

Course Detail

FUNDAMENTAL OF MEDICAL LABORATORY TECHNOLOGY

1. Basic laboratory principles
2. Code of conduct of medical laboratory personnel.
3. Organization of clinical laboratory and role of medical laboratory technician
4. Safety measures
5. Medical laboratory professional - professionalism in laboratory workers, code of conduct, communication between physician and lab technician
6. Common glassware's in clinical laboratory.
7. Cleaning, care and maintenance of glasswares.
8. Calibration of pipettes and other volumetric apparatus.
9. Laboratory instruments.
 - Microscopes-Principles, parts, use, care and maintenance of
 - Light microscope,
 - Electron microscope,
 - Fluorescent microscope,
 - Dark ground microscope,
 - Phase contrast microscope etc
 - Centrifuge
 - Water bath
 - Refrigerators
 - Autoclave
 - Hot air oven
 - Mixer
 - Water distillation apparatus.

10. General approach to specimen collection, transport and disposal.
11. Anticoagulants- E.D.T.A, Dipotassium salts of EDTA Double oxalate, single oxalate, sodium citrate. Sodium Fluoride.
12. Preparation of solution: Normal solution, Buffer solution, Percent solution, normal saline, Molar solution.
13. Preparation of Normal saline
14. Methods of measuring liquids, weighting solids.
15. Clinical Laboratory records.
16. Modern Laboratory set up.
17. Quality control in clinical laboratories, basic outline

GENERAL BIOCHEMISTRY

- 1) Carbohydrates: Classification, chemistry, properties of metabolism. monosaccharides, disaccharides, and polysaccharides. Carbohydrate metabolism
 - 2) Proteins: Classification of proteins and amino acids, their properties structure of proteins and amino acids. Plasma proteins, general reaction of amino acids.
 - 3) Lipids – Classification of lipids, properties of fatty acids, phospholipids and sterols Biosynthesis of lipids and lipid metabolism.
 - 4) Nucleic acid chemistry -Metabolism, products of hydrolysis, synthesis and degradation of purines and pyrimidines, nucleosides and nucleotides.
- Structure of DNA- primary and secondary structure, different forms of DNA - RNA - Structure and functions. -Synthesis of DNA & RNA, protein synthesis.

5) Specimen collection & Transport-General methods of collection, Transportation, Preservation, Storage of Biochemical specimens.

PHYSICAL BIOCHEMISTRY

1) Definition of chemistry and its branches, important terminology substance. Elements, compounds, Eq. weight mixture etc

2) Acid, Bases and salt

3) pH, Buffer solution

4) Indicators

5) Preparation of Standard solutions

- Percent solution

- Normal solution

- Molar solution

6) Various grades of chemical reagents including LNR, evedity test

1. Reactions of carbohydrates Monosaccharide, Disaccharides Fructose, Lactose, sucrose, Starch, Glycogen.

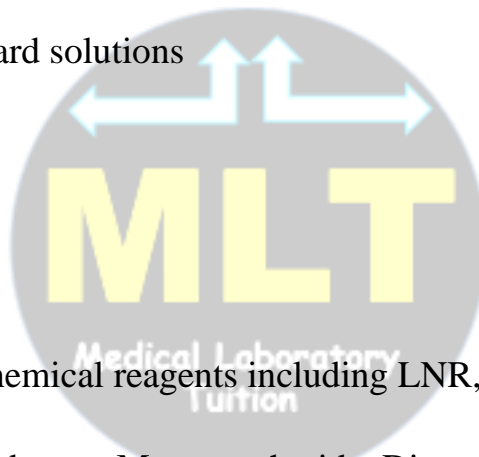
2. Reactions of Proteins Color reactions reaction of albumin, Globulin, peptones, gelatin and casein.

3. Preparation of standard solutions.

4. De ionized and double distilled water

CLINICAL BIOCHEMISTRY

1) COLORIMETRY – principle and its working



2) CARBOHYDRATES-blood sugar and its types, diabetes mellitus, complications of diabetes mellitus, test for blood sugar carbohydrates digestion and absorption

3) LIPIDS - digestion and absorption. Metabolism- synthesis of fatty acids, oxidation of fatty acids, cholesterol biosynthesis and regulation, biologically important compounds synthesized from cholesterol, lipotropic factor and Laboratory tests for cholesterol

4) PROTEINS -Digestion and absorption metabolism, synthesis and degradation of amino acids.

