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# MD PATHOLOGY CURRICULUM

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ACADEMIC SECTION  
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**PATHOLOGY – M. D.****1. BROAD GOALS AND PROGRAMME OUTCOME:**

The goals of MD Pathology course are to produce a specialist who is competent to provide a laboratory-based diagnosis of illness, is able to teach undergraduates and to a certain extent postgraduate, and should have an idea regarding the rudiments of research. He or she should on successfully completing the training and examination be:

1.1 Capable of offering a high-quality diagnostic opinion in a given clinical situation with an appropriate and relevant sample of tissue, blood, body fluid, etc. for the purpose of diagnosis and management of the patient.

*1.1.A. It must be emphasized that with the development of newer specialized areas such as Molecular Biology and Laboratory Medicine, the MD (Pathology) may not be sufficient to train and equip candidates to be equally versatile in these specialties which may have been partly under the realm of Pathology. Therefore, appropriate expectations need to be drawn from time to time. For example, it is likely that in future, Hematology as is practiced by Pathologists in this country today, maybe the subject of the super-specialist Hematologist. It is however to be expected that the MD (Pathology) course of Indian Universities should provide sufficient training, competence and confidence in practice and diagnosis related to Histopathology (Surgical Pathology), Cytopathology, Clinical pathology, Hematology & Blood-Banking. Wherever possible the course should provide an opportunity to give some knowledge of the newer diagnostic specialties so that the candidate on qualifying in MD (Pathology) should be able to pursue further specialization and training in these fields.*

1.2 Interpretive skills at both macroscopic and microscopic levels such that clinically useful opinions can be produced from the materials and specimens and from the findings of post-mortem examinations.

1.3 The skill to teach and share his knowledge and competence with others

*1.3.A. Pathology forms the basis of understanding, diagnosis and hence the treatment of diseases. It is therefore an essential subject in the training and curriculum of various undergraduate and postgraduate courses of medicine and allied disciplines such as nursing etc. The MD (Pathology) course should therefore provide an opportunity to candidates to teach colleagues and students. There is a dearth of inspiring teachers and hence the course should attempt to bring out the best of such talents in these candidates so that, when given an opportunity, the successful candidate is equipped to take this responsibility in an academic institution. It is also expected that this aspect of the training of the candidate will enhance the capacity of expression and ability to explain scientific data in simple and unambiguous terms.*

#### 1.4 Capable of pursuing clinical and laboratory-based research.

1.4.A. *The training should include means by which the student can pursue research either independently or as a part of a team. This would inculcate a spirit of enquiry and also make it possible to accurately record observations, analyze rationally and arrive at an unbiased conclusion of problems. This entire facet is essential to the overall practice of Pathology. It is recommended that a Thesis or Dissertation be included as a part of partial fulfillment to the award of the degree of MD (Pathology).*

## 2. SUBJECT-SPECIFIC LEARNING OBJECTIVES

### 2.1 Cognitive Domain

- 2.1.0 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).
- 2.1.1 Interpret clinical and laboratory data with reasonable accuracy.
- 2.1.2 Able to correlate clinical and pathology data so that various clinical signs, symptoms and manifestations of disease can be correlated and explained.
- 2.1.3 Advice on the nature of appropriate specimens and the tests necessary to arrive at a diagnosis in a difficult or problematic case.
- 2.1.4 To be able to correlate clinical and laboratory findings with pathology findings at autopsy, identify discorrelations and the causes of death due to diseases (apart from purely metabolic causes).
- 2.1.5 Should be able to teach Pathology to undergraduates, postgraduates, nurses and paramedical staff including laboratory personnel.
- 2.1.6 Carry out research and be able to systematically write a scientific paper and publish in journal.
- 2.1.7 Maintain accurate records of tests and their results for reasonable periods of time so that these may be retrieved as and when necessary.
- 2.1.8 Make and record observations systematically that is of use for archival purposes and for furthering the knowledge of Pathology.
- 2.1.9 Able to systematically write a paper and publish in a journal.
- 2.1.10 Able to present a paper in a conference through an oral presentation and poster presentation.
- 2.1.11 Should be able to identify problems in the laboratory and offer solutions thereof so that a high order of quality control is maintained.
- 2.1.12 Should be capable of effectively disposing laboratory waste to ensure minimisation of risk

to infection and accidents to laboratory personnel.

- 2.1.13 Able to supervise and work with subordinates and colleagues in a laboratory.
- 2.1.14 Subject himself/herself to continuing education and constantly update his/her knowledge of recent advances in Pathology and allied subjects.

## 2.2 Psychomotor Domain

- 2.2.1 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.
- 2.2.2 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. It is implied that the complications of these procedures and handling of complications are apparent. Further, whenever necessary must be able to provide appropriate help to colleagues performing an invasive procedure such as a biopsy or an imaging guided biopsy.
- 2.2.3 Perform an autopsy, dissect various organ complexes and display the gross findings.
- 2.2.4 Should be familiar with the function, handling and routine care of equipment in the laboratory.

## 2.3 Affective Domain

- 2.3.1 Should be able to function as a part of a team that is essential for the diagnosis and management of a patient. He/she should therefore develop an attitude of cooperation with his/her colleagues so necessary for this purpose. It is implied that he/she will whenever necessarily interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
- 2.3.2 Always adopt ethical principles and maintain proper etiquette in his/her dealings with patients, relatives and other health personnel.
- 2.3.3 Respect the rights of the patient including the right to information and second opinion.
- 2.3.4 Should seek and give second opinion only where necessary.
- 2.3.5 Provide leadership and inspire members of the team with whom he/she is involved with in the fields of diagnostic pathology, teaching and research.
- 2.3.6 Develop communication skills not only to word reports and professional opinions but also to interact with patients, relatives, peers and paramedical staff.

## 3. COURSE DESCRIPTION

### 3.1 Duration of Course

It's recommended that the course of Doctor of Medicine (Pathology) or M.D. (Pathology) be of THREE YEARS duration in the form of a Residency Programme that is FULL TIME.

### 3.2 Eligibility

- 3.2.1 The essential qualification shall be MBBS Degree of any Indian University/ Deemed University/Autonomous Institutions etc., as recognised by the Medical Council of India (MCI).
- 3.2.2 Postgraduate Diploma in Clinical Pathology (DCP) may be taken as an added qualification for the eligibility of a candidate only if such a clause is recognized by the rules and regulations of any particular university/ deemed university/autonomous institution etc.
- 3.2.3 Any other qualification of a foreign university that is recognized by the MCI and the concerned university as equivalent to the MBBS Degree.

*3.2.3.A. The guidelines in such situations are obviously beyond the scope of this curriculum and can be provided by the competent authorities only.*

### 3.3 Selection

It is recommended that the selection be made on the basis of an entrance examination with Multiple Choice Questions of the level of MBBS, including all subjects of the MCI recognized MBBS course and preferably with at least 10% of questions testing cognition in Pathology. A separate additional paper in Pathology (predominantly MBBS level with 10% questions testing higher levels) would be ideal.

*3.3.A. It is appreciated that individual universities or equivalent bodies/institutions will have their own methods of selection.*

## 4. SCOPE OF TRAINING

While professional training in all branches is equally important, since they are inter-dependent and competitive, a balance of emphasis is desirable, as a guideline to the student. It must be appreciated that within the time period of the Training Programme which covers a wide range of subjects and subspecialties, it is difficult, if not impossible, to achieve full proficiency in all the technological methods and available theoretical knowledge. The following categorization is recommended.

### 4.1 High Degree of Professional Competence

In the following fields in which a high degree of professional competence and theoretical knowledge is expected. The candidate is expected to know both the theoretical as well as practical aspects especially related to diagnosis of appropriate diseases.

#### 4.1.1 Pathologic Anatomy (Surgical Pathology and Cytopathology)

The study of Pathologic Anatomy includes all aspects of Pathology as encompassed in the branches of General Pathology and Systemic Pathology. Therefore, only the broad outlines are provided and a compendium of chapters as available in standard books is avoided.

#### 4.1.1.1 General Pathology:

Normal cell and tissue structure and function. The changes in cellular structure and function in disease. Causes of disease and its pathogenesis. Reaction of cells, tissues, organ systems and the body as a whole to various sublethal and lethal injury.

*4.1.1.1.A. The scope of General Pathology is vast and the above is a guideline that in essence covers all aspects.*

#### 4.1.1.2 Systemic Pathology:

The study of normal structure and function of various organ systems and the etiopathogenesis, gross and microscopic alterations of structure and function of these organ systems in disease.

*4.1.1.2.A. All organ systems are to be studied. This forms the basis of Histopathology (Surgical Pathology), Cytopathology, Autopsy Pathology and clinico-pathological correlation.*

#### 4.1.2 Haematology

The study of Haematology includes all aspects of the diseases of the blood and bone marrow. This would involve the study of the normal and the causes of diseases and the changes thereof.

#### 4.2 Reasonable working knowledge

In the following fields the student is expected to achieve reasonable working knowledge and diagnosticskill, and be able to run independently a routine service in a teaching hospital, and if necessary, at somefuture date, with some additional effort acquire the level of competence as in 4.1. Some centers have separate degrees/diplomas/postgraduate courses for some of these subjects. However, the current practice of pathology, both institutional or otherwise demands a reasonable working knowledge of these subjects, and therefore until such time as the situation demands, these subjects should be an integral part of post-graduate training in pathology.

4.2.1 Laboratory Medicine (Clinical Chemistry/Clinical Biochemistry/Chemical Pathology and Microscopy/Clinical Pathology including Parasitology).

4.2.2 Transfusion Medicine (Blood–Banking).

#### 4.3 General Acquaintance

Following are the fields in which the student is expected to acquire a general acquaintance of techniquesand principles and competence to understand and interpret data without being called upon to achieve technologic proficiency.

4.3.1 Immunopathology

4.3.2 Electron microscopy

4.3.3 Histochemistry

4.3.4 Immunohistochemistry

- 4.3.5 Use of radioisotopes
- 4.3.6 Cytogenetics
- 4.3.7 Tissue culture
- 4.3.8 Medical statistics
- 4.3.9 Molecular Biology
- 4.3.10 Maintenance of records
- 4.3.11 Information retrieval, Computer, Internet in medicine.

*4.3.A. It is expected that the level of proficiency that is to be expected may vary. Therefore, the level of competence in Immunopathology assumes importance in the interpretation of renal diseases. Similarly, the findings on Immunohistochemistry may be as important as the findings on light microscopy in a particular case.*

## 5. SYLLABUS

Unlike the undergraduate syllabus, it is difficult to give a precise outline of the Course Content for postgraduate training. A postgraduate appearing for the MD degree is supposed to have acquired not only professional competence expected of a well-trained specialist but also academic maturity, a capacity to reason and critical analyze a set of scientific data. He is supposed to keep himself *au courant* with the latest developments in the field of pathology and related sciences. A brief outline of what is expected to have learned during each of the postings in the different sections/laboratories during the MDCourse will be given under each head.

### 5.1 Surgical Pathology

#### 5.1.1 Knowledge

5.1.1.1 The student should be able to demonstrate understanding of the histogenetic and pathophysiologic processes associated with various lesions during discussions with colleagues, clinicians, students, and patients.

5.1.1.2 Should be able to identify problems in the laboratory and offer viable solutions.

#### 5.1.2 Skills

5.1.2.1 Given the clinical and operative data, the student should be able to identify, and systematically and accurately describe the chief gross anatomic alterations in the surgically removed specimens and be able to correctly diagnose at least 80percent of the lesions received on an average day from the surgical service of an average teaching hospital.

5.1.2.2 A student will be able to demonstrate ability to perform a systematic gross examination of the tissues including the taking of appropriate tissue sections and in special cases as in intestinal mucosal biopsies, muscle biopsies and nerve biopsies, demonstrate

the orientation of tissues in paraffin blocks.

5.1.2.3 Given the relevant clinical, operative and radiological data, the student should be able to identify and systematically and accurately describe the chief histo-morphological alterations in the tissue received in the surgical pathology service. He/she should also correctly interpret and as far as possible, correlate with the clinical data to diagnose at least 90% of the routine surgical material received on an average day. He/she should be able to diagnose at least 75% of the classical lesions being commonly encountered in the surgical pathology service without the aid of clinical data.

5.1.2.4 Start the automatic tissue-processing machine and verbally demonstrate his understanding of the principles of its running.

5.1.2.5 Process a tissue, make a paraffin block, and cut sections of good quality on a rotary microtome.

5.1.2.6 Select appropriate blocks to show lesions in relevant planes of section, including using protocols for minimum datasets where relevant.

5.1.2.7 Handle different types of specimen appropriately according to the degree of clinical urgency.

5.1.2.8 Stain paraffin sections with at least the following:

- (i) Haematoxylin and eosin
- (ii) Stains for collagen, elastic fibers, and reticulin
- (iii) Iron stain
- (iv) PAS stain

5.1.2.9 Demonstrate understanding of the principles of:

- (i) Fixation of tissues
- (ii) Processing of tissues for section cutting
- (iii) Section cutting and maintenance of related equipment
- (iv) Differential (Special) stains and their utility

5.1.2.10 Cut a frozen section of tissues received from the operating room for quick diagnosis, stain and interpret the slide in correlation with the clinical data provided, and correctly diagnose at least 75 percent of the lesions within 15 minutes.

5.1.2.11 Demonstrate the understanding of the utility of various immunohistochemical stains especially in the diagnosis of tumor subtypes.

5.1.2.12 Practice in writing histopathology reports in their appropriate format.

## 5.2 Autopsy Pathology

### 5.2.1 Knowledge

5.2.1.1 Should be aware of the technique of autopsy.

**5.2.1.2** Should have sufficient understanding of various disease processes so that a meaningful clinicopathological correlation can be made.

### 5.2.2 Skills

5.2.2.1 Demonstrate ability to perform a complete autopsy independently with some physical assistance, correctly following the prescribed instructions. Correctly identify all major lesions which have caused, or contributed to, the patient's death on macroscopic examination alone in at least 90% of the autopsies in an average teaching hospital. In exceptional circumstances, help of a frozen section may be obtained.

5.2.2.1.A. *In places where non-medico-legal autopsies are not available each student/candidate should be made to dissect organs from atleast five medico-legal autopsies.* An improvised autopsy may also be arranged in places where full autopsy is not possible. Relevant organs from wet specimens in the museum with appropriate clinical history may be arranged for a detailed description and diagnosis. At least ten such improvised autopsies may be discussed by each candidate

5.2.2.2 Identify and correctly diagnose at least 90% of the microscopic lesions found in most autopsies, and be able to correlate the pathologic changes with the patient's clinical history and events of a few days preceding death.

5.2.2.3 Write correctly and systematically Provisional and Final Anatomic Diagnosis reports (on gross and microscopy respectively), the major findings at autopsy, and the Autopsy Protocol as per prescribed instructions, of a standard fit for an international journal.

## 5.3 Cytopathology

### 5.3.1 Knowledge

5.3.1.1 Should possess the background necessary for the evaluation and reporting of Cytopathology specimens.

5.3.1.2 Demonstrate verbal familiarity with, and guide the clinical residents in the following, keeping in view the special requirements of each case (Cyto-hormonal status, malignancy, infection, etc.)

- (i) Choice of the site from which smears may be taken (as in the case of vaginal smears)
- (ii) Type of smear/sample (morning specimen, after specimen, pre-menstrual specimen, etc)
- (iii) Method of obtaining various specimens (urine sample, gastric smear, colonic lavage, etc.)

### 5.3.2 Skills

5.3.2.1 Independently prepare and stain good quality smears for cytopathologic

examination and be conversant with the principles and preparation of solutions of stains.

5.3.2.2 Demonstrate conversance with the techniques for concentration of specimens: i.e. various filters and cytocentrifuge.

5.3.2.3 Independently be able to perform fine needle aspiration of palpable superficial lumps in patients; make good quality smears, and be able to decide on the type of staining in a given case.

5.3.2.4 Given the relevant clinical data, he/she should be able to independently and correctly:

- (i) Evaluate hormonal status in all cases as may be required.
- (ii) Diagnose the status of malignancy or otherwise in at least 75% of the cases received in a routine laboratory and categorize them into negative, inconclusive and positive.
- (iii) Demonstrate ability in the technique of screening and dotting the slides for suspicious cells.
- (iv) Identify the difference between normal cells in common diagnostic cytology specimens (breast fine needle aspirations (FNAs), sputum, bronchial brushings, serous effusions, urine) and typical examples of malignancy
- (v) Indicate correctly the type of tumour, if present, in at least 75% cases.
- (vi) Identify with reasonable accuracy the presence of organisms, fungi and parasites in at least 75% of cases.

## 5.4 Haematology

### 5.4.1 Knowledge

5.4.1.1 Should demonstrate the capability of utilizing the principles of the practice of Haematology for the planning of tests, interpretation and diagnosis of diseases of the blood and bone marrow.

5.4.1.2 Should be conversant with various equipment's used in the Haematology laboratory.

5.4.1.3 Should have knowledge of automation and quality assurance in Haematology.

### 5.4.2 Skills

5.4.2.1 Correctly plan a strategy of investigating at least of the cases referred for special investigations in the Hematology Clinic and give ample justification for each step-in consideration of the relevant clinical data provided.

5.4.2.2 Correctly and independently perform the following special tests, in addition to doing the routine blood counts:

- Haemogram including Reticulocyte and Platelet counts.

- Bone marrow staining including stain for iron
- Blood smear staining
- Cytochemical characterization of leukemia with special stains like Peroxidase, Leukocyte Alkaline Phosphatase (LAP), PAS, Sudan Black, Oil Red O, Acid Phosphatase (including Tartarate resistant) and Non-specific esterase
- Test for hemolytic anemia such as Osmotic fragility, Fetal Hemoglobin, Sickling phenomenon, Hb electrophoresis.
- Test for coagulation such as Bleeding time, clotting time, Prothrombin time (PT), Activated partial thromboplastin time (APTT), Clot Solubility Test
- Paper electrophoresis
- Coombs Test

5.4.2.3 Demonstrate familiarity with the principle and utility in the diagnosis of the following:

- Red cell indices
- Plasma hemoglobin
- Haemosiderin in urine
- Presumptive tests for complete antibodies
- Ham's Acid test
- Sugar water test
- Serum electrophoresis
- Platelet function tests including platelet aggregation and adhesion and PF3 release
- Russell's viper venom time (RVVT)
- Coagulation Factor assays
- Screening for coagulation factor inhibitors
- Fibrin Degradation Products (FDP), D-Dimers
- Monitoring of anticoagulant therapy
- Tests for thrombosis: Lupus anticoagulant (LAC), Anticardiolipin Antibody (ACA), Activated Protein C Resistance (APCR), Protein C (Pr C), Protein S (Pr S), Antithrombin III (AT III)
- Serum ferritin
- Serum iron and total iron binding capacity
- Immunophoretic typing
- Cytogenetics

5.4.1.1 Demonstrate verbally and in writing, his/her understanding of the principles of the above tests their utility in diagnosis and interpretation of results.

5.4.1.2 Perform a successful bone marrow aspiration/iliac crest biopsy and stain the peripheral and bone marrow smears with Romanowsky stains.

5.4.1.3 Describe accurately the morphologic findings in the peripheral and bone marrow smears, identifying and quantitating the morphologic abnormalities in disease states and arriving at a correct diagnosis in at least 90% of the cases referred to the Haematology clinic, given the relevant clinical data.

5.4.1.4 Possess working knowledge of the following:

- Independently run a sample in the hematology analyzer and interpretation.
- Bone marrow transplantation
- Prenatal diagnosis of genetic hematological diseases
- Molecular biology of hematological diseases

## 5.5 Laboratory Medicine

### 5.5.1 Knowledge

5.5.1.1 Demonstrate familiarity with the normal range of values of the chemical content of body fluids, significance of the altered values and interpretation thereof.

5.5.1.2 Possess knowledge of the principles of following specialized organ function tests and the relative utility and limitations of each and significance of the altered values.

- Renal function test
- Liver function test
- Gastric and Pancreatic function
- Endocrine function test
- Tests for malabsorption

5.5.1.3 Explain the biochemical principles involved in the above estimations.

5.5.1.4 Know the principles, advantages and disadvantages scope and limitation of Automation in laboratory.

5.5.1.5 Learn the principles and methodology of quality control in laboratory.

### 5.5.2 Skills

5.5.2.1 Plan a strategy of laboratory investigation of a given case, given the relevant clinical history and physical findings in a logical sequence, with a rational explanation of each step. He should be able to correctly interpret the laboratory data of such studies, and discuss their significance with a view to arrive at a diagnosis.

5.5.2.2 Demonstrate familiarity with and successfully perform a routine Urinalysis

including Physical, Chemical and Microscopic, examination of the sediment.

5.5.2.3 Demonstrate familiarity with and successfully perform the macroscopic and microscopic examination of Faeces and identify the ova and cysts of common parasites.

5.5.2.4 Independently and successfully perform a complete examination; physical, chemical and cell content of Cerebrospinal Fluid (C.S.F.), Pleural and Peritoneal fluid.

5.5.2.5 Successfully perform an examination of Peripheral Blood for the commonly occurring parasites.

5.5.2.6 Independently perform a Semen analysis.

5.5.2.7 Independently and correctly perform at least the following Quantitative Estimations by Manual Techniques and/or Automated Techniques.

- Blood urea
- Blood sugar
- Serum Proteins total & fractional
- Serum Bilirubin total & fractional
- Serum amylase

5.5.2.8 Demonstrate familiarity with the following Quantitative Estimations by Automated Techniques.

- Serum cholesterol\*
- Uric acid
- Serum Transaminases (ALT and AST/SGOT and SGPT)
- Serum Alkaline Phosphatase
- Creatinine\*
- Serum calcium and phosphorous
- Serum Electrolyte (Na<sup>+</sup> and K<sup>+</sup>)

5.5.2.8.A. \*Must also be familiar with the manual method

5.5.2.9 Demonstrate familiarity with:

- Determination of bicarbonates
- Blood gas analysis.

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

5.5.2.11 Explain the principle of Instrumentation, use and application of the following instruments.

- Photoelectric colorimeter
- Spectrophotometer

- pH meter
- Flame photometer
- Centrifuge
- Analytical balance
- Electrophoresis apparatus
- Light Microscope
- Blood gas analyzer

## 5.6 Transfusion Medicine (Blood Banking)

### 5.6.1 Knowledge

It is expected that students should possess knowledge of the following aspects of Transfusion Medicine.

- 5.6.1.1 Basic immunology
- 5.6.1.2 ABO and Rh groups
- 5.6.1.3 Clinical significance of other blood groups
- 5.6.1.4 Transfusion therapy including the use of WB and RBC concentrates.
- 5.6.1.5 Blood component therapy.
- 5.6.1.6 Rationale of pre-transfusion testing.
- 5.6.1.7 Infections transmitted in blood.
- 5.6.1.8 Adverse reactions to transfusion of blood and components
- 5.6.1.9 Quality control in blood bank

### 5.6.2 Skills

It is expected that the student shall correctly and independently perform the following.

- 5.6.2.1 Selection and bleeding of donors
- 5.6.2.2 Preparation of blood components i.e. Cryoprecipitates, Platelet concentrate, Fresh Frozen Plasma, Single Donor Plasma, Red Blood Cell concentrates.
- 5.6.2.3 ABO and Rh grouping.
- 5.6.2.4 Resolving ABO grouping problems by secretor status in saliva and expanded panel.
- 5.6.2.5 Demonstrate familiarity with Antibody screening by
  - LISS (Low-ionic salt solution)
  - Enzymes
  - AHG (Anti-Human Globulin)

- 5.6.2.6 Steps to be taken if the above are positive.
- 5.6.2.7 Demonstrate familiarity with Crossmatching by
  - LISS (Low-ionic salt solution)
  - Enzymes
  - AHG (Anti-Human Globulin)

- 5.6.2.8 Steps to be taken if there is incompatibility.

- 5.6.2.9 Demonstrate familiarity with Antenatal and Neonatal work
  - Direct antiglobulin test
  - Antibody screening and titre
  - Selection of blood for exchange transfusion

- 5.6.2.10 Demonstrate familiarity with principle and procedures involved in
  - Resolving ABO grouping problems.
  - Identification of RBC antibody.
  - Investigation of transfusion reaction.
  - Testing of blood for the presence of
    - i. HBV (Hepatitis B Virus Markers).
    - ii. HCV (Hepatitis C Virus Markers)
    - iii. HIV (Human Immunodeficiency Virus Testing)
    - iv. VDRL

## 5.7 Basic Sciences (in relation to Pathology)

### 5.7.1 Immunopathology

#### 5.7.1.1 Knowledge

- a. Demonstrate familiarity with the current concepts of structure and function of the immune system, its aberrations and mechanisms thereof.
- b. Demonstrate familiarity with the scope, principles, limitations and interpretations of the results of the following procedures employed in clinical and experimental studies relating to immunology.
  - i. ELISA techniques
  - ii. Radioimmuno assay
  - iii. HLA typing

#### 5.7.1.2 Skills

- Perform and interpret simple immunological tests used in diagnosis of diseases and in

research procedures.

- (a) Immunoelectrophoresis
- (b) Immunofluorescence techniques especially on kidney and skin biopsies
- (c) Countercurrent electrophoresis for demonstration of antigen
- (d) Latex agglutination
- Perform and interpret:
  - (a) Anti-nuclear Factor (ANF)
  - (b) Anti-neutrophil cytoplasmic antibody (ANCA)

### **5.7.2 Electron Microscopy**

#### **5.7.2.1 Knowledge**

- Demonstrate familiarity with Principles and techniques of electron microscopy and the working of an electron microscope (including Transmission and Scanning Electron microscope: TEM and SEM)

#### **5.7.2.2 Skills**

- Perform proper fixation, processing and staining of tissues for electron microscopy.
- Recognize the appearance of the normal subcellular organelles and their common abnormalities (when provided with appropriate photographs).

### **5.7.3 Enzyme Histochemistry**

#### **5.7.3.1 Knowledge**

Should be familiar with the principles, use and interpretation of common enzyme histochemical procedures (Alkaline Phosphatase, Acid Phosphatase, Glucose-6-Phosphate Dehydrogenase, Succinyl Dehydrogenase, Chloroacetate Esterase, Gamma glutamyl Transpeptidase and Acetyl Cholinesterase).

#### **5.7.3.2 Skills**

- Operate the cryostat, and demonstrate familiarity with the principles of its working and be able to stain tissue sections for some cell constituents.
- Demonstrate familiarity with the commonly used enzyme histochemical procedures.

### **5.7.4 Immunohistochemistry**

#### **5.7.4.1 Knowledge**

Demonstrate familiarity with the principles and exact procedures of various immunohistochemical stains using both PAP (Peroxidase-Antiperoxidase) and ABC (Avidin-Biotin Conjugate) Systems; employing monoclonal and polyclonal antibodies.

#### 5.7.4.2 Skills

Be able to perform immunohistochemical staining using paraffin section with at least one of the commonly used antibodies (*Cytokeratin or LCA*) using the PAP method.

### 5.7.7 Molecular Biology

#### 5.7.7.1 Knowledge

Should understand the principles of Molecular biology especially related to the understanding of disease processes and its use in various diagnostic tests.

#### 5.7.7.2 Skills

Should be conversant with the steps of a Polymerase Chain Reaction (PCR) and should demonstrate understanding of the steps and principles of interpretation of Western Blot, Southern Blot, Northern Blot and Hybridization procedure.

### 5.7.8 Principles Of Medical Statistics

#### 5.7.8.1 Knowledge

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

#### 5.7.8.2 Skills

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

### 5.7.9 Radio Isotope and Autoradiography

#### 5.7.9.1 Knowledge

Demonstrate familiarity with the principles of the commonly used radioisotopes in medicine and autoradiography, and the instruments used to measure radioactivity.

### 5.7.10 Tissue Culture

#### 5.7.10.1 Knowledge

Demonstrate familiarity with methods of tissue culture.

### 5.7.11 Cytogenetics

#### 5.7.11.1 Knowledge

Demonstrate familiarity with methods of Karyotyping and Fluorescent in-situ Hybridization (FISH).

#### 5.A. Important Note

(i) *It is appreciated that the facilities in Institutions vary and this is more likely in the case of Basic Sciences Training. All efforts must be made so that the student gets an opportunity to be familiar with all the aspects of expected training that have been mentioned. If necessary extra-mural postings may be considered to take care of any likely shortcomings in the training. It must be emphasized that the training for the degree of MD (Pathology) is not*

*merely to produce a diagnostic pathologist well versed with routine diagnosis but also to ensure all-round development of the student who will be an asset to the society as a responsible teacher and scientist.*

- (ii) *Development of knowledge and skills in fields not mentioned explicitly should be encouraged. Thus, knowledge in imaging techniques and their interpretation would be an asset while interpreting diseases of bones and joints. Knowledge regarding the nature of therapy for various diseases would be helpful not only in identifying iatrogenic diseases but also in actively participating in the diagnosis and management of patients. The relevance of every report of a patient thus becomes more easily understood. No branch of medicine is today restricted or isolated to it. The overall well-being of the sick is a team effort. The student must learn that working, as a team is essential today.*
- (iii) *It should be the endeavor of every training program to emphasize quality control and also on the limitations of each and every test.*

## 6. RESEARCH

All effort must be made so that research methodology is apparent at the end of the course. It is recommended that students submit a thesis or dissertation six months prior to examinations as a partial fulfillment to the award of the degree of MD (Pathology). Students should be encouraged to present papers in conferences and publish papers in peer reviewed journals. Due emphasis must be laid on the importance of obtaining ethical clearance from appropriate committees for both animal and human studies.

A separate course for training in research methodology may not be necessary. Skills will be acquired largely depending on the topic of research. The following points are guidelines to what may be expected of the student at the end of the course.

- 6.1 Recognize a research problem – basic or applied
- 6.2 Clearly state the objectives in terms of what is expected to be achieved in the end.
- 6.3 Plan rational approaches with appropriate controls with full awareness of the statistical validity of the size of experimental material.
- 6.4 Carry out most of the technical procedures required for the study.
- 6.5 Accurately and objectively record on systematic lines the results and observations made.
- 6.6 Analyze the data with the aid of an appropriate statistical analysis, if necessary.
- 6.7 Interpret the observations in the light of existing knowledge and highlight in what ways the study has advanced existing knowledge on the subject and what further remains to be done.
- 6.8 Take photomicrographs, of a quality fit for publication in an international journal
- 6.9 Write the thesis or a scientific paper in accordance with the prescribed instructions, as expected of international standards.

i. It should be appreciated that a clear definition of the goals and precise objectives before starting a research project is as essential as stating one's destination before starting the journey. These must be stated in clear, unambiguous terms as the ultimate results of the study and not as the methods of approach to the problem.

ii. For the purpose of thesis/dissertation, as far as possible each individual must be given the freedom of choice of his/her own subjects he would like to study. He/she should be given an opportunity to apprise himself/herself with topics of current research interests of each member of the faculty. In case the student does not have a preference of his/her own, topics are to be suggested by the faculty who ensure that there is generally the equitable distribution of the postgraduates among the faculty. It is obvious that the thesis or dissertation will be on a topic on which there is general interest, expertise, and facilities with the faculty. Interdepartmental collaboration should be encouraged to widen the scope and outlook of the research proposal and training.

## 7. TEACHING-LEARNING METHODS:

7.1 Human pathology consists of two fundamentally inter-related disciplines: the function of the cell, integration and correlation of the structural and functional alterations undergone by it and the organ and body as a whole in disease. The superstructure is constituted by diagnostic pathology concerned with the application of the above knowledge, and that of the investigative procedures in the recognition and quantitation of disease. In the training of a pathologist, the acquisition of both these disciplines is essential. Eventually, the primary role of the pathologist is to apply the basic understanding of the disease processes to patient care, with the intellectual rigor and careful delineation of problems, characteristic of the research investigator. The training program should be designed to enable the student to acquire a capacity to learn and investigate for himself, to synthesize and integrate a set of facts and develop a faculty to reason. The curricular programmes and scheduling of postings must provide the student with opportunities to embrace the above broad objectives. *Much of the learning is to be accomplished by the student himself. Interactive discussions are to be preferred over didactic sessions.* The student must blend as an integral part of the activities of an academic department that usually revolves around three equally important basic functions of teaching, research and service. As mentioned earlier the emphasis is recommended under a residency programme or learning while serving/working. The following is a rough guideline to various teaching/learning activities that may be employed.

The following is a rough guideline to various teaching/learning activities that may be employed.

- Collection of specimens including Fine needle aspiration of superficial lumps.
- Grossing of specimens.
- Performing autopsies.

- Discussions during routine activities such as during signing out of cases.
- Presentation and work-up of cases including the identification of special stains and ancillary procedures needed.
- Clinico-pathological conferences.
- Intradepartmental and interdepartmental conferences related to case discussions.
- Conferences, Seminars, Continuing Medical Education (CME) Programmes.
- Journal Club.
- Research Presentation and review of research work.
- Guest and in-house lectures.
- Participation in workshops, conferences and presentation of papers etc.
- Laboratory-work.
- Use and maintenance of equipment.
- Maintenance of records.
- Teaching undergraduates and paramedical staff.
- Minimum of 75% attendance in teaching activities.
- Log book maintenance of duty postings.
- Department should encourage and train for e-learning activities.
- Required to present a poster presentation, to read one paper at a national/ state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his PG studies so as to make him eligible to appear at the PG degree examination.

Note: *For the purpose of thesis/dissertation, as far as possible, each individual must be given the freedom of choice of his/her own subjects he would like to study. He/she should be given an opportunity to apprise himself/herself with topics of current research interests of each member of the faculty. In case the student does not have a preference of his/her own, topics are to be suggested by the faculty who ensure that there is generally equitable distribution of the postgraduates among the faculty. It is obvious that the thesis or dissertation will be on a topic on which there is general interest, expertise and facilities with the faculty. Interdepartmental collaboration should be encouraged to widen the scope and outlook of the research proposal and training.*

## 7.2 Timeline for departmental TLM activities

Sl.no.	Category	Activity	1	2	3	4	5	6
1	Academic	UG Teaching PG Activity Case-Based Learning						
2	Dissertation	Selection of topic & synopsis submission	Yellow					
		Review of Lit & Data Collection		Green	Green	Green		
		Analysis & Submission				Blue	Blue	
3	Rotational Posting	Sectional duties Sample collection & processing Daily participation in reporting	Dark Purple					
4	Resident Emergency duties	Practice of clinical and lab skills	Pink	Pink	Pink	Pink	Pink	Pink
5	Clinicopathological conferences	Intra & Interdepartmental CME, Discussions		Dark Blue				
		Presentation of poster and paper		Red	Red	Red	Red	Red
6	Workshop	Research Methodology	Orange					
		MET			Green	Green		
7	Publication	Indexed Journal			Dark Brown	Dark Brown	Dark Brown	Dark Brown
8	Lab Maintenance	Participation in quality checks, BMW training, Maintenance of records and equipments	Light Purple					

## 7.3 Teaching schedule:

Sl No.	Activity	Frequency
1	Slide Seminar	Once a week
2	Subject seminar	Once a week
3	Gross Meet	Once a week
4	Technique discussion	Once a week
5	Journal Club/Case discussion	Once a week
6	Thesis review	6 Monthly
7	Invited Guest Lectures	-
8	Presentation by faculty and students	Regional/National/International conferences/project submission

## 8. TENTATIVE SCHEDULE & TRAINING PROGRAMME

A structured scheme of training is recommended so that every student is exposed to different aspects of the subject and acquires sufficient knowledge and skill as expected from the course. The method by which this is done may vary from institution to institution.

However, it is suggested that one senior member of the faculty be given the chief responsibility for organizing and coordinating this program and any inquiries may be made or assistance taken, if necessary, from him/her. The 3-year training program for the M.D. degree may be arranged in the

form of postings to different assignments/ laboratories for specified periods as outlined below. The period of such assignments/postings is recommended for 35 months. Posting schedules may be modified depending on needs, & feasibility.

### 8.1 Tentative Posting of PG students-

Subject/ section	Duration
<b>1<sup>st</sup> year</b>	
• Orientation	1 month
• Histopathology	4 month
• Cytology	3 month
• Hematology & Clinical pathology	3 month
• Clinical biochemistry	1 month
<b>2<sup>nd</sup> year</b>	
• Histopathology	4 month
• Cytology	3 month
• Hematology & Clinical Pathology	2 month
• Blood banking	1 month
• Autopsy	1 month
• Clinical rotation <ul style="list-style-type: none"> <li>○ <b>Radiology:</b> CT Biopsy- 2, US biopsy-2, Mammography 3.</li> <li>○ <b>Ob &amp; Gyn:</b> PAP smear-3, Endocervical curetting-2, Endometrial curetting-2</li> <li>○ <b>Endoscopy:</b> Esophageal, gastric, small &amp; large intestinal biopsy 1 each, Bladder/TURP-1 each</li> </ul>	2 week
• Advanced Techniques (IHC, IF, Cytogenetics, EM, Molecular lab)	2 week
<b>3<sup>rd</sup> year</b>	
• Histopathology	4 month
• Cytology	2 month
• Hematology & Clinical pathology	2 month
• Advanced Techniques (IHC, IF, Cytogenetics, EM, Molecular lab)	2 week
• Blood banking	1 month
• Thesis work	1 month
• Revision	2 week

Total postings:

- Histopathology: 12 months
- Cytology: 08 months
- Hematology, Clinical pathology: 09 months
- Blood banking: 02 months
- Others: 04 months
- **Total duration:** **35 months**

i. *Extramural postings to reputed institutions or to other institutions to learn techniques not available in the parent institution and also to acquire knowledge and skill in some aspects of*

the course may be encouraged.

ii. What has been provided above is a rough guideline. Duration of each posting may vary depending on the resources available and the needs of each institute. Extramural postings to reputed institutions or to other institutions to learn techniques not available in the parent institution and also to acquire knowledge and skill in some aspects of the course may be encouraged.

## 8.2 Entrustable Professional Activities (EPA)

S no	EPA	Competencies						Expected level		
		MK	PC	ISC	P	PBLI	SBP	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year
1	Should be able to perform gross examination and sampling of surgical pathology specimens	-	-	-	-	-	-	III	IV	IV
2	Should be able to interpret gross and microscopic histomorphological alterations in tissue	Y	Y	-	Y	Y	Y	I	II	IV
3	Should be able to correlate histomorphological alterations with relevant clinical, operative and radiological data and arrive at the diagnosis	Y	Y	Y	Y	Y	Y	I	II	IV
4	Should be able to process tissue bits	Y	Y	-	Y	Y	Y	III	IV	IV
5	Should be able to take sections using a microtome	-	-	-	-	-	-	II	III	IV
6	Should be able to perform H & E stain	Y	Y	-	Y	Y	Y	II	III	IV
7	Should be able to decide appropriate special stain and perform it whenever necessary	Y	Y	-	Y	Y	Y	--	II	III
8	Should be able to decide appropriate immunohistochemical markers, perform and interpret	Y	Y	-	Y	Y	Y	--	II	III
9	Should be able to interpret frozen sections	Y	Y	-	Y	Y	Y	--	II	III
10	Should be familiar with indications and interpretation of ancillary techniques like karyotyping, FISH, PCR, EM	Y	Y	-	Y	Y	Y	--	II	III
11	Should be able to interpret and	Y	Y	-	Y	Y	Y	II	III	IV

	diagnose cytological smears									
12	Should be able to interpret cytology of sputum, bronchial washings, serous effusions, etc.	Y	Y	-	Y	Y	Y	II	III	IV
13	Should be able to prepare, stain and interpret peripheral smear	Y	Y	-	Y	Y	Y	II	III	IV
14	Should be able to interpret bone marrow smears	Y	Y	-	Y	Y	Y	II	III	IV
15	Should be able to perform and interpret routine hematological investigations like hemoglobin, TLC, DLC, ESR, PCV, Blood indices	Y	Y	-	Y	Y	Y	II	III	IV
16	Should be able to perform and interpret special investigations like retic count, sickling test, osmotic fragility test, hemoglobin, electrophoresis, fetal hemoglobin etc.	Y	Y	Y	Y	Y	Y	II	III	IV
17	Should be able to plan investigations in a clinical case	Y	Y	Y	Y	Y	Y	II	III	IV
18	Should be able to perform and interpret urine examination	Y	Y	-	Y	Y	Y	II	III	IV
19	Should be able to perform and interpret CSF, pleural fluid, Peritoneal fluid, Synovial fluid examination	Y	Y	-	Y	Y	Y	II	III	IV
20	Should be able to perform and interpret semen analysis	Y	Y	-	Y	Y	Y	II	III	IV
21	Should be able to perform urgent investigations like CSF, Platelet count in emergency duties	Y	Y	Y	Y	Y	Y	II	III	IV
22	Should demonstrate familiarity within laboratory investigations in microbