

M.D. (PATHOLOGY)

[Syllabus Approved by Board of Studies, Medical & Health Sciences]

Programme Code	HLTH09A01
Programme Details	MD PATHOLOGY
Programme Learning Outcomes (PLOs / PSOs)	ANNEXED IN THE BELOW FORMAT
Eligibility Criteria	AS PER NMC NORMS
Duration of the Course	3 YEARS
Programme Structure (Credit-Based)	NA
Detailed Course Syllabus	ANNEXED IN THE BELOW FORMAT
Teaching–Learning Methodologies	3 YEARS RESIDENCY PROGRAM
Examination & Evaluation System	ANNUAL APPRAISALS FOLLOWED BY FINAL YEAR EXAMINATION AS PER NMC NORMS
Internship / Project / Dissertation Guidelines	1 YEAR MANDATORY BOND
Program In Charge	HEAD, DEPT OF PATHOLOGY Coordinators: Dr. Ayushi Sahay __ayushi.sahay@tmc.gov.in
Annexure (Books / Journals etc)	ANNEXUED

M.D. (PATHOLOGY)

Programme Code: HLTH09A01

Programme Outcome:

- To produce a specialist who is competent to provide a high quality diagnostic opinion in a given clinical situation with an appropriate and relevant sample, able to teach undergraduate and post-graduate, capable of pursuing clinical and laboratory based research and is familiar with current developments and advances in the field of pathology.
- Experience of the diagnostic techniques required to become technically competent in Practical Laboratory Diagnostic Work.
- Broad practical and theoretical knowledge of all aspects of routine surgical pathology and also specialist areas such as cytopathology, hematology, oncopathology and histopathology of specific systems in order to be able to provide specialist advice
- Experience of the practice of evidence based clinical medicine through attendance in joint clinics or multi-disciplinary teams.
- Inculcating a habit of literature searches, attendance at scientific meetings, and the presentation of scientific work.
- Competency for planning, organizing and establishing pathology services / department in all types of medical establishments.
- Competency to impart training to students at various levels including postgraduate level in the subject and carry out research

PROGRAMME CURRICULUM

1. INTRODUCTION

The MD Pathology course under the HBNI comprises of histopathology, autopsy pathology, cytopathology, clinical pathology and hematology and transfusion medicine

The course complies with Medical Council of India Guidelines and ensures the following:

- MD Pathology Post Graduate (PG) program is of three years duration after MBBS
- Postgraduate curriculum is competency based.
- Learning in Postgraduate program is essentially autonomous and self-directed
- A combination of both formative and summative assessment is vital for the successful completion of the PG program.
- The training of PG students involves learning experience 'derived from' and 'targeted to' the needs of the community.

2. SELECTION GUIDELINES

- Students for the postgraduate medical course shall be selected strictly on the basis of their academic merit.
- The basis of merit will be determined by the competitive test conducted by the State Government of Maharashtra or by the competent authority appointed by the State Government of Maharashtra to determine merit (such as MHCET)
- Any other inputs may be obtained from Dean's Office.

3. DURATION OF TRAINING

The period of training will stretch over three years

It is recommended that the course of Doctor of Medicine (Pathology) or MD (Pathology) be of THREE YEARS duration in the form of a residency program that is FULL TIME.

The course curriculum is divided into three stages covering these three years as

Junior registrar I,

Junior registrar II,

Junior registrar III

The major components of the postgraduate curriculum are as under:

- Theoretical Knowledge
- Practical and Clinical skills
- Thesis skills
- Attitudes including communication skills
- Training in research methodology

4. PURPOSE OF THE CURRICULUM

The period of training will stretch over three years

- Experience of the diagnostic techniques required to become technically competent in Practical Laboratory Diagnostic Work.
- Broad practical and theoretical knowledge of all aspects of routine surgical pathology and also specialist areas such as cytopathology, hematology, oncopathology and histopathology of specific system in order to be able to provide specialist advice.
- Experience of the practice of evidence based clinical medicine through attendance in joint clinics or multi disciplinary teams.
- Inculcating a habit of literature searches, attendance at scientific meetings, and the presentation of scientific work.
- Competency to impart training to students at various levels including postgraduate level in the subject and carry out research
- Competency for planning, organizing and establishing pathology services / department in all types of medical establishments.

5. BOARD OBJECTIVES

- **Cognitive Domain**
 - Diagnose routine and complex clinical problems on the basis of Histopathology (Surgical Pathology) and Cytopathology specimens, Blood and Bone Marrow examination and various
 - tests under the domain of Laboratory Medicine (Clinical Pathology, Clinical Biochemistry / Chemical Pathology) as well as Blood Banking (Transfusion Medicine).
 - Interpret clinical and laboratory data with reasonable accuracy.
 - Correlate and advice further on pathology data so that various clinical aspects of disease can be correlated and explained.
 - Should be able to teach pathology undergraduates, postraduates, nurses and paramedical staff

including laboratory personnel

- Able to supervise work of subordinate laboratory staff and colleagues.
- Able to initiate research questions and systematically write or present a paper and publish in a journal.
- Aware of quality control and biosafety and waste disposal issues in a laboratory.
- Subject himself / herself to continuing education and constantly update his / her knowledge of recent advances Pathology and allied subjects.

▪ **Psychomotor Domain**

- Able to perform most of the routine tests in a Pathology Laboratory including grossing of specimens, processing, cutting of paraffin sections making smears, making frozen sections and staining.
- Able to collect specimens by routinely performed non-invasive out-patient procedures such as venipuncture, finger-prick, fine needle aspiration biopsy of superficial lumps and bone-marrow aspirates.
- Perform an autopsy, dissect various organ complexes and display the gross findings.
- Should be familiar with the function, handling and routine care of equipment in the laboratory

▪ **Affective Domain**

- Should be able to function as a part of team that is essential for the diagnosis and management of a patient and interact with the patient, the clinician and all other colleagues to provide the best possible diagnosis or opinion.
- Always adopt ethical principles and maintain proper etiquette in his / her dealings with patients relatives and colleagues.
- Develop communication skills to word reports and interact with patient's relatives, peers and paramedical staff.

6. TRAINING SCHEDULE

▪ **Scope of training:**

As pathology is a bridge between basic medicine and all other clinical branches it covers a wide range of subjects and subspecialties. It involves both clinical skills and laboratory technological methods which are both traditional and novel. It is difficult to expect full proficiency in all branches of pathology within the limited span of three years. Keeping the aims of this course in mind the following are the levels of competence that are expected to be achieved.

- **High Degree of Professional Competence:** In the subjects of Anatomic Pathology (Surgical Pathology and Cytopathology) and Histopathology
- **Reasonable working knowledge:** In the subjects of Laboratory Medicine (Clinical Chemistry / Clinical Pathology / Microscopy) and Transfusion Medicine (Blood – Banking)

- General / Theoretical Acquaintance in the following subjects:
 - Immunopathology / Immunofluorescence
 - Immunohistochemistry
 - Molecular Pathology / Cytogenetics/ Tissue Culture
 - Medical Statistics / Ethics
 - Library / Information retrieval / Web search engines in medicine

7. ROTATION SCHEDULE

There will be two years of training in Tata Memorial Hospital and one year training in a General Teaching Hospital (either Government or Municipal)

Section / Subject	Duration in months
Orientation Rotation	2
Government / Municipal Medical College / Hospital*	6
Surgical Pathology and Fine Needle Aspiration Cytopathology	14
Hematology	2
Exfoliative Cytology	1
Transfusion Medicine / Blood Bank	2
Basic sciences including Molecular Biology, Cytogenetics, Research techniques	1
Government / Municipal Medical College / Hospital **	6
Elective / Reorientation)	2
Total	36 months

*The peripheral posting the first year in Government / Municipal Medical College / Hospital will specifically include Autopsy, non-oncology related aspects of Pathology, Clinical Pathology, Hematology, Systemic Pathology, Blood bank and Immunohematology.

**The peripheral posting in the third year in Government / Municipal Medical College / Hospital will include Surgical Pathology specialized posting such as Neuropathology, Dermatopathology, Cardiac Pathology and Renal Pathology

8. LEARNING MODULE

The following teaching/learning methods will be used to identify how individual objectives will be achieved:

- Routine work: the most important learning experience will be day-to-day work.
- Textbooks: A departmental library is available for quick reference for students
- Histology, cytology and hematology slide meetings.
- Gross meetings
- Journal club & Symposia
- Intradepartmental student debate
- Interhospital CPC meeting
- Attend monthly teaching pathologist meeting
- Attend specialist lectures, training courses and CME's conducted in house and elsewhere
- Scientific meetings: Residents will be encouraged to attend and participate in the Maharashtra Chapter and National meeting of the Indian association of Pathologist and microbiologist (IAPM).
- Clinical meetings: - Comprising weekly multi faculty hospital joint meeting and interdepartmental multidisciplinary joint meeting.
- E-learning and internet literature search
- Log book
- Basic statistics training program
- Good clinical practice training

9. DETAILED SYLLABUS

• SURGICAL PATHOLOGY

Course Details:

AIM -Training to include

- Grossing of all surgical specimens in keeping with protocol or guidelines for handling various specimens
- Identify, and systematically and accurately describe the chief gross and microscopic alterations in the surgically removed specimens
- Correctly diagnose majority of the lesions received on an average day from the surgical service of a general hospital.
- Knowledge and incorporation of internationally approved terminology for classification of diseases e.g. WHO and TNM staging for tumors.

▪ **General Surgical Pathology**

- **Gross**

Correct specimen orientation Protocols for obtaining fresh tissues for ancillary methods Grossing of all common specimens and understanding attention to detail during specimen description and section taking

- **Skill**

Setting up a microscope. Normal histology of various organs. Be able to start a tissue processor, process tissues make a paraffin block and cut sections of good quality on a rotary microtome. Stain paraffin sections Haematoxylin & eosin, PAS stain, mucin, Masson Fontana, AFB.

- **Knowledge**

Normal histology and pathologic conditions, types of fixatives, tissue processing, special stains. Frozen section competency, Ancillary methods in histopathologic diagnosis like Immunofluorescence, ultra-structure, cytogenetics, understand integration of ancillary methods and clinical information

▪ **Breast**

- **Gross**

Grossing mastectomies, breast conservative surgical resection specimens including lymphnode dissection.

- **Skill**

Diagnosis of invasive breast carcinoma and subtypes, Histopathology reporting and essentials to be included in a report on breast carcinoma.

- **Knowledge**
Prognostic and predictive factors in breast cancer, Identifying DCIS, fibroadenoma, phyllodes tumor, spectrum of proliferative breast disease, special tumors like Adenomyoepithelioma, Paget's disease, Diagnostic methods, disease of male breast.
- **Gastrointestinal tract**
 - **Gross**
Grossing of Radical excisions such as APR, anterior resections etc.
 - **Skill**
Classification of gastritis, identifying Barrets esophagus, identifying H pylori, diagnosis and classification of inflammatory bowel disease, different histology's in polyps, Adenomas, Infections and parasites affecting the GIT Diagnosis and histopathology sprue, reporting of carcinomas and other tumors such as Gastrointestinal stromal tumors.
 - **Knowledge**
Congenital and mechanical disorders, Molecular and etiopathogenetic mechanisms in adenocarcinoma, premalignant disease, Prognostic and predictive factors in carcinomas of GIT, unique lymphomas involving the GIT, neuroendocrine tumors of GIT, Polyposis syndromes, malabsorption syndromes, Celiac disease and tropical vascular disorders, diverticulosis, intussusceptions.
- **Hepatobiliary system**
 - **Gross**
Hepatectomy specimens Cholecystectomy specimen Whipple's surgery
 - **Skill**
Histopathology reporting in hepatectomy, Cholecystectomy and Whipple's resection. Liver biopsy - diagnosis of cirrhosis and malignancies, classification or grading of hepatitis
 - **Knowledge**
Types of cirrhosis, Drug induced hepatitis, metastatic carcinoma, Hepatocellular carcinoma (HCC) variants like fibrolamellar HCC, hepatoblastoma, Metabolic liver disease, Liver in inherited disorders of metabolism e.g. Wilsons disease, glycogen storage disorder Pancreatic disease e.g. diabetes mellitus, islet cell tumors
- **Head and Neck**
 - **Gross**
Grossing of major resections in head and neck e.g. composite resection, hemi mandibulectomy, maxillectomy, gland excisions etc.
 - **Skill**
Diagnosis of squamous carcinoma Evaluating dysplastic changes in squamous epithelium Identify chief types of salivary gland tumors- Pleomorphic adenoma, adenoid cystic carcinoma, Warthin's tumor, ductal carcinoma.
 - **Knowledge**
Nasal polyps, common tumors in children, Myoepithelial salivary gland tumors, neck cysts

- **Neuropathology**
 - **Gross**
Neurosurgical resections
 - **Skill**
Common brain tumors, Metastatic carcinomas, tumors of peripheral nerves, WHO classification of CNS
 - **Knowledge**
Dementia, Demyelinating diseases of brain, muscle/ tumors nerve biopsy
 - **Gynaecology**
 - **Gross**
Examination of hysterectomy and salphingo- oophorectomy for benign and malignant diseases. Cervix cone biopsy Processing. Grossing of placenta
 - **Skill**
Endometrial pathology, leiomyoma, endometriosis, adenomyosis, common ovarian tumors, Cervical pathology, including intraepithelial neoplasia, Reporting of Wertheim's hysterectomy.
 - **Knowledge**
Normal ovarian and endometrial histology, Polycystic ovarian disease, endometrial biopsy interpretation in infertility or dysfunctional bleeding, Endometrial stromal sarcoma malignant mixed Mullerian tumor, placental pathologic abnormalities, ectopic pregnancy, Gestational trophoblastic disease.
 - **Male genital system**
 - **Gross**
Radical prostatectomy, Orchidectomy and penectomy specimen evaluation
 - **Skill**
Evaluating prostatic biopsies for cancers Diagnosis of testicular germ cell tumors. Histopathology reporting of orchidectomy
 - **Knowledge**
Gleason's grading system, Non germ cell tumors of testes. carcinoma of penis and scrotum, Testicular biopsy and male infertility investigations in male infertility.
 - **Urology and Nephropathology**
 - **Gross**
Renal and bladder tumor excisions
 - **Skill**
Renal biopsy interpretation with emphasis on glomerular disease, bladder biopsy evaluation for urothelial tumors and inflammations, Histopathologic reporting of nephrectomy
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specimens.

- **Knowledge**

Immunofluorescence and ultrastructural findings in glomerular diseases, Urinary outflow obstruction causes and pathology.

- **Dermatopathology**

- **Gross**

Orientation of skin biopsy

- **Skill**

Inflammatory skin biopsy: -descriptions and observations, Diagnose basic skin carcinomas, Diagnosis of nevi and melanoma.

- **Knowledge**

Histologic findings in bullous skin lesions, pemphigus, psoriasis, dermatitis herpetiformis, seborrheic keratosis, actinic keratosis, hemangiomas, skin cysts, granulomatous lesions of skin, infections, common skin adnexal tumors.

- **Lymph Node pathology**

- **Gross**

Recording abnormal gross appearances

- **Skill**

Identifying metastatic carcinoma, granulomatous lesions, distinguish reactive Vs malignant lymphoid proliferation, Hodgkin's from Non- Hodgkin's lymphoma, Identify broad categories of Non-Hodgkin's lymphoma.

- **Knowledge**

Recognition of viral/bacteria lymphadenitides and lymphadenopathies, Immunohistochemical distinction between different primary carcinomas Immunohistochemistry in lymphoid disorders and lymphomas.

- **Respiratory tract**

- **Gross**

Lung resections lobectomy and pneumonectomies

- **Skill**

Reporting on lung cancer resections, Lung biopsy interpretation for cancer, granulomas.

- **Knowledge**

Histologic subtypes of lung carcinomas, Lung biopsy interpretation in interstitial lung disease Distinguishing primary from metastatic lung carcinomas, common pleural tumors: - mesothelioma

- **Mediastinum**

- **Gross**

Wide excisions of tumors.

- **Skill**
Core biopsy in mediastinal tumors, Thymic tumors- classification and diagnosis.
- **Knowledge**
Diagnosis and approach to common tumors and cysts within the mediastinum.

▪ **Endocrine System**

- **Gross**
Thyroidectomy and parathyroid, adrenal excisions
- **Skill**
Diagnose goitre, papillary thyroid carcinoma, follicular carcinoma, adenoma in thyroid. Distinguish parathyroid hyperplasia from adenoma or carcinoma Distinguish adrenal adenoma from a carcinoma. Diagnose a Pituitary adenoma.
- **Knowledge**
Approach to evaluation of solitary thyroid nodule, Hurthle cell tumors, Types of thyroiditis, Graves' disease, Functional disorders of thyroid, Metabolic disorder associated with parathyroid hormone secretion. Clinical presentation and Investigations in secreting tumors of pituitary and adrenal gland, Multiple endocrine neoplasia.

▪ **Musculoskeletal system**

- **Gross**
Soft tissue tumor resections, Bone tumor and amputation grossing
- **Skill**
Common bone and soft tissue tumors
- **Knowledge**
Paget's disease of bone, osteomyelitis, Degenerative and dystrophic muscle disease, synovial diseases, Cytogenetic and immunohistochemistry in bone and soft tissue tumors, tumor like lesions, joint diseases and arthritis, metabolic bone disease and bone biopsy interpretation, synovial biopsy indications and evaluation

▪ **Pediatric pathology**

- **Gross**
Pediatric embryonal tumor excision grossing
- **Skill**
Inflammatory and neoplastic lesions in children Hirshsprung's disease evaluation.
- **Knowledge**
My fibroblastic tumors in children, common developmental pediatric tumors e.g. neuroblastoma, retinoblastoma, hepatoblastoma, Wilms tumors and rhabdomyosarcoma.

Course Outcomes:

- Grossing of all surgical specimens in keeping with protocol or guidelines for handling various specimens
- Identify and accurately describe the chief gross and microscopic alterations in the surgically removed specimens
- Correctly diagnose majority of the lesions received on an average day from the surgical service of a general hospital.
- Knowledge and incorporation of internationally approved terminology for classification of diseases
e.g. WHO and TNM staging for tumors.

- **AUTOPSY PATHOLOGY**

- **Objective**

Training to include

- To perform autopsies safely, eviscerate and dissect organs
- To lease with clinician and identify issues to be addressed by autopsy examination
- Correctly identify all major lesions which have caused, or contributed to, the patient's death on macroscopic examination.
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Course Details:

- **Cardiovascular**

- **Technique**

Demonstration of heart chambers, major vessels and coronaries. Demonstration of pulmonary embolism identification of abnormalities like infarcts and congenital anomalies.

- **Knowledge expected**

Normal age-related changes, All major pathologic processes involving valves and vessels, causes of cardiac failure, infarction, rheumatic heart disease, infective and non-infective endocarditis, cardiomyopathy, myocarditis, pericarditis and effusion, causes of sudden cardiac death, congenital heart disease, dissection of aorta, classification of vasculitis, aneurysms, tumors of vessels and heart

- **Respiratory**

- **Technique**

Dissection of bronchi and lung lobes Demonstration of pneumonia, air embolism, pneumothorax.

- **Knowledge expected**

Gross appearance of lung tumors, infarct, interstitial lung disease, pneumoconiosis, sarcoidosis, infections like tuberculosis, fungal infections etc, adult respiratory distress syndrome, drug, toxin and radiation induced injury, obstructive pulmonary disease, bronchial asthma, bronchiectasis, chronic bronchitis, emphysema, atelectasis, pulmonary hypertension, pleural effusion causes.

- **Gastrointestinal tract (GIT)**

- **Technique**

Dissection of entire system in continuity, Identification of ampulla of Vater Normal mucosal surface in entire GIT.

- **Knowledge expected**
Appearances of esophageal varices, distinguishing the various ulcerative lesions within the GIT, Diverticulitis, gangrenous changes etc.
 - **Hepatobiliary**
 - **Technique**
Removal of liver and dissecting the gall bladder and entire biliary tract, hepatic vein and portal vein.
 - **Knowledge expected**
Evaluation of different abnormal changes in liver in cirrhosis etc. Causes and spectrum of acute and chronic liver failure chronic and acute hepatitis, autoimmune hepatitis, alcoholic liver injury and alcoholic liver disease, Biliary obstruction, veno occlusive disorder, Budd Chiari syndrome, Portal hypertension effects and causes, cholecystitis, Acute and chronic pancreatitis Identification of tumors in the system.
 - **Male Genital**
 - **Technique**
Dissection of entire urinary system with kidneys and urinary bladder in continuity with vas deferens, prostate and testes.
 - **Knowledge expected**
Evaluation of abnormalities of kidney and pelvic/urinary system. Diseases affecting the male genitals.
 - **Endocrine**
 - **Technique**
Removal of pituitary, parathyroid, adrenal and thyroid glands.
 - **Knowledge expected**
Normal weights and gross abnormalities in these organs.
 - **Nervous**
 - **Technique**
Brain removal and slicing to demonstrate important brain nuclei, internal capsule, hypothalamus and other structures. Demonstration of circle of Willis.
 - **Knowledge expected**
Abnormal appearances of vessels, infarcts, atrophic changes and tumors. Arteriovenous malformations, cerebrovascular disease, increased intracranial pressure causes and effects.
 - **Lymphoreticular**
 - **Technique**
Examination of draining nodes in different systems. Spleen removal and examination. Collecting marrow.
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- **Knowledge expected**
Knowledge on common blood diseases and causes of nodal or spleen enlargement.
 - **Musculoskeletal**
 - **Technique**
Identify fractures and collecting muscle biopsy.
 - **Knowledge expected**
Pathological conditions affecting bone and soft tissue.
 - **Cytopathology**
 - **Gynaecologic cytology**
 - **Technique**
Technique for spreading and fixing a smear, specimen adequacy, how to screen a smear, knowledge of infections in cervical smears, picking up abnormal cells, understanding the Bethesda system of reporting cervical smears, understand reasons for cytology- histology discrepancy.
 - **Knowledge expected**
Smear taking techniques, Basic knowledge of colposcopy and treatment implications of abnormal cytology report, awareness of pitfalls and limitations of cervical smear screening.
 - **Non gynecologic exfoliative cytology**
 - **Technique**
Preparation and fixing of smears Diagnose malignancy in commonly investigated sites like pleural fluid, ascitic fluid and urine, distinguish from reactive mesothelial cells.
 - **Knowledge expected**
Knowledge of staining techniques, understand structuring of reports and histological correlation, understand pitfalls and artifacts in processing.
 - **Fine needle aspiration cytology (FNAC)**
 - **Technique**
Breast: Diagnose malignancy and fibroadenoma. Thyroid: Diagnose papillary carcinoma, approach to diagnosis of follicular lesions, medullary carcinoma and lymphoma. Lymph nodes: Recognize specific and nonspecific reactive lymphadenitis, diagnose metastatic carcinoma and lymphoma. Salivary gland: Diagnose pleomorphic adenoma, Warthin's tumor, adenoid cystic carcinoma. Diagnose cancer in Lung, Liver, Mediastinal and Abdominal FNAC.
 - **Knowledge expected**
Understand role of FNAC in diagnosis of lesions of thyroid, breast, node and salivary gland. Recognize when definitive diagnosis requires histology. Familiarity with processing of guided FNAC. Awareness of situations requiring multidisciplinary discussions.
 - **Miscellaneous**
 - **Technique**
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Knowledge of likely outcome of all diagnosis of malignancy or infections in unusual specimens (e.g., bile duct brushings).

- **Knowledge expected**

Quality assurance in cytology, audit of cervical screening programs, role of ancillary methods like immunocytochemistry and flow cytometry in common cancers.

Course Outcomes:

- To perform autopsies safely, eviscerate and dissect organs
- To liaise with clinician and identify issues to be addressed by autopsy examination
- Correctly identify all major lesions which have caused, or contributed to, the patient's death on macroscopic examination.

▪ **CLINICAL PATHOLOGY AND ROUTINE HEMATOLOGY**

• **Objective**

- Establish and direct a hematopathology laboratory that included clinical hematology, urine analysis, clinical microscopy, flow cytometry and diagnostic hematopathology.
- To provide consultation to clinicians on patient problems related to hematopathology. Training period: four-month rotation in the service, weekly didactic teaching and slide sessions.
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Course Details:

▪ **Blood Collection**

• **Technique**

Learn safe practices for patient blood collection, use of different anticoagulants for blood collection. Blood collection procedures for venous, capillary and from central lines.

• **Knowledge expected**

Understand physiological variation in samples.

▪ **Blood cell counters / Automated Hematology**

• **Technique**

Interpret results of automated and manual cell counts and scattergrams. Review abnormal results and correlate with peripheral blood smear findings and clinical history.

• **Knowledge expected**

Knowledge of the principles of automated cell counting including RBC indices and their derivation. Principles by which each instrument type arrives at a 5-part differential. Effect of nucleated RBC on WBC counting and appropriate WBC correction. Importance of absolute versus relative counts and the absolute neutrophil count (ANC) and its clinical utility. Principles of automated reticulocyte enumeration, pathophysiology and laboratory findings of major disorders causing anemia.

▪ **Peripheral smear analysis**

• **Technique**

Learn proper preparation and handling of peripheral blood smear. Learn normal RBC, WBC and platelet morphology. Estimate WBC and platelet counts. Recognize abnormal RBC, WBC and platelet morphology and interpret in a clinical context. Detection of parasites in peripheral blood.

• **Knowledge expected**

Knowledge of methods of staining peripheral thick and thin smear and troubleshooting. Knowledge of WBC, RBC and platelet disorders. Implications of abnormal peripheral smear findings. Knowledge of special types of smears and timing for collecting blood for detection

of parasites like microfilaria.

▪ **Blood indices, ESR, Reticulocyte counting**

• **Technique**

Methods to estimate hematocrit and blood indices. Perform manual hematocrit and ESR testing.

• **Knowledge expected**

Principle of estimation and abnormalities in erythrocyte sedimentation rate. Understand the principle and utility of supravital stains, reticulocyte stain and Heinz body demonstration.

▪ **Body fluid analysis (Pleural, ascitic fluid, CSF, synovial fluid)**

• **Technique**

Learn manual hemocytometer cell counting, Understand cytocentrifuge preparation and slide staining Identify blood and body fluid cell morphology Recognize malignant cells and recommend appropriate confirmatory tests. Identify organisms: bacteria, fungi, parasites

• **Knowledge expected**

Neuberg's chamber use and counting principle, Stains used to count cells in fluid, Knowledge of fluid composition in normal and pathologic states, ability to diagnose based on findings documented and Correlate with clinical history and other laboratory results.

Principles and use of dark field or fluorescent and polarized microscopy in fluid examination. Abnormalities seen and reporting of a semen sample in infertility. Special stain on fluid, India Ink preparation on CSF, Gram stain, Z N stain

▪ **Urine analysis**

• **Technique**

Interpret routine urinalysis (Cellular and chemical) and identify abnormal cells and organisms, Know to perform chemical tests in urine sample for pH, occult blood, protein, sugar chyluria, bile salts/ pigments, etc.

• **Knowledge expected**

Understand the principles of methods involved in urine chemistry and urine cytology by wet preparation examination. Understand indications for urinalysis Understand the principles of automated urine cytology analyzers.

▪ **Stool examination**

• **Technique**

Wet mount of stool for examination Identify abnormal cells, parasites. Learn to detect occult blood in stools.

• **Knowledge expected**

Knowledge of parasites in stool, their stages of development. Implications of detection of abnormalities.

Course Outcomes:

- Establish and direct a hematopathology laboratory that includes clinical hematology, urine analysis, clinical microscopy, flow cytometry and diagnostic hematopathology
- To provide consultation to clinicians on patient problems related to hematopathology.

▪ HEMATOPATHOLOGY

Course Details:

Subject like lymph node pathology and bone marrow trephine biopsy will be reported in the surgical pathology section while marrow aspirates and fluid hematology will be covered in 7th floor hematology laboratory and residents will rotate through Government/ Municipal hospital for non-neoplastic and immuno-hematopathology training.

▪ Bone marrow aspirates

• Skill

Work up an aspirate right from obtaining the peripheral blood smear, aspirate smear, relevant lab results /history to seeing cells

Learn normal aspirate cellular findings, approach to diagnose abnormal findings and integrate aspirate with trephine biopsy findings.

Recognize normal WBC, RBC and platelet maturation, as well as cellular dysplasia. Diagnosis of all common haematological conditions.

Stain and interpret cytochemical stains like Pearl/Iron stain, Myeloperoxidase, Non-Specific Esterase.

• Knowledge

Abnormalities detected in a marrow aspirate including abnormal cells, abnormal maturation, viral inclusions, marrow in storage disorders, diagnose iron overload, Marrow findings in refractory anemia's, leukaemia's and lymphomas. Understand the principle and clinical utility of cytochemical stains, their interpretation, and applications.

▪ Bone marrow trephine biopsy

• Skill

Learn technical aspects of performing and analyzing bone marrow aspiration and biopsy
Learn handling, preparation and interpretation of bone marrow biopsy specimen including special stains

(e. g. Wright's, LAP (Neutrophil Alkaline Phosphatase), Iron, Myeloperoxidase, Non-Specific Esterase, Tartrate Resistant Acid Phosphatase, Alkaline Phosphatase, Prussian blue)
Correctly assess bone marrow cellularity, storage iron and fibrosis. Recognize reactive bone marrow and abnormal infiltrates, effects of chemotherapy and growth factor stimulation on blood and bone marrow Diagnose and classify leukemia, hematolymphoid malignancies

• Knowledge

Know causes of cytopenias or aplastic marrow, integrate morphology, cytochemistry, immunophenotype and molecular and cytogenetics and render a preliminary diagnosis.

Knowledge of all subtypes of acute and chronic leukaemias, myeloproliferative disease, patterns of involvement by lymphoma.

▪ Flow Cytometry

• Skill

Observe lymphoma/leukemia panel performed on blood and/or bone marrow.

Clinical Presentation, morphology, evaluate and interpret results of flow cytometry in conjunction with cytochemistry Clinical Presentation, Morphology and immunohistochemistry studies

- **Knowledge**

Understand the physical components and operating principles of a flow cytometer and quality control procedures, Know the principles of routine flow cytometry evaluation of leukocytes, including both surface and intracellular markers, and recognize clonal abnormalities, principle of tests designed to evaluate the DNA content (ploidy) and cell cycle.

Understand the diagnostic, prognostic information provided by flow cytometry and lymphocyte subset analysis: know the commonly used antigens to define T helper, T suppressor, natural killer and B cell, Understand the characteristic clinical, morphologic, immunophenotypic, cytochemical and cytogenetic/molecular features of leukemia's, lymphomas and Plasma cell dyscrasias, Paroxysmal Nocturnal Hemoglobinuria.

- **Coagulation profile**

- **Skill**

Be able to perform coagulation tests like Prothrombin Time, Activated Partial Thromboplastin Time.

Interpret results of laboratory tests utilized in the management of bleeding and thrombotic disorders, Interpret results of coagulation tests in the setting of fibrinolytic therapy

Recognize platelet function abnormalities associated with acquired and congenital thrombocytopathies (thrombasthenia, Bernard Soulier Syndrome, Storage Pool Disease),

Interpret platelet function studies including platelet aggregation and secretion studies, and screening studies and "in vitro" screening tests of platelet function.

Interpret studies performed for the evaluation of vWD

- **Knowledge**

Develop basic understanding of haemostatic and thrombotic disorders Knowledge of the effect of hematocrit and blood drawing technique on anticoagulation of blood sample for coagulation testing.

principles of routine coagulation analysis (PT, APTT, fibrinogen, Thrombin Time), INR derivation and its clinical significance, principle of tests involved in monitoring heparins, laboratory evaluation of DIC, qualitative and quantitative testing. pathophysiology of the coagulation factor deficiencies tests involved in the identification of lupus anticoagulant and antiphospholipid antibody syndromes.

Interpret results of tests measuring components of the fibrinolytic system

Interpret results of test for thrombotic risk factor identification: Protein C, S, ATiii, and Activated Protein C Resistance.

Discuss risk factors leading to arterial and venous thromboembolic disease.

Understand the mechanism of action of platelet directed inhibitors and fibrinolytic agents, and their effects on laboratory testing.

- **Hemoglobinopathies**

- **Skill**

Be able to perform Sickling test and osmotic fragility test, Interpret an Hb electrophoretic pattern and diagnose major hemoglobinopathies (Sick cell anemia, alpha/beta thalassemia, Hgb E disease and Hgb C disease)

- **Knowledge**

Understand the role of Fe in RBC Production/haemoglobin synthesis. Describe Fe metabolism and laboratory tests for Fe (Serum ferritin Serum iron and total iron binding capacity) Understand Hemoglobin synthesis and degradation and genetic mechanisms in hemoglobinopathies.

Knowledge of principles of haemoglobin screening by HPLC and electrophoresis, osmotic fragility test, sickle solubility screening, Kleihauer Betke, Ancillary tests for the RBC disorders related to enzyme defects (G6PD deficiency, methemoglobinemia) / Hereditary spherocytosis/ Paroxysmal nocturnal hemoglobinuria/ Hemolytic Anemia / Congenital dyserythropoietic anemias Prenatal diagnosis of Thalassemias.

- **Platelet disorders**

- **Skill**

Perform manual estimation of platelets

- **Knowledge**

Knowledge of causes of Thrombocytopenia and thrombocytosis, Understand the principles of platelet discrimination and counting by automated hematology analyzers, Knowledge of platelet function tests and their uses.

Course Outcomes:

- Work up of an aspirate right from obtaining the peripheral blood smear, bone marrow aspirate smear, requesting relevant lab tests and obtaining history to microscopic examination.
- Learn normal aspirate cellular findings, approach to abnormal findings and integrate aspirate with trephine biopsy findings
- Recognize normal WBC, RBC and platelet maturation, as well as cellular dysplasia
- Diagnosis of all common hematological conditions including hemogloleukaemia and lymphomas.
- Recognize reactive bone marrow and abnormal infiltrates, effects of chemotherapy and growth factor stimulation on blood and bone marrow
- Evaluate and interpret results of flow cytometry in conjunction with morphology, cytochemistry, clinical presentation, and immunohistochemistry studies

■ IMMUNOLOGY

Course Details:

■ Cells of immune system

- **Skill**

Interpret lymphocyte immunophenotyping on flow cytometry data used to characterize leukocyte populations.

- **Knowledge**

Understand the growth and development of cells that comprise the immune system and the principles of structural and functional evaluation of &cells, T-cells, NK-cells, and phagocytic cells. Knowledge of the T-cell receptor end Ig rearrangement, HLA class I and class II molecules, pathways for acquired immune response, acquired immunodeficiency disorders.

Understand principles of neutrophil and phagocyte function assays, and methods to evaluate Understand the molecular changes in lymphoid neoplasms and be able to correlate with clinical behavior of disease and current and potential therapy.

■ Immunoglobulin - Quantitative and Qualitative Disorders

- **Skill**

Interpret the protein electrophoresis patterns observed in normal serum, normal plasma, normal urine, and in large monoclonal gammopathies such as multiple myeloma and Waldenstrom's macroglobulinemia.

- **Knowledge**

Knowledge of the basic biology of Immunoglobulins structures, classes of immunoglobulins, the type of immunoglobulin fragment and the principles of protein electrophoresis & immunofixation.

■ Proteins of Innate Immunity and Inflammation

- **Skill**

Knowledge of the role of the complement system or proteins in health and disease, complement protein measurements to assess inherited and acquired deficiency states, Understand the acute phase response and acute phase proteins, such as C-reactive protein, to assess inflammatory conditions.

Understand cytokines as mediators and markers of immune and inflammatory responses.

■ Transplant associated pathology

- **Skill**

Bone marrow and solid organ transplant - principles, GVHD typos and diagnosis, chimerism.

Course Outcomes:

- Interpret lymphocyte subset by immunophenotyping on flow cytometry and use data to characterize leukocyte populations

- Interpret the protein electrophoresis patterns observed in normal serum, normal plasma, normal urine, and in large monoclonal gammopathies such as multiple myeloma and Waldenstrom's macroglobulinemia.
- Knowledge of the role of the complement system or proteins in health and disease, complement protein measurements to assess inherited and acquired deficiency states, Understand the acute phase response and acute phase proteins, such as C-reactive protein, to assess inflammatory conditions.
- Understand cytokines as mediators and markers of immune and inflammatory responses.
- Bone marrow and solid organ transplant – principles, GVHD types and diagnosis, chimerism

▪ **TRANSFUSION MEDICINE**

Course Details:

The objective is to produce a specialist who possesses the competencies and skill to cope with the problems presented by every day in-hospital and outpatient Transfusion Medicine practice.

- **Donor selection and bleeding**
 - **Skill**

Good practices for collection of blood and bleeding donors, phlebotomy techniques.
 - **Knowledge**

Donor selection criteria, Donor counselling, donor notification associated with positive infectious disease testing results, blood bags and coagulants used in a blood bank, adverse reactions associated with blood donation/ phlebotomy (whole blood and aphaeresis donations)
Knowledge of handling massive transfusion protocols, Multiple transfusions, evaluating patient's refractory to platelet transfusions.
 - **Routine blood grouping and cross matching**
 - **Skill**

Procedure for correct identification of blood samples. Able to do ABO and Rh Grouping (cell and reverse), cross match procedure.
 - **Knowledge**

Knowledge of abnormal blood groups like Bombay O group, Lewis Blood Group Substance Secretors, non-secretors and ABO groups in saliva, identify ABO and Rh Discrepancies, weak antibodies, auto antibodies etc.
Demonstrate familiarity with the requirements of all applicable regulatory and accrediting agencies.
 - **Antibody**
 - **Skill**

Perform Direct Coombs (DoT) and Indirect Coombs Test (IAT)
 - **Knowledge**

Antibody Identification Procedure, Causes for warm and cold antibodies and handling transfusions in patients with these antibodies.
 - **Special techniques in blood bank**
 - **Knowledge**

Viral inactivation, autologous transfusion, therapeutic apheresis, plasma fractionation, Cryopreservation, leucodepletion and use of irradiated blood.
 - **Transfusion reactions**
-

- **Skill**
Recognize the symptoms and signs of hemolytic and non-hemolytic transfusion reactions.
- **Knowledge**
Pathophysiology, treatment, outcomes and prevention of non-infectious and infectious transfusion transmitted diseases. Knowledge of protocol for investigating a transfusion reaction and typing the exact nature.
- **Blood components**
 - **Skill**
Be able to review requests for blood components and discuss with the requesting physician, Collect blood for component preparation and know how to store blood components.
 - **Knowledge**
Steps in blood component and blood derivative preparation, Composition and Clinical use of common blood components: - Packed cells, platelets, granulocytes etc Artificial blood substitutes.
- **Transplantation**
 - **Knowledge**
Knowledge of HLA cross matching problems, Principles of hemopoietic stem cell transplantation including collection, processing, and storage of these stem cell products, and the marrow peripheral blood, and cord blood.

Course Outcomes:

- Good practice for collection of blood and bleeding donors, phlebotomy techniques.
- Procedure for correct identification of blood sample and to perform ABO and Rh Grouping (cell and reverse), cross match procedure, Direct Coombs (DCT) and Indirect Coombs Test (IAT)
- Recognize the symptoms and signs of hemolytic and non-hemolytic transfusion reactions,
- To be able to review requests for blood components and discuss with the requesting physician,
- Collect blood for component preparation and know how to store blood components

▪ **BIOCHEMISTRY / LABORATORY MEDICINE**

Course Details:

AIM

- Plan and organize the work flow in a routine clinical pathology laboratory in keeping with good laboratory practices.
- Be able to correctly interpret the laboratory data of such studies, and discuss their significance with a view to arrive at a diagnosis.

▪ **Laboratory instrumentation**

- **Skill**
Handling and use of automated biochemical analyzers.

- **Knowledge**
Principle of instrumentation, use and application of

- Photoelectric colorimeter
- Spectrophotometer
- pH meter
- Centrifuge
- Analytical balance
- Electrophoresis apparatus
- Electrolyte Analyzer
- Osmometer

Prepare standard solutions and reagents relevant to the above tests, including the preparation of normal solution, molar solution and Buffers.

▪ **Routine biochemical investigations**

- **Skill**
Independently perform the Quantitative Estimations by Manual / Automated Techniques: Blood urea, Blood sugar, Albumin, Serum Proteins (total & fractional) Serum Cholesterol, Serum Creatinine Knowledge of manual evaluation of the tests listed above is desirable.

- **Knowledge**
Normal values and units for each of the investigations, significance and interpretation of an abnormal result Demonstrate familiarity with the following Quantitative Estimation by Automated Techniques Cholesterol, Proteins, Billirubin (Total & Direct) Uric acid. Serum Transaminases (ALT and AST/SGOT and SGPT) Serum Alkaline Phosphatase Creatinine.
Biochemical principles involved in the estimation of Renal function test, Liver function test, Gastric and Pancreatic function, Endocrine function test and Tests for malabsorption.

▪ **Arterial, Capillary, & Venous blood gas analysis**

- **Skill**
Familiarity with use of machines used for the blood gas analysis Interpret results generated

and ability to diagnose conditions based on same.

- **Knowledge**

Knowledge of causes of electrolyte imbalances - Serum Electrolyte (Na⁺ and K⁺), Serum calcium and phosphorous, etc.

- **Tumor Markers**

- **Skill**

Interpretation of Electrophoresis in Multiple Myeloma/ Abnormal proteins.

- **Knowledge**

Automated procedures for Estimation of protein Electrophoresis, Immunofixation, Quantitation of immunoglobulins, Bence Jones Proteins Significance and reference values Background of Tumour markers, New Tumour Markers Principle of Enzyme Immuno Assay, Radio Immuno Assay.

- **Quality control and Automation in a laboratory**

- **Skill**

Know the principles, advantages and disadvantages scope limitation of Automation in laboratory, Types of methods used to monitor quality in a routine laboratory, use of standards for routine biochemical testing, Levy Jennings chart etc. Accreditation in Biochemistry, Proficiency Testing (EQAS), and peer evaluation.

Course Outcomes:

- Plan and organize the work flow in a routine clinical pathology laboratory in keeping with good laboratory practices.
- Be able to correctly interpret the laboratory data of such studies, and discuss their significance with a view to arrive at a diagnosis.

▪ **MOLECULAR PATHOLOGY**

Course Details:

- Basic structure of DNA/RNA, Various techniques used in molecular pathology, principles, scope and limitations
- **Reverse Transcriptase Polymerase Chain Reaction (RT-PCR)**
 - **Knowledge**
Principle, steps in technique, role in diagnostic pathology and infectious diseases, advantages and disadvantages, modifications of technique such as real time PCR, qPCR etc.
- **Fluorescent In Situ Hybridization (FISH)**
 - **Knowledge**
Principle, technique, advantages and disadvantages of hybridization procedures. Role in diagnostic pathology and neoplasia, Types of FISH - interphase, metaphase.
- **Other Techniques**
 - **Knowledge**
Southern Blot/ Northern Blot and Western Blot techniques.

Course Outcomes:

- To know the basic structure of DNA / RNA, Various techniques used in molecular pathology, principles, scope and limitations
- Basics of PCR, FISH, Sequencing, NGS Principle, steps in technique, role in diagnostic pathology and infectious diseases, advantages and disadvantages, modifications of technique.

▪ **CYTOGENETICS**

Course Details:

▪ **Tissue culture and karyotyping**

- **Knowledge**

Demonstrate familiarity with methods of tissue culture and karyotyping in medical cytogenetics and cancer cytogenetics on peripheral blood culture, amniotic fluid culture, bone marrow aspiration culture Basic cytogenetics nomenclature.

▪ **Molecular cytogenetics**

- **Knowledge**

Advanced technologies of molecular cytogenetics such as FISH, CGH. Role of cytogenetics in diagnostic pathology, haematological malignancies, solid tumors and patient management.

Course Outcomes:

- Demonstrate familiarity with methods of tissue culture and karyotyping in medical cytogenetics and cancer cytogenetics on peripheral blood culture, amniotic fluid culture, bone marrow aspiration culture and basic cytogenetics nomenclature
- Advanced technologies of molecular cytogenetics such as FISH, CGH
- Role of cytogenetics in diagnostic pathology, hematological malignancies, solid tumors and patient management

▪ **MEDICAL STATISTICS**

Course Details:

▪ **Principles of medical Statistics**

- **Skill**

Calculate means, standard deviation and standard error from the given experimental data.

- **Knowledge**

Demonstrate familiarity with importance of statistical methods in assessing data from patient material and experimental studies e.g. correlation coefficients, expected versus observed, etc and their interpretation Use of SPSS program.

Course Outcomes:

- Demonstrate familiarity with importance of statistical methods in assessing data from patient material and experimental studies e.g. correlation coefficients, expected versus observed, etc. and their interpretation.
- Use of SPSS program

▪ **Library / Information Retrieval/ Web Search Engines in Medicine**

Course Details:

▪ **Skill**

Online access for all journals listed in the curriculum Use of Web based search engines, pubmed for research, case studies and thesis.

▪ **Knowledge**

To get acquainted with the digital library, its services and the effective use of e-resources information to further their knowledge and to supplement conventional reading.

Course Outcomes:

- To get acquainted with digital library, its services and the effective use of e-resources information to further their knowledge and to supplement conventional reading.

General Pathology Training Schedule

Aims

Theoretical knowledge of basics of all disease processes:

- **Cell Injury & Death**
 - Causes of cell injury.
 - Reversible and irreversible cell injury.
 - Mechanisms of cell injury and Structural changes
 - Necrosis: definition, types of necrosis
 - Apoptosis: definition, causes, morphology and mechanisms. Systemic effects of cell injury.

- **Cellular adaptations to injury**
 - Growth disturbances: atrophy, hypertrophy, hyperplasia, metaplasia, dysplasia.
 - Intracellular accumulations: fatty change, cholesterol and cholesterolesters, proteins, glycogen.
 - Pigments: exogenous and endogenous. Lipofuscin, melanin, haemosiderin, bilirubin, haematin.
 - Matrix changes : Pathology of collagen, elastin, basement membranes. Amyloid. Pathological calcification; dystrophic and metastatic. Crystal depositions - Uric acid deposition.

- **Tissue Responses to Injury**
 - Inflammation - Definition; Acute /Chronic inflammation. Definition; primary causes, Cells involved; Chemical mediators. Granulomatous inflammation: definition of a granuloma; causes; morphology. Special macroscopic appearances in certain tissues.
Healing, Regeneration & Repair

 - Vascular Disturbances - Oedema, Hyperaemia and congestion, Haemorrhage, Ischaemia, Thrombosis, Fate of thrombi; Embolism, Infarction, Shock, Atherosclerosis, Neoplasia
 - Definition and terminology.
 - Definition of benign and malignant tumours
 - Nomenclature of neoplasms.
 - The biology of neoplasms: immortalisation, DNA abnormalities, mitosis and apoptosis in neoplasms, metabolic abnormalities.
 - The molecular basis of cancer: oncogenes, suppressor genes, regulatory genes of apoptosis, DNA repair genes.
 - Molecular basis of invasion and metastases.
 - Carcinogenic agents
 - Multistep hypothesis of carcinogenesis.
 - Epidemiology of cancer Host factors in carcinogenesis;
 - Host defence, cell mediated and humeral immunity.
 - Clinical effects of neoplasia: local effects, general effects; cachexia and paraneoplastic syndromes.

- Ancillary methods is; morphological techniques, excision/biopsy, fine-needle aspiration, cytology, immunocytochemistry, flow cytometry
 - Biochemical assays for tumour markers
 - Molecular diagnosis
 - DNA microarray analysis
 - Prognostic factors: type of tumour, grading and staging of tumours. Tumour dormancy.
- Infections & Parasitic Diseases

Importance of infections & parasitic diseases

- Changing patterns; effects of travel, change in the environment, new infectious diseases.
- Methods of identifying organisms in tissues. Types of reaction in tissues to the presence of an organism. Interaction with hosts immune state

General pathology of diseases caused by bacteria, viruses, fungi, parasites and prions.

Selected examples to illustrate mode of spread, tissue reaction, identification of organism in tissues, type of disease and host modifying factors.

▪ **Environmental Pathology**

▪ **Inhaled pollutants**

- Air pollution and occupational dust diseases (pneumoconiosis)*. *(Covered in lectures on respiratory diseases).
- Enumeration of diseases associated with smoking.

▪ **Chemical injury:**

- Organic and inorganic compounds, metals, gases, toxic mushrooms.
- The pathology of alcohol (covered in 4th medical year) and drug abuse.
- Adverse reactions of therapeutic drugs.

▪ **Physical agents**

- Mechanical trauma, thermal injury, atmospheric pressure, electrical injury, ultraviolet light, ionising radiation injury (mechanisms and morphological changes, complications of radiotherapy, whole body radiation).

▪ **Nutritional Pathology**

- Causes and effects of malnutrition. Protein-energy malnutrition. Anorexia nervosa and bulimia.
- Vitamin deficiencies and vitamin toxicity.
- Trace elements and disease

10. ASSESSMENT

▪ Purpose of assessment

This assessment seeks at evaluating students in the areas they were trained within the period. A standardized scheme is necessary to train candidates in any teaching program

▪ Method of assessment

Log book (Work Diary): Record of Three Years

- The postgraduate students should record all their activities in a log book includes duration of posting, the period of absence if any, skills performed, and remarks if any by teacher/ faculty member
- The log book should also record journal clubs, seminars attended, **I part taken** as well as undergraduate and paramedical teaching activities the candidate has participated
- Annual assessment based on the work diary shall be done by the PG teacher and Head of the Department

First year assessment (External & Internal): Total Marks 500

- Multiple choice question I MCQ paper (Hematology & Surgical Pathology) = 220 marks
- Brief answer question paper comprising 10 questions X 10 marks= 100 marks
- Microscopy test (10 slides X 5 marks) = 50 marks
- Thesis status discussion by external assessor 30 marks
- General Viva= 100 marks

Final year examination: Total marks 800

a) Essay paper - 400 marks

There shall be four theory papers of 100 marks each

Paper I - General pathology including general neoplasia, immunopathology and cytopathology Paper

II - Systemic Pathology including Systemic Neoplasia

Paper III - Hematology, Transfusion Medicine, Immunohematology, including recent advances Paper

IV - Clinical Pathology, Chemical Pathology, Pathology of Infectious Diseases, Recent Advances

b) Practical examination-400marks

Details of exercises and marks

- Histopathology Slides (25slides X 5 marks each)- 125 marks
- Clinical case - 75 marks
 - Urine Examination
 - Biochemical Test
 - Hemogram
 - Special Hematology test
 - Case Discussion

- Hematology and Cytology Slides (15 slides X 5 marks each) - 75 marks
- Gross/ Morbid Anatomy - 35 marks
 - Seven spots of Gross specimens (7 X 5 marks each) and no viva for the same

- Autopsy/Reconstructed Autopsy - 20 marks
Student have to do internal or external examination of dead body in post mortem room

- Histopathology Techniques - 15 marks
 - To perform H & E staining
 - Block cutting on microtome
 - To perform special stains
 - Viva for the same

- Serology technique - 15 marks
 - Blood grouping
 - Cross matching
 - OCT! ICT titre
 - Viva for the same

c) Viva Voce Examination - 40 marks Includes thesis discussion

d) Dissertation

Date of submission: Six months before the Final Examination

Aims:

To encourage the spirit of enquiry, inventiveness and inculcate aptitude for research.

Objectives:

- Discern and recognize areas where research is informative and useful to improve medical practice.
- Assimilate/ analyze data and compare results from similar studies in past or in latest world literature.

General Guidelines:

- Dissertation based on research work is aimed at encouraging a spirit of enquiry, aptitude for research, critical analysis of methods and results in the light of the latest developments in medicine.

- All students registered for the course will have to submit dissertation/thesis work during the course. The research work done independently by the candidate under the guidance of his guide should be the basis of the dissertation.

- Prior sanction - IRS review

If the research work involves coordination or collaboration with another department, a suitable co-guide from that department from among the PG teachers may be designated by the Head of the Institution.

If the PG guide becomes unavailable, on account of transfer, retirement etc in the last two terms of training, the student may be allowed to continue under the same guide and sign the required certificate with specific approval from the University. If the guide becomes unavailable earlier than the 5th term, a new guide has to be assigned to the student. The new guide cannot be assigned for another PG student for the next term or next two terms as the case may be.

The age limit for PG teachers for guiding students shall be 65 years.

Once the dissertation is accepted, the candidate can appear for the final examination for up to 4 years. Any candidate failing to appear in the final examination within 4 years, will be required to undergo training again for a period of 4 terms before appearing for degree examination.

Grading of students

Criteria for passing: Minimum 50% of total marks in each paper and practicals separately

READING MATERIAL

A complete list of reading material is extremely difficult to provide for the postgraduate student in Pathology. In any postgraduate course reading should not be limited only to the subject of specialization. One is expected to acquire as much theoretical and practical knowledge as possible. There can be no set guidelines in this regard. Students must be encouraged to utilise the Internet and similar information technologies to further their knowledge and to supplement conventional reading. The following is an incomplete list of reading material that may be helpful to a postgraduate student of Pathology. The habit of referring to current literature and the method of searching for literature must be made a mandatory component of the training.

Journals and Periodicals

- Acta Cytologica
- The American Journal of Pathology
- The American Journal of Surgical Pathology The American Journal of Hematology
- The American Journal of Clinical Pathology Archives of Pathology and Laboratory Medicine
British Journal of Haematology
- Blood
- Diagnostic Cytopathology Histopathology
- Human Pathology
- Indian Journal of Cytology
- Indian Journal of Pathology and Microbiology Journal of Pathology
- Journal of Clinical Pathology
- Laboratory Investigation
- Modern Pathology
- Pathology
- Seminars in Hematology
- Seminars in Diagnostic
Pathology
- Virchows Archives
- Year Book Series
- Recent Advances Series

The list of journals is incomplete. It is also expected that the students make it a habit to read other journals because pathology is not confined to pathology journals alone. Specialty journals such as those related to oncology (Cancer, British Journal of Cancer, International Journal of Cancer, Cancer Research, Journal of National Cancer Institute, Journal of Surgical Oncology etc.) are excellent sources of information regarding the pathology of tumors. Similarly journals related to Cardiology, Chest Diseases, Dermatology, Endocrinology, Gynecology, Gastroenterology, Hepatology, Nephrology, Neurology, Neurosurgery, etc. are invaluable sources of material on the appropriate pathology. Further Journals such as Lancet, New England Journal of Medicine, Nature and Science are a must for every postgraduate student who wishes to keep abreast with what is new in medical science and therefore in pathology.

- Histology for Pathologists. Stephen S. Sternberg (Ed), Raven Press, New York.
- General Pathology JB Walter, MS Israel. Churchill Livingstone, Edinburgh
- Robbin's Pathologic Basis of Disease Ramzi S.Cotran, Vinay Kumar, Stanley L Robbins WB Saunders Co., Philadelphia.
- Pathology Emanuel Rubin, John L Farber. JB Lippincott Co., Philadelphia Anderson's Pathology. John M Kissane (Ed). The CV Mosby Co., St Louis
- Ackerman's Surgical Pathology. Juan Rosai Mosby. St. Louis
- Diagnostic Surgical Pathology. Stephen S Sternberg. Lippincott, William Wilkins. Philadelphia
- Systemic Pathology. W St. C Symmers (Series Ed) Churchill Livingstone, Edinburgh Diagnostic Histopathology of Tumours. Christopher OM Fletcher (Ed). Churchill Livingstone. Edinburgh.
- Soft Tissue Tumors. Franz M Enzinger, Sharon W Weiss. Mosby, St. Louis Cardiovascular Pathology Malcolm D Silver Churchill Livingstone New York. Pathology of Pulmonary Diseases Mario J Saldhana. JB Lippincott Co., Philadelphia Spencer's Pathology of the Lung. PS Hasleton. Mc Graw-Hill, New York.
- Dahlin's Bone Tumors. K Krishnan Unni. Lippincott-Raven Publishers, Philadelphia, New York Bone Tumours Andrew G Huvos WB Saunders Co. Philadelphia
- Greenfield's Neuropathology. J Hume Adams (Ed) Edward Arnold, London.
- Russell & Rubenstein's Pathology of the Tumours of the Nervous System. Darrell D Bigna. Roger E Mc Lendon, Janet M Bruner (Eds.), Arnold, London
- Rosen's Breast Pathology. Paul Peter Rosen. Lippincott-Raven Publishers, Philadelphia, New York.
- Pathology of the Gastrointestinal Tract. S-1Chun Ming. Harvey Goldman (Eds.) Williams & Wilkins, Baltimore.
- Haynes and Taylor Obstetrical & Gynaecological Pathology. H Fox, M Wells. Churchill Livingstone New York.
- Heptinstall's Pathology of the Kidney. J Charles Jenette, Jean L Olson, Melvin M Schwartz,

- Fred G Silva (Eds.). Lippincott-Raven Publishers, Philadelphia, New York.
- Potter's Pathology of the Fetus & Infant. Enid Gilbert-Barnes (Ed). Mosby, St. Louis
- Lever's Histopathology of the Skin, David Elder (Ed), Lippincott-Raven Publishers, Philadelphia, New York
- Theory and Practice of Histological Techniques, Bancroft JD, Stevens A, Turner DR, Churchill Livingstone, Edinburgh
- Histotechnology - A Self Instructional Text, Carlson FL, American Society of Clinical Pathologists, Chicago
- Histochemistry Theoretical and Applied. AG Everson Pearse. Churchill Livingstone, Edinburgh Manual & Atlas of Fine Needle Aspiration Cytology. Svante R Orell, Gregory F Sterrett, Max NI. Walters, Darrel Whitaker. Churchill Livingstone, London
- Cytopathology. Zuher M Naib. Little Brown and Company, Boston.
- Diagnostic Cytology and its Histopathologic Basis, Koss LG, J.B. Lippincott, Philadelphia

Comprehensive Cytopathology, Bibbo M, W.B. Saunders Co.. Philadelphia

- William's Hematology Beutler E, Lichtmann MA, Coller BS, Kipps TJ, McGraw Hill, New York Postgraduate Hematology Hoffbrand AV, Lewis SM, Tuddenham EGO, Butterworth Heinemann, Oxford
- Wintrobe's Clinical Hematology, Lee GR, Foerster J, Lupeus J, Paraskevas F, Gveer JP, Rodgers GN, Williams & Wilkins, Baltimore
- Practical Haematology, Dacie JV, Lewis SM, Churchill Livingstone, Edinburgh Bone Marrow Pathology, Bain BJ, Clark OM, Lampert IA, Blackwell Science, Oxford
- Leukemia Diagnosis- A guide to the FAB Classification, Bain BJ, J.B. Lippincott. Philadelphia Clinical Diagnosis and Management by Laboratory Methods, Henry JB, WB Saunders.(Indian Edition, Eastern Press, Bangalore).