CURRICULUM FOR

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

(Applicable w.e.f. academic session 2017-18)

COURSE NAME: DIPLOMA in (MEDICAL LABORATARY TECHNOLOGY)

DURATION OF COURSE: TWO YEARS

FULL-TIME/ PART – TIME: FULL-TIME

IMPLEMENTATION FROM:

SRI GURU RAMDAS UNIVERSITY OF HEALTH SCIENCES, SRI AMRITSAR, PUNJAB

1. Diploma in Medical Laboratory Technology

Medical Laboratory Technology, also known as clinical laboratory sciences, is an allied health/ paramedical profession, which is concerned with the diagnosis, treatment and prevention of disease through the use of clinical laboratory tests. Doctors rely on laboratory technologies to detect, diagnose and treat diseases. DMLT courses covers the basics of preclinical subjects such as Biochemistry, Pathology, Microbiology and Blood Banking Medical Laboratory Technologists (MLT) do these tests by analysing body fluids, tissues, blood typing microorganism screening, chemical analyses, cell counts of human body etc.

2. Duration of Course

The Diploma in Medical Laboratory Technology Course is proposed to be 2 years diploma course.

3. Eligibility Criteria for Admission

The students shall be admitted as per the admission criteria and qualification prescribed in the Notification issued by the Board of Management of Sri Guru Ram Das University of Health Sciences from time to time.

4. Medium of Instructions

The Medium of instruction during the course and for the university examination shall be in English.

5. Examination Scheme

5.1 The examination for the first and second shall ordinarily be held twice year in the months of May/June and November/ December by the Institute as per University rules.

5.2 Annual Examination shall be held in May/June and supplementary within 6 months of annual examination.

5.3 The examination in theory/practical shall be held at the end of the 1st academic year (1st Year) and the end of 2nd academic year (2nd Year) with one internal and one external examiners.

5.4 Date of examination and appointment of examiner will be made by the Board of Management on recommendation of Faculty of Medical Sciences.

5.5 The examination for the first, second year of Diploma in Medical Laboratory Technology Course would be held according to the prescribed syllabus.

6. Rules of Examination for Diploma in Medical Laboratory Technology Course:

6.1 The students shall submit his/her application for admission to the examination to Controller of Examinations SGRDUHS, Sri Amritsar through the Director Principal of the SGRDIMSAR, Sri Amritsar on the prescribed form with the required fee (the last date of which will be updated on university website after notification issued from Board of Management time to time).

6.2 The candidates will be given 25 marks for theory and 15 marks for practical as internal assessment in each subject on the basis of their performance during the year. That a

candidate be eligible to appear in the examination provided he/she secured a minimum of 35% marks in internal assessment in theory and practical.

6.3 There will be fresh internal assessment and compulsory attendance for the students for the examination in which he/she has failed at the time of subsequent examination in that subject.

6.4 The students will not be allowed to appear in the examination unless he/she attends 75% of the total theory and practical in each subject separately.

6.5 Director Principal of the college is empowered to condone the shortage of attendance of lectures to the extent of 5% lectures delivered in each course of theory and practical.

6.6 A student will be deemed to have passed in the examination if he/she passes in each subject separately.

6.7 In case of students joining late owing to the late admission with the approval of the Vice-chancellor, their lecturers are to be counted from the date of joining. Deficiency in studies should be made up by attending special classes for them at the level of Head of the Department.

7. <u>First Year Diploma in Medical Laboratory Technology Examination:</u>

The First Year **Diploma in Medical Laboratory Technology** examination shall be in the following subjects and candidate shall be required to pass all the subjects:-

Diploma Part – I

Paper	**Subject**	**Theory**			**Practical**			**Grand Total**
		Marks	**Internal Assessment**	**Total**	**Marks**	**Internal Assessment**	**Total**	
Paper-I	Basic Principles of Biochemistry	75	25	100	35	15	50	150
Paper-II	Fundamentals of Histopathology/ Histotechnology and Cytology	75	25	100	35	15	50	150
Paper-III	Basic Techniques in Laboratory Haematology, Blood Banking and Clinical Pathology	75	25	100	35	15	50	150
Paper-IV	General Microbiology, Immunology	75	25	100	35	15	50	150
	Basics of Computer	----	-----	-----	----	----	----	---

<u>Note.</u> The Examination in the subject of Basics of Computer will be conducted at college level and marks will be sent to University for final inclusion in the result.

Grading System

Marks Range	81 - 100	76 - 80	71 - 75	61 - 70	51 - 60	41 - 50	31 - 40	0 - 30
Grade	**A+**	**A**	**B+**	**B**	**C+**	**C**	**D**	**E**

8. <u>Second Year Diploma in Medical Laboratory Technology Examination:</u>

The First Year Diploma in Medical Laboratory Technology Examination shall be open to a person who has previously passed the Second Year Diploma in Medical Laboratory Technology Examination of this University.

Diploma Part – II

S. No.	Subject	Theory			Practical			Grand Total
		Marks	Internal	Total	Marks	Internal Assessment	Total	
Paper-I	Analytical Biochemistry and Metabolism	75	25	100	35	15	50	150
Paper-II	Basic Cellular Pathology, Allied Techniques, Cytology and Histopathology	75	25	100	35	15	50	150
Paper-III	Fundamentals of Hematology	75	25	100	35	15	50	150
Paper-IV	Systemic Microbiology including Mycology and Parasitology	75	25	100	35	15	50	150

9. Promotion and Number of Attempts allowed

9.1 A candidate who fails in all the subjects in the First Year Diploma in Medical Laboratory Technology examination shall not be promoted to Second Year class.

9.2 A Candidate who fails in one more or more subjects will be given four attempts including first attempt as a regular candidate, plus one mercy chance at the discretion of the Vice- Chancellor, at six monthly intervals. However, he/she will have to clear all these attempts within 4 years of admission to the said course.

9.3 The candidate who will absent himself/herself from the examination will be deemed to have been failed in that subject.

9.4 A candidate who passes in at least one subject of University level First Year Diploma in Medical Laboratory Technology examination will be permitted to attend classes of Second Year. However, the candidate will be required to pass in all subjects of 1st Year examination at least 6 months before the final examination of 2nd Year examination.

9.5 Candidate who passes in one or more subjects of Second Year Diploma in Medical Laboratory Technology examination shall be exempted from appearing in these subject at a subsequent examination, but the candidate must pass the examination in a maximum of four attempts including first attempt, as a regular candidate plus one mercy chance at the discretion of the Vice- Chancellor, at six monthly intervals. However, he/she will have to clear all these attempts within 4 years of admission to the said course.

