

POST GRADUATE DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY (PGDMLT)

Subject Curriculum

Discipline	Medical Laboratory Technology
Program	Post Graduate Diploma in Medical Laboratory Technology
Specialization	Medical Laboratory Technology
Subject Code	PGDMLT
Tenure	1 year

AIM

- To prepare a post-graduate student to acquire in-depth knowledge of various aspects of Medical Laboratory Technology

OBJECTIVES

- Demonstrate the ability in the conduct of diagnostic procedures
- To inculcate appropriate professional relationships in multi-disciplinary set up, patient management and co-partnership basis.
- To prepare a student to address problems related to laboratory technology and acquaint him/ her with the concept of quality at the institutional level.
- To provide experience in clinical training.
- To incorporate concept of management in medical laboratory technology.

COURSE DURATION

- Regular full-time course of 1-year duration [maximum 2 years]

MEDIUM OF INSTRUCTION

- English will be the medium of instruction for the subjects of study and for the examination of the PGDMLT program

METHOD [S] OF INSTRUCTION

- This course is to be operated on a lecture, discussion, practical including demonstration and student participation format
- Learner shall be required to present selected materials to the peers
- Structured problem-based exercises shall be provided to simulate specific case examples
- Audio visual material and/or printed handouts shall be provided to supplement reading and classroom instruction

METHOD [S] OF LEARNING

- Full time pattern with graded responsibilities in the conduct of laboratory work
- Participation in seminars, group discussions, and CME.
- Involvement in laboratory, experimental work.

COURSE OF STUDY PGDMLT

Sr. No.	Subject	Course No.	Teaching Hours	Credits per Lecture
Main Subjects				
1	Clinical Biochemistry	1261101	70	4
2	Medical Microbiology	1261102	70	4
	Clinical Pathology & Blood Banking	1261103	60	4
4	Hematology & Histopathology	1261104	60	4
5	Practical: Medical Laboratory Technology	1261105, 1261106, 1261107	120	8
Teaching hours-Theory/ Practical			400	
Laboratory Posting			455	
Total Teaching hours			855	

PGPGDMLT- Examination System and Marks distribution: Theory and Practical

Course Code	Subject	Duration of Examination (hours)	Distribution of marks		Total
			University exam	Internal assessment	
1261101	Clinical Biochemistry	3 hours	70	30	100
1261102	Medical Microbiology	3 hours	70	30	100
1261103	Clinical Pathology & Blood Banking	3 hours	70	30	100
1261104	Haematology & Histopathology	3 hours	70	30	100
1261105, 1261106, 1261107	Practical and Oral	3 days*	210**	90**	300
Total			490	210	700

COURSE CONTENT

PAPER I: CLINICAL BIOCHEMISTRY

Must know

UNIT:1 Introduction & General aspects

- Introduction to Clinical Biochemistry
- Study of weights, volumes and Units, Inter-conversion of units, Measurements, Preparation of solution, Normal range, glasswares used in laboratory
- Different vaccutes of anticoagulants used in Clinical Biochemistry, its application and Mechanism of action.
- Hazards in the Laboratory.

UNIT:2 Instrumentation

- Automation in Clinical Biochemistry laboratory
- Electrophoresis, Chromatography, Colorimeter, Spectrophotometer, ELISA, RIA, Flame photometer, Weighing balance

UNIT:3 General Biochemistry of Carbohydrates

- Classification, Biomedical importance, properties (chemical & physical)
- Carbohydrate Metabolism (In brief): Glycolysis, TCA, HMP shunt, Hormonal Regulation of blood sugar, GTT, Diabetes and Diabetic markers.

UNIT:4 General Biochemistry of Proteins

- Classification of Amino acids and proteins, Peptides,
- Classification & Properties of Plasma, Immunoglobulins,
- Protein metabolism: Transamination, Deamination, Urea cycle, Phenyl ketonuria, Alkaptonuria.

UNIT:5 General Biochemistry of Lipids

- Lipids: Definition, Classification, Properties, Phospholipids.
- Lipid metabolism: Cholesterol, Lipoproteins, VLDL, LDL, HDL, Atherosclerosis, Ketosis, Lipid Profile, Metabolism of Ketone bodies, Beta-Oxidation of fatty acid & its energetics.