5) LIVER FUNCTION TESTS - Bile pigment metabolism, jaundice and its type, tests for liver function.

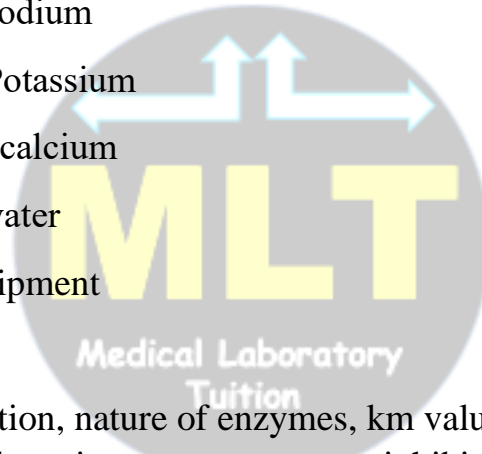
6) RENAL FUNCTION TESTS – Functions of Kidney, disease of kidney, Renal Function Tests.

7) GASTRIC FUNCTION TESTS– Functions of stomach, tests for gastric function.

8) UROLITHIASIS - Formation of calculi, composition and types of calculi. Examination of calculi

- Estimation of glucose
- Estimation serum of creatinine
- Estimation of serum bilirubin
- Estimation of serum albumin
- Estimation of SGPT by UV kinetic
- Estimation of serum triglycerides
- Estimation of serum cholesterol

- Estimation of serum HDL cholesterol
- Estimation of serum uric acid
- Estimation of serum urea
- Estimation of total protein, AG Ratio, Globulin Fraction
- Estimation of serum alkaline phosphatase
- Estimation of SGPT
- Estimation of SGOT
- Estimation of serum acid phosphatases
- Estimation of serum Amylase
- Estimation of serum inorganic phosphorous
- Estimation of serum sodium
- Estimation of serum Potassium
- Estimation of urinary calcium
- Estimation of pH of water
- Demonstration of equipment



1) ENZYMES – Definition, nature of enzymes, km value and its determination co enzymes, factors influencing enzyme enzyme inhibition, mechanism of enzyme action, Isoenzymes, Enzymes in clinical diagnosis.

2) HORMONES - Introduction, classification, chemistry and function.

3) HAEMOGLOBIN – Chemistry, properties and synthesis, metabolism of pigments Hb- derivatives – abnormal hemoglobin, Hb electrophoresis Porphyrins and disorders of porphyrins metabolism, chemistry of porphyrins metabolism, chemistry of porphyrines, primary disorders of haem synthesis, secondary disorders, Analytical procedures

4) WATER AND MINERAL METABOLISM – General consideration, Regulation of water. Phenomenon of thirst, mineral Metabolism (Ca, Na, Cl K, P)

5) CARDIAC PROFILE TESTS – Introduction, Heart diseases, Laboratory tests for heart diseases. Troponin TM, qualitative and quantitative

6) VITAMINS – Introduction, classification, chemistry, clinical significance.

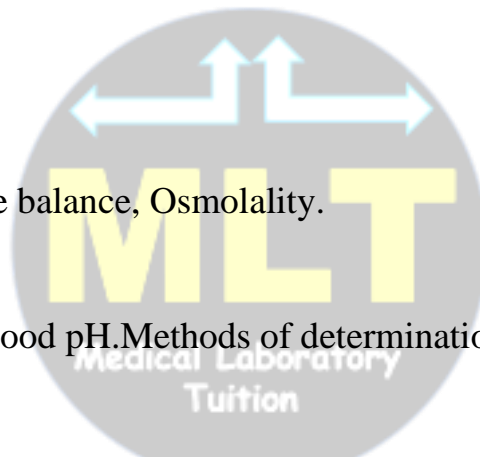
7) URINALYSIS – 24 hour urine sample collection and assays for proteins, Ca, P, urea, creatinine, uric acid.

