal 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 Henary
30. Medical Laboratory Technology Methods & Interpretation(5th edition) by RamnikSood
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.
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
17. Quality control in blood bank
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 reference to P.vivax and P.falciparum
8. Laboratory diagnosis of hydatid cyst and cysticercosis
9. Concentration techniques for demonstration of Ova (Principles and applications)
10. Introduction to medical virology
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)
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.

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 toludine 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
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.
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
15. Tissue typing for kidney transplant.
1. Routine stool examination for detection of intestinal parasites with concentration methods: -
   Saline preparation - Iodine preparation - Floatation 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
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 Per iodic 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 reticulinfibers.
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 eliments.
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 mucicarmin, alsian 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) Schamorl’s reaction for reducing substances (melanin)
11. To stain for nuclic 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.
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