CURRICULUM & SYLLABUS

For

ONE YEAR P.G. DIPLOMA

IN

MEDICAL LABORATORY TECHNOLOGY

(PGDMLT)

ACADEMIC BOARD

ALL INDIA MEDICAL LABORATORY TECHNOLOGISTS' ASSOCIATION

Member Society, International Federation of Biomedical Laboratory Science, Canada
(Registered under, Societies Registration Act XXI of 1860, Regd No. S/12081), New Delhi

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ACADEMIC BOARD

ALL INDIA MEDICAL LABORATORY TECHNOLOGISTS' ASSOCIATION

Ordinances Governing Post–Graduate DMLT One Year Regular Course

(Effective from 2011 – 2012)

Authority : Academic Board (AB), All India Medical Laboratory Technologists' Association (AIMLTA). The functions of the study centres (Institution / Colleges) are within the frame work of the objectives of Academic Board, AIMLTA.

Commencement of the Course : July 2011.

Eligibility for Admission :

i) Passed the B.Sc. / B.Sc. (Hons) with Biology as a subject in all the years of Graduation course or an equivalent examination of a recognized Indian University.

ii) Obtained a minimum 50% marks in the aggregate. Schedule Caste / Schedule Tribe candidates shall be given a relaxation of 10% in the above minimum marks. 15% seats shall be reserved for Schedule Caste & Schedule Tribe (7.5%) and 5% seats shall be reserved for Govt. sponsored candidates.

iii) The candidate should have adequate knowledge of English as per requirements of the course.

iv) The candidates submit certificate verified by authority that he / she has been subject to AIDS test and found negative.

v) Admission can not be claimed by any candidate as a matter of right.

vi) The admission or readmission of a candidate shall be entirely at the discretion of the Admission Committee of the Institutes / Colleges as per rules & regulations of Academic Board, AIMLTA.

Duration of Study : The curriculum of the study for the PG Diploma shall be one Academic year prescribed by Academic Board, AIMLTA. The Academic year will start from the first week of July to the last working day of the concerned Academic year.

Explanatory Instructions :

i) The Candidates will have to fill in the admission form & other documents prescribed by the Academic Board, AIMLTA & produce the attested photo copies of documents required by him / her.

ii) The admitted candidates by the Institutes / Colleges under Academic Board, must join their regular classes by a date fixed by the Director / Principal which shall ordinarily be in the month of July / August.

iii) All students admitted to the Institute shall maintain good conduct, pay the requisite fee and other charges by the due dates, and abide by the rules and regulations of the Centre.

iv) Admission, enrolment and registration of a candidate is liable to be cancelled at any time by Academic Board, AIMLTA, if it is detected that something is against the student for providing

false information, act of gross misconduct and indiscipline involving moral turpitude.

v) A student should have completed the age of 21 years on or before 31st December.

vi) Leaving or transfer certificate signed by the Principal of the College last attended and certifying to the satisfactory conduct of the student mentioning the Examination he / she has passed is required.

vii) Maximum 50 candidates and minimum 15 candidates can take admission in an Institute / College subject to sanction of seat by the Academic Board according to its infrastructure.

viii) Self supporting foreign nationals recommended by the Govt. of India, Embassies or who apply directly for admission may be admitted on merit basis. The admission of student who apply directly shall be subject to the clearance of the Govt. of India.

Attendance : Every student is expected to have attendance i.e. 100% and condonation upto 30% can be considered by the Director / Principal for specified congent reasons only.

Syllabus : The students must purchase syllabus from the Academic Board office at the cost of **Rs. 100/-** each. The student membership and examination forms are attached with the syllabus and obtainable from

Academic Board, AIMLTA, 404, Capitol Tower, Fraser Road, Patna – 1, either in person or on payment of **Rs.100/-** through mail in favour of **Chairman, Academic Board, AIMLTA, Patna.** Applications which are incomplete in required informations or enclosures are liable to be rejected.

Fee Structure : Examination fee shall be paid only in one installment as per Academic Board Norms.

Examination Regulations :

Essentials for qualifying to appear in examination :

The performances are essential components of training and are to be assessed based on :

i) Attendance : At least 75% of attendance in a subject for appearing in the Examinations is compulsory.

ii) A candidate shall be examined in 4 theory papers each of 100 marks will be prepared by the examiners as prescribed by the Academic Board, AIMLTA. Nature of questions will be short answer type / objective type / descriptive and marks for each part indicated separately.

iii) Examinations in theory courses shall be conducted by means of written papers each of 2 hours duration.

iv) Practical examinations will be conducted in the practical Hall / Laboratories of the Institutes / Colleges. Objectives will be to assess proficiency in skills, conduct of experiment, interpretation of investigations, accuracy in results and logical conclusions.

v) Viva includes candidates' skill in interpretation of investigative data, result, identification & clinical significance of the investigations.

vi) The examinations are to be designed with a view to ascertain whether candidate has acquired the necessary knowledge, minimum skills alongwith clear concepts of fundamentals which are necessary for him / her to carry out his / her day to day work competently.

vii) The examination shall be held once a year. Examination will be decided by Academic Board and the date and time will be prescribed by the Controller of Examinations, Academic Board, AIMLTA.

viii) Weightage for the internal assessment shall be 10% of the total marks in each group of subject. During the period of study the candidate will prepare SOPs (Standard Operational Protocols) in all disciplines which will be assessed by the external examiner during the examination.

ix) The class test shall be conducted by teachers conducting the course and the marks shall be displayed on the notice board of the Institute / College.

x) The candidate will have to fill the examination form and necessary documents prescribed by the Academic Board, together with the examination fee.

xi) The last date for the receipt of examination forms shall be fixed each year by the Chairman / Controller of examinations, Academic Board, AIMLTA.

xii) There shall be at least one External Examiner for 25 students but where candidates appearing are more than 25, one additional Examiner, for every additional 50 or part there of candidates appearing, be appointed.

xiii) The External Examiner shall not be from the same Institute & preferably be from outside the state.

xiv) There shall be a board of paper setters and shall moderate the questions.

xv) The Controller of Examinations shall register the application which is found to be in orders in the register for examination and shall issue Admit Card to the candidate.

xvi) No candidate shall be allowed to any examination unless he / she produces his / her Admit Card in respect there of to the external Examiner conducting the examination.

xvii) The Chairman / Controller of Examinations may, if satisfied that Admit Card has been lost or destroyed, allow the candidate to appear in the examination.