10. Appointments of Examiners:

There shall be two examiners – One internal and one external.

10.1 Professor & head of the Department shall be Convener. The Examiner at least 3 years post PG teaching experience in that specification field will be appointed as Internal Examiner.

10.2 The external examiner shall be appointed from other Universities at least 3 years post PG teaching experience in that specification field.

11. Paper Setting and moderation of Question Papers

The questions papers for 1st Year and 2nd Year will be set under the direction of Controller of Examinations.

Each Question Paper covering entire course consists of seven questions out of which six questions carry 10 Marks and one question carry 15 marks.

12. Evaluation of Answer Books

The answer books shall be got evaluated by putting fictitious roll numbers thereon or spot evaluation (Table marking) or any other method under the direction of the Controller of Examinations.

13. Minimum Pass Marks

During all the three annual examinations in each subject paper the candidate shall have to obtain 50% in theory, practical & internal assessment taken together.

The successful candidates shall be classified into divisions as under:-

a. Those who obtain 60% or more marks First Division.
b. Those who obtain 50% or more marks but below 60% marks Second Division.
c. A candidate who will obtain 75% or more marks of the total marks in any subject shall be declared to have obtained distinction in that subject provided he/she passed in all the subjects of the courses in all the parts in the first attempt.
d. A candidate is eligible to appear in the examination provided he/she secures a minimum of 35% marks in internal assessment in theory and practical separately.

14. Grace Marks

There shall be no provision for grace marks.

15. Declaration of Result

The results will be tabulated and declared by the Controller of Examination's office.

16. Award of Diploma

On successfully passing the Second Year Diploma in Medical Laboratory Technology examination the students shall be awarded the diploma of Diploma in Medical Laboratory Technology.

SYLLABUS – DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

Course Distribution : **First Year**

Subject	Theory Hours	Practical and Training Hours	Total Hours
Anatomy, Physiology a) Anatomy b) Physiology			
Biochemistry	64	256	320
Fundamentals of MLT & Microbiology	64	256	320
Fundamentals of Histopathology/ Histotechnology and Cytology	60	250	310
Basic Techniques in Laboratory Haematology and Clinical Pathology	60	250	310
Total	**248**	**1012**	**1260**

Second Year

Subject	Theory Hours	Practical and training Hours	Total Hours
Biochemistry	64	256	320
Basic Cellular Pathology, Allied Techniques, Cytology and Histopathology	60	250	310
Fundamentals of Hematology, clinical pathology and Blood Banking	60	250	310
Microbiology	64	256	320
Total	**248**	**1012**	**1260**

SYLLABUS FOR DIPLOMA IN MEDICAL LABORATORY
1st YEAR

Curriculum & Syllabus

1. ANATOMY & PHYSIOLOGY

Module1: Introduction to anatomy

Scope of Anatomy and Physiology – Definitions and Terms in Anatomy and Physiology- Structure and function of human cell – Elementary tissues of human body – Brief account on Composition of Blood – Functions of blood elements – Blood Group and coagulation of blood.

Module 2: Cardio Vascular System

Structure and function of various parts of the heart, arterial and venous system, brief account on common cardiovascular disorders

Module 3: Respiratory System

Various parts of respiratory system and their functions, Physiology of Respirations

Module 4: Digestive System

Names and various parts of digestive system – Liver, Spleen, Gall Bladder, Pancreas, Buccal Cavity, Pharynx, Oesophagus, Stomach, Intestine etc. physiology of digestion and absorption

Module 5: Urinary System

Various parts of urinarysystem and its function- structure and function of kidneys – physiology of urine formation – pathophysiology of renal disease and edema

Module 6: Reproductive System

Physiology and anatomy of male & female reproductive system – Prostate & Uterus & Ovaries etc.

Module 7: Musculoskeletal System

Classification of bones & joints, Structure of skeleton – structure of skeletal muscle- physiology of muscle contraction

Module 8: Nervous System

Various parts of nervous system- Brain and its parts- functions of nervous system – Spinal Cord & Nerves

Module 9: Endocrine System

Endocrine glands, their hormones and functions – Thyroid, Parathyroid, Suprarenal, Pituitary, Pituitary and Thymus

Module 10: Haemopoieticand Lymphatic System

Name of the blood vessels & Lymph gland locations

Module 11: Surface Anatomy & Surface Marking of Human Body

Practical's

- Study of Human Skeleton parts with skeletal models.
- Study with charts and models of all organ systems mention above.
- Microscopic slides examination of elementary human tissues, cells.

REFERENCES

1. Solomon. E.A., (2008) Introduction to Human Anatomy and Physiology 3rd Ed, Saunders: St Louis.
2. Chaursia, B.D, &Garg K., (2012) Human Anatomy Regional and Applied CBS Publications : New Delhi

3. T.S Ranganathan – A text book of Human Anatomy
4. Fattana, Human anatomy (Description and applied) Sauder's & C P Prism Publishers, Bangalore – 1991

PAPER- I: BASIC PRINCIPLES OF BIOCHEMISTRY (1ST YEAR)

RATIONALE

The students are imparted basic training of theoretical and practical aspects in the field of clinical biochemistry. The students are made to learn the technique of collection of clinical samples and their processing along with recording of data. The students will also obtained the basic knowledge of chemistry and metabolism of various metabolites which are routinely estimated in different diseases so that a clear understanding of the different test is obtained. The students are also given basic training in safety measures, quality control and automation. The students are imparted basic training of theoretical and practical aspects in the field of clinical biochemistry. The students are made to learn the techniques of collection of clinical sample and their processing along with recording of data. The students will also obtain the basic knowledge of chemistry and metabolism of various metabolites which are routinely estimated in different disease so that a clear understanding of the different tests is obtained. The students are also given training in safety measures, quality control and automation.

DETAILED CONTENTS

THEORY :

1. Chemistry Of Carbohydrates

   Introduction: Definition, functions, classification, Types (Monosaccharide, Disaccharide, Oligosaccharide & Polysaccharide)
   Isomerism (Stereoisomerism, Optical, Epimers, Anomers, Mutarotation and enantiomers), Reducing properties (Oxidation and reduction), Glycosides.
2. Chemistry Of Proteins
   Introduction, Functions, classification of proteins and amino acids, Types of biologically important peptide.
   Properties: Isoelectric pH (Zwitter / Dipolar ions), Solubility, Molecular weight (proteins), Shape(proteins), Acidics and basic proteins, Colour reaction of proteins, Denaturation of proteins. General properties of amino acids and proteins. General reaction of amino acids and proteins.
3. Chemistry Of Lipids

Lipids (Essential fatty acids/triacylglyerol/phospholipids):- Introduction: Definition, functions, Classification, types (Simple, Complex, Derived, Miscellaneous, Neutral Lipids). Antioxidants, Lipids Peroxidation.