8) Acid- Base balance.

9) Water and electrolyte balance, Osmolality.

10) Buffers of blood-Blood pH.Methods of determination of blood pH.

11) Quality control in clinical biochemistry laboratory.

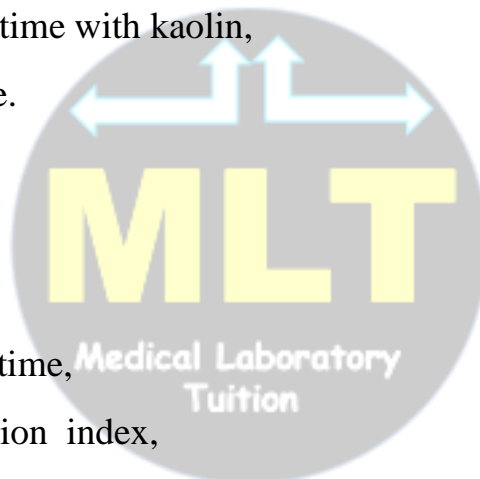


GENERAL HAEMATOLOG & Coagulation

- Blood and its constituents
- Origin, Development, maturation and fate of blood cells.
- Collection of blood –capillary and venous blood collection, various anticoagulants and their uses, advantages and disadvantages.
- Different types of haemocytometers, their ruling and uses.

- ERYTHROCYTES – morphology of RBC in health and disease, functions of RBC, RBC counting, diluting fluids used, erythrocyte indices
- LEUCOCYTES – Structure, function morphology, leucocyte count, absolute eosinophil count, variation in WBC count.
- PLATELETS – Structure and function counting of platelets, diluting fluids, causes of thrombocytopenia/ thrombocytosis.
- PRINCIPLES OF STAINING- Romanowsky stains, preparation and use of buffer solutions in staining.
- PREPARATION OF BLOOD SMEAR –Thin smear, thick smear, wet preparation and buffy coat preparation, Leishman staining differential leukocyte count (DLL) with recognition of abnormal blood cells.
- Quality control methods in cell counts Automatic blood cell counter.
- Bone marrow aspiration – Indications aspiration, preparation of bone marrow smears, morphologic study of bone marrow films and its differential count.
- Identification of parasites (Malaria) microfilaria, L D bodies, typanosoma in blood and bone marrow films.
- Supravital staining technique- principle and uses, demonstration and counting of reticulocytes, composition and preparation of brilliant cresyl blue stain.
- Principles and different methods of determining ESR and PCV, advantages and disadvantages, Clinical significance of ESR and PCV normal values.
- Hemoglobin – Structure and function, Estimation of hemoglobin- principles, techniques, advantages and disadvantages methods of identification of abnormal hemoglobin,
 - HB electrophoresis,
 - Alkali denaturation tests and sickling phenomenon HbF and its demonstration.
- Different methods of blood collection & Preparation of anticoagulant bottles
- Hemoglobin
- TLC
- RBC count

- Platelet count
- ESR
- PCV
- Differential leukocyte count
- Absolute eosinophil count
- Reticulocyte count.
- Examination of Bone marrow smears
- **Mechanism of blood coagulation** – coagulation factors, laboratory methods used in investigation of coagulation disorders
- Bleeding time,
- whole blood coagulation time,
- one stage prothrombin time,
- partial thromboplastin time with kaolin,
- Thrombin clotting time.
- platelet function test,
- clot retraction ,
- tourniquet test,
- plasma recalcification time,
- prothrombin consumption index,
- Estimation of fibrinogen,
- clot lysis time,
- lysis of fibrin clots,
- assay of coagulation factors,
- Haemophilia and its laboratory parameters,
- measurement of life span of platelets.
- Cytochemistry – Peroxidase, Sudan block, and Esterases, Perl's staining and estimation of Iron content in bone marrow smears and its significance.
- Thalassemia and hamoglobinopathies



