POST GRADUATE DIPLOMA COURSE IN MEDICAL LABORATORY TECHNOLOGY

REGULATIONS FOR THE POST GRADUATE DIPLOMA COURSE IN MEDICAL LABORATORY TECHNOLOGY

1. **SHORT TITLE AND COMMENCEMENT :** These regulations shall be called "THE REGULATIONS FOR THE POST GRADUATE DIPLOMA COURSE IN MEDICAL LABORATORY TECHNOLOGY
2. **REGISTRATION:** A candidate admitted into Post-Graduate diploma courses in any of the affiliated Institutions of the Tamil Nadu Dr. M.G.R. Medical University, Chennai shall register with the University by remitting the prescribed fees along with the application form for registration duly filled in and forwarded to the Controller of Examinations of this University through the Head of the affiliated institution within the stipulated date. The candidate's name must be registered in the University within 3 months from the date of his/her admission.
3. **ELIGIBILITY:** Candidates for admission to the One year Post-Graduate Diploma course shall be required to possess the following qualifications.
   - ✓ Bachelors of Science with any stream
4. **RECOGNITION FEE:** Candidates who have passed the Bachelors in University shall remit a recognition fee as prescribed along with the stipulated registration fees.
5. **DURATION OF THE COURSE**
   - ✓ The period of certified study and training for the Post-Graduate Diploma course shall be for 1 year.
6. **COMMENCEMENT OF THE COURSE:** The academic year for POST GRADUATE DIPLOMA COURSE IN MEDICAL LABORATORY TECHNOLOGY course will commence from April 1st of every academic year.
7. **CUT-OFF DATE OF THE COURSE:** Last date of Admission to POST GRADUATE DIPLOMA COURSE IN MEDICAL LABORATORY TECHNOLOGY course 31st May of every academic year.
8. **COMMENCEMENT OF THE EXAMINATION:** There shall be one University examinations in an academic year i.e. June 1st. If the date of commencement of the examination falls on Saturdays, Sundays or declared Public Holidays, the examination shall begin on the next working day.
9. **WORKING DAYS IN AN ACADEMIC YEAR. :** Each academic year shall consist of not less than 270 working days.
10. **ATTENDANCE REQUIREMENTS FOR ADMISSION TO EXAMINATIONS:** No candidate shall be permitted to appear for the Examination unless he/she put in 85% attendance during his/her period of study and training in the affiliated institution recognized by this University and produces the necessary certificate of study, attendance and progress from the Head of the Institution by maintaining log book.
11. **MAINTAINENCE OF LOG BOOK**
    - ✓ Every Post-graduate Diploma candidate shall maintain a record of skills he has acquired during the one year training period certified by the various Heads of Departments he has undergone training.
    - ✓ The candidates should also be required to participate in the teaching and training programme of the institute.
    - ✓ In addition, the Head of the Department shall involve their post-graduate candidates in Seminars, Journal Clubs, Group discussions and conferences.
    - ✓ The Head of the Department shall scrutinize the Log Book once in every three months.
    - ✓ At the end of the course, the candidate should summaries the contents and get the Log Book certified by the Head of the Department.
    - ✓ The Log Book should be submitted at the time of practical examination for the scrutiny of the Board of Examiners.

12. MIGRATION/TRANSFER OF CANDIDATES

- ✓ A student studying in **POST-GRADUATE DIPLOMA COURSE IN WARD ADMINISTRATION** can be allowed to migrate/transfer to another institution of Allied Health Science under the same or another University.
- ✓ Under extraordinary circumstances, the Vice Chancellor shall have the powers to place any migration/transfer he/she deems fit before the Governing Council and get its approval for grant of permission/ratification for Migration/Transfer to the candidates undergoing the course of study in affiliated institutions of this University.

13. RE-ADMISSION AFTER BREAK OF STUDY: The regulations for re-admission are as per the University Common Regulation for Re-admission after break of study for all courses**.**

POST GRADUATE DIPLOMA COURSE IN MEDICAL LABORATORY TECHNOLOGY

Subjects
Paper I- Biochemistry & Clinical Biochemistry
Paper II- Microbiology and Pathology
Paper III- Blood bank services and quality

Paper I Biochemistry & Clinical biochemistry

I. BIOCHEMISTRY (Theory)

Module 1: Biomolecules and the cell
Introduction to biochemistry and its definition, Major complex biomolecules of cell and cell organelles (Prokaryotic and eukaryotic cell)

Module 2: Carbohydrates
Chemical structure, function- Classification- Monosaccharides- Disaccharides-Polysaccharides-Homopolysaccahrides-Heteropolysaccharides-Glycoproteins

Module 3: Proteins:
Amino acids- Classification- Structure of proteins- Determination of protein structure- Properties of proteins- Denaturation- Classification of proteins- Antigen, Antibody- Types, Plasma proteins- Blood clotting.

Module 4: Lipids:
Chemical structure, functions, Classification-fatty acids Triacylglycerols, Phospholipids, glycoproteins, Lipoproteins- Steroids - Amphipathic lipids.

Module 5: Nucleic acids & Enzymes:
Definition of DNA, nucleic acids **-** Structure of DNA – Watson & Crick model of DNA - Types of RNA.
Enzymes Definition – Nomenclature – Classification – Factors affecting enzyme activity – Active site – Coenzyme – Mechanism of enzyme action – Enzyme pattern in diseases.

Module 6: Vitamins & Minerals:
Fat soluble vitamins (A,D,E,K) – Water soluble vitamins – B-complex vitamins – principal elements(Calcium, Phosphorus, Magnesium, Sodium, Potassium, Chlorine and sulphur)- Trace elements – Calorific value of foods – Basal metabolic rate(BMR) –
Respiratory quotient (RQ) Specific dynamic action (SDA) – Balanced diet – Marasmus –Kwasoirkar.

Module 7: Hormones
Classification – Mechanism of action – Hypothalamic hormones – Pitutary – Anterior, posterior – Thyroid – Adrenal cortex, Adrenal medulla – Gonadal hormones – Menstrual cycle – GI hormones

Module 8: Acids and bases
Definition, pH, Buffers, Indicators, Normality, Molarity, Molality. Renal control of acid base balance. Clinical causes of Acid base imbalances - Respiratory acidosis, respiratory alkalosis, metabolic acidosis & metabolic alkalosis

II. CLINICAL BIOCHEMISTRY (Theory)

Module 1: Introduction to Clinical Biochemistry
Definition of biochemistry, The use of Biochemical tests - The use of the laboratory - application of biochemistry in the hospital setting.
Module 2: Basic Steps for Drawing A Blood Specimen
Requirement of Blood Collection **-** Blood collection - Phlebotomy - Sampling errors - Collection and preservation of biological fluids - Anticoagulants - Preservation of samples - Chemical preservatives - Process of analysing the specimens - The laboratory report.
Module 3: Photometery
Introduction and definition of photometry. Colorimetry - Lambert Beer's Law - Parts of photo colorimeter
Module 4: Preparation of Reagents & Quality Control
Solution Preparation **-** Molarity - Normality - Dilutions - Preparation of Stock Solutions - Percent Solutions - PH – Buffers-Definition of Quality contyrol - need for quality control in the laboratory - Internal quality control (QC) programme - External QC programme
Module 6: Manual Vs Automation in Clinical Laboratory
Types of analyzers - Semi-auto analyzer - Batch analyzer - Random Access autoanalyzers. Steps in the automated systems - Responsibilities of a technician in the maintenance of the analyzers.
Module 7: Electrophoresis & Chromatography
Introduction and General principle of Electrophoresis: Forces acting on the component in an electrophoresis system - Factors affecting the electrophoresis - Types of Electrophoresis - Applications - Separation of Serum Proteins by Agar Gel Electrophoresis. Chromatography Technique: General principle - Classification of chromatography - Principle of partition chromatography - Procedure - Other Chromatographic Techniques - Adsorption chromatography - Thin layer chromatography - Gas-liquid chromatography - Ion -exchange chromatography - Gel filtration chromatography - Affinity chromatography - HPLC (High performance liquid Chromatography)
Module 8: Metabolic disorders and Diagnostic enzymology:
Disorders of metabolism: carbohydrate – Lipids – Amino acids and Nucleic acids. Diagnostic enzymes: Role of Enzymes in Clinical Practice: Marker enzymes in myocardium, liver and pancreas. Tumour markers.
Module 9: **Organ function tests:**
Evaluation of organ function test: Assessment and clinical manifestation of renal, hepatic, pancreatic and gastric function. Bile pigment metabolism - tests for liver function. jaundice and its type –– Functions of Kidney, Urine formation and renal function tests, disease of kidney - Renal Calculi. Gastric Analysis - Composition of gastric juice, concepts of free and bound acid, Fractional Test Meal.
Module 10: Hormones:
Hormonal disturbances, Thyroid function – Endocrine disorders. **Acids and bases -** Electrolytes and water: Clinical causes of Acid base imbalances - Respiratory acidosis, respiratory alkalosis, metabolic acidosis & metabolic alkalosis

BIOCHEMISTRY (Practical)

Module 1: Carbohydrates
Qualitative tests of monosaccharides (Glucose and fructose) (Demonstration by the faculty)
1. Molisch's test
2. Fehling's test
3. Benedict's test
4. Seliwanoff's test

Module 2: Proteins:
Qualitative tests of proteins (Demonstration by the faculty)

1. Isoelectric precipitation tests
2. Heat coagulation tests

Module 3: Lipids:

Qualitative tests of lipids (Demonstration by the faculty)

1. Solubility tests
2. Emulsification tests
3. Saponification tests

CLINICAL BIOCHEMISTRY (Practical)

Module 1: Carbohydrates

Glucose Determination - Body Sources Of Glucose - the Clinical Significance Of Abnormal Blood Sugar Levels - The Glucose Oxidase Method Of Glucose Determination -The Colormetric Method--Ortho-Toluidine - The Glucose Tolerance Test (GTT) - Glycated Hemoglobin

LIPID PROFILE

Module 2: Estimation of Serum Cholesterol (Total) - Sackett's Method

Module 3: Estimation of Serum Triglycerides: Lipid profile - Total lipids – Phospholipids, Estimation of Serum HDL & LDL cholesterol**.**

ORGAN FUNCTION TEST

RENAL FUNCTION TEST (RFT)

Module 4: Estimation of Blood Urea - Enzymatic using urease - 'Neseler's Method - Berthelot Reaction - In the urease/glutamate dehydrogenase method - Kinetic Method - GLDH method - Colorimetric Method - Diacetyl Monoxime Method - Estimation of Serum Creatinine.

Module 5: Estimation of Serum Uric Acid - Caraway's Method of Estimation - Hyperuricaemia - Hypouricaemia

Module 6: Estimation Total Protein - Biuret Method

LIVETR FUNCTION TEST (LFT)

Module 7: Estimation of Serum Bilirubin (Estimation By Method Of Malloy And Evelyn) Jaundice - Biochemical tests - Unconjugated Hyperbilirubinaemia (Retention Jaundice - Haemolytic (Pre-hepatic Jaundice) - Non haemolytic - Conjugated Hyperbilirubinaemia (Regurgitation Jaundice)

Module 8: Estimation of Serum Alkaline Phosphatase - King & King Method

Module 9: Estimation of Aminotransferases, Transaminases (SGOT & SGPT) Modified Reitman & Frankel Method

Module 10: Estimation of Serum Albumin and Globulin - Bromocresol Green Method

ELECTROLYTES:

Module 11: Estimation of Serum Phosphorus - Method of Fiske and Subbarow, Sodium, potassium and calcium.

Module 12: Chemical Analysis of Urine

Collection of specimen and its preservation - Preservatives used - Physical examination of urine - Colour - Appearance - Turbidity - Specific gravity - Volume - Polyuria - Oliguria - Anuria - PH - Chemical Examination - Proteins - Glucose / Reducing Substances - Ketone Bodies - Blood - Bilirubin - Urobilinogen -Tests - For Proteins - Heat test - TCA test - For Sugars - Benedict's Tests - For Blood/Haemoglobin - Benzidine test - For Ketone bodies: Rothera's nitroprusside test - Gerhardt's Test. For Bile Salts: Hay'sTest - For Bile Pigments - Fouchet'sTest- Determine the presence of normal or abnormal components-Know what is implied by the presence of abnormal constituents in body- Reporting of abnormal constituents. Relevant legislation, standards, policies, and procedures followed in the hospital.

Paper II- Microbiology and Pathology

I. MICROBIOLOGY & IMMUNOLOGY (Theory)

Module 1: Introduction and brief history of Microbiology
Historical Aspect -Branches of Microbiology-Prokaryotic Organisms - Prokaryote Vs Eukaryote-Cell Wall, Structures external to Cell Wall, Structures internal to Cell Wall, Spores.-Eukaryotic Organisms - Structure of eukaryotes, Characteristics of eukaryotes,

Module 2: Common Laboratory Equipments
Incubator, Hot Air Oven, Water Bath - Anaerobic Jar, Centrifuge, Autoclave -Microscope - Fundamentals of Microscopy, Resolution & Magnification, Light Microscopy, Electron Microscopy- Glassware – Description of Glassware, its use, handling and care

Module 3: Sterilization & Disinfection
Sterilization -Definition -Classification and General Principle of Sterilization
Disinfection - Definition -Types - Mode of Action - Uses

Module 4: Cultivation, Nutrition, Growth & Multiplication of Bacteria
Growth Requirements for Microorganisms **-** Chemical requirements - Physical requirements - Bacterial Classification Based on Shapes - Bacterial Classification Based on Staining Methods - Classification based on oxygen requirement (Aerobic and Anaerobic Bacteria) - Autotrophic and Heterotrophic Bacteria - Bacterial Classification Based on Environment - Growth and multiplication of bacteria - Bacterial growth

Module 5: Staphylococcus
Introduction**:** Staphylococcus aureus - Susceptibility to physical and chemical agents - Biochemical reactions - Resistance - Virulence Factors - Cell wall associated - Extracellular factors - Extracellular enzymes - Coagulase - Coagulase (tube) test (Free Coagulase) - 4Clumping Factor (Bound coagulase) - Pathogenicity - Cutaneous infections - Food Poisoning - Toxic Shock - Lab Diagnosis - Coagulase Negative Staphylococci

Module 6: Streptococcus
Streptococcus **:**Introduction - History - Classification: Based on oxygen requirement - Streptococcus pyogenes - Toxins and other virulence factors - Pathogenicity - Suppurative Infections - Non-Suppurative sequale - Culture - Rapid identification - Prophylaxis - Epidemiology - Other Streptococci - Group D - Enterococcus group [fecal streptococci] – Streptococcus – Introduction – Pathogenesis - Identification - Serotyping - Treatment

Module 7: Neisseria Gonorrhoeae and Neisseria Mmeningitidis
Gram Negative bacteria Cocci - Diseases - Important Properties - Properties of the Polysaccharide Capsule of the Meningococcus - Neisseria meningitidis - Pathogenesis & Epidemiology - Clinical Findings - Laboratory Diagnosis - Treatment - Prevention - Neisseria gonorrhoeae - Pathogenesis & Epidemiology - Clinical Findings - Laboratory Diagnosis - Treatment

Module 8: Enterobacteriaceae
Introduction **-** Family Enterobacteriaceae – Classification - Lactose Fermenters - Non-lactose Fermenters - Late Lactose Fermenters - Escherichia Coli – Morphology – Culture - Biochemical Reaction - Antigenic structure – Toxins – Pathogenesis - Urinary tract infection – Diarrhoea - Enteropathogenic E.coli (EPEC) - Enterotoxigenic E.coli (ETEC) - Enteroinvasive Esch.Coli (EIEC) - Verotoxigenic (Enterohaemorrhagic) Esch.coli - Enteroaggregative Esch.Coli - Pyogenic infection – Septicaemia - Laboratory diagnosis - Urinary Tract Infection – Diarrhoea - Pyogenic infections:- Septicaemia – Citrobacter – Klebsiella – Pathogenesis - Laboratory diagnosis – Proteus – Pathogenesis - Laboratory diagnosis – Salmonella: History Cultural characteristics Biochemical reactions - Classification – Pathogenesis - Enteric fever - Typhoid - Septicaemic stage - Stage of localization: Para-typhoid fever is a milder form of febrile illness - Lab diagnosis: Culture and isolation is important in the diagnosis. - Isolation of organism. Shigella –

History - Morphology – Culture - Biochemical reaction – Pathogenesis - Lab diagnosis - Biochemical reaction

Module 9: Non Enterococcal groups

Cornebacteria – Clostridia - Bacillus

Module 10: Pseudomonas Aaeruginosa

Introduction - Pseudomonas Aaeruginosa – Morphology - Cultural characters - Pigment production - Biochemical tests – Resistance – Pathogenesis - Cross Infection - Laboratory Investigation - Treatment

Module 11: Non-Sporing Anaerobes

Introduction - Non-Sporing Anaerobes – Classification - Gram positive cocci - Gram negative cocci - Anaerobic bacilli - Lab diagnosis

Module 12: Mycobacterium

Introduction - Mycobacterium (Fungus like bacteria) – Morphology - Cultural Characters - Biochemical Reactions – Pathogenesis - Primary TB - Laboratory investigations - Petroff's method - Animal Inoculation - Tuberculin test (skin test) – Prophylaxis - Atypical Mycobacteria – Photochromogens – Scotochromogens - Mycobacterium leprae - Lepromin test

Module 13: Vibrio cholerae

Introduction – History Morphology – Culture - Blood agar - Biochemical Reactions - Cholera red reaction - Hemolytic reaction - Vibrio – Antigenic classification - Differences between Classical and El tor – Pathogenesis - Laboratory Investigation (Microscopy) - Treatment

Module 14: Mycology

Classification - Fungal Diseases - Structural-functional relationships – Metabolism – Classification - Common fungal infections in animals

Module 15: Virology

Introduction to Virology **-** General Properties of Viruses - Morphology of viruses - Physical and chemical properties of virus - Classification of viruses - Viral multiplication - Cultivation of viruses - Animal inoculation - Embryonated eggs - Tissue culture (cell lines) - Inclusion body formation - Laboratory diagnosis of viral infections - Isolation and characterization of causative virus - Direct demonstration of virion, viral antigen or viral nucleic acid and in tissues, secretions or excretions - Detection and measurement of specific antibodies – HIV – Hepatitis – Adenovirus – Rhabdovirus – Pox virus

Module 16: Parasitology

Classes of parasites - Classes of hosts – Protozoology – Morphology - Cytoplasmic body - A nucleus – Cytoplasm – Ectoplasm – Endoplasm - Structures seen in the protozoans - Organelles of locomotion - Contractile Vacuoles - Rudimentary digestive organ - Cyst wall – Nucleus - Reproduction - Asexual reproduction:-By simple binary fission - By schizogony - Sexual reproduction - Life cycle - Classification of protozoa - Entamoeba histolytica - Life cycle of Entamoeba histolytica - Pathogenicity of E. histolytica - Clinical features of Amoebic dysentery - Laboratory diagnosis of E. histolytica - Malarial parasite - Life cycle - Mosquito Cycle/ Sporogony/ Sexual Cycle - Complication of Malaria - Complication of P. falciparum infection - Cerebral malaria: Black water fever - Laboratory diagnosis of Malaria - Peripheral blood film for parasites - Thin blood smear preparation - Thick smear preparation - Morphological features in thin films – Treatment – Helminthology - Classification of Helminths - Differences between Platy helminthes and Nemathelminthes - Differences between Cestoidea, Trematodea and Nematodea - Habitat classification of Tremotades - Blood flukes - Liver flukes - Intestinal flukes - Lung flukes - Habitat classification of Nematodes – Intestinal - Small Intestine - Large intestine - Somatic location

Module 17: Immunology & Serology

Introduction to Immunology - Definition - Immunity – innate and acquired immunity, humoral and cell mediated. - Antigen antibody reactions and their applications - Complement - Hypersensitivity - Histocompatibility, autoimmunity autoimmune diseases and tumour immunity - Immune deficiency diseases & its Investigations (HIV)

Module 18: Examination of Urine

Introduction – Formation of urine, Collection of Urine - Special type of collection of urine - Biohazard management - Components of routine urine analysis - Colour - Clarity - Odour - Volume - Chemical Examination - Sugar in Urine - Tests for Sugar In Urine - Benedict's Test - Fehling's test - Chemistrip method - Protein in Urine - Test for Protein in Urine - Heat and Acetic Acid Test - Sulphosalicylic Acid Test - Heller's Test. - Heat and Acetic Acid Test - Ketone Bodies in Urine - Test for Ketones in Urine - Rothera's Test - Gerhardt's test - Bile in Urine - Test for Bilirubin - Fouchet's Test - Test for Bile salts - Hay's Test - Blood in Urine - Test for Hematuria - Benzidine Test - Guaiacum Test - Gregersen's Test. Microscopic Examination of Urine: Crystals Found In Urine - Crystals Found In Acid Urine - Uric Acid & Urates - Calcium oxalates in Crystals - Cystine Crystals - Leucine and tyrosine crystals - Drug crystals - Crystals Found In Alkaline Urine - Ammonium magnesium phosphates - Dicalcium phosphates - Calcium carbonate - Ammonium biurate - Casts In Urine - Cells in Urine:- Red Blood cells, Pus cells, Epithelial cells, Spermatozoa, Bacteria, Tumour cells**,** Examination of stool- physical, chemical & microscopic examination

Module 19: Body Fluids

Characteristics of Cerebrospinal Fluid - Synovial fluid - Pleural fluid - Pericardial fluids - Peritoneal fluids Semen analysis- physical, chemical & microscopic examination, sperm count, motility,

II. HISTOPATHOLOGY & CYTOGENETICS (Theory)

Module 1: Histology

Introduction - Tissue Preparation - Receipt of specimens - Labeling of specimens with numbering – Fixation - Aims and functions of a fixative - Classification of fixatives - Simple fixatives - Compound fixatives - Micro anatomical fixatives - Cytological fixatives - Histochemical fixatives - Post-chromatization - Fixation of specimens - Fixation for individual tissues – Dehydration - Ethyl alcohol – Acetone - Isopropyl alcohol – Dioxane - Clearing (Dealcoholisation) - Cedar wood oil – Benzene – Xylene – Chloroform - Embedding Media - Paraffin wax – Paraplast - Paraplast plus – Gelatin - Water soluble waxes – Celloidin - Techniques of impregnation - Embedding or Blocking - Type of mould - Techniques of moulding - Decalcifying Agents - Selection of the tissues - Determination of end point - Neutralization of acid - Washing - Decalcifying agents - Use of ion exchange resins - Chelating agents - Electrophoretic decalcification - Treatment of hard tissues.

Module 2: Tissue processing & Section cutting

Processing of histological tissues, Tissue Processor - Automatic Tissue Processor (Vacuum) - Application of Microwave Technology to Histology – Principle - Applications - dehydration and cleaning. Embedding - Water soluble substances, embedding in paraffin nitrocellulose.

Equipment for sectioning: Microtome, knife, honing and stropping. Types, care and use of microtome. Technique of section cutting & Mounting

Module 2: Handling and Embedding of Tiny Tissue Biopsies

Introduction - Labeling of Tissues - Fixation and Cutting of Small Biopsies - Renal biopsies - Intestinal biopsies - Skin biopsies - Muscle biopsies - Other tissues - Orientation of Tissue Blocks

Module 3: Staining Techniques

Preparation of slide, deparaffinization, Staining – theory, types of staining agent. Automatic slide stainer, Instruments for grossing, electric saw, Microphotography – technique - Routine staining techniques - Special Stains.

Module 4: Frozen Technique

Introduction - Frozen Section – Overview - Use of Freezing Microtome – Fixation - Freezing Microtome - Fixing sections on slides - Staining of frozen sections (rapid staining) - Advantages and disadvantages - Frozen Sections Using Cryostat – Uses - The Cryostat - LEICA CM 1850 Cryostat - The components - Set up of instrument prior to operation - Operation of the Cryostat - Terminating work - Trouble shooting - Cleaning, disinfection, maintenance - Staining of Frozen Sections for Rapid Diagnosis

Module 5: Cytology & Cytogenetics

Human genetics; an introduction to the subject - Terminology, classifications and nomenclature of human Chromosomes - Methods for Karyotypic analysis - Culture of bone marrow, peripheral blood lymphocytes, solid tumours, skin fibroblast, etc. - Direct preparations from tumour material - Characterisation of human chromosomes by various banding techniques. - Sex chromatin identification. - Karyotyping and analysis of chromosomal abnormalities - Common chromosomal observations in cancer, mechanisms of their production and of Oncogenes. – Photomicrography- Mass screening methods for early detection of cancer, Sputum examination

Module 6: Cytotechnology

Introduction - Specimen Collection - Specimen samples - Fine needle aspiration cytology (FNAC) – Preservation - Fresh specimen - Prefixation refers - Preparation of Smears - Viscid Secretions - Body fluids – Sputum - Precautions against infections – Fixation - Fixation method falls into one of 3 categories - Alcohol fixatives - Unstained smears which require to be mailed to a cytology laboratory – Staining - Papanicolaou method - Maygrunwald giemsa (MGG) stain - Mounting - Destaining Procedures - Automation

HISTOPATHOLOGY & CYTOGENETICS (Practical)

1. Fixatives
2. Processing Of The Tissues Including Bone
3. Embedding
4. Section Cutting
5. Staining & mounting
6. Special stains
7. Handling and embedding of tiny tissue biopsies
8. Frozen section technique
9. Techniques Equipments &Procedures
10. Specimen Collection And Preparation
11. Staining Procedure And Mounting
12. Preparation Of Fluids For Cytological Examination
13. Paraffin section cutting.
14. H & E staining
15. Special staining
16. PAS staining, principle&uses.
17. Reticulin
18. PTAM
19. Van gerson
20. Amyloid stain , pearl stain
21. Melanin bleach& masson’s Fontana
22. AFB staining(TB and Leprosy)
23. Pap staining
24. MGG staining for enac
25. Museum techniques
26. Preparation of mounting medium & mounting of specimen-
27. Hormonal Cytology
28. Malignant Cytology
29. Karyotyping for genetic abnormalities.

MICROBIOLOGY & IMMUNOLOGY (Practical)

1. Use and care of microscopes.
2. Measurement of microbes by micrometry.
3. Simple staining methods and gram stains
4. Special staining methods – capsule, spore, acid fast, Metachromatic etc,
5. Tests for motility in bacteria.
6. Preparation of media.
7. Using of autoclave hot air oven, other common laboratory equipment etc.
8. Disinfection practices in laboratory and wards.
9. Assay for disinfection.
10. Techniques of cultivation of bacteria.
11. Isolation of bacteria from clinical specimens.
12. Biochemical testing – Catalase, oxidase, citrate, urease, TSI,Carbohydrate fermentation,MR VP, Indole
13. Purification of microbial cultures.
14. Standard Plate Count.
15. Antibiotic sensitivity test
16. Isolation, Characterization and identification of pathogens from various clinical specimens.
17. Techniques in tissue culture.
    a. Demonstration of Cytopathogenic effect (CPE)
    b. Haemagglutionation test.
    c. Haemagglutination inhibition test.
    d. Viral Serology,PCR
18. Mycology:
    a. Lactophenol blue staining.
    b. KOH Preparation.
    c. Morphology of fungi.
    d. Yeasts.
    e. Culture demonstration of contaminants- Aspergillus, Penicillium, Mucor, Rhizopus
    f. Dermatophytes.
    g. Dimorphic fungi.
19. Study of antibiotic sensitivity of common pathogens
20. Examination of stool for parasites.
21. Culture techniques for parasites
22. Examination of Urine – Physical, chemical and microscopic
23. Examination of Body fluids
24. Semen Analysis
25. Stool Examination

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4. P.B. Godkar, (2003) *Text Book of Medical Laboratory Technology*, 2nd Edn. Bhalani Publication.
5. Mukharji, *Medical Laboratory Techniques*, Vol - I, II & III, 5th Edn. Tata McGrawHill , Delhi.
6. G. Guru*, Histotechnology*, 1st Edn. NCERT, New Delhi.
7. C. F. A. Culling, *Hand Book of Histotechnological & Histochemcial Techniques* , 3rd Edn. Butterworth – London.

8. Leopold G. Koss, Myron R. Melamed (2005) *Koss' Diagnostic Cytology and Its Histopathologic Bases*, Volume 1, 5th Ed, Lippincott Williams & Wilkins.
9. Winifred greg – Diagnostic cytopathology
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11.Sachdev K.N. *Clinical Pathology and Bacteriology* 8th Ed, J.P. Bros, New Delhi.

Paper III- Blood Bank services And Quality control

I. HEMATOLOGY (Theory)

Module 1: Introduction to Haematology
What is a blood - Components of blood - Functions of blood - Components of Blood
Module 2: Maintenance and Equipments of Haematology Lab
Introduction to a microscope - Parts of a microscope - Centrifuge - Automated Cell Counter - Urine Analyser - Maintenance of equipments in the hematology lab - Coagulometer Responsibilities of a lab technologist
Module 3: Principles of patient
Assessment of a patient and brief history collection. Collection of blood, sputum, urine and stool specimens, packing of equipments for CSSD, Develop specific goals and plans to prioritise, organise, and accomplish work
Module 4: Collection of Blood Samples
Specimen Collection - Methods - venipuncture - Patient Identification - Site selection - Tourniquet application - Cleansing the Venipuncture site - Sample Collection - Specimen Collected by skin puncture - Collection from indwelling catheters- Use basic non-automated tests to assess blood cells- See and analyse details at close range- Collect, receive and conduct a pre-analytical processing of clinical laboratory specimens.
Module 4: COAGULATION STUDIES
Hemostasis - Definition, Basic concept and principle, Basic steps involved in Hemastosis. Coagulation - a. Basic Physiology, coagulation factors. b. Mechanism of blood coagulation. Extrinsic Pathway, Intrinsic Pathway. Regulators of blood coagulation. Role in Diseases, Bleeding disorders- . Platelet disorder - Thrombocytopenias - causes including aplastic anemia. D I C IT P , Hemophilia
Module 5: Hematological Disorders
Classification of Anemia : Morphological & etiological. Iron Deficiency Anemia : Distribution of body Iron, Iron Absorption, causes of iron deficiency, lab findings. Megaloblastic Anemia : Causes, Lab findings. Hemolytic Anemia : Definition, causes, classification & lab findings. Bone Marrow : Cell composition of normal adult Bone marrow, Aspiration, Indication, Preparation & Staining, Special Stain for Bone Marrow -Periodic Acid Schiff, Sudan Black, Myeloperoxidase. Leukemia : Classification, Blood Picture, Differentiation of Blast cells
Module 6: Basic Haematological diagnosis
1.Preparation of Blood Smears - Specimen - Advantages of EDTA blood - Disadvantages of EDTA blood - Blood Smear Method - Cover slip method - Spreader slide method - Wedge method - Characteristics of a Proper Wedge Film - Types of Smear - Thick Smear - Thin Smear - Common causes of a poor blood smear - Biological (in diseased condition) causes of a poor smear - Precautions - Drying of Smears - Staining Of the Blood Films - Preparation of Stains - Leishman's stain - Wright's Stain - Field's stain - Romanowsky stains - Steps for staining - Manual staining methods - Rack method - Dip method. Automated staining methods: - Platen type - Carousel type. Criteria for a good stain: Problem encountered during staining - Troubleshooting

2.Total Cell Count – Rbc, Wbc, Platelets and Absolute Eosinophil Count, Estimation of Hemoglobin PCV & Erythrocyte Indices - M.C.V. - M.C.H - M.C.H.C - methods and process of estimation, Erythrocyte Sedimentation Rate [E.S.R.] - Westergren Method - Factors Influencing Sedimentation - Laboratory factors which influence ESR - Importance of ESR
Reticulocyte Count , Differential Count ,Bleeding time, clotting time, prothrombin time,

II. BLOOD BANKING & TRANSFUSION PRACTICES (Theory)

Module 1: Basics of Immunology Related to Blood Group Serology
Introduction to blood banking
Module 2: Blood Bank Antigens and Antibodies
Definition - Antigen - Antibodies - Parts of an antibody - Classes of antibodies - Characteristics of IgG and IgM antibodies - Clinical significance - Size of the antibodies -Serum concentration - Complement activation -Placental transfer - Optimum temperature of reactivity - Number of antigen-binding sites - Terms used to describe antibodies
Module 3: Red Cell Antigen-Antibody Reactions
Common Antigen and Antibody Reactions - Agglutination - Hemolysis - Precipitation - Enzyme linked immunosorbent assay (ELISA) - Factors affection agglutination reaction:
Module 4: Methods for Enhancement of Antigen-Antibody
Physical methods **-** Chemical methods
Module 5: ABO Blood Group System
Antigens and Antibodies - Indications for ABO grouping - Discovery of the ABO system - Characteristics of ABO antigens - Characteristics of ABO antibodies - ABO Inheritance - ABO Genes - Inheritance Patterns - ABO phenotypes and genotypes - Offspring possibilities - Biochemistry Of The ABO System - Subgroups of A and B
Module 6: The Rh Blood Group System
Rh Antigens **-** Characteristics of Rh antigens - Rh Antibodies - Rh System Inheritance - Fisher-Race Theory - Weiner Theory - Tippett Theory - Translating From Wiener to Fisher-Race - Determining Genotypes from Phenotypes - Applications of Rh genotyping - Variants - Rh Typing-. **Guidelines in blood grouping techniques. Problems in blood grouping and cross matching. Rh incompatibility**
Module 7: Blood transfusion
Guidelines on blood transfusion, Apply the principles of genetics and immunology to transfusion practice. History of transfusion medicine. Transfusion reactions
Module 8: Donor Selection and Blood Collection
Materials & equipments used in blood bank.-Selection of Donors - donor motivation- Blood collection - Donor Room - Equipment - Identification of Donors - Post Donation Care - Instructions to Donors - Adverse reactions in blood donors
Module 9: Storage and Preservation of Blood
Introduction - Anticoagulant & Preservatives - **labelling of blood units-** Whole Blood - Red Cells - Red Cells- Frozen State - High glycerol solution. - Low glycerol solution. - Storage of Blood and its components - Whole Blood - Platelets - Leucocytes - Plasma - Fresh Frozen Plasma
Module 10: Documentation in Blood Bank
Documentation in blood bank- Types of documents- Record Maintenance- Period of record archival- Process information by compiling, coding, categorising, calculating, tabulating, auditing or verification of data- The standard protocol for documenting the data in the patient's files and in the computer for future records- Evaluate the completeness of patient data- Monitor quality control data to rapidly identify analytical deficiencies- Document errors and note the remedial actions they have taken.

Module 11: Providing Information

Interpret test results in logical manner-Providing appropriate and relevant information about the tests he conducts as and when required- Policies and practices involved in personnel/human resource functions- Administrative and clerical procedures and systems.

Module 12: Maintain a safe , healthy and secure working environment

Individual responsibilities in relation to maintaining workplace health safety and security requirements-Managing biomedical Waste- Reporting any identified breaches- e organisation's emergency procedures-create safety records and maintaining them- common health, safety, and security hazards that affect people working in an administrative role

Module 13: Biomedical Waste Management

Classification, Segregation, proper collection and storage of waste-Standard precautions for infection prevention and control-Personal Protective Equipment-categorisation of waste according to national, local and organisational guidelines-Hazards and risks associated with the disposal- Importance of risk assessments-Method of transporting the waste- Record maintenance

III. LABORATORY MANAGEMENT & QUALITY CONTROL

Module 1: Laboratory Set up

Introduction and planning - Role of laboratory in human health and diseases, - Human diseases and methods of diagnosis, - Laboratory at different level (National / State /District), - Duties and responsibilities of laboratory personnel, - Laboratory services as - a backbone of health care delivery system. General principles, Laboratory goals, - Space requirements, - Designing of laboratory sections. - Stores used in laboratory practice - Maintenance of stores - Record keeping and Inventory

Module 13- Laboratory Management

Inspect equipment, structures, or materials to identify the cause of errors or other problems or defects-Deal with people at junior levels to effectively direct their work towards optimum output- The role and importance of assisting other healthcare providers- How to manage people/patient effectively- The principles of leadership and guidance-Team Work- Decision making(Decide which tasks to assign to junior Technicians and other medical laboratory workers on their teams, Choose the methods, times, locations and durations to train health care workers assigned to the collection, identification, transportation, preparation, storage and analysis of specimens)- Monitor/Assess one's own performance or that of other individuals, or organisations to make improvements or take corrective action

Module 2: Care of laboratory glassware, chemicals, equipment's and instruments

General Principles, Care and Cleaning of Glassware, Care of equipment and apparatus, Laboratory chemicals – Proper use, care, storage and labelling, Specimen handling, Appropriate container, Method of collection, Method of transportation, Method of preservation and disposal of laboratory waste .

Module 3: Laboratory Safety

General principles of safety programmes, First aid and safety measures for Mechanical, Electrical, Chemical, Radioactive and Biological hazards; Universal safety precautions.

Module 4: Medico Legal Aspects of Laboratory Maintenance

Definition of ethics - principles of Bio ethics - Ethics of laboratory practice, confidentiality of reports. Definition - Records & Reports - Importance of Records and Reports - Medico legal aspects of record keeping

Module 5: Introduction to Biostatistics

Basic mathematics and biostatistics, mean, median, SD, Tests of significance

Module 6: Introduction to Medical Research

Definition of research - Principles of research - Sampling - types - The research process overview.
Evidenced based practices - role of a technologist in medical research.

Module 7: Laboratory Quality control and quality assurance
Internal and external quality control programmes. Anticipating demand and ensuring availability of adequate medical and diagnostic supplies(Guidelines on anticipating demand for medical and diagnostic supplies, Contents of all diagnostic and medical kits, Guidelines on procurement and storage of medical and diagnostic kits)

BLOOD BANKING & TRANSFUSION PRACTICES (Practical)
1. Screening of donors.
2. Preparation of anticoagulant fluids
3. Grouping of blood.
4. Cross matching of blood samples.
5. Coomb's test **ELISA Test**
6. Screening of HbS .Ag. HIV and HCV **and rapid kit methods**
7. Antiglobulin Test
8. Dat
9. Ict
10. Saline Cross-Matching
11. Albumin Cross Matching
12 Enzyme Cross Matching
13. Antiglobulin Test (Ahg)
14. Bio safety Precautions and Guidelines
15. Abo Blood Grouping Procedure
16. Slide or Tile Method, Tube Method, Microplate Method, Micro-Typing System (Diamed/Bioview), Automated Or Semi-Automatic Instrumentation.

HEMATOLOGY (Practical)
- Collection of Blood Samples
- Obtaining peripheral Blood Smear
- Staining Of Blood Smear
- Obtaining Cell Counts – Rbc, Wbc, Platelets both manual and automated
- Absolute Eosinophils Count
- Estimation of Haemoglobin
- Packed Cell Volume, Erythrocyte Indices
- Reticulocyte Count
- Differential Count
- Bleeding Time
- Clotting Time
- Pt
- APTT

REFERENCES:

1. Robert H. Carman, *Handbook of Christian Medical Association, India (CMAI) Medical Laboratory Technology*-. 2nd Ed. CMAI, New Delhi.
2. G. Guru, *Laboratory Setup & Procedures*, 1st Edn. 1989 NCERT, New Delhi
3. WHO, Geneva *Biosafety Manual for laboratories*, 2nd Edn. 1993 . WHO Publication, Geneva.
4. P.B. Godkar (2003) *Text book of Medical Laboratory Technology*, 2nd Ed. Bhalani Publication.

Scheme of Examination

Paper	Subject	Internal assessment		Theory exam		Practical exam		Viva	
		Max	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**
I	Biochemistry & Clinical Biochemistry	50	25	100	50	100	50	50	25
II	Microbiology and Pathology	50	25	100	50	-	-	-	-
III	Bank services and quality control	50	25	100	50	-	-	-	-

Distribution of the theory Marks

Type of Questions	Distribution of marks	Total Marks
Long Essays	2x 20	40
Short Notes	10X6	60
	Total	100