RE–EVALUATION OF ANSWER BOOKS

Provisions for re-evaluation of answer books exist in the Academic Board for an examinee who is in doubt or not satisfied with the marks obtained in any theory papers. Provisions for re-evaluation of Practical does not exist.

i) The fee for re-evaluation is Rs. 100/= for each answer book. Application for re-evaluation of answer books should reach the office of Controller of Examinations within one month from the date of declaration of the results of the examination concerned.

ii) The fee deposited by the candidates shall not be refunded. There will be possibilities of both increase or decrease in original marks but no appeal shall lie against the revised awarded marks.

Supplementary Examination :

The supplementary examination shall be held after the reopening of New Session. Date and time shall be specified by the Controller of Examinations. Candidates shall be eligible to appear in supplementary examination in the concerned papers alongwith regular students of next Academic Session's examination.

Scale of Marks, Division or Distinction :

Maximum Marks in each paper 100.

Minimum pass marks in each paper 40%.

Division :

First Class	:	65% and above of the aggregate of marks including theory & practical.
Second Class	:	45% and above of the aggregate of marks including theory & practical.
Distinction	:	A candidate who without failing in any course, secures an average of 75% or more marks in the aggregate may be declared to have obtained distinction.

Merit : The order of merit shall be determined on the basis of aggregate marks obtained in the examination among candidates, subject to the rule / regulations prescribed by the Academic Board, in this regard.

Award of Certificate :

i) During the period of study, the candidate will prepare SOPs (Standard Operational Protocols) in all disciplines which will be evaluated by the external examiner during examination.

ii) PG-DMLT qualifying certificate will be awarded to candidates securing 40% marks in theory and 50% marks in practical and in aggregate 50% marks.

iii) The certificate of merit and prizes shall be awarded to the candidates obtaining highest number of marks at top position and next order of second position.

NOTE : The interpretation of any rules as well as amendment to it rests solely and entirely with the Governing Body of Academic Board, AIMLTA. This shall be final and binding on students/ Institutions / Colleges (recognized by Academic Board) and in no case shall lie in any Court of Law in respect of its decision.

Distribution of Marks

A – Theory Papers : 100 marks in each paper			
Paper	**Subject**	**Marks**	**Total Marks**
Paper - I	Anatomy & Physiology	50	100
	Histopathology	50	
Paper - II	Biochemistry	50	100
	Clinical Pathology	50	
Paper - III	Hæmatology	70	100
	Blood Banking	30	
Paper - IV	Microbiology	70	100
	Serology	30	
Total marks in theory papers : 400			
B – Practical (Including all disciplines except Anatomy & Physiology)			
Biochemistry		100	150
Clinical Pathology		50	
Hæmatology		100	150
Blood Banking		50	
Microbiology		100	150
Serology		50	
Histopathology		50	50
Total Mark in Practical : 500			

Note : Candidates will have to take three months training on Phlebotomy.

Pass : In each of the practical the candidate must obtain 50% marks.

Academic Calendar for the examinations shall be announced at the beginning of every Academic Year by Controller of Examinations.

Distribution of minimum Days and Hours for Theory & Practical Classes

Name of Subject	No. of Days	Thoery (FN)	Practical*(AN)
Anatomy & Physiology	30	90	
Histopathology	25	75	
Biochemistry	40	120	
Clinical Pathology	40	120	
Hæmatology	40	120	
Blood Banking	15	45	
Microbiology	40	120	
Serology	30	90	

* Practical in related disciplines will be done in the afternoon.

ANATOMY & PHYSIOLOGY

(One Year PGDMLT Course)

- **The Blood and Lymph :** Structure and composition. The development of Blood, Hæmopoietic Tissues, Nature of Tissues. The stem cell, Development of Lymphoid, Lymph nodes, Lymphoid organs, Development of Myeloid elements. The marrow as an oragn.
- **Epithelium :** Characteristics of epithelial cells, the function of epithelium, the connective tissues (loose and dense), the constituents of connective tissues.
- **Cartilage :** Hyaline, Elastic, Fibrous cartilage, Ligaments, Tendon, Regenerative ability of cartilage.
- **Skeletal & Muscular System :** Osteology of human Skeleton, Bones, Development of Bones, General features of Bone, Classification of Bones, Chemical composition of Bones, Structures, elements and quality of Bones, Bone marrow Spongy Bone, Functional correlation of red and yellow bone marrow, Skeletal muscles, Smooth muscles, Muscular tissues, Cardiac muscle, Nerve supply and action, Forces exerted by muscle, Articulations; the joints; synarthroses, diarthroses, functional correlation of joints.
- **Circulatory System :** Structure of Heart, the Blood vessels, the Lymphatic vessels, Cardiac cycle, Pulmonary circuit, Blood pressure and its regulation.
- **Respiratory System :** Nasal cavity, Pranasal sinuses, Naso-Pharynx, Larynx, Trachea and Chief Bronchi, the Lung, Mechanism of breathing.
- **Digestive System :** Gastrointestinal tract and associated glands. Function of intestine. The process of digestion and absorption, the Liver, the functions of liver, the extra hepatic passage.
- **Urinary System :** The kidney, the Renal Pelvis, Ureter and urinary bladder, the urethra, Physiological process involved in excretion. Nephrons, mechanism of urine formation osmoregulation by kidney.
- **Nervous System :** Components, parts of Nervous System, Brain, meninges, Nerve terminals, Motor and sensory pathways, Cranial Nerves, Spinal cord & their Blood Supply.

- **Endocrine System :** The Endocrine glands and their functions, Regulation of endocrine secretion and effect of hyper and hypo secretion of endocrine glands. The suprarenal gland, the pineal body, thymus gland, pancreas, sex glands.
- **Male & Female Reproductive System :** The Testis, the Scrotum, the Penis, the male genital ducts, the Auxiliary genital glands, the Ovary, the Uterine tube, the Uterus, the Vagina, the External genitalia, the Gestation period, definition of Gonads, definition of Gamete, Sperm, Structure of Sperm, Ovum, Semen, Morphology of Semen.
- **Integumentary System :** The characteristics of Skin, Nail and Hair. The Cutaneous glands.
- **Special Sensory Organs :** The olfactory organ, the Gustatory organ, the Eye, the Ear.
- **Radiological Anatomy :** Concept of Skiagrams, Concept of Special radiological investigations. Barium meals, IVP, CT Scan, Ultrasound, MRI.