4. Heme Metabolism

5. Bilirubin Metabolism
6. Formation and excretion of bilirubin
7. Formation of bile pigments
8. Conjugated and unconjugated bilirubin
9. Principle and procedures of serum bilirubin estimation (Direct & Indirect)
10. Clinical importance and Reference values.
11. Jaundice and its clinical aspects
12. Radioisotopes
13. Porphyrias and its types.

PRACTICAL TOPICS

1. Introduction to biochemistry (4 hrs)
    - Definition
    - Importance of Biochemistry
    - SI Units and their use
    - Volumetric apparatus and their calibration
2. Handling and maintenance of Balance, Centrifuge, Colorimeter, ion Selective electrode and flucmeter
3. Preparation of various anticoagulants and specimen collection vials/containers
4. Collection of blood by various methods including vacutainer system
5. Preparation of different protein precipitating agents, PFF preparation
6. Qualitative Estimation Of Normal and Abnormal urine components.
7. Quantitative Estimation of blood glucose/sugar (Folin-Wu method, O-toluidine method and enzymatic method)
8. Serum urea estimation
9. Serum creatinine estimation
10. Serum uric acid estimation
11. Plasma and serum protein estimation
12. Estimation of electrolyte levels of Na^+,K^+ and CI^- by flame photometer and kit method .

TRAINING TOPICS

1. Cleaning and storage of laboratory, glass and plastic ware (8hrs)
    - Cleaning and care of laboratory glass and plastic ware
    - Different cleaning agents (soaps, detergents, chromic acid)
    - Methods of cleaning and storage
2. Standardization of glass ware

3. Important instruments; principle, working, handling and care of (18 hrs)
    - Balance (Analytical, electrical/ electronic)
    - Centrifuge
    - Colorimeter
    - Spectrophotometer
    - Ion selective electrodes
    - Glucometer
4. Anticoagulants
    - Definition
    - Types
    - Uses
    - Merits and Demerits
5. Blood fractions
    - Preparation of Serum
    - Preparation of Plasma
6. Collection and preservation of clinical specimens
    - Blood
    - Urine
    - Stool
    - Other Body fluids
7. Separation of serum and plasma
8. Solutions: Definition, Preparation of solutions,Molarity, Molality, Normality.
9. pH Measurement, pH indicators, Buffers solutions, pH meter
10. Principle and methods of estimation
    - Reference values
    - True and apparent sugar
    - Renal threshold
    - Important and Performance of ST/GTT
    - Clinical importance of blood sugar, ST/GTT
11. Reference values and Clinical importance of of various parameters.
12. Preparation of all types of reagents.

RECOMMENDED BOOKS

1. Textbook on Biochemistry for DMLT & Paramedical courses.Dr I Clements.
2. A Procedure Manual for Routine Diagnostic Tests Vol.I and III by KL Mukerjee; Tata McGraw Hill publishers, New Delhi
3. Biochemistry estimations by F.J. Baker

PAPER-II: BASIC CELLULAR PATHOLOGY, ALLIED TECHNIQUES, CYTOLOGY AND HISTOPATHOLOGY

HISTOPATHOLOGY AND CYTOLOGY-I (First Year)

RATIONALE

This part of the subject is aimed at introducing the students to the various types of tissue preparations and developing expertise in the students to cut very thin tissue sections from tissue blocks and facilitate visualization using various stains and dyes. Cytology part aims at exposing the students to the latest advancements in cytological investigations.

DETAILED CONTENTS

Theory

1. Introduction and definition of:
   - 1.1 Histology
   - 1.2 Histopathology
   - 1.3 Biopsy
   - 1.4 Autopsy
   - 1.5 Autolysis
   - 1.6 Putrefaction
2. Preparation of Tissue (Different Methods of Preparation of Tissue)
   - 2.1 Unfixed Tissue preparations
     - 2.1.1 Imprint methods – Impression Smears
     - 2.1.2 Teased preparation
     - 2.1.3 Squashed preparation
     - 2.1.4 Frozen section
   - 2.2 Fixed Tissue preparations (introduction only)
     - 2.2.1 Paraffin embedding
     - 2.2.2 Celloidin embedding
     - 2.2.3 Gelatin embedding
3. Reception, recording, labeling and preservation of histological specimen.
4. Fixation (Histological Specimens)
   - 4.1 Classification of fixatives
   - 4.2 Composition of various fixatives
   - 4.3 Advantages and disadvantages
5. Processing (by Paraffin Technique)
   - 5.1 Dehydration
     - 5.1.1 Clearing/Dealcoholization
     - 5.1.2 Infilteration and impregnation
     - 5.1.3 Paraffin embedding
     - 5.1.4 Automation: Histokinete (automatic tissue processor) - its types, working, care and maintenance.
6. Microtome
   - 6.1 Microtomy
     - 6.1.1 Types

6.1.2 Advantages and disadvantages
6.1.3 Working principle, care and maintenance

6.2 Microtome Knives
6.2.1 Various types of knives
6.2.2 Sharpening of knives
- Honing technique
- Stropping technique
- Automation: Automatic knife sharpener – uses, care and maintance
- Stropping technique
- Uses of abrasives and lubricants

6.3 Section Cutting
6.3.1 Rough cutting
6.3.2 Fine cutting
6.3.3 Use of tissue floatation bath
6.3.4 Use of various adhesive media and lifting of sections to the slide
6.3.5 Errors /cutting faults in sections and their remedies

7. Theory of staining (Routine)
7.1 Dye Chemistry
7.2 Principle and mechanism of routine stain (Haematoxylin and Eosin)
7.3 Various steps of staining (Haematoxylin and Eosin)
- Hydration
- Nuclear Staining
- Differentiation
- Blueing
- Counterstaining
- Dehydration
- Clearing and Mounting
- Results

7.4 Automation: Use of automatic stainer and coverslipper

8. Mountants
8.1 Various types of mounting media (aqueous, resinous)
8.2 Advantages and Disadvantages

9. Various Terms associated with staining
9.1 Solvents
9.2 Mordants
9.3 Metachromasia
9.4 Accelerators
9.5 Progressive and regressive staining
9.6 Use of controls in staining and their significance

10. Cell
10.1 Defination and function
10.2 Structure

11. Exfoliative Cytology
11.1 Introduction
11.2 Preparation of vaginal & cervical smears
11.3 Collection and Processing of specimen for cytology
- Urine
- Sputum