- Definition, Classification, Laboratory diagnosis of various types of anemia, polycythaemia vera, leucocytosis, leucopenia, lymphopenia, monocytosis, neutropenia and Agranulocytosis, infectious monucleosis.
- Definition and FAB classification of leukemia, Acute and Chronic leukemia blood and bone marrow findings in acute myeloid Leukemia (AML).acute lymphoid leukemia (ALL) chronic myeloid leukemia (CML),chronic lymphatic leukemia,(CLL), Erythroleukemia, Eosinophilic Leukemia, megakaryocytic leukemia, leukemoid blood reactions, FAB classification, Multiple Myeloma (in brief)
- Systemic methods of examination of blood film (blood Picture) and reporting
- LE cell phenomenon and demonstration of LE cells, principle, method and significance of osmotic fragility test, Acid haemolysis (ham's test), G6PD estimation and its significance.
- Automation and recent advances in hematological techniques.
- Bleeding time
- Clotting time
- PT
- APTT
- Determination of fetal hemoglobin
- Osmotic fragility test
- LE cell phenomenon
- Heinz body preparation
- Determination of G-6-PD
- Demonstration of slides of various disorders of anemia and leukemia

IMMUNOHAEMATLOGY AND BLOOD BANKING

- General Introduction to blood banking
- Antigen-Antibody Concept, precipitation, flocculation
- General management and essential components of blood bank.
- ABO blood group system – Inheritance, distribution antibodies in ABO system, Subgroups, ABO grouping methods and factors influencing
- RH Blood group system - Inheritance and distribution, antibodies, Hemolytic disease of newborn, RH typing methods.
- Blood transfusion – Donor screening, collection of blood.
- Screening of blood, Anticoagulants used in blood bank, storage of blood.
- Transfusion reaction – Principles and methods of investigating Transfusion reactions, diseases transmitted by blood transfusion .
- Component therapy – preparation and transfusion of leucocytes poor blood, RBC concentrate platelet rich plasma, platelet concentrate factor VIII, Transfusion of plasma, components and preparation of cryoprecipitate, its use and advantages.
- Human Leukocyte Antigen (H L A) system.

CLINICAL PATHOLOGY

1. Urine Collection of urine and its preservation, 24 hour urine collection for protein. Physical examination of urine – examination of urine for colors, cloudiness, specific gravity, reaction and pH. Chemical examination of urine. Microscopical examination of urine- Urine sediment preparation, types of sediments and its examination.

2. Faeces Collection and preservation, examination of motion for color, mucus, consistency, ova, ameba, cysts, parasites, pus cells, RBC and crystals. Detection of occult blood in stool, concentration techniques.

3. Sputum Method of collection for various purposes including AFB fungal, malignant cells and others. Microscopic examination of sputum, sputum for AFB.

4. Semen method of collection examination of semen for time for liquefaction, volume, colour, reaction pH, motility of sperm, sperm count and other findings staining and morphological study of spermatozoa, semen fructose determination, Antisperm antibodies

5. CSF General introduction method of CSF collection, Transport of CSF, examination of CSF, colour, turbidity and fibrin clot (Cob web), total and differential leukocyte count. CSF examination by gram's staining and acid fast staining, biochemical tests, clinical significance of CSF analysis in various meningitis and encephelitis and interpretations.

6. Other body fluids Methods of collection, transport and macroscopic and microscopic examination of ascetic fluid, pleural fluid, pericardial fluid and synovial fluid.

7. Pregnancy tests Different methods of testing and chronic gonadotropin assay with urine

- Urine-collection, processing, physical, chemical and microscopic examination.
- Collection, preservation and examination of stool
- Sputum collection and microscopy.exminaton of sputum for AFB.
- Analysis and examination of semen-physical examination, sperm motility, morphological study of sperms, fructose determination in semen.
- Analysis of CSF, microscopical and chemical examination of CSF.
- Macroscopic and microscopic examination of Ascitic fluid, Pleural fluid, pericardial fluid and synovial fluid.

GENERAL BACTERIOLOGY

1. History of microbiology – classification of microorganism – Prokaryotes and Eukaryotes
2. Morphology of bacteria – size, shape and arrangement of bacterial cell – cell wall, cytoplasmic membrane, flagella, fimbriae and pilae, cytoplasmic matrix,nucleoid, cytoplasmic inclusions.
3. Bacteria – Bacterial growth curve, growth requirements
4. Stains –simple stain, negative stain, differential stain, special stain.
5. Sterilization and disinfection – Definition physical agents – (sunlight, Drying, Dryheat, Moist heat, filtration, Radiation, Ultrasonic and sonic vibration) 6. Chemical- (Alcohols, Aldehydes, Dyes, Halogens, Phenols, Gases)
7. Culture methods (streak culture, Pour plate culture, Stab culture, Anaerobic culture methods)
8. Identification of bacteria sero-typing and sub-typing, phage typing.

9. Bacterial genetics- methods of gene transfer – Transformation-mechanism, natural and artificial, Transduction-mechanism, generalized and specialized transduction, lysogenic conversion, Conjugation-Properties of F-plasmid, HFr strains, col factor, Mechanism

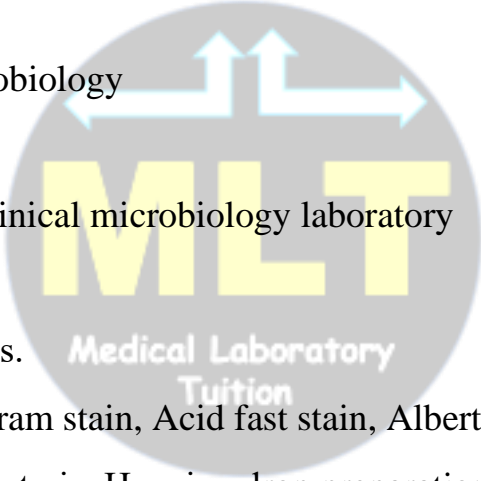
10. Bacteric Culture

11. Antibacterial antibiotics and their mode of action.

12. Normal bacterial flora of human body.

13. Automation in microbiology

14. Quality control in clinical microbiology laboratory

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- Sterilization techniques.
 - Staining techniques-Gram stain, Acid fast stain, Albert stain.
 - Study of motility of bacteria, Hanging drop preparation.
 - Preparation of different culture media and Biochemical media.
 - Culture techniques
 - Isolation of bacteria on Nutrient agar, Blood Agar, MacConkey agar
 - Biochemical reactions-Sugar fermentation test, Oxidation-Fermentation test, Urease test, Citrate test, TSI, M.R., V.P.
 - Antibiotic sensitivity test-MIC, MBC, Agar dilution, Broth dilution, Disc diffusion etc
 - Anaerobic culture methods.

Systematic study of morphologic, cultural biochemical and antigenic characters, epidemiology, pathogenesis, Laboratory diagnosis, treatment and prophylaxis of following bacterial pathogens.

1. Staphylococcus, Streptococcus, Pneumococci, Neisseria.
 2. Haemophilus, Corynebacterium diphtheriae, Mycobacterium tuberculosis, Mycobacterium leprae, Atypical mycobacteria.
 3. Enterobacteriaceae- Salmonella, Shigella, Escherichia coli, Klebsiella, Proteus, Vibrio, Pseudomonas.
 4. Yersinia, Anthrax bacilli, Clostridia, Non sporing anaerobes.
 5. Spirochetes- Treponema, Borrelia, Leptospira
 6. Mycoplasma, Rickettsia, Chlamydia, Actinomycetes.
 7. Bacteriology of air, water and milk
 8. Laboratory diagnosis of bacterial infections.
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9. Serological diagnosis of microbial diseases
 10. TORCH profile
 - Widal test
 - V.D.R.L test
 - R.P.R TEST
 - Antistreptolysin'O test
 - C.R.P.



• Rheumatoid factor test Rose waaler test Latex
agglutination test

• Fluorescent antibody test

Antinuclear antibody test

Fluorescent treponemal antibody absorption test

• Identification of unknown bacteria

• Study of cultural characteristics, Biochemical reactions and antibiotic sensitivity of the following bacteria

• Staphylococcus, Streptococcus • E.coli, Salmonella, Shigella,
Pseudomonas, Klebsiella, Proteus, Vibrio etc

Serology

• Widal test

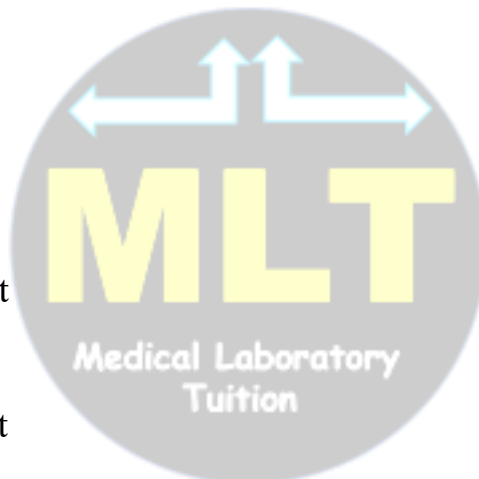
• V.D.R.L test

• R.P.R TEST

• Antistreptolysin'O test

• C.R.P.

• Rheumatoid factor test



PARASITOLOGY

1. Introduction

2. Classification of parasite

3. Classification of host

4) Study of morphology, important developmental stages, Symptoms, Pathogenesis, epidemiology, diagnosis, treatment, prevention of the following parasites

- Protozoa-Entamoeba, Trichomonas, Trypanosoma, Leishmania, Giardia, Plasmodium, Toxoplasma, Isospora, balantidium, Cryptosporidium, Pnemocystis carinii.

- Platyhelminthes-Diphyllobothrium, Taenia, ccinococcus, Hymenolepsis, Schistosoma, Fasciola, Clonorchis, Paragonimus.

- Nematelminthes-Ascaris, Ancylostoma, Necator, Strongyloides, Trichinella, Enterobius, Trichuris trichura, wuchereria, Brugia, Loa loa, Dracunculus.

6) Laboratory diagnosis of parasitic infections.

7) Demonstration of various stages of parasites

8) Direct and indirect means of demonstration of parasites in the body, nonspecific gamma globulins, specific antibody demonstration, complement fixation, malaria card antigen

VIROLOGY

1) Introduction to virology-Classification, Structure and General properties of viruses

2) Laboratory diagnosis of viral infections-Specimens collected, Processing of specimens, Different methods of diagnosis.

3) Bacteriophage

MYCOLOGY

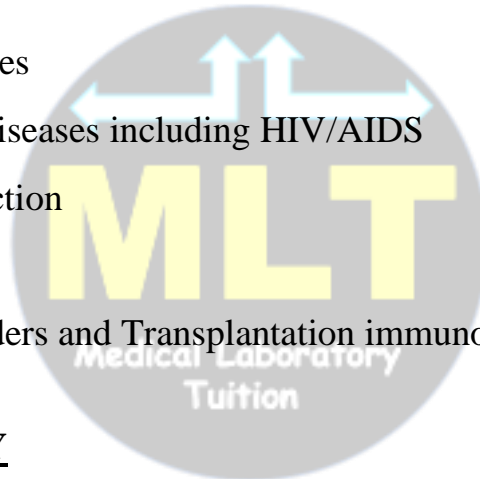
- 1) Introduction to mycology, classification of fungal infections, fungal infections in men.
- 2) Laboratory diagnosis of fungal infections-Specimens collection, transport of specimens, Different methods employed-direct microscopic examination, Slide culture technique, fungal culture, serology and animal inoculation.
- 3) Superficial cutaneous mycoses- Malassezia infections, Taenia nigra, Piedra, Dermatophytosis.
- 4) Subcutaneous mycosis-Mycetoma, Sporotrichosis, Chromoblastomycosis, Phaeohyphomycosis, Rinosporidiosis, Lobomycosis
- 5) Systemic mycoses-Histoplasmosis, Blastomycosis, Coccidioidomycosis, Paracoccidioidomycosis.
- 6) Opportunistic mycoses- Candidiasis, cryptococcosis, Penicilliosis, Aspergillosis, Zygomycosis.