BIOCHEMISTRY (CHEMICAL PATHOLOGY)

(One Year PGDMLT Course)

- **Biomolecules and the Cell :** The major complex biomolecules of cells and their major functions, chemical composition of normal man, Prokaryotic and Eukaryotic Cells, Comparison between Prokaryotic and Eukaryotic Cells.
- **Carbohydrates :** Definition, Digestion of Carbohydrates, Entry of Glucose into Cells, Insulin dependent transport system of glucose, Major pathway of carbohydrate metabolism, Non-digestable Carbohydrates, Abnormilities of Carbohydrate, Glycolysis, Regulation of Glycolysis, Gluconeogenesis, Function of Glycogen, Glycogenolysis, Formation of Glucose, Glycogen storage diseases.
- **Proteins :** Definition, simple, conjugate and derived proteins, Nutritional classification of proteins (structural function and dynamic function), Major elements of protein, Digestion of protein by pancreatic proteases, Abnormalities of protein digestion, Amino acids, Formation of Ammonia, Function of Ammonia, Phenylketonuria (PKU), Urea Cycle, Blood Urea, Non–Protein Nitrogen (NPN), Biosynthesis of Creatine, Clinical importance of Creatine and Creatinine.
- **Lipids :** Definition, Digestion of Lipids by Pancreatic Enzymes, Degradation of Triglycerols and Cholesterol esters, Phospholipids, Plasma Lipids, Role of Bile Salt in Lipid absorption, Peptic Ulcer, Pancreatitis, Triglycerols (The body fuel reservoir).
- **Enzymes :** Diagnostic importance of enzymes, Amylase, Lipase, Serum Glutamate Pyruvate Transaminase (SGPT), Serum Glutamate Oxaloacetate Transaminase (SGOT), Alkaline Phosphatase, Lactate Dehydrogenase (LDH), Creatine Phosphokinase (CPK), Y-Glutamyl Transpeptidase – Clinical Significance.
- **Biological Oxidation :** Redox potential, Mitochondria (The power house of Cell)

- **Hormones :** Definition, Classification, Hypothalamic and Pituitary Hormones, Glycoprotein, Hormones, TSH, FSH, LH, Thyroid Hormones, Laboratory diagnosis of T3, T4, TSH – by ELISA. Hormones of Adrenal cortex, Hormones of Gonads.
- **Vitamins :** Classification, Fat soluble and water soluble Vitamins, Biochemical function of Vitamins.
- **Electrolyte and Acid Base Balance :** Water Balance, Water intake (exogenous, endogenous), Water output, Urine, Hormonal regulation, Diabetes insipidus, Electrolyte balance, Osmolality of body fluids. Metabolism of Electrolyte.
- Health and Biosafety guidelines and proper disposal of wastes.
- Internal Quality Assurance and adoptation of Standard Operation Procedures (SOPs).
- Knowledge of preparing Format for Investigation Reports.
- Prepare manual (Standard Operational Protocols – SOPs), Maintain the record for Internal assessment.

CLINICAL PATHOLOGY

(One Year PGDMLT Course)

- Collection, Transportation and preservation of blood, serum, plasma etc; Organic and inorganic components of Plasma.
- Preparation of Anticoagulants, Reagents and Buffers.
- **Hæmoglobin and Porphyrins :** Hæmoglobin, Globin, Fœtal Hæmoglobin (HbF), Abnormal Hæmoglobins, Porphyrins, Degeneration of Hæme to Bile pigments. Excretion of Bilirubin into Bile.
- **Plasma Proteins :** Separation of Plasma Proteins, Abnormal Electrophoretic pattern; Multiple Myeloma, Nephrotic Syndrome, Primary Immunodeficiency, Antitrypsin deficiency, Albumin–Globulin (A/G) ratio.
- **General Characteristics of Plasma Proteins :** Synthesis of Albumin, Function of Albumin, Globulin, Immunoglobulins, Classes of Immunoglobulins, Abnormal production of Ig, Bence-Jones Protein, Amyloidosis, Bradshaw's test.
- **Lipoproteins :** Definition, Classification, Chylomicrons, Very Low Density Lipoproteins (VLDL), Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), Free Fatty Acids – Albumins (Hyperlipoproteinuria, Hypolipoproteinuria), Clinical Significance & Medical importance.
- **Urine :** The formation of Urine, Excretion of metabolic waste products, Glomerular filtration, Glomerular function test (Insulin, Creatinine, Urea), Tubular function test, Urine examination (Physical and Chemical), Osmolality, Abnormal Constituents, (Protein, Blood, Glucose etc.), Causes of presence of excess Urobilinogen in Urine, Causes of Hæmaturia, Pyuria, Oliguria, Polyuria, Anuria, Ketone bodies, Ketogenesis, Utilization of Ketone bodies, Over production of Ketone bodies, Ketoacidosis, Synthesis of Bile acids.
- **Jaundice :** Classification of Jaundice, Jaundice due to genetic defects, causes of Gilbert disease, Hepatitis, Types of Hepatitis, Peptic Ulcer, Colitis, Pancreatitis, Cirrhosis, Causes of Hepatocellular failure, Hodgkin's and non-Hodgkin Lymphomas, Causes and effect of splenomegaly, Thymus hyperplasia, Neoplasia.

- **Diabetes Mellitus :** Types, Pathogenesis and Pathology, Insulin, Metabolic effects of insulin, Regulation of Blood glucose Level (Hæmostasis of Blood glucose, Utilization of Blood Glucose, Diagnostic approach.
- **Protozoan :** Global and National prevalence of parasitic diseases, Laboratory diagnosis and interpretation; Helminths : Cestodes, Tænia, Echinococcus, Nematodes : Intestinal tissue, Blood.
- Medical Entomology with reference to vectors; Hymenolepis, Trematodes of medical importance.
- Quality Control Assurance (QSA) and adaptation of SOPs (Standard Operational Procedures).
- Bio-safety, Health Care and proper disposal & decay of wastes.
- Prepare manual (Standard Operational Protocols – SOPs) and keep the record for internal assessment.

HISTOPATHOLOGY

(One Year PGDMLT Course)

- The Historical background of Histopathology.
- Labelling and documentation of specimens and keeping records.
- Diseases accompanied by alteration of cell either in structure or in function.
- **The study of cell and tissues :** Chemical nature of Cell, Histo-technology of the tissues of various organs in the body, Concept of various tissues.
- **Examination of Fresh Specimens :** Teased and squash preparations, Impression smear, Frozen sections.
- **Preparation of Dead Tissue :** Fixation, Functions of fixatives, Classification of fixatives. Advantage and disadvantages of fixatives, Microanatomical fixatives, Preparation of Zenker's fluid, Helly's fluid. Bouin's fluid, Gender's fluid, Cytological fixatives; Carnoy's fluid, Clarke's fluid, Champy's fluid, Method of Secondary fixation, Freeze drying technique.
- **Tissue Processing :** Collection, labeling and technique of Fixation, Dehydration, Clearing and Embedding, Technique of impregnation with Paraffin wax, Paraplast, Celloidin, the properties of Embedding media.
- **Technique of Blocking or Embedding:** Types of Moulds.
- **Section Cutting :** Technique of section cutting, Technique of paraffin embedded section, Types of Microtome, Basic principle of Microtome, Parts of Rotary Microtome, Mode of operation, care of Microtome Knives, Sharpening of Microtome Knives, Technique of Honing and stropping.
- **Mounting of Section :** Adhesives; Preparation of Albumin solution, starch paste, Gelatin and their uses.
- **Staining :** Properties of dyes (Natural, aniline, synthetic), Characteristics of Acid, Base and Neutral dyes, Metachromatic dye, Advantage of Mordant, Types of staining, Vital staining, Histochemical staining (Progressive and Regressive), Hæmatoxylin and Eosin technique, Special stain; PAS (Picric acid Schiff), van Gieson stain, Selection of stain for diagnosis, Factor influencing staining reaction.

- **Mounting of Stained tissue section :** Mounting media, Functions & Method of mounting.
- **Frozen Section Technique :** Fixation of Slides, Staining process of Frozen Sections.
- **Decalcification :** Methods of decalcification.
- **Diagnostic Cytology :** FNAC, Study of the normal and abnormal cells of various body cavities, aspirates from deep seated organs in the body.
- **Fixation :** Preparation of smears, staining technique (Papanicolaou, Methyl green pyronin), Microscopy of cell, Diagnostic features and influence, von Kossa's stain for Calcium, Prussian Blue reaction for Haemosiderin, van Gieson's differential stain for fibrous tissue and muscle tissue.
- **Laboratory Technique :** Preservation, fixation, preparation of smears, staining and microscopy, papanicolaou staining.
- **Museum Technique :** Method of preservation of dead diseased organs, Fixation, Restoration of colour of organs, Mounting techniques.
- Safety guidelines in the Laboratory and Internal Quality Control.
- **Disposal of Waste :** Decontamination and incineration.
- Prepare manual (Standard Operational Protocols – SOPs) and keep the record for internal assessment.

HÆMATOLOGY

(One Year PGDMLT Course)

- **Phlebotomy :** Collection, Preservation and Transportation of Blood. Routine Venipuncture and sample handling, Venipuncture procedures, Venipuncture site selection, Procedure for vein selection, Sterilization of site, Disposal of needle into sharps, Labelling & documentation of specimen, Safety precaution and infection Control, prevention of Hematoma, Hemolysis, Hemoconcentration, Effect of prolonged Tourniquet application, Technique of blood collection on New born babies and infants, self protection awareness.
- Maintenance of Laboratory investigations record.
- **Anticoagulants :** Universal anticoagulants, Selection of anticoagulants, Effects of anticoagulants on Blood Cell morphology, Preparation of Anticoagulants.
- **Study of Blood :** Constituent of Blood and Bone marrow, Regulation of Hæmatopoiesis, Staining of blood films, and identification of different Cell (Microscopy).
- Preparation of fluids for total RBC, WBC and Platelet Count. Rees and Ecker's Solution for thrombocyte count, Reticulocyte count, Leishman's, Wright's, Simon's, Giemsa, Supravital stains and staining technique.
- Differential Leucocyte Count, Causes of Neutrophilosis, Monocytic Leukemia, Hodgkin's disease, Agranulocytosis, causes of Leucocytosis, Causes of Leucopenia, Causes of Lymphocytosis, Absolute Lymphocytosis, Relative Lymphocytosis, Nuclear Indices, Arneth's Index (five classes of Neutrophils).
- **Peripheral Blood Smear Study :** Size, Shape, Stomatocytes, Elliptocytes, Spherocytes, Sickle Cells, Target Cells, Crenated Cells, Acanthocytes, Colour Variation : Normochromic, hypochromic, polychromic inclusions of RBCs : Nucleated RBC, Howell–Joly bodies, Basophilic stippling, Cabot rings, Heinz bodies, Siderocytes, Malaria.
- **Study of Anæmia :** Classificaton, diagnosis and clinical features, Hereditary Hæmolytic Anæmia; Thalassemia, Acquired Hæmolytic Anæmia, Hereditary Spherocytosis, G-6PD deficiency. Nutritional Anæmia.

- **Hæmolytic disorders :** Platelet deficiency, Hæmolytic Anæmia, Iron-deficiency Anæmia, Autoimmune Anæmia, Alloimmune drug induced Anæmia.
- **Plasma Cell Disorders :**Multiple Myeloma, Primary Amyloidosis, Splenomegaly, Hypo and Hyperplasia.
- **Study of Coagulation Factors :** Blood coagulation (Hæmostasis), Generation of Plasma, Prothrombin, Formation of Thrombin from prothrombin, Formation of Fibrin from Fibrinogen; Coagulation factor deficiency Hæmophilia.
- **Study of Leucocytic Disorders :** Leucocytosis, Leukopenia, Leukemoid reaction. Acute and Chronic Leukemia, Classification and diagnosis of Acute Myelolytic Leukemia (AML), Chronic Myelolytic Leukemia (CML), Acute Lympholytic Leukemia (ALL), Acute Grassulolytic Leukemia (AGL), Myeloproliferative disorders : Polycythemia, Myelofibrosis.
- Lupus Erythematosus (LE) Cell, Systemic Lupus Erythematosus (SLE).
- **Antibodies :** Immunoglobulins, Classes and Characteristics.
- **Study of Blood Parasites :** Malaria, Transmission, Life Cycle. Characteristics features of **P. vivax, P. falciparum, P. malariæ, P. ovale,Filariasis, Elephantiasis, Leishmaniasis (Kala-azar).**
- Disposal of waste following National Policy.
- Quality Control Assurance (Internal).
- Management of Disposal of Biohazardous Material (Blood, Tissues, Serum, Plasma, Sharps etc.).
- Biosafety Guidelines while working in the Laboratory and maintenance of Record Books (SOPs).

Hepatitis B & C, AIDS, CMV, Leukemia Virus, Syphilis, Malaria, Toxoplasmosis, Technique of freezing and thawing of reagent, Red Cells, Selection of Blood, Compatibility testing. Labelling and issue of Blood.

- **Antenatal and Neonatal Serology :** Hæmolytic disease of New born Antibodies associated with Hæmolytic diseases, Rh Hæmolytic disease, Laboratory detection of Rh immunization, hæmolytic disease due to other Rh antibodies, ABO hæmolytic disease.
- Practical aspects of transfusion of blood, Transfusion technique of Red Cells, Platelet, Granulocyte, Plasma and its components.
- Proper disposal of Wastes.
- Prepare manual (Standard Operational Protocols – SOPs), maintain the record for Internal assessment.

BLOOD BANKING (Transfusion Medicine)

(One Year PGDMLT Course)

- **Quality assurance in Blood Bank and Transfusion services:** Laboratory Quality assurance, Quality Control reagents, instruments and Equipments, Quality monitoring.
- Biosafety guidelines in the laboratory and Remedial action of any kind of errors.
- **Aspects of proper collection of blood documentation:** Prevention, Disinfection, Sterilization. Proper preservation, storage and transportation of Blood, Physical and Biochemical effects of storage, Storage of Blood and Blood Components.
- **Preparation of Citrate based Anticoagulants:** ACD (Acid Citrate Dextrose), Citrate Phosphate Dextrose (CPD-A, CPD-A1, CPD-A2), Heparin, Ethylene diamino tetra acetic acid (EDTA), Optimal Additive Solutions (OAS).
- **Donor selection and Blood collection:** Recruitment of safe donors, Criteria for Donor's selection, Donor records, Identification of Donor, Procedure of Venipuncture, Post donation reactions, Processing of Donor Blood.
- **Inheritance of Blood Group :** Phenotypes and Genotypes, ABO and Rh Blood Group (Karl Land Steiner and Weiner's Principle).
- ABO grouping techniques, Testing for A_1 and A_2 Subgroups. Errors encountered in ABO blood grouping, Bombay Group.
- **Rh Grouping :** Rh (D) grouping (Slide and tube technique), Rh (D) grouping in Hæmolytic disease of New born, ABO and Rh (D) grouping of Recipient and Donor.
- **Compatibility Testing :** Cross matching, Major and Minor Cross matching.
- **Antihuman Globulin Test (AHG) :** Direct and Indirect Coomb's Test.
- **Pre-transfusion Test :** Collection, Identification and storage of Blood (Whole blood, A, O, B, AB, Red cell concentrate, Plasma, Platelet concentrate, Alternate compatible group), Specialised serological tests :

MICROBIOLOGY

(One Year PGDMLT Course)

- Significant milestones in the history of Microbiology.
- Safety guidelines in the laboratory and safe code of practices, Biosafety Level of Risks with microorganisms.
- Quality Control (Internal) Assurance in Microbiology Laboratory, Accuracy of investigations, Standardization of methods, Reliability of results, Knowledge of phlebotomy, Facilities of equipment, chemicals, reagents, glassware etc.
- Biohazard waste management and disposal options, sources of Health hazards and control of environmental pollution.
- Right method of collection, storage, transportation, and proper documentation of specimens and maintenance of records.
- Methods of sterilization (Physical & Chemical), disinfection, decontamination of spills and universal precaution in relative to patient care and disease.
- The definition of growth, growth curve, measurement of growth and maintenance of cultures.
- Different modes of nutrition in bacteria, Bacterial Reproduction, Generation time, bacterial count.
- Basics of gene interaction, Double Helix; Physico–Chemical considerations, DNA Replication – Mechanism of replication of chromosome.
- **Mutation** : Types of Mutations, Mutagens, DNA repair.
- **Morphology of Bacteria :** Size, shape, arrangement, capsule, cell wall, chemical structure of cell wall, Gram positive and Gram negative cell wall, cytoplasm, nucleus, flagella, spores etc.
- **Smear Microscopy and Staining of Slides :** Simple staining, Gram staining, Albert staining, Capsular staining, (India Ink), Hiss's method, Ziehl–Neelsen staining (AFB), Auramine–Rhodamine procedure.
- **Media for Bacterial Growth :** Types of Liquid, Solid, Semisolid media, Basal media, Defined media, Complex media, Enriched media, Enrichment media. Examples of Enrich and Enrichment media. Selective media, LJ media, Drug containing LJ media, Transport media, Blood culture media.

- **Culture Techniques :** Isolation of bacteria in pure culture, methods of culture & inoculation, streak culture, lawn or carpet culture, liquid culture, stroke culture, stab culture, description of colonies of bacteria.
- Study of normal flora of Human body.
- **Infection :** Definition, routes of infection and spread, source and reservoir of infections, definition : Parasite, Host, Vector, Contageous diseases, Infectious diseases, Epidemic, Endemic, Pandemic, Zoonosis, Epizootic.
- Basic knowledge of organisms and their identification causing UTI, sore throat, wound infection, diarrhœa, dysentery, food poisoning, septicemia, meningitis, Enteric fever, Tuberculosis, Leprosy and Sexually Transmitted Disease (STD).
- **Identification and biochemical characterization of clinically significant bacteria :** Microscopy of stained smear, motility test, culture character, biochemical reactions : sugar fermentation, Indole production, catalase, oxidase coagulase test, urease production. Citrate utilization, Nitrate reduction, H_2S production, PPA production, MR, VP test, Bacitracin, optochin, polymyxin B sensitivity, Esculin hydrolysis, Hippurate hydrolysis.
- General Study of V. choleræ and related genera, Campylobacter spp., H. pylori spp.
- Study of Hospital Associated (Nosocomial) Infections, safety measure & control policy.
- Definition of Virus, composition of viruses in general, Basic concept of Hepatitis Virus, Retrovirus, Polio Virus, Chicken Pox virus.
- Acquired Immune Deficiency Syndrome (AIDS), HIV-I & HIV-II infection, Safety measures & Control policy.
- General principles of fungal detection, Identification of Candida albicans, Cryptococcus neoformans, Aspergillus fumigatus.
- Antimicrobial susceptibility testing (NCCLS standard) : Diffusion method (Modified Kirby–Baner method) and dilution method (broth and agar dilution), Interpretation of results, Drug resistance spectrum of antibiotics.
- Prepare manual (Standard Operational Protocols – SOPs) and keep the record for internal assessment.

SEROLOGY / IMMUNOLOGY

(One Year PGDMLT Course)

- Biosafety in Serology Laboratory, General Laboratory direction for safety and proper disposal of wastes.
- Laboratory Quality Assurance and Internal Quality Control.
- Collection, storage and preservation of serological specimens, proper documentation and maintenance of records.
- Basic principles of Immunity, Innate immunity (Non–specific, specific)' Acquired immunity (Active & Passive), Adoptive Immunity, Local Immunity, Cell–mediated immunity, Immunodeficiency with relevance to opportunistic infection, Autoimmunity.
- **Regulation of Immune Response :** Activation of B and T Lymphocytes, Cytokins, T-Cell regulation, Immunization (Active and Passive), vaccines and their importance, Auto immunity, Humoral immune response. Cellular immune response, Factors influence antibody production, Lymphokines, Lymphocytes, Macrophages, Granulocytes, cultured cells, Inter Leukins.
- Immune deficiency syndromes **(AIDS)**, study of HIV-I, HIV-II infection, safety measure & control policy.
- **Study of antigens :** Incomplete antigen (Hapten), Antigen–Antibody reactions, Factors affecting Antigen–Antibody reactions, Zone Phenomenon, Determinants of Antigenicity, Antigenic specificity, Auto specificity, organ specificity, Hetrophilic specificity, Antibodies, Monoclonal antibodies, function of antibodies.
- Study of Hypersensitivity.
- Serological tests, Precipitation, single Radial Immuno diffusion (Mancini technique) for detection of IgG, IgA, IgM, Flocculation (VDRL test), Agglutination (Bacterial, Widal, Weil–Felix, Brucella), Hetrophil agglutination (Paul–Bunnell absorption test), Hemagglutination, Passive Hæmagglutination, Treponema Pallidum Hæmagglutination (TPHA), Reverse Passive Hæmagglutination (RPHA), Carrier Particle

Agglutination (Latex), Rose–Waller test (Rheumatic factors), Neutralization (Antistreptolysin 'O' test ASO, Rheumatic factors), Complement Fixation Test (CFT), Wasserman Reaction, Khan's test, Reitter's Protein CFT test, ELISA (Detection of either antigen or antibody).

- **Study of Spirochætes :** General characters of Borrelia, Leptospira and Treponema and their pathogenicity, Relapsing fever, Lyme disease, Weils disease, venereal syphilis, yaws, pinta.
- Study of Dengue fever and Dengue Hæmorrhagic fever, Dengue stock syndrome (DSS), serodiagnosis : Rapid Immuno chromatographic test for detection of IgM & IgG antibody, Dot Blot Immunoassay.
- Study of Enteric fever, causative agents of enteric fever (Salmonella typhi, S. paratyphi A, B & C), serodiagnosis : Widal test, ELISA techniques : antigen capture, antibody capture, competitive ELISA, dipstick ELISA and sandwich immunoassay.
- **Serodiagnosis of Tuberculosis :** By individual Enzyme Immunoassay for the detection of IgG, IgM antibodies to Mycobacterium species.
- Study of Viral Hepatitis, Detection of HAV, HBC, HCV (Latex agglutination).
- Accuracy and Clinical value of diagnostic and Screening tests (Sensitivity, Specificity, Predictive value), Validation of Tests.
- Prepare manual (Standard Operational Protocols – SOPs) and keep the record for internal assessment.

Biochemistry (Chemical Pathology) – Practicals

(PGDMLT One Year Course)

(1) Estimation of Serum Potassium, Serum Calcium, Urinary Calcium and clinical significance.

(2) Laboratory detection of Arsenic, Copper, Lead, Mercury, Alcohol, Morphine and their physiological importance.

A) Liver Function Test:

(i) A specific reaction to identify the increase in serum bilirubin (van den Bergh reaction- direct and Biphasic) and differentiate Hæmolytic Jaundice, Obstructive jaundice and Hepatic jaundice.

(ii) Serum Bilirubin test **(King: Malloy & Evelyn method)**

(iii) Estimation of Total Protein Albumin and Globulin **(Biuret Method)**.

(iv) Thymol Turbidity test and Thymol flocculation test to detect an increase of gamma globulin in serum.

(v) Alkaline Phosphatase test.

B) Renal Function Test:

(i) Estimation of Blood urea by Diacetyl Monoxime method, Causes of raised and Lowered Urea Level (Pre renal, Renal & Post Renal).

(ii) Estimation of Serum Creatinine (Alkaline, Picrate method, **Jaffe's** Picrate method), Causes and its medical importance.

(iii) Estimation of Uric acid and its clinical significance.

C) Lipids:

(i) Estimation of Cholesterol (Pres. Total & Esterified), Clinical significance.

(ii) Estimation of Triglyceroides, interpretation and clinical importance.

D) Glucose Metabolism:

(i) Estimation of Blood sugar (Toluidine, **Folin-Wu** and glucose oxidase method) Interpretation of result and clinical significance.

(ii) Estimation of True Sugar.

E) Hormones:

(i) ELISA for the assessment of Thyroid Hormones $T_{3,}T_{4,}T_{SH}$ (Commercial Kit)

F) Other Tests:

(i) Separation of Serum protein (Gel electrophoresis)

(ii) Separation of Amino-acids, Sugars, Sugar derivatives and peptides (Paper Chromatography)

G) **Prepare & Maintain the Standard Operational Protocols (SOPs)** For Internal Assessment

HÆMATOLOGY – PRACTICALS

(PGDMLT One Year Course)

Collection of Blood, Whole Blood, Serum and Plasma

Determination of Hæmoglobin Concentration:

(i) Sahli's Acid Hæmation method

(ii) Cyanmethæmoglobin method

Principle, Procedure, Precautions, Sources of errors, advantages and disadvantages, Clinical significance, causes of High & Low Hb values.

Cell Counts:

(i) Total Leucocyte count (TLC), causes of Leucocytosis, Leukopenia.

(ii) Red cell count and its significance (Physiologic, Polycythemia rubra-vera, Secondary Polycythemia, Anemias, Hæmodilution).

(iii) Platelet Count: Direct method, Simple method (A.S. Weiner), sources of error, clinical significance (Thrombocytopenia, Thrombocytosis)

(iv) Absolute Eosinophil Count (AEC), eosinophilic Leukemia, Idiopathic hyper eosinophilic syndrome, Sources of error & Clinical significance.

(v) Reticulocyte count, Rectic correlation of Anemia,

Peripheral Smear and Differential Leucocyte Count (DLC): Peripheral Blood Film (PBF), Morphology to diagnose different types of Anemias and other hæmatologic disorders, Fixation of Smear. Staining of the smear (Leishman's Stain), Sources of error, Romanowsky stains, Giemsa staining.

Evaluation of Peripheral Smear (PS): Steps, Area for DLC, Area for Red Cell morphology, Red cell morphology and platelet clumps examination, Record the different types of white cells. Alteration in DLC, common causes of Neutrophilia, Lymphocytosis, Eosinophilia, Monocytosis, Basophilia.

Hematocrit: Red cell indices (MCV, MCH, MCHC, CI), Packed cell volume (PCV), ESR, stages of Sedimentation, factors influencing ESR, stages of alternation in ESR. Sources of error and clinical significance.

Hæmostasis: Bleeding Time (BT), Template method for BT. Prolonged BT, (Hess's Capillary resistance test), whole Blood Clotting Time (CT), Lee and White methods, Quick's one stage Prothrombin Time (PT), Activated partial Thromboplastin Time with kaolin (APTT/PTTK), Test for Fibrinogen/Fibrin degradation product (FPD/D-D1MER), Precaution of Tests, Common causes of prolonged APTT. Causes of DLC, Red cell fragility test (Osmotic fragility), How are carriers of Hemophilia detected?

Spot Identification by Blood Picture: Anemias, Leukemias, Microscopic appearance of acute Blastic Leukemia, Chronic Myeloid Leukemia (CML), Acute Myelocytic Leukemia (AML), Chronic Lymphocytic Leukemia (CLL).

- Autoimmune Disorder: LE Cell test (Gamma Globulin in Serum).
- Screening Test for G-6 PD deficiency (Methemoglobin reduction Test-MRT), Thalassemia Major. Thalassemia Trait, HbA estimation (Column Chromotography or Hb electrophoresis).
- Laboratory Diagnosis of Blood Parasites: MP, MF and LD bodies, characteristics of Malarial parasites. Filarial Staining (Field staining Napier's Aldehyde test, Chopra's Antimony test (Kala-azar) and K-39 strip test (commercial kits).
- Preparation of Standard Operational Protocols (SOPs) and its Maintenance for Internal assessment.

MICROBIOLOGY – Practical

(PG-DMLT one year Course)

1. Collection of Specimen, Criteria for rejection of specimen.
2. Safe guidelines in Laboratory and safe code of practice for Microbiology Laboratory.
3. **Preparation of Bacteriological Media:** Checking of pH, Peptone water, Nutrient broth, Glucose broth, Alkaline peptone water, MacConkey agar. Cysteine-Lactose electrolyte-deficient agar (CLED), Deoxycholate citrate agar (DCA), Bile Salt agar (BSA), Thiosulphate Citrate Bile salt Sucrose agar (TCBS), Blood agar (BA), Chocolate agar, Mannitol Salt agar, Mueller-Hinton agar (MHA), Media for carbohydrate fermentation.
4. **Cultivation of bacteria on Laboratory Media:** Inoculation of culture media. Instrument for seeding media, Performance of Plated media, seeding a culture plate. (Streak cultures. Lawn culture, stroke culture, stab culture), seeding a liquid medium, Subculture from a solid medium to solid medium, Precaution about inoculation of culture media, Aerobic incubation of cultures, Incubation in a atmosphere with added CO_2, Description of colonies of bacteria & characteristics (Macroscopic).
5. **Staining Technique:** Methylene Blue Staining, Gram staining, Albert staining, India Ink staining, Ziehl-Neelsen staining, Quality Control of stains.
6. **Morphology of Bacteria:** shape, size, group pattern of bacteria, swarming, pigments, Gram positive and Gram negative cocci and Bacilli, Slime Layer, Capsule, spore etc.
7. **Motility of Bacteria:** Hanging drop preparation (detect motile/non-motile bacteria).
8. Performance of coagulase test, catalase test and Oxidase test.
9. **Biochemical characterisation and Identification:** Inoculation of suspected colonies: TSI (Triple sugar Iron agar slope), SIM (Sulphide-Indole Motility Test), PPA Glucose (acid and gas production), Sucrose,

BLOOD BANKING – Practical

(PGDMLT One Year Course)

- Collection, Storage and Transportation of Blood.
- Biosafety measure and Infection control in Blood Bank and Medico–legal aspects.
- ABO Grouping: Methods for Red cell suspension, slide agglutination technique and Tube agglutination technique for ABO grouping,
- RH(D) typing: Slide and Tube Technique

  RH (D) grouping in HDN
- Testing for A_1 and A_2 subgroups
- Compatibility Testing:

  Cross Matching, Routine Cross matching, (Major & Minor) interpretation, Clinical significance, Cross matching by Liss (Low ionic strength solution)
- **Antihuman Globulin test (A.H.G.) :** Direct Coomb's test, Indirect Coomb's test, Indications of Direct & Indirect test result.
- **Blood Transfusion :** Collection of Blood, Anticoagulants, Pre donation check up: ABO; Rh-D typing, Hepatitis BsAg, HIV testing, Test for syphilis, Hepatitis C antigen.
- **Blood Components :** Obtaining whole blood, Red cell (Packed Red Cells), Plasma, Fresh Frozen Plasma (FFP), Platelet concentrates, Cryoprecipitate, Apheresis (Separation of Plasma and Platelets), use of cryoprecipitate, storage of components and Medical importance.
- Preparation of standard operational protocols (SOPs) and Maintenance of SOPs for Internal assessment

Lactose, Mannitol, Maltose, Arabinose Inositol, Urease Citrate. Utilization test, Bile Solubility test, optochin, Polymyxin B Bacitracin test, Esculin hydrolysis, Hyppurate hydrolysis test.

10. **Antimicrobial susceptibility testing:** Basic sets of drug for routine susceptibility tests (NCCLS recommendation), Modified Kriby-Bauer method, Turbidity standard, Procedure, Zone of inhibition, sizes with different antimicrobial agents, Interpretation of results (Susceptible, Intermediate, susceptibility, Resistent), Salient features of quality assurance in susceptibility testing and Biosafety.

11. Preservation and storage of Medically important bacteria in bacteriological media.

12. **Ziehl-Neelsen Staining Procedure:** Smear examination procedure, Morphological characteristics of Acid-Fast-Bacilli, Grading of AFB, Smears by Z-N microscopy, causes of error in microscopy, consequences of false positive and false negative results.

13. **Mycological Technique:** Collection and Processing of specimens (Hair, Nails, and other specimens), Presumptive Identification (Acid-fast staining; Gram staining, India Ink preparation, KOH preparation).

14. Microbiological examination of water and food: Culture procedure & Identification of bacteria.

15. Sample processing for DNA extraction Amplification of Mycobactrial DNA by PCR.

16. Prepare and Maintain standard operational Protocols (SOPs) for internal assessment.

SEROLOGY – Practical

(PGDMLT One Year Course)

- General Laboratory direction for Safety and proper disposal of wastes.
- Laboratory Quality Assurance.
- Collection, storage and preservation of specimens, documentation and maintenance of records.
- Detection of Antibodies by precipitation test (Inter facial ring test).
- **Agglutination Test :**
  - i) Widal test qualitative and quantitative for diagnosis of Enteric fever (Typhoid and paratyphoid), Principle, Test procedure, Interpretation of titre, Factors affecting Widal test, Time for collection of blood sample. Effect of past infection or typhoid vaccination.
  - ii) Hæmagglutination Test : Paul–Bunnell test, (available commercially) for infectious mononucleosis, concept of disease status.
  - iii) Carrier Particle Agglutination Test : Rapid detection of HBsAg (Latex agglutination, Australia antigen), Precautions & Limitation of the test.
- **Neutralisation Test :** For Rheumatic fever, Antistreptolysin 'O' test (ASO): Detection of antibody to streptolysin 'O' produced by Group A streptococci procedure, and interpretation of result (commercial kits).
- **Flocculation Test :** VDRL Slide flocculation test for syphilis, principle, materials, procedure, preparation of serum, preparation of antigen emulsion, Test procedure (qualitative & quantitative). Reading & reporting of results, causes of False positive results.
- **Rapid Plasma Reagin (RPR) test :** Qualitative & quantitative for diagnosis of syphilis, principle, reagents & materials, precaution, test procedure, interpretation of results. Limitation of the tests (RPR and VDRL flocculation test).

- **Confirmatory test for syphilis :** TPHA (T. pallidum Hæmagglutination Assay, (commercial Kit).
- Serodiagnosis of tuberculosis by estimating specific IgM and IgG antibodies in the sera by ELISA or EIA (commercial kits) principle, procedure & interpretation of results.
- **TORCH Profile :** Detection of Toxoplasma, Rubella, Cytomegalovirus and Herpes in patient's sera, principle, procedure, precaution and clinical significance.
- **Dengue Fever :** Rapid Immuno chromatographic test (comm. Kit).
- Serological test for detecting antibodies to HIV (Simple Rapid assay, Commercial kits).
- **Single Radial Immunodiffusion (SRID) Technique :** Mancini technique for quantitative determination of immunoglobulin classes IgG, IgM, IgA in serum.
- Preparation and maintenance of standard operational protocols (SOPs) for internal assessment.

CLINICAL PATHOLOGY – Practical

(PGDMLT One Year Course)

- Collection, preservation and storage of samples.
- Preparation of Anticoagulants, Buffers, Reagents and solutions etc.
- **Urine Examination :**

  i) **Physical Examination :** Colour, Odour, Reaction, specific gravity (Indication of increased and decreased SG), cause of fixed specific gravity.

  ii) **Examination for Abnormal Constituents :** Sulfosalicylic acid test, Heat method, Heller's method, Dipstick method, Interpretation, indication of Proteinurea, Quantitative estimation of protein (Esbach's albuminometer); Bence-Jones Protein's (Albuminuria + Bence Jones Proteinuria). Causes of Proteinuria (Albuminuria).

  iii) **Reducing Substance in Urine :**

  a) Sugar (Glucose, Fructose, Pentose, Galactose), Non-Sugars (Ascorbic acid, uric acid, urates, salicylates, streptomycin, Phenol, PAS).

  b) Benedict's qualitative test (semiquantitative).

  c) Glucose oxidase test (by multistick / dip stick).

- **Ketone Bodies:** Cause of ketonuria, occurrence of Acetone bodies, concept of ketosis.

  a) Rothera's test.

  b) Gerhardt's (for the presence of acetoacetic acid and B-hydroxybutyric acid).

  c) Heat test (for the presence of B-hydroxybutyric acid accompanied by acetoacetic acid).

  d) Dipstick method (on fresh urine).

- **Urobilinogen in Urine :** By Ehrlich's test, Wallace–Diamond test, Clinical significance of increased urobilinogen in urine, decreased / absent urobilinogen in urine. Principle, Procedure & Precautions of the test.
- **Estimation of Urobilinogen in Urine (Schesinger's test) :** Decreased / absent urobilinogen in urine. Principle, Procedure & Precautions of the test.
- Bile salts (Hary's sulphur test), Bile pigments (Smith's test, Gmelin's test), Interpretation of Hepatocellular and obstructive jaundice.
- **Presence of Bilirubin in Urine :** Fouchet's test, Principle, method, Interpretation of Jaundice.
- **Test for Hb / Blood in Urine :** Cause of Hematuria, Hemoglobinuria, Benzidine test, Principle & Method, Dipstick method. Appearance of urine in cases of Hematuria.
- Estimation of Urea in urine (Window's method).
- Amylase activity in urine.
- **Microscopic Examination :**

  i) **Cells :** Detection of Red Cells, Pus Cells, (Detection by staining with crystal violet safranin), causes of pus cells in urine. Epithelial cells and causes of increased number, Renal tubular cells and indication and chemical significance, oral fat bodies, detection & interpretation.

  ii) Crystals : Detection of calcium oxalate, uric acid. Amorphous urates, crystalline urates, cystine, phosphates, amorphous phosphates, calcium carbonates; interpretation of the presence of crystals.

  iii) Casts : Hyaline casts, Granular casts, Cylindroids, Fatty casts, Leucocyte cell casts, Red cell casts, Waxy casts, Epithelial casts and their importance.
- **Encountered Parasites in Urine :** Detection of Trichomonas, ova of schistosoma hematobium, Microfilaria.
- Other Cells : Malignant Cells, spermatozoa, Budding yeast cells etc.

- **Examination of Sputum :** Microscopy (Eosinophilic Leucocytes, Curshmann's spirals, C-L crystals, Pus Cells, Asbestos bodies, Red Blood Cells, Bacteria, Yeast Cells, Parasites etc.).
- **Physical Examination of CSF :** Cell Count (Sulphosalicylic test), Gross evaluation of CSF, Sugar, Protein, Chloride, Globulin.
- **Semen Analysis :** Collection, Quantity, Viscosity, Reaction (pH), Time of complete liquefaction, Microscopic examination (sperm count, motility, sperm morphology).
- Biosafety, infection control, and proper disposal of wastes.
- Prepare standard operational protocols (SOPs) for internal assessment.