- CSF (Cerebro Spinal Fluid)
- Other fluids

12. Fixation (Cytological Specimen)
    12.1 Definition
    12.2 Various types of Cytological fixatives
    12.3 Advantages and Disadvantages
13. Cytological Staining
    Principle, Technique and interpretation of results in
    - Papanicalaou staining
    - May Grunwald&Giemsa staining
    - Haematoxylin and Eosin staining
14. Role of Laminar airflow and cytotechnician in cytology

LIST OF PRACTICALS

1. Reception of specimen, labeling and preserving the specimen
2. Preparation of various smears by unfixed methods
    - Imprint smears
    - Teased smears
    - Squashed smears
3. Preparation of different fixatives with special emphasis on preparation of formaline based fixatives.
4. Preparation of paraffin blocks from various tissue pieces and labeling with emphasis on orientation
5. Handling of microtome
6. Sharpening of microtome knives
7. Preparation of blocks for fine cutting
    - Rough cutting
    - Trimming
8. Practice of fine section cutting
9. Practice of lifting of sections on the slides
10. Performing H&E staining on sections
11. Mounting and labeling of tissue section using various mounting medias
12. Demonstration of cell
13. Processing of urine samples for malignant cells
14. Processing of sputum sample for malignant cytology
15. To perform PAP stain on given smear
16. To perform MGG stain on given smear
17. To perform H&E on given smear

PAPER-III: FUNDAMENTALS OF HEMATOLOGY, CLINICAL PATHOLOGY AND BLOOD BANKING

RATIONALE

The training in hematology is imparted to enable the students to know the principle of tests, methodology of routine as well as advanced procedures being carried out in the laboratory by using routine as well as sophisticated instruments. He should also be able to carry out routine clinical

laboratory investigation (blood, urine etc).Stress is also given in use of safety measures in the laboratory

DETAILED CONTENTS

Theory

1. Introduction to haematology
   - 1.1 Various apparatus used in haematology labs.
   - 1.2 Precautions to be taken while working in a lab.
   - 1.3 Role of technician in infection control

2. Apparatus and Instruments
   Parts, functions, principle, maintenance and working of microscope, centrifuge machine, water bath, hot air oven and incubator, blood counter, blood mixture.

3. Haemopoeisis
   - 3.1 Erythropoiesis, leucopoeisis, thrombopoeisis
   - 3.2 Definition, composition and functions of blood
   - 3.3 Factor effecting/Contributing haemopoeisis

4. Anticoagulants
   Definition and various types of anticoagulants alongwith their mode of action their preparation with merits and demerits of each
5. Diluting fluid (Hb, TLC, Platelets, RBC count) Uses, preparation and composition.
6. Collection and preservation of blood
   - 6.1 Collection of blood; venous and capillary
   - 6.2 Various equipment used for collection of blood samples
   - 6.3 Safety measures at the time of sampling and collection
   - 6.4 Preservation and disposal of processed blood samples
   - 6.5 Changes on stored blood
7. Romanowsky stains
   - 7.1 Theory and preparation
   - 7.2 Choice of slide and spreader and preparation of blood film
   - 7.3 Characteristics of good film preparation
   - 7.4 Staining procedure
   - 7.5 Effects of pH on staining

LIST OF PRACTICALS

1. Demonstration of various parts of centrifuge; its functioning and care
2. Demonstration of various parts of microscope its functioning and care
3. Cleaning and drying of glass and plastic ware
4. Preparation of various anticoagulants
5. Collection of venous and capillary blood
6. Preparation of the stains and other reagents
7. Preparation of peripheral blood film (PBF)
8. To stain a peripheral blood film by Romanowsky stain

8. Haemoglobinometery
   - 8.1 Formation of haemoglobin, function and its degradation
   - 8.2 Types of haemoglobin

8.3 Various methods of estimation with specific reference to cyanmethaemoglobin method.

9. Haemocytometery
   - 9.1 Various counting chambers
   - 9.2 Methods of counting of RBC, WBC and platelets, their calculation and reference values.
   - 9.3 Errors involved in haemocytometery and means to minimize them
10. Differential leucocyte counting (DLC)
   - 10.1 Preparation and staining of blood film
   - 10.2 Performance of DLC
   - 10.3 Normal values and significance of DLC
   - 10.4 Blood cell morphology in health and disease
11. Quality Assurance in haematology such as accuracy, precision etc.
12. Automation in haematology such as blood cell counters

LIST OF PRACTICALS

1. Preparation of peripheral blood film and recognition of different cellular components
2. Preparation and standardization of stains (leishman and giemsa)
3. Preparation of thick and thin blood smear
4. Haemoglobin Estimation by Oxy-Hb and Cyanmethaemoglobin method
5. Counting of RBC
6. Counting of WBC
7. Platelet counting
8. Absolute eosinophil counting
9. Study of morphology of normal RBC and WBC with the help of stained slide
10. To study abnormal morphology of RBC with the help of stained slide
11. To study abnormal morphology of WBC with the help of stained slide
12. To study abnormal morphology of platelet with the help of stained slide

PAPER – IV: GENERAL MICROBIOLOGY & IMMUNOLOGY

(INCLUDING GENERAL BACTERIOLOGY, VIROLOGY, MYCOLOGY, PARASITOLOGY & IMMUNOLOGY)

Rationale:

The students undergoing training of medical laboratory technology are given the knowledge of basic morphological features of bacteria, their staining characters, sterilization methods, preparation of culture media, biochemical test for identification of bacteria and their anti-microbial sensitivity tests. They are also taught safety measures in microbiology.

Detailed content:

THEORY

1. Introduction & brief history of Microbiology- Louis Pasteur, Robert Koch, Joseph Lister, Paul Ehrlich, Edward Jeinner.
2. Safety measures in Microbiology
3. Care and maintenance of laboratory equipments

4. Principals and methods of sterilization
5. Uses and modes of action of antiseptics & disinfectants
6. Handling and cleaning of glassware apparatus, Decontamination and disposal of contaminated material.
7. Preparation uses and standardization of culture media
8. Aerobic and anaerobic culture methods
9. Collection, transportation and processing of clinical samples for Microbiological investigations.
10. Principles and mode of action of antibiotics and chemotherapeutic agents for bacteria and fungi.
11. Principles, functioning, care of microscopes i.e Monocular/Binocular microscope, Dark ground microscope, Phase contrast microscope, Fluorescent microscope.
12. Principles of staining methods and preparation of reagents.
13. General characteristics and classification of bacteria & fungi
14. Growth and nutrition of Bacteria
15. Identification & characteristics of bacteria by

i.Microscopic examination
ii.Colony characteristics
iii.Motility demonstration methods
iv.Biochemical's such as –

a) Carbohydrate utilization tests
b) Catalase, Oxidase, Coagulase
c) Indole
d) MR & VP

16. Antibiotic sensitivity testing

Immunology

1. Lymphoreticular System, T and B cells and their differences
2. Immune Response
3. Antigens, Antibodies, Complement System
4. Hypersensitivity
5. Autoimmunity

Virology

1. General properties of viruses including Size, shape, symmetry, Cultivation of viruses by various methods, inclusion body and antiviral agents.
2. Classification of viruses by various methods
3. Lab diagnosis of viral infections, including collection, transportation processing and storage of various samples.