Mycology

1. Collection, Transport and Processing of specimens & stains.
2. Morphologic study of fungi.
 - Lacto Phenol Cotton Blue Mount, KOH preparation
 - India ink preparation.
 - Germ tube test.
3. Fungal culture
 - Preparation of culture media
 - Methods of culture.
 - Study of colony characteristics.

IMMUNOLOGY

- 1) Immunity-definition, classification, mechanism-Innate immunity and Acquired immunity, Vaccines
- 2) Antigens-Definition properties and Types of antigens
- 3) Antibodies-definition, structure of immunoglobulin, immunoglobulin classes and its function
- 4) Complement system
- 5) Antigen -Antibody reaction
- 6) Immune responses-Humoral and Cell mediated immune responses, Lymphokines, basic knowledge of different kinds of immunocompetent cells.
- 7) Monoclonal antibodies
- 8) Immunodeficiency diseases including HIV/AIDS
- 9) Hypersensitivity reaction
- 10), Autoimmunity
- 11) Autoimmune disorders and Transplantation immunology, autoimmune disorders.



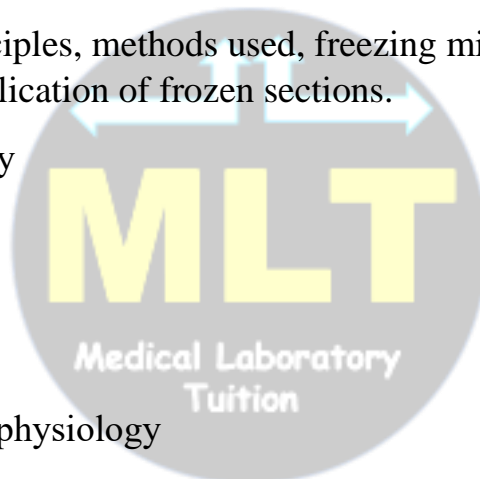
HISTOPATHOLOGY

- General understanding of the terms –Histology, histopathology and histopathological techniques.
- General organization of histopathological laboratory and basic requirements of histopathology laboratory. (Glass wares, chemical and Reagent, Equipment and Instruments). Responsibilities of a histotechnologist.
- General introduction to processing of tissues. cell nucleus, cyto. Membrane, cytoplasm, cell division).
- Basic steps in tissue processing fixation, embedding, microtomy, staining, mounting.
- Fixation and fixatives- Aim of fixation, classification of fixation, classification of fixatives, Different fixatives used, its advantages and disadvantages.

- Decalcification- Aim of decalcification, selection of tissue, fixation, decalcifying agents used, Decalcification techniques.
- Tissue processing- Technique of dehydration, clearing (Aim of cleaning, different cleaning agents), Impregnation, techniques of casting Blocking, section cutting.
- Principles, operation, parts and use of automatic tissue processors.
- Different types of microtomes, microtone knives.
- Staining- Principles of staining Basic staining techniques, special stains in histopathological studies.
- Mounting- Different mounting media and mounting techniques.
- Museum techniques- General introduction, organization of museum, mounting of museum specimens.
- Frozen sections- Principles, methods used, freezing micro sections, staining of frozen sections and application of frozen sections.
- Immunohistochemistry

CYTOLOGY

- Cell morphology and physiology
- Cell structure and functions – lining membrane epithelia, stratified squamous epithelia, columnar epithelia, epithelia serving reproductive function and miscellaneous epithelia.
- Various cells seen in cytological preparations
- Body fluids: method of collection transport and macroscopic and microscopic of Ascitic fluid, pleural fluid, and synovial fluid with special reference to cytology
- Fine Needle Aspiration Cytology (FNAC).



- Clinical procedures: Preparation and fixation of smears and fluid specimens. Collection, fixation and transport of cervical smears and vaginal smears for hormonal studies. Standards of adequacy of cytology examination of female genital tract.

ADVANCED DIAGNOSTIC TECHNIQUES

- PCR-principal and diagnostic application
- Flow cytometri and application
- ELISA techniques and clinical application
- TORCH profile: techniques and its interpretation
- ETC..