UNIT:6 Nucleic acids

- Nucleotides: Nucleic acids, Functions (In Brief), Purine catabolism, Uric acid: Formation, Estimation, Interpretation, Gout

UNIT:7 Hemoglobin

- Hemoglobin structure, Hbs, Thalassemia
- Hemoglobin: Synthesis (In brief), Heme breakdown, Bilirubin, Jaundice, Lab. diagnosis

UNIT:8 Enzymes

- Enzymes: Definition, Classification, Factors affecting enzyme activity, Inhibition, Diagnostic and therapeutic use of Enzyme

UNIT:9 Minerals & Vitamins

- Minerals: Calcium, Iron, Phosphorus, Iodine, Sodium, Potassium and Selenium.
- Vitamins (In brief): A, D, E, K, B12, Folic acid, Coenzyme form of Vitamins & Vitamin C (In brief)

UNIT:10 Function Test

- Liver Function tests: Introduction, function of liver, type of investigations carried out, normal range and interpretation of results
- Renal function tests: Functions of kidneys, Various renal function tests including clearance tests and interpretation of results.
- Thyroid function tests: Estimation of T-3, T-4, Free T3, Free T4 & Interpretation of results.
- pH, Blood buffers, Acid-base balance, Anionic gap
- Internal and External Quality Control, Westguard rules

UNIT:11 Nutrition

- Principles of nutrition, Balance diet, BMR.
- Nutritional disorder, and Obesity

UNIT:12 Molecular biology

- Molecular biology (In brief): Replication, transcription, DNA recombinant technology, Blot techniques, PCR

PAPER II: GENERAL & CLINICAL MICROBIOLOGY

Must know

UNIT 1: HISTORY & CLASSIFICATION

- History and Pioneers in Microbiology: Contributions of Antony Van Leeuwenhoek, Louis Pasteur, Joseph Lister, Robert Koch (Koch's Postulates)
- Bacterial Taxonomy: Nomenclature and classification of microbes (in brief)

UNIT 2: MORPHOLOGY

- *Microscopy, Stained preparation, Size & Shape*
- Morphology of bacteria: Structures of a bacterial cell and their functions
- Physiology of Bacteria: Nutrition, Gaseous requirement, temperature requirement and other growth requirements

UNIT 3: GENERAL MICROBIOLOGY

- Sterilization and disinfection
- Culture media
- Culture methods
- Identification of Bacteria: biochemical tests
- Antibiotic sensitivity testing

UNIT 4: IMMUNOLOGY

- Immunology
- Infection, Immunity, Antigen, Antibody,
- Antigen-Antibody reactions (General features, Precipitation, Agglutination, Complement fixation test, Immunofluorescence, Radio Immunoassay, ELISA),

UNIT 5: SYSTEMIC MICROBIOLOGY

- Staphylococcus, Streptococcus, Pneumococcus, Neisseria,
- Corynebacteria, Clostridia,
- Coliforms, Proteus, Salmonella, Shigella,
- Vibrio, Pseudomonas, Haemophilus,
- *Mycobacteria, Spirochaetes*

UNIT 6: MYCOLOGY

- Morphological Classification of fungi
- Laboratory diagnosis of Fungal Infections

UNIT 7: PARASITOLOGY

Morphology, life cycle, laboratory diagnosis of following parasites:

Protozoa:

- *Entamoeba, Giardia, Trichomonas,*
- *Leishmania, Plasmodium*

Helminthology

Cestodes:

- *Taenia, Echinococcus*

Nematodes:

- *Trichuris, Ancylostoma,*
- *Ascaris, Enterobius, Wuchereria bancrofti(filaria)*

UNIT 8: VIROLOGY

General Properties of Virus: Morphology, Replication & cultivation of viruses

- Disease caused, Laboratory diagnosis & prevention of
- Hepatitis viruses
- HIV

UNIT 9: CLINICAL / APPLIED MICROBIOLOGY

- Collection, Transportation & Culture of
- Sputum and other respiratory specimens
- Urine
- Faeces
- Blood
- CSF and other body fluids
- Hospital-acquired infections & Laboratory Hazards
- Disposal of Biomedical waste
- Quality control in Diagnostic Microbiology
- Automation in Diagnostic Microbiology

PAPER – III: CLINICAL PATHOLOGY & BLOOD BANKING

Clinical Pathology

Must know

- Urine Examination: Physical, Chemical and Microscopic
- Stool examination : Gross, chemical & microscopic
- CSF Examination
- Semen examination
- Other body fluids examination

Nice to know

- Sex chromatin determination.
- Quality control in Clinical Pathology

Blood Banking

Must know

- Immunohematology of red cell and blood group systems
- Apparatus used in blood banking, its care and cleaning
- Record keeping
- Methods of ABO and Rh blood grouping
- Screening of a blood donor, tapping of blood donor
- Cross matching tests
- Storage of blood
- Coomb's test
- Blood component therapy

Nice to know

- Antibody titrations
- Blood transfusion reactions
- Quality control in Blood Banking

PAPER – IV: HEMATOLOGY & HISTOPATHOLOGY

Hematology

Must know

- Vein puncture
- Instruments used in hematology
- Common anticoagulants and their use
- Composition of blood cellular elements, functions of blood
- Estimation of Hemoglobin
- Methods and counting of red blood cells, white blood cells, platelets and reticulocytes.
- Estimation of erythrocyte sedimentation rate, packed cell volume, blood indices
- Preparation of blood films, staining methods and preparation of different stains and diluting fluids
- Study of blood smear examination for red blood cells, different white blood cells, normal and abnormal cells, platelets, and parasites.
- Studies for blood coagulation and haemostasis
- Sickling tests, red cell fragility test and LE cell test. Foetal Hemoglobin Estimation and Hemoglobin electrophoresis.
- Basics of automated Blood Cell counters

Nice to know

- Quality control in Hematology
- Bone Marrow Examination
- Laboratory diagnostic approach on Anemias, Leukemias, and Bleeding disorders.

Histopathology/Cytology

Must know

- Introduction to Histology
- Handling Biopsy Specimen
- Instruments in Histopathology
- Fixation & common fixatives
- Tissue processing: dehydration, clearing, embedding, methods of tissue processing: automated & manual, Preparation of paraffin block.
- The manipulation and use of microtomes, Microtome knives and methods of sharpening.
- Paraffin block, section cutting, picking up sections, drying sections,
- Staining : principle of staining, preparation and use of Hematoxyline and eosin stain.
- Mounting,
- Frozen section apparatus: a theoretical knowledge of its application, construction and use.
- Diagnostic Cytology : preparation of smears and Papanicolaou stain.

Nice to know

1. Quality control in Histopathology
 - Methods in common use for decalcification
 - recognition and correction of faults in section cutting
 - Preservation of slides and blocks

List of Practicals/ skills

1. Pathology

Students should be able to perform the following:

Haematology:

1. Microscopy
2. Collection of Blood
3. Preparation of bulbs for collection
4. Blood cell counter
5. Estimation of Hemoglobin
6. RBC count
7. PCV & RBC indices
8. Platelet count
9. Total WBC count
10. Differential count
11. Peripheral smear
12. Reticulocyte count
13. ESR
14. Sickling tests
15. Bleeding time & Clotting time

Clinical Pathology

1. Urine Exam. R & M
2. Stool R & M
3. Semen examination R & M
4. CSF Exam. R & M

Blood Banking

1. Blood Group
2. CM Tests
3. Du Tests
4. Comb's Tests,
5. Antibody Tests

Histopathology & cytology

1. Preparation of fixatives
2. Haematoxylin and eosin

Must acquire

Nice to acquire

1. Logging of tissue processing
2. Paraffin embedding
3. Section cutting
4. Staining
5. Mounting
6. Pap Stain.

2. Biochemistry

Students should be able to perform the following:

Must acquire

1. Preparation of standard solution, molar solution and other reagents
2. analysis of normal and abnormal urine
3. Estimation of blood /serum glucose by various methods
4. GTT
5. Estimation of total protein and A/G ratio
6. Electrophoresis of plasma proteins
7. Electrophoresis of lipoproteins
8. Estimation of total cholesterol and its fractions
9. Estimation of calcium
10. Estimation of phosphorous
11. Estimation of Creatinine
12. Estimation of urea
13. Estimation of uric acid
14. Estimation of AST
15. Estimation of ALT
16. Estimation of alkaline phosphatase
17. Estimation of Bilirubin , direct , total
18. Auto analyzers
19. Electrolyte analyzer
20. Arterial blood gas analyzer
21. Chemiluminance equipment
22. Spectrophotometer
23. Electrophoresis
24. Chromatography

3. Microbiology

Students should be able to perform the following:

Bacteriology

Must acquire

1. Aseptic practices in laboratory and safety precautions.
2. Preparation and pouring of media – Nutrient agar, Blood agar, Mac Conkey agar, Sugars, Serum sugars, TSI, Sabouraud dextrose.
3. Operation of autoclave, hot air oven, distillation plant, filters like Sietz and membrane and sterility tests.
4. Washing and sterilization of glassware (Plugging and packing)
5. Disposal of contaminated materials like cultures.
6. Quality control of media, reagents etc.
7. Care and maintenance of common laboratory equipments like water bath, centrifuge, refrigerators, incubators, etc.
8. Performance of antimicrobial susceptibility testing e.g. Kirby-Bauer,
9. Collection of specimens for Microbiological investigations such as Blood, Urine, Pus (Swabs),
10. Identification of Bacteria of Medical Importance upto species level
11. Preparation of stains viz. Gram, Ziehl Neelsen (ZN) etc. and performing of staining.
12. Care and operation of Microscopes viz. Light and Fluorescent microscopes.
13. Preparation, examination, and interpretation of direct smears from clinical specimens, viz. Sputum for AFB: ZN, Slit smears for *M. leprae* by modified ZN staining,
14. Quantitative analysis of urine by pour plate method and semi-quantitative analysis by standard loop test for finding significant bacteruria.
15. Plating of clinical specimens on media for isolation, purification, identification and quantitation purposes.
16. Methods for the preservation of bacteria, Maintenance of stock cultures.
17. Tests for motility: hanging drop preparation

Nice to acquire

1. Techniques of anaerobiosis, anaerobic jars, evacuation and filling with CO₂ and H₂.
2. Preparation of stains viz., capsules, spores etc. and performing of staining.
3. Skin tests like Mantoux.
4. Special tests-Bile solubility, chick cell agglutination, sheep cell haemolysis, niacin and catalase tests for mycobacterium, satellitism, CAMP test, catalase, slide agglutination tests.
5. Culture and Antimicrobial susceptibility tests for mycobacteria.

Immunology

Must acquire

1. Collection of blood by venipuncture, separation of serum and preservation of serum for short and long periods.
2. Performance of serological tests viz. Widal, VDRL/RPR
3. Enzyme linked immunosorbant assay: HIV, HBsAg, HCV
4. Latex agglutination tests: RA, CRP,
5. Rapid tests (Immunochromatography or Flow through type) HIV .

Nice to acquire

1. Performance of serological tests viz. Brucella tube agglutination, Weil-Felix, cold agglutination, indirect haemagglutination, Paul-Bunnell, Rose-Waaler, IFA.

Mycology

Must acquire

1. Direct Examination of specimens by KOH, Gram, Kinyoun's, Giemsa, Lactophenol Cotton Blue stains.

Parasitology

Must acquire

1. Performance of stains – Leishman, Giemsa.
2. Examination of faeces for parasitic ova and cysts etc. by direct and concentration methods (Salt flotation and Formol-Ether methods).
3. Examination of blood for protozoa and helminths by wet mount, thin and thick stained smears.

Nice to acquire

1. Identification of common arthropods and other vectors viz., Mosquito, sand-fly, Ticks, Mite, Cyclops.
2. Collection of specimens.
3. Preservation of parasites-mounting, fixing, staining, etc.
4. Serodiagnosis of parasitic infection.

- **Virology**

Must acquire

- Serological tests – ELISA for HIV, HBsAg, HCV

Nice to acquire

- RPHA for HBsAg, Haemagglutination Inhibition for Influenza, and Haemadsorption for parainfluenza.
- Chick Embryo techniques – inoculation and harvesting.

LEARNING RESOURCES/ MATERIAL FOR STUDENTS [books/ journals]:

- Dr. Praful B. Godkar, Text Books of Medical Laboratory Technology
- Anathanarayana & Panikar – A Text Book of Medical Microbiology
- Essentials of Medical Microbiology by Apurba Sastry
- P. Chakraborty- A Text Book of Parasitology
- Vasudevan & Shreekumar : Biochemistry for Medical students
- Dacie, Practical Haematology
- K.Laxminarayan : Histological techniques
- Dr. Mukherjee, Medical Laboratory Technology, Volume I , II & II
- Silvertone : Introduction to Medical Lab. Technology
- Manual for Clinical Pathology by Sabitry Sanyal
- Harper's Biochemistry