Parasitology

1. Introduction of medical parasitology and safety measures.
2. Collection, preservation and processing and samples and parasites:- stool, blood, fluids.
3. General characters, classification of protozoa of medical importance.
4. Morphology, lifecycle, pathogenicity and lab, diagnosis of intestinal protozoa:- Entamoeba histolytica, Entamoeba coli, Giardia intestinalis, Balantidium coli, Free living amoebae, Cryptospordium, Isospora and Microsporidium.
5. Morphology, life cycle, pathogenicity and lab. Diagnosis of haemoprotozoa:-
    - Genus, Plasmodium, Toxoplasma
    - Genus Leishmania
    - Genus Trypanosoma

LIST OF PRACTICALS

1.Demonstration of safety rules (universal precautions) in a microbiology laboratory.
2.Preparation of cleaning agents and techniques of cleaning of glass and plastic ware.
3.Sterilization by autoclave and hot air oven.
4.Sterilization by filtration (Seitz)
5.Handling and use of Compound microscope
6.Staining techniques : Gram, Albert's, Ziehl – Neelson's
7.KOH preparation
8.Demonstration of motility (Hanging drop method)
9.Preparation and sterilization of various culture media (Nutrient agar, Nutrient broth,Blood agar, Chocolate agar, Mac-Conkey agar, Lowenstein-Jensen Media).
10. Aerobic and anaerobic culture methods
11. Antimicrobial susceptibility testing by Stokes disc diffusion method
12. Biochemical testing (Carbohydrate utilization tests, Catalase, Oxidase, Coagulase, Indole, MR
13. Stool examination: Methods of collection, transportation and processing of stool samples for intestinal protozoa
14. Collection, handling, storage of samples for viral diagnosis.

BASICS OF COMPUTERS

Theory : 30 hours
Practicals : 30 hours
THEORY

Introduction to computer – I/O devices – memories – RAM and ROM – Different kinds of ROM – kilobytes. MB, GB their conversions – large computer – Medium, Micro, Mini computers - Different operating system – Networking – LAN, WAN, MAN (only basic ideas)

Typing text in MS word – Manipulating text – Formatting the text – using different font sizes, bold, italics – Bullets and numbering – Pictures, file insertion – Aligning the text and justify – choosing paper size – adjusting margins – Header and footer, inserting page No's in a document – Printing a file with options – Using spell check and grammar – Find and replace – Mail merge – inserting tables in a document.

Creating table in MS-Excel – Cell editing – Using formulas and functions – Manipulating data with excel – Using sort function to sort numbers and alphabets – Drawing graphs and charts using data in excel – Auto formatting – Inserting data from other worksheets.

Preparing new slides using MS-POWERPOINT – Inserting slides – slide transition and animation – Using templates – Different text and font sizes – slides with sounds – Inserting clip arts, pictures, tables and graphs – Presentation using wizards.

Introduction to Internet – Using search engine – Google search – Exploring the next using Internet Explorer and Navigator – Uploading and Download of files and images – E- mail ID creation – Sending messages – Attaching files in E- mail.

Role of Computers in the Health care: - HIS, Medical Equipment, Pharmacy in inventory management, Patient record maintenance.

PRACTICAL

- Typing a text and aligning the text with different formats using MS-Word
- Inserting a table with proper alignment and using MS-Word - Create mail merge document using MS-word to prepare greetings for 10 friends
- Preparing a slide show with transition, animation and sound effect using MSPowerpoint
- Customizing the slide show and inserting pictures and tables in the slides using MSpowerpoint
- Creating a worksheet using MS-Excel with data and sue of functions Using MSExcel prepare a worksheet with text, date time and data Preparing a chart and pie diagrams using MS-Excel
- Using Internet for searching, uploading files, downloading files creating e-mail ID

2ND YEAR

PAPAR-I: Analytical Biochemistry and Metabolism

RATOINALE

The students are imparted basic training of theoretical and practical aspects in the field of clinical biochemistry. The students are made to learn the techniques of collection of clinical samples and their processing along with recording of data. The student will also obtain the basic knowledge of chemistry and metabolism of various metabolites which are routinely estimated in different diseases so that a clear understanding of the different tests is obtained. The students are also given basic training in safety measures, quality control and automation. The students are imparted basic training of theoretical and practical aspects in the field of clinical biochemistry. The students are made to learn the technique of collection of clinical samples and their processing along with recording of data. The student will also obtain the basic knowledge of chemistry and metabolism of various metabolites which are routinely estimated in different diseases so that a clear understanding of different tests is obtained. The students are also given basic training in safety measures, quality control and automation.

DETAILED CONTENTS

Theory

1. Metabolism Of Carbohydrates

Outline of Glycolysis, outline of TCA, outline of Gluconeogenesis outline of Glycogen metabolism (Glycogenesis, Glycogenolysis, Glycogenstorage disease, Hormonal regulation) Outline of HMP (Biomedical importance and metabolic disorder and regulation), GTT.

2. Metabolism of Proteins

Oxidative and nonoxidative deamination, Transamination and decarboxylation, Transamidation, Transport and function of ammonia, Urea cycle with inborn errors of metabolism; Outline of metabolism, Specialised products and inborn errors of glycine,

Phenylalanin, Tyrosine, Tryptophan, Methionine, Cysteine, Cystine and Histidine, Branch chain amino acids, Creatinine metabolism

3. **Metabolism of Lipids**

Outline of B fatty acid oxidation along with inborn errors, Outline of fatty acids synthesis, Outline of Cholesterol : Synthesis, Catabolism, Regulation, Inborn errors and atherosclerosis, Outline of Lipoproteins, Ketosis, Lipid Peroxidation and role of antioxidants.

4. **Renal Function Tests**
    1 Renal clearance test-Principles and Procedures
    2 Clinical importance

5. Quality Assurance in Biochemistry as per National Standards

6. Internal quality assurance

7. External quality assurance

Training

1. **Urine Analysis**
    a. Normal composition of urine and its properties
    b. Clinical importance of Urine analysis
    c. Qualitative analysis of proteins, sugar, bile salts, bile pigments, Uorobilinogen and blood.
    d. Detailed discussion on glycosuria and albuminuria
    e. Ketone bodies.
2. **Stool Chemistry**
    a. Physical characteristics and chemical composition of stool
    b. Significance of presence of blood and excess fat in stool
    c. Occult blood detection
3. **Cerebrospinal fluid**
    a. Composition and functions of CSF
    b. Methods of determination of proteins, sugar and chloride in CSF
    c. Reference values
    d. Clinical importance
4. **Biological fluids**

Formation, composition and significance of biological fluids (peritoneal, pleural, synivial, ascetic fluid and gastric juice)

5. **Electrophoresis**
    a. Theory
    b. Principles and procedure of paper, gel electrophoresis, method of elution
    c. Clinical importance

6. **Chromatography**
    a. Theory of Chromatography, separation between stationery and mobile phases
    b. Principle and procedure of Paper chromatography
    c. Importance of chromatography
7. **Automation in Biochemistry**

8. **Thyroid function tests**

    8.1 Functions of thyroid

    8.2 Principle, reference values and clinical importance of T_3, T4 and TSH

List of Practicals

Quantitative Estimation Of :

1. Serum Bilirubin estimation
2. Phosphorus estimation
3. Calcium estimation
4. Renal clearance tests
5. SGOT estimation
6. SGPT estimation
7. ALP estimation
8. ACP estimation
9. Total cholesterol estimation
10. Triglyceride estimation
11. Estimation of HDL and calculation of VLDL and LDL
12. Urinary protein and creatinine estimation (24 hr)
13. Estimation of serum amylase
14. Analysis of urine for sugar ad proteins (qualitative and quantitative)
15. Detection of ketone bodies in urine
16. Detection of haemturia
17. Detection of bile pigments, bile salts and urobilinogen
18. Occult blood test for stool specimen
19. Estimation of glucose , Total proteins, globulins and chloride in CSF
20. Demonstration of electrophoresis (Paper electrophoresis)
21. Demonstration of chromatography (Paper chromatography)

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on concepts and principles while covering the subject contents. In the practical work, the students should be given opportunity to do practical work individually.

Visits to hospital/medical colleagues should be planned to demonstrate the processes. It is important to make use of models and audiovisual aids to show specific processes. Experts should be invited to deliver lecture on specific topics and share their experiences.

RECOMMENDED BOOKS

1. A Procedure Manual for Routine Diagnostic Tests, Vol.I,II and III by KL Mukherjee;

   Tata MCgraw Hill Publishers, New Delhi

2. Practical Clinical Biochemistry by Varley ; Heinmann Publishers, Oxfors

3. A text book of Medical Laboratory Technology by P Godkar; Bhalani Publishers, Mumbai

4. Medical Laboratory Sciences Theory and Practice by J Ochaei and A Kolhatkat, Tata McGraw Hill

PAPER-II: BASIC CELLULAR PATHOLOGY, ALLIED TECHNIQUES, CYTOLOGY AND HISTOPATHOLOGY

HISTOPATHOLOGY AND CYTOLOGY – II (Seond Year)

DETAILED CONTENT

Theory

1. Light Microscope
   - 1.1 Principles of light microscope
   - 1.2 Various parts of microscope
   - 1.3 Uses of microscope
   - 1.4 Cleaning and maintenance of microscope
   - 1.5 Various attachments of light microscope (introduction only)
     - Polarizing
     - Dark field
     - Phase contrast
     - Fluorescent
2. Special stains

   2.1 Principle, significance and interpretation of different types of stains
     - PAS
     - Silver impergnation stain – Reticulinfibre
     - ZiehlNeelson's – for AFB and Leprae
     - Masson's trichrome stain
     - Pearl's Prussion Blue – Iron
     - Oil Red O – fat
     - Gram's stain – Gram +ve and Gram –ve
3. Decalcification
   - 3.1 Process of decalcification
   - 3.2 Various types of decalcifying methods
   - 3.3 Their mechanism, advantage, disadvantage and applications
   - 3.4 Assessment of decalcification
4. Handling of fresh histological tissues (Frozen Section)

4.1 Reception and processing of frozen tissue
4.2 Freezing microtome and cryostat
4.3 Advantages and dis-advantages of freezing microtome and cryostat
4.4 Working, care, maintenance of freezing microtome and cryostat
4.5 Frozen section cutting
4.6 Staining
- Rapid H&E
- Fat stain
4.7 Mounting of frozen section

5. Museum Techniques
5.1 Introduction to museum with emphasis on importance of museum
5.2 Reception, fixation and processing of various museum specimens
5.3 Preparation of mounting solutions
5.4 Technique of mounting specimen
5.5 Care of mounted specimen
5.6 Cataloguing of museum specimen

6. Autopsy
6.1. Introduction to autopsy technique
6.2. Use of autopsy

7. Malignant Cells
7.1 Characteristics
7.2 Differences from normal cell

8. Hormonal Assessment
8.1 Introduction
8.2 Uses

9. Sex Chromatin (Barr bodies)
9.1 Introduction
9.2 Collection of sample
9.3 Staining
9.4 Interpretation

10. Aspiration Cytology
10.1 Principle of FNAC (Fine Needle Aspiration Cytology)
10.2 Indications of FNAC
10.3 Uses of FNAC
10.4 Staining Techniques
- MGG (May-Grunwald – Giemsa)
- PAP (Papanicolaou Stain)
- H&E (Haematoxylin& Eosin Stain)

11. Cytological special stainsPrinciple, Technique & Interpretation of
11.1 PAS (Periodic Acid Schiffs reagent Stain)
11.2 ZeihlNeelson's(ZN) Stain (AFB)

12. Advancement
12.1 Automation in Cytology- Use of Cytospin
12.2 Immunohistochemistry: Principle and Role
12.3 Immunohistochemistry: Antigen & Antibody binding
12.4 Immunohistochemistry: Retrieval
12.5 Immunohistochemistry: Procedure
12.6 Immunohistochemistry: Interpretation

LIST OF PRACTICALS

1. Demonstration of various parts of light microscope (Mechanical & Optical)
2. Demonstration of cryostat
3. Processing of tissue for frozen section
4. Staining and mounting of frozen section using H&E stain (rapid method), Oil Red "O".
5. Preparation of various mounting reagents for museum specimens
6. Demonstration and care of autopsy instruments
7. Demonstration of malignant cell
8. Preparation, Staining and interpretation of buccal smear
9. Preparation of dry smear and wet smear
10. To perform Pap stain
11. Fixation of smears and staining with MGG
12. Immunohistochemistry

RECOMMENDED BOOKS

1. Theory and Practice of Histological Technique by John D. Bancroft, Churchill Livingstone, London
2. Laboratory Practices in Surgical Pathology by Shameen Shariff. JayPee Publishing House, New Delhi

PAPER-III: FUNDAMENTALS OF HEMATOLOGY, CLINICAL PATHOLOGY AND BLOOD BANKING

HAEMATOLOGY-II (Second Year)

DETAILED CONTENTS

Theory

1. Erythrocyte sedimentation rate (ESR) and packed cell volume (PCV)
   - 1.1 Introduction
   - 1.2 Various methods of estimation of ESR and PCV and their merits and demerits
   - 1.3 Factors involved in ESR
   - 1.4 Interpretation of results
2. Red Cell indicies(Mean Corpuscular Values) – MCV, MCH, MCHC Theory, reference range, calculation and interpretation
3. Supravital stain and reticulocyte counting
   - 3.1 Introduction
   - 3.2 Principle and procedure of staining and calculation
   - 3.3 Reference values and interpretation
   - 3.4 Variation in Physiological Values
4. Anemias
   - 4.1 Definition and classification
   - 4.2 Laboratory diagnosis of:
     - (a) Iron deficiency anaemia

(b) Megaloblasticanaemia
(c) Haemolyticanaemia
(d) Aplastic anaemia

5. Tests of Various Hemolytic Anaemias
   5.1 Principle and procedure
   5.2 Clinical importance
   5.3 FoetalHaemoglobin
   5.4 Osmotic Fragility Test
   5.5 G-6 PD Test
   5.6 Sickiling Test

LIST OF PRACTICALS

1. ESR estimations (wintrobe and westergren) in blood
2. Determination of PCV (wintrobe and capillary) in blood
3. Counting of Reticulocyte in blood
4. To perform red cell fragility test on blood
5. To perform Sickling test on blood
6. Estimation of foetalhaemoglobin by alkali denaturation test
7. Estimation of plasma haemoglobin and G_6PD (MRT)

Theory

6. Introduction to normal haemostasis
   6.1. Theories of blood coagulation
   6.2. Platelets and their role in haemostasis
   6.3. Bleeding disorders and related diseases
   6.4. Principles, clinical importance, reference values and methods of: prothrombin time, prothrombin time index (PTI) International normalized ratio (INR), Activated Partial Thromboplastin time (APTT) – bleeding time (BT), Hess test, clotting time (CT), and clot retraction test (CRT)
7. Bone – marrow
   7.1 Composition and function of bone-marrow
   7.2 Aspiration of bone-marrow by various methods
   7.3 Preparation, staining and examination of bone-marrow smears
   7.4 Iron staining (Perls' reaction)
   7.5 Significance of bone-marrow examination
8. Leukemia
   8.1 Definition of leukemias
   8.2 Classification (FAB)
   8.3 Laboratory diagnosis of various leukemias
9. LE Cell phenomenon
   9.1 Phenomenon of LE cell, its differentiation from tart cell
   9.2 Demonstration of LE cell by various methods
   9.3 Clinical importance
10. Processing of biological fluids and interpretation of results such as semen, CSF, pleural and ascitic fluids, urine

LIST OF PRACTICALS

1. Determination of bleeding time by lvy's and Dukes method
2. Determination of clotting time by Lee and white and capillary method
3. Determination of prothrombin time, index and INR (International Normalised Ratio)
4. Determination of Activated Partial thromboplastin time (APTT) Demonstration of Hess test
5. Performance of Clot retraction test
6. Demonstration of LE Cell
7. Processing of biological body fluids

RECOMMENDED BOOKS

1. Practical Pathology, P.Chakraborthy, New Central Book Agency (P) Ltd New Delhi.
2. Medical Lab Technology Methods and Interpretations. Ramneek Sood. JayPee Publishing Company, New Delhi
3. Practical Pathology. K Uma Chaturvedi, Tejinder Singh. Arya Publishing, New Delhi.

TRANSFUSION MEDICINE-II (Second Year)

(Blood Banking)

RATIONALE

Blood transfusion has become a life saving procedure in modern medical sciences. To avoid any mistake, the students must understand to learn the blood bank procedures, such as ABO & Rh blood grouping carefully and accurately. He must also have an adequate knowledge of cross matching both major and minor procedures as well as selection of a suitable donor. He should be competent enough to collect blood and its long-term preservation for safe blood transfusion.

DETAILED CONTENTS

1. Historical introduction to Transfusion medicine (blood banking)
2. Development of ABO antigen in red cells
3. Glassware used in Blood Banking
   - 3.1 Types of glassware and cleaning agents used
   - 3.2 Cleaning of new and used glassware/plastic ware
   - 3.3 Care of glassware/plasticware
4. Anticoagulants used in blood bank
   - 4.1 Types and composition of various anticoagulants
   - 4.2 Advantages and disadvantages of various anticoagulants
5. Screening of blood donors for:

5.1 MP
5.2 VDRL
5.3 HIV
5.4 HbsAg
5.5 HCV

6. Antigen and Antibody
   6.1. Definition of antigen and antibody
   6.2. Classification of antigens and antibodies.
7. ABO Blood Group System
   7.1 Antigens and antibodies involved
   7.2 Principle and procedure of ABO blood grouping
   7.3 Various other sub groups A1,A2,A1B,A2B
8. The Rh Blood Group System
   8.1 Antigen and antibody involved
   8.2 Principle and procedure of Rh grouping
   8.3 Variant of D antigen (Du)
9. Coombs Test
   9.1 Direct coombs test (principle, procedure, importance and application)
   9.2 Indirect coombs test (principle, procedure, importance and application)
10. Cross Matching
   10.1 Types of cross matching
   10.2 Various methods and their procedures
11. Blood Collection and storage
   11.1 Screening of blood donor and characteristics of ideal blood donor.
   11.2 Blood collection procedure
   11.3 Transportation and storage
12. Various blood components (Packed cells, Fresh frozen plasma,Cryoprecipitate, PRP(Platelet rich plasma)
   12.1 Preparation
   12.2 Preservation
13. Blood Transfusion reactions

LIST OF PRACTICALS

1. Washing and sterilization of glass ware
2. Performing ABO blood grouping by following method:
   - Direct
   - Tube Test
   - Indirect (reverse)
   - Subgroup
3. Performing-Rh grouping by following techniques:
   - Slide
   - Tube technique
4. Performance of Coombs Test
   - Direct
   - Indirect
5. Cross Matching (compatibility testing)
   - Major
   - Minor
6. Preparation of anticoagulants

- ACD (Acid Citrate Dextrose)
- CPD (Citrate Phosphate Dextrose)
- CPDA (Citrate Phosphate Dextrose Analine)

RECOMMENDED BOOKS

1. Introduction to Modern Lab Technology by FJ Baker, Butterworth, Heinemann Publishers Oxford
2. Modern Blood Banking and Transfusion Practices by Denise M Harmering, Jay Pee Brothers, New Delhi

PAPER-IV: Systemic Microbiology Including Systemic Bacteriology/ Virology/ Mycology/ Parasitology

RATIONALE

The students undergoing training of medical laboratory technology learn the knowledge of basic morphology, staining, culture, biochemical characteristics and lab-diagnosis of pathogenic bacteria. In addition to this, they are also made aware about the examination of bacteria present in milk and water.

DETAILED CONTENTS

THEORY

Systemic Bacteriology

To study Morphology, culture characters, Biochemical reactions, pathogenicity, lab diagnosis and anti microbial sensitivity testing of the following organisms:-

1. Staphylococci including Micrococci
2. Genus- Streptococcus.
3. Genus- Neisseria
4. Genus- Corynebacterium, Mycobacterium
5. Family Enterobacteriaceae
6. Pseudomonas, vibrio, Hemophilus, brucella, Bordetella
7. Aerobic and anaerobic spore forming organisms i.e Genus Bacillus & Clostridium
8. Non sporing anaerobes
9. Spirochaetes, Mycoplasma, Helicobacter, Campylobacter, Legionella
10. Rickettisia and chlamydiae

Mycology

Brief Study of:-

1. Pathogenic and non-pathogenic fungi, identification, pathogenicity, lab diagnosis& drug sensitivity of fungi.
2. Superficial mycosis including – dermatophytes.
3. S/C mycosis:- Sporotrix shenkii, Mycetoma, Chromoblastomycosis, Rhinosporidiosis
4. Deep mycosis:- Histoplasmosis, Coccidiodomycosis, Blastomycosis. Paracoccidiodomycoses
5. Candida
6. Nocardia
7. Cryptococcus
8. Actinomycosis
9. Lab. Contaminants.
10. Mycotic Poisoning

Virology

1. Different staining techniques used in virology
2. Brief knowledge about:-

Rabies virus, Polio virus, Hepatitis Viruses, HIV , Arbo viruses

Parastilogy:

1. Study of intestinal and tissue nematodes
    - Ascaris lumbricoides
    - Ancylostoma duodenale/Necator americanus
    - Trichinella spiralis
    - Trichiuris trichura
    - Dracunculus medinensis
    - W. Bancrofti, B. malayi, Loa Loa, Oncocerca volvulus.
    - Stronglyloides stercoralis.
    - Enterobius vermicularis.

PRACTICALS

1. Identification of various bacteria by studying colony characters, Gram's staining, Biochemical reactions, special tests for particular isolate.
2. Collection, transportation of clinical samples, processing including culture of following clinical samples for identification of pathogens- Urine, Stool, Sputum, Throat swabs, Pus and Pus swabs, Blood, Skin, Eye and Ear swabs and CSF
3. Identification of pure bacterial cultures of common pathogens.
4. Bacteriological examination of water and milk samples.
5. Methods of collection and processing of hair, nail, skin, pus, sputum samples for fungal examination.
6. Identification of fungi by KOH preparation, Gram's staining.
7. LCB mount preparation.
8. Germ tube test for Candida albicans.

9. Laboratory organization, management, recording of results and quality control in Microbiology.

RECOMMENDED BOOKS

1. Textbook on Microbiology for DMLT & Paramedical courses.
2. Textbook on Microbiology Dr C P Baveja
3. Medical parasitology, D R Arora
4. Essentials of Practical Microbiology
5. Textbook on Microbiology Ananthanarayan & Panikar
6. Text book of Medical Microbiology by Cruckshiank Vol. I and II
7. Medical Laboratory Science by Jockie and Kolhatkar, Tata McGraw Hill.

MEDICAL LABORATORY MANAGEMENT-IV (B)

RATIONALE

The students are taught techniques of planning a clinical laboratory. They are also supposed to be taught how to procure chemicals, reagents and equipment. The students are imparted special training in maintaining laboratory equipment, the preventive maintenance and daily up keeping. They are also given training for the maintenance of stocks and inventory. They are also given knowledge of recording results, interpretation, quality control and reproducibility. Students also learn how to communicate effectively.

DETAILED CONTENTS

1. Introduction, Layout, Facility of Lab

   Role of medical laboratory technology in total health care, principles of management, techniques of planning, physical facilities/equipment – layouts and design

2. Laboratory Organization

   Laboratory organization, operation, job description, evaluation, performance

3. Material Required

   Material management, procurement, financial resources, importing, inventory, control and analysis, inspection, storage etc

4. Quality Assurance

   Analytical control, Internal and external quality assurance in clinical laboratories, precision, accuracy, standard deviation as per national standards

5. Safety Precaution

   Safety measures in clinical laboratories (microbiology, haematology, biochemistry, histopathology and cytology, transfusion medicine), Disposal of Biomedical waste.

6. Human Relations and Motivation

   Inter-personal relations, inter and intradepartmental relations and their importance, concept and importance of motivation-drives and incentives; intrinsic and extrinsic motivation

7. Managing Psychological self
   - Stress
   - Emotions
   - Anxiety
8. Leadership

   Concept, types, qualities of good leader

9. Medical Ethics and Code of Conduct

Ethics and code of conduct - legal aspects – confidentiality malpractice/ negligence; legal implications, law suits, consumer protection and insurance for professional health hazards

RECOMMENDED BOOKS

1. Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House, Mumbai (India)
2. Text Book of Medical Laboratory Technology by FJ Baker; ButterworthsHeinmann Publishers, Oxford
3. Text Book of Medical Laboratory Technology by KL Mukherjee Vol I, II and III; Tata McGraw Hill Publishers, New Delhi
4. Mdical Lab Technology by RamnikSood, Jay Pee Brothers, New Delhi
5. Ditrict Laboratory Practice in Tropical Countries by Monica Chesbrough, Churchill Livingstone.