DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS (DMLT)

Revised in 2022

Government of Odisha

Health & Family Welfare Department

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Syllabus

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS (DMLT)

2022

Health & Family Welfare Department

Govt. of Odisha

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY
(DMLT) COURSE CURRICULUM

GENERAL INFORMATION

1. The Duration of Diploma Course of Medical Laboratory Technology (DMLT) is two years.
2. The minimum educational qualification for selection of trainees for the Diploma Course of Medical Laboratory Technology is +2 Science with Biology as one of the subject.
3. A total mark of the DMLT Course is 1000.
4. Minimum pass mark of the trainees is 40% in Theory, 50% in Oral & Practical and 50% in Aggregate.
5. 1st Class mark is 60% in Theory, Practical & Oral in aggregate respectively.
6. Less than 40% either in Theory or in Practical or in Oral in any paper will be treated as unsuccessful (Fail).

Examination schedule: There will be two Regular Examinations one at the end of each year

Part-1: Annual: In First year

Part-2: Annual: In Second year

There will be a supplementary examination within six weeks of annual result publication.

1st Year

	Subjects	Mark distribution	Hours
Paper-I	Section-A (Anatomy)	**Total Mark 50** Theory 35 Practical & Oral 15	20hrs + 10hrs
	Section-B (Physiology)	**Total Mark 50** Theory 35 Practical & Oral 15	20hrs + 10hrs
Paper-II	Section-A (Community Medicine & statistics)	**Total Mark 100** SPM -35, Statistics- 5 Computer-20	20hrs+ 10hrs
	Section-B (Computer)		
	Section-C (Pharmacology)	Theory 40	20hrs
Paper-III	Pathology- Laboratory, Lab wares, instruments, safety & Clinical Hematology	**Total Mark-100** Theory- 60 Oral-20, Practical-20	40hrs
Paper-IV	Microbiology- General Bacteriology, Systemic Bacteriology, Clinical Microbiology	**Total Mark-100** Theory- 60 Oral-20, Practical-20	40hrs
Paper-V	Bio-Chemistry-. 1.Chemistry of Carbohydrates, proteins, fat 2. Water & Fat soluble Vitamin, Plasma proteins 3. Enzymes 4. Buffers, Molarily, indicators, Radioisotopes, Radiation hazard, RA. 5. Overview of Iron, Calcium, Iodine, Flourine. 6. Overview of Nucleic Acids & Uric Acid.	**Total Mark-100** Theory- 60 Oral- 20, Practical-20	40hrs

2nd Year

Papers	Subjects	Mark distribution	Hours
Paper-I	**(Pathology)** Immunohematology & Blood Banking, Histo-Technique,Cytology, Museum Technique, Autopsy Technique.	**Total Mark-200** Theory 100 Practical 50 Oral 50	60 hours
Paper-II	**(Microbiology)** Immunology& Serology, Parasitology, Virology, Animal care, Mycology	**Total Mark-200** Theory 100 Practical 50 Oral 50	60 hours
Paper-III	**Biochemistry** Glucose Homeostasis, overview of DM, HbA1c, Organ function tests, Water & Electrolyte Balance.	**TotalMark-100** Theory - 60 Practical - 20 Oral - 20	60 hours

FIRST YEAR

PAPER-I

Section-A (Anatomy)

1. **Introduction to the subject** - Anatomical position, common planes & Anatomical terms. -Different branches of Anatomy.
2. **Histology** -Typical animal cell (Structure & Function) -4 primary tissues (Classification & function)
3. **Skeletal System** - Axial and appendicular bones -Joints &movements
4. **Skin, Fascia and Muscles & Tendons**
5. **Circulatory System** –Heart & blood vessels
6. **R.E.System** - Spleen, Thymus & Tonsils
7. **Respiratory System-** Nose, Pharynx, Bronchi, Lungs and Pleura
8. **Digestive System-** Alimentary canal (different parts)-Liver, Gall Bladder, Pancreases
9. **Urogenital System-** Different parts of urinary system -Different parts of Male & Female genital -System (Internal & External Genitalia)
10. **Special Senses& General Sensibilities-** Eye & Vision-Ears, Hearing & Equilibrium, -Taste.
11. **Central & Peripheral nervous system-** Brain & Spinal Cord. - Cranial & Spinal Nervous.- Autonomic Nervous System.
12. **Regional Anatomy (Only Demonstration) –** Extremities, Head & Neck, Thorax, Abdomen & Pelvis.

Section-B (Physiology)

1. **Blood-** Composition and general function of blood. Description of blood cells - normal counts & function. Steps of coagulation, Anticoagulants. Cerebrospinal Fluid, Formation, Composition & Function. Importance of blood groups composition & function of lymph.
2. **Reparatory System** -Name of structures involved in respirations and their function. External and internal respiration. How inspiration, expiration are brought about Transport of O_2 and CO_2 in the blood. Definition of respiratory rate, Tidal volume, vital capacity, Hypoxia.
3. **Excretory System**-Functions of Kidney, Nephron - Functions of Glomerulus and tubules, compositions of Urine, normal& abnormal. Skin- Function of Skin.
4. **Digestive System**-Composition and functions of saliva, mastication and deglutition. Functions of stomach, composition of gastric juice. Pancreatic Juice, Bile and Digestion of food by different Enzymes, Absorption and Defecation.
5. **Endocrine-glands**-Definition of endocrine gland, Names of the endocrine gland and the hormone secreted by them.Major actions of such Hormones.
6. **Reproductive System**-Name of primary and accessory organs in male and female. Name of secondary sexual characters in male and female. Function of ovary-formation of

ova, actions of ovarian hormone, menstrual cycle. Functions of Testes-Spermatogenesis and secretions of testosterone. Fertilization Vasectomy and tubectomy.

PAPER-II

Section-A (Community Medicine & Statistics)

Environment & Health

a. Water- Sanitary sources of water ,water borne diseases
   Purification of water
   Physical, Chemical & Bacteriological standards of drinking water quality &
   Tests for assessing bacteriological quality of water
b. Health hazards of Air, Water, Noise, Radiation pollution
c. Sanitation in public health
d. Identification and Public Health Importance of arthropods (Entomology):e. Mosquitoes, Lice, Fleas, Tick, Mite
e. Insecticides
f. Diseases transmitted by Rodents

Food and Nutrition:

a. Common sources of various nutrients and special nutritional requirement according to age, sex, activity, physiological action
b. Assessment of Nutritional status.
c. Food-borne diseases of Public Health importance
d. Food fortification , additives & adulteration , Food hygiene

Biomedical Waste Management

a. Define, Classify, Sources, Health Hazards & Treatment of Biomedical Waste
b. Laws related to Hospital Waste Management

STATISTICS-GENERAL Mark-05

TABULATIONS	:	Simple Tables, Frequency Distribution Tables
DIAGRAMS	:	Bar Diagrams, Histogram, Line Diagram Pie Diagram
STATISTICAL AVERAGES	:	Mean, Median, Mode
MEASURES OF DISPESION	:	Normal Curve, Range, Standard Deviation Standard Error.
TESTS OF SIGNIFICANCE	:	't' Test.

Section-B (COMPUTER)

1. Computer Basics:

Importance, History, Computer Generation, Types of Computer, Anatomy of Computer, Input –output Devices, Processing Units and outline of Data Processing, Computer memory, external storage devices, Hardware, Software

Basic functioning of Computers.

2. **Computer and Communication, Networking, Internet**
3. **Use of computer in Radio-diagnosis / Pathology Laboratory**

Section-C (Pharmacology)

General Pharmacology:-

1. Drug, Drug nomenclature, Route of administration, concept of Pharmacokinetics, Pharmaco-dynamics and Adverse during action.
2. **Drugs for the diseases of fundamental Systems**
   GI System, Respiratory System, Cardiovascular System, Blood, Blood Coagulation, Thrombosis, different types of anti-coagula (Special emphasis).Drugs affecting the Urine and renal functions, excretion of drugs in stool, bile and other body fluids (Special emphasis).

3. **Drugs for diseases of integrating systems of body**
   Central Nervous System. Autonomic Nervous System, Endocrine System and autacoids.

4. **Chemotherapeutic Agents**
   Anti-Viral including AIDs, Hepatitis, Anti-Bacterial Drugs, Anti-Fungal Drugs, Anti-Protozoan Drugs, Anthelmintics, Anti-Cancer Drugs.
5. **Antiseptic, disinfectants.**
6. **Drugs interfering in different Pathological tests.**
7. **Measurement of Drug levels in different body fluids and significance.**

PAPER-III

PATHOLOGY

1. Chapter 1: Laboratory [3 classes]

- General overview, Organization of the laboratory, Structure of medical laboratory service, Role of medical laboratory services, Role of the medical laboratory technologist , Lab. rules, ethics and, professional code of conduct, Laboratory policies, Solutions used in medical Laboratory, Expressing concentration of solutions

2. Chapter 2: Laboratory wares [1 class]

- Laboratory glasswares , Plastic wares

3. Chapter 3: Laboratory instruments[2 class]

- Balances , Centrifuges, Refrigerators, Ovens, Water bath, Incubators, Colorimeter (photometer), Desiccators, Instruments and materials used for pH determination, Instrument for purifying water , Microscope, Instruments and materials used for advanced laboratory techniques

4. Chapter 4: Laboratory accidents and safety [1 class]

- Laboratory hazards and accidents, Factors contributing to laboratory hazards, First aid for laboratory hazards, Safe use and storage of chemicals and reagents, Planning for safety, General precautions for the avoidance of laboratory accidents

5. Chapter 5: Quality assurance [1 class]

- Types and Causes of errors in medical laboratories

6. Chapter 6: Clinical Hematology [22 classes]

- Blood - Formation [Hemopoiesis] ,Composition, Morphology of blood cells, Function

- Blood collection- Safety precautions, Sites of blood collection, Steps for prevention of hemolysis,

  Capillary blood collection-Sites, Materials required, Procedure, Advantages and disadvantages,
  Venous blood collection-Sites, Materials required, Procedure, Advantages and disadvantages,
  Arterial blood collection- Indications, Sites, Benefits of use of vacutainer.
- Anticoagulants- What are anticoagulants? Classification. Mechanism of action, dosage and uses of: Heparin, EDTA, Citrate, Double oxalate, Sodium fluoride, Standard color codes of anticoagulant vials.
- Peripheral blood smear: Importance, Types of blood smear, their advantages,
- Staining of blood smears: Romanowsky stains (Leishman's stain, MGG stain, Diff Quick stain, Wright's stain, JSB stain, Giemsa stain). Composition of different Romanowsky stains specially Leishman's stain- Procedure of Leishman stain, pitfalls and remedies.
- Differential leukocyte count [DLC] –Indications, how to perform a DLC, Interpretations.
- Hemoglobin- Different types, Composition, different methods of estimating hemoglobin value –

  Sahali's Acid hematin method, Cyanomet- hemoglobin method- Principles, Advantages & Disadvantages.

- Hematocrit/Packed Cell Volume (PCV)- Clinical significance of PCV, Methods of determining the PCV. Wintrobe's tube – identification, procedure, other uses.
- Erythrocyte Sedimentation Rate (ESR), Clinical significance, Different methods, Westergren's method, Westergren's tube, Sample required. Procedure, Do's and Don'ts. Interpretation.
- Blood Cell Counts- RBC count – Methods, Requirements, Result. WBC count – Methods, Requirements, Result. Total Platelet count – Methods, Requirements, Result, Reticulocyte count.
- RBC Indices: MCV, MCH, MCHC, their significance, how to determine them.
- Automation in hematology: Complete Blood Count (CBC) - Principles, Advantages and Disadvantages,
- Qualitative Assessment of G6PD Deficiency
- Sickling test:- Principle, Procedure, Interpretation
- Hemoglobin and Protein electrophoresis- Principle, Requirements, Procedure, Results.
- HPLC- Principle, Procedure, Results
- Examination of Fetal Hemoglobin
- LE cell phenomenon- Principle, Procedure, Interpretation, Indications
- Quality Control in Hematology
- Bone marrow examination- Indications, Sites, Requirements, Procedure, Preparation of smears,

  Staining- Leishman stain,

  MPO / SBB stain – Principle and procedure

  PAS stain – Principle and procedure

  Perl's stain – Principle and procedure

1. **Chapter 7: Bleeding disorders [5 classes]**
   - Hemostasis- Vascular phase, Platelet phase, Coagulation phase, Fibrinolytic phase
   - Bleeding disorders-

     Screening tests for bleeding disorders

   i. Bleeding time [BT]: Principles, Requirements, Procedure, Interpretation.

ii. Clotting time [CT]: Principles, Requirements, Procedure, Interpretation.
iii. Prothrombin time [PT test]: Principles, Requirements, Procedure, Interpretation, PT INR.
iv. Activated partial thromboplastin time [aPTT]: Principles, Requirements, Procedure, Interpretation.
v. Thrombin time: Principles, Requirements, Procedure, Interpretation.
vi. Clot retraction test: Methods, Requirements, Result.

- Confirmatory tests- Factor assays, Inhibitor study, Platelet function study.

2. **Chapter 8: Examination of urine [3 classes]**
   - Physical Examination of Urine -Collection of urine specimens, Types of urine specimen, Preservation of urine specimens, Examination of urine specimens , Appearance, Testing for the presence of blood , Measuring the specific gravity
   - Chemical Examination of Urine -Measuring the pH , Detection of glucose, Detection and estimation of protein, Detection of ketone bodies, Detection of abnormal elements,
   - Microscopic Examination of Urine- Urinary sediment, Automation in urine analysis
3. **Chapter 9: Examination of CSF [2 class]**
   - Collection of CSF specimens: Site, Procedure, Precautions.
     Examination of CSF specimens-Direct examination, Microscopic examination, Determination of glucose & protein concentration
4. **Chapter 10: Examination of Seminal Fluid[2 class]**
   - Methods of sample collection, Sample Preparation
     Physical Examination- Volume, Color, Odor, Viscosity, pH, Liquefaction time
   - Chemical Examination- Fructose, Acid phosphatase
   - Microscopy: Total count, Motility, Viability Assessment
   - Immunological study.

PRACTICALS: [25 classes]

5. **Urine: [9 classes]**

a. Test for Glucose – Benedict's method, Dipstick [GOD POD] method
b. Test for Protein – Heat & Acetic acid method, Dipstick method

c. Test for Bile salt – Hay's test
d. Test for Bile pigment – Fouchet's method, Dipstick method
e. Test for Ketone bodies – Rothera's method, Dipstick method
f. Test for Urobilinogen – Erlich's aldehyde method, Dipstick method
g. Test for Hematuria / Hemoglobinuria – Benzidine test
h. Test for 24 hour Urine protein estimation – Esbach's method
i. Specific gravity measurement – Urinometer, Dipstick method

6. Hematology: [16 classes]

a. Preparation of peripheral blood smear, staining with Leishman's stain and perform a DLC.
b. ESR estimation.
c. Hemoglobin estimation – Sahli's method, Cyanomet-hemoglobin / SLS method
d. PCV determination by Wintrobe's tube.
e. Determination of TLC.
f. Stain a smear for reticulocyte and do a Reticulocyte count from it.
g. Sickling test – preparation and observation.
h. Osmotic fragility test.
i. PT INR

PAPER-IV
MICROBIOLOGY

GENERAL BACTERIOLOGY

- History of Microbiology, Microbes and their classification , Study of different , microscopes, Morphology of bacteria, Motional requirements of bacteria, Preparation and uses of culture media, Culture methods and identification of bacteria

Sterilization and Disinfection

- Physical Chemical, Mechanical methods, Sterilization of media, syringe, glassware's etc., Safe disposal of contaminated media etc.

Common Laboratory equipments and uses

- Different microscope, incubator, BOD incubator, Refrigerator, Deep Freeze,
- Hot air oven, Autoclave, Inspissator, Bacterial Filters, Water bath, VDRI rotation Centrifuge machine, Vacuum pump, media pouring chamber EUSA reader,etc

Anaerobic culture, Inoculation techniques, subculture and maintenance of stock culture.Isolation and identification of bacteria (Cultural characters biochemical reaction) serotyping etc. Antimicrobial susceptibility tests

SYSTEMIC BACTERIOLOGY

- More importance should be given to culture methods and identification of bacteria that other properties like Pathogenesis etc.
- Cocci - Staphylococci, streptococci,Pneumococci, Gonococci, Meniogococci.
- Bacilli – Corynebacterium, Bacillus, Clostridium, Nonsporing anaerobes, Enterobacteriaceae, E.Coll,Klebsiella, Salmonella, Shiegella, Proteus, Vibrio
- Pseudomonas, Mycobacterium (M. tuberculosis, M. Leprae), Basic idea on
- Actinocycetes,Ricketsiaeae, - Spirochetes

CLINICAL MICROBIOLOGY

- Normal microbial flora of human body, Collection and transport of specimen
- BacterimiaPyaemia, Septicemia, Pyrexia of unknown origin (P.U.O)
- Meningitis, Food Poisoning , Respiratory Infection (Sore throat pneumonic, pulmonary Tuberculosis), Nosocomial Infections, Opportunistic Infection

PRACTICAL & ORAL

- **General Introduction**- Safety measures in the laboratory, First Aid in Laboratory accidents and general precaution- any measures. ,Handling and care of microscopes., Operation and maintenance of laboratory equipments, Anaerobic jor and other methods of anaerobic culture, Care and cleaning of all glassware (test tubes, slides petridishes pipettes, beakers, Rashes, funnels, syingesetc), Collection & transport of clinical specimens (Blood CSF Urine, Stool, Bone marrow, Sputum, Swabs, Aspiration fluid etc)., Receipts, Labeling, recording and dispatching clinical specimens., Keeping records after final computerization., Conversant with S.I. unit system for reporting. , Conversant with Fundamental Chemistry, I.e. use of indicators, strength of a solution, percent solution, part-dilution, molar solution, normal solutions etc.

- **Various staining technique**:- Simple stain, Gram's stain, Z.N. stain, Albert's stain, Negative stain, Spore stain, Neisser's stain, Lactophenol cotton blue staining for fungi, Leishman stain, Geimsa stain, Other special stain,

- **Wet preparations like** Hanging drop preparation, KoH preparation for fungi, Vaginal fluid examination, -Isolation of bacteria in pure culture and Antibiotic sensitivity., -Identification of common bacteria by studying their morphology, cultural character, Biochemical reactions, slide agglutination and other tests., Maintenance and preservation of stock culture. , Study of fungi by wet preparation, staining, culture etc.

CLINICAL MICROBIOLOGY:-

- **Approach to various clinical syndromes**

  Collection transport and processing of various clinical specimens , i.e. blood, CSF urine swabs faeces, etc. For microbiological diagnosis.,Investigation of various common epidemics , Gastroenteritis, Cholera, Food poisoning, Meningitis , Encephalitis, P.U.O., Study of nosocomial infection.

PAPER-V

BIOCHEMISTRY (Theory): -

1. Chemistry of Carbohydrates including proctiglycon, Fat, Protein & Amino acid
2. Water & Fat soluble Vitamin.
3. Enzymes (Classification, factors regulating, inhibitors 2 clinical application)
4. Buffers, Molarily, indicators, Radioisotopes, Radiation hazard, RA.
5. Overview of Iron, Calcium, Iodine, Flourine.
6. Overview of Nucleic Acids & Uric Acid.

PRACTICAL

Tests for Carbohydrates, Lipids, Proteins, Normal Urine (Biochemical Tests), Blood & Urine (Sample collection & Preservation).

PART-II (2nd Year)
PAPER–I
PATHOLOGY

IMMUNO-HEMATOLOGY &BLOOD BANKING TECHNIQUE [12 classes]

1. **Chapter 1: Introduction To Immunohematology [2 classes]**

   Historical Overview of Immunohematology , Blood Group Genetics , The Role of H-Gene in the Expression of ABO Genes , Secretors and Non Secretors

2. **Chapter 2: Principles Of Antigens And Antibodies [1 class]**

   Antigens , Antibodies

3. **Chapter 3: The ABO Blood Group system [2 classes]**

   The Discovery of ABO Blood Group, Inheritance of The ABO Groups , The ABO Blood Group, Antiserum, Manifestations and Interpretation of Ag-Ab reactions

   -Techniques of ABO grouping:

   Preparation of 5% RBC cell wash suspension, Forward grouping, Reverse grouping, Slide method, Tube method, Gel-card method, Microplate method

4. **Chapter 4: The Rh Blood Group system [1 class]**

Historical Background of Rh Blood Grouping, Nomenclature & Genetic Theories, The Antigens of the Rh Blood Group System , Variants of Rh Antigen, Rhesus Antibodies

The Rh Blood Grouping Technique

5. **Chapter 5: The Anti-globulin test [The Coomb's test] [1 class]**

The Direct Anti- Globulin Test (DAT)

Principle, Procedure, Interpretation

The Indirect Anti- Globulin Test (IAT)

Principle, Procedure, Interpretation

6. **Chapter 6: The Cross-matching [The Compatibility testing] [1 class]**

Purpose of Cross-Match, Types of Cross-Match , Selection of Blood for Cross-Match

-Procedure for Cross-Match

Saline method, Protein, AHG method, Enzyme method

7. **Chapter 7: Transfusion reactions [1 class]**

What is transfusion reaction, Types, Investigation of a transfusion reaction, samples to be collected

8. **Chapter 8: Blood Banking techniques [2 classes]**

Donor selection-Criteria, Screening

Blood collection-Pre-requisites, Procedure of venipuncture

Anticoagulants

Blood components

What are blood components?

Advantages of using blood components.

Preparation, storage and usage

9. **Chapter 9: Basic Quality Assurance in Blood Banking [1 class]**

PRACTICALS:

1. **Blood banking and Immunohematology: [3 classes]**

Preparation of 2 / 5% RBC suspension.

Determination of ABO group and Rh (D) typing from a supplied sample.

Slide method, Tube method, Reverse grouing

HISTOLOGY, CYTOLOGY & ADVANCED TECHNIQUES [30 classes]

Part I Basic Laboratory Techniques in Histology Laboratory

1. Fixation of Histology Samples: Principles, Methods and Types of Fixatives. [3 classes]

Introduction, Aims of Fixation, Ideal Fixative,Tissue Changes in Fixation, Types of Fixatives, Essential Precautions for Fixation in General, Mechanism of Fixation, Factors Affecting Fixation

Commonly Used Fixatives in the Laboratory

Formaldehyde, Preparation of Different Formalin Solution,

Glutaraldehyde, Osmium Tetroxide, Methyl and Ethyl Alcohol, Acetone

Bouin's Fixative

Mercury Salt-Containing Fixatives-

Zenker's Fluid, Helly's Fluid , B5 Fixatives

Fixatives of Choice

Fixation Artefact

2. Processing of Tissue in Histopathology Laboratory [2 classes]

Factors that Influence Tissue Processing,

Dehydration -Individual Dehydrating Agents- Alcohol, Dehydrating Agents Other than Alcohol

Clearing- Individual Clearing Agent, Other Clear Agents

Infiltration and Embedding: Different Impregnating Medium

Tissue Processing Methods

Overall Precautions of Tissue Processing

Time Schedule for Overnight Processing

Manual Tissue Processor, Microwave Processing

3. Embedding of Tissue in Histopathology [1 class]

Embedding Medium, Different Types of Mould Used for Block, Tissue Embedding Method, Tissue Orientation and Embedding, Tissue Marking

4. Decalcification of Bony and Hard Tissue for Histopathology Processing [1 class]

Introduction, Factors Controlling the Rate of Decalcification, The Methods of Decalcification, Chelating Agents, Other Procedures of Decalcification, Surface Decalcification, End Point Determination of Decalcification

5. **Tissue Microtomy: Principle and Procedure [2 classes]**

    Introduction

    Microtomes

        Microtome Knife, Disposable Knife, Materials Used in Knife, Angles of Knife

    Microtome Knife Sharpening

        Manual Method , Factors Involved in Cutting

    Steps of Tissue Sectioning

6. **Frozen Section: Principle and Procedure [1 class]**

    Introduction , Indications, Principle, Cryostat Sectioning , Staining : H&E Staining,

    Factors Affecting the Good-Quality Section

7. **Staining Principle and General Procedure of Staining of the Tissue [2 classes]**

    Introduction

        Dyes Used for Staining, Types of Dye,

        Types of Dye Based on Chemical Structures Chromophore Groups

    Mechanisms and Theory of Staining

    Factors Influencing Staining: Nomenclature Used Regarding Dye

    Metachromasia - Metachromatic Dyes, Progressive and Regressive Staining , Mordant,

    Accentuators, Staining Procedure, Preparation of Buffer Solutions

8. **Haematoxylin and Eosin Stain of the Tissue Section [2 class]**

    Introduction, Haematoxylin, Bluing

    Preparation of Different Haematoxylins and Their Properties

        Mayer's Haematoxylin, Ehrlich's Haematoxylin, Cole's Haematoxylin

    Counterstain by Eosin

    Routine Haematoxylin and Eosin Stain

    Iron Haematoxylin

        Heidenhain's Iron Haematoxylin, Verhoeff's Iron Haematoxylin,

        Tungsten Haematoxylin

    Clearing of the Smear

    Mounting, Coverslipping

9. **Special Stains for the Carbohydrate, Protein, Lipid, Nucleic Acid and Pigments [3 classes]**

    Introduction

    Staining of Different Carbohydrates- Glycogen, Combined PAS-Alcian Blue Staining

Lipids Stains- Oil Red O,Sudan Black B, Ferric Haematoxylin for Phospholipid

10. Connective Tissue Stain: Principle and Procedure [2 classes]

Fibrous Part of Connective Tissue-Collagen, Reticulin Fibres, Elastic Fibres, Basement Membrane

Stains: Masson Trichrome, Van Gieson Stain , Reticulin Stain, Gordon and Sweet's Method for Reticulin Stain

Elastic Fibres- Verhoeff's Stain for Collagen , Weigert's Resorcin-Fuchsin Stain , Orcein for Elastic Fibres, Phosphotungstic Acid Haematoxylin (PTAH)

Amyloid Staining-

Stains for Amyloid-Alkaline Congo Red Stain, Congo Red Stain by Highman, Thioflavine T Stain

11. Stains for the Microbial Organisms [1 class]

Bacteria- Gram's Stain, Ziehl-Neelsen Stain, Fite Acid-Fast Stain for Leprosy

Fungal Infection: Grocott's Methenamine Silver

Spirochaetes : Warthin and Starry Technique ,

Viral Inclusions: Phloxine-Tartrazine Stain

12. Museum techniques: [2 classes]

Importance.

Kaiserling's solution: Composition. Principle, Preparation

Requirements for the museum

Procedure of mounting the specimens

13. Autopsy techniques: [1 class]

Purpose, Indications, Pre-requisities, Collection and storage of organs removed

Part II Basic Laboratory Techniques in Cytology Laboratory

14. Cytology Sample Procurement, Fixation and Processing [2 classes]

Introduction

Sample Collection

Fine Needle Aspiration Procedure, FNAC of Deep-Seated Lesions, USG-Guided FNAC, CT-Guided FNAC, Endoscopic Ultrasound-Guided FNAC (EUS-FNAC)

Cervical Cytology

Respiratory Samples

Fixation,Special Fixatives,

Processing of Laboratory Samples-

Processing of Sputum ,

Processing of Fluid: Urine, Body Fluids and Lavage , Millipore Filtration,

Processing of Haemorrhagic Fluid

Cell Block

15. Routine Staining in Cytology Laboratory [2 class]

Papanicolaou's Stain

Dyes Used in Papanicolaou's Staining, Principle of Basic Steps

Papanicolaou's Staining Steps, Bluing Solution

Precautions to Be Taken in Papanicolaou's Staining

May Grunwald Giemsa Stain, Principle. Procedure

Diff-Quick stain- Principle, Procedure

16. Liquid-Based Cytology: [1 class]

Introduction, Advantages of LBC over conventional smears, Limitations.

Two methods – Thin Prep & Sure Path, Comparison of the two

Part III Advanced Techniques in Histology and Cytology Laboratories [2 classes]

17. Immunohistochemistry / Immunocytochemistry

Introduction, Basic principles, Procedure

18. Flow Cytometry:

Introduction, Basic principles, Procedure

19. Polymerase Chain Reaction:

Introduction, Basic principles, Procedure

20. Fluorescent In Situ Hybridization

Introduction, Basic principles, Procedure

PRACTICALS:

The Practicals in Histopathology, Cytopathology and Museum techniques should be on hands on basis during their postings in the different Laboratories. The following are to be given importance:

Histopathology: [50 hours]

Fixation: Preparation of 10% NBF, Preparation of B-5 fixative, Preparation of Zenker's fluid.

Dehydration: Preparation of different grades of alcohol.

Tissue processing

Section cutting

Preparation of some common stains: Hematoxylin, Eosin, Reticulin, Masson Trichrome stain, PAS stain, Alcian blue stains, Oil Red O, Van Gieson's test, GMS stain,Von kossa test

Mounting and cover-slipping

Preparation of Kaiserling's solution 1, 2 & 3.

Cytology: [25 hours]

Preparation of the cytological fixatives.

Preparation of some common cytological stains:

Diff Quick stain, MGG stain, PAP stain, H & E stain

Preparation of different body fluids for analysis:

Ascitic fluid, Pleural fluid, Synovial fluid, Seminal fluid

Staining of smears with- PAP stain. H & E stain. Diff Quick stain

PAPER–II

MICROBIOLOGY (THEORY):-

1. **IMMUNOLOGY AND SEROLOGY**

   Emphasis on principal and uses/application ,Immunity –Basic principles and classification, Antigen, Antibody (Immunoglobulin's), Complement system, Antigen – Antibody reactions, Hypersensitivity- classification & different skin tests used for diagnosis., Immunodeficiency diseases including AIDS –in brief, Autoimmunity – Basic concept, Immuno-prophylaxis & Immunization schedule, Vaccines-classification & uses.

2. **PARASITOLOGY**

   - Introduction & classification of medically important parasites, Intestinal & Tissue protozoa (Entamoeba histolytica), Giardia Primary Amoebic meningo-encephalitis)
   - Malaria parasite, Leishmanial parasites, Tapeworms, Flukes of liver and , Intestine, Intestinal nematodes, Filarial worms and other tissue nematodes

3. **VIROLOGY**

   - General Characters of viruses, Classification in brief and name of the diseases they produce., Hepatitis viruses, HIV, (Polio, Rabies, Rata, Measles, Dengue)
   - Oncogenic viruses in brief, Collection and transport of virological specimens

- Laboratory diagnosis of viral infections (various methods of virus culture, serology etc.)

4. ANIMAL CARE

- Care of sheep and procedure to draw blood from sheep.,Handling, feeding and Breeding of laboratory animals.

5. MYCOLOGY

- Classification of pathogenic Fungi, Morphology of Fungi, Laboratory diagnosis of Fungi (KOH prepn. Culture media and methods, LCB mount, etc.)
- Brief idea on Dermatophytes, Candida, Aspergillums, Cryptococcus and Opportunistic Fungi.

PRACTICAL & ORAL (Serology + Parasitology + Virology + Animal Care)

1. **Parasitology**

Collection, transportation, preservation of fecal materials or examination of parasites.

a) Saline and lodine preparation of faeces for identification of Ova Cysts, RBC, Pus cells, Macrophage bacterial and fungal study
b) Concentration techniques for examination of faeces.
Blood smear examination for malaria parasite L.D. bodies, micro filarial etc.

2. **Virology**

a) (All theory discussion), Embryonated egg inoculation, Tissue culture techniques
b) Serological tests for diagnosis of common viral diseases, HIV surveillance lab and EUSA / Rapid tests.

3. **Serology**

a) Widal test and preparation of Salmonella antigens, VDRI Test, Latest agglutination tests for (RA, CRP, ASO, Pregnancy Test, Australia Antigen, Toxoplasmosis)

b) ELISA test RIA Test, Get diffusion techniques and ,Immuno electro phoresis, Detection of Antigen / Antibody for Malarial (ICT), Optimal Test, Assay of immunoglobulins

4. **Diagnostic skin tests**

Tuberculin test (Mantoux test), Lepromin test, Casoni's test, Other tests.

PAPER–III

BIOCHEMISTRY

1. Glucose Homeostasis, overview DM, HbAIc.
2. Lipoprotein & Hyper Lipoprotein.
3. Liver function test.
4. Renal function test.
5. Thyroid function test.
6. Alimentary function test.
7. Water & Electrolytic Balance.

ORGAN FUNCTION TESTS

1. Thyroid Function Tests
2. Renal FunctionTests (24 hr collection, preservation, Physical characteristics, clearance tests)
3. Liver function tests
4. Gastric Function Tests
5. Pancreatic Function Tests (Serum Amylase, Serum Trypsin, Serum Lipase)
6. Biochemical tests of CSF.
7. Instrumentation (Instrument maintenance)
8. Quality control, Laboratory errors & Preventions

ORAL AND PRACTICAL

List of Practical's in Clinical Bio-chemistry

1. Principals of colorimetry & overview of semi analyzer.
2. Determination of Glucose in Blood/Serum, Glucose Tolerance Tests
3. Quantitation of Urea
4. Quantitation of Creatinine
5. Quantitation of Uric Acid
6. Cholesterol, Triglycerides, HDL Cholesterol, Lipid Profile (Demonstration Only)
7. Total serum protein and albumin
8. T_3, T_4, TSH (Data Interpretation Only)
9. Demonstrations of Electrophoresis & chromatogram

Model question papers in theory examination:

*** Short notes and Brief notes - 40%**

*** True or false/fill in the blanks-40%**

***Long questions- 20%**

N.B- The mark allotment per question will be according to full mark for each subject.

- **Time for Theory Paper**
- **50 Marks----------2hrs**
- **60-100marks-----3hrs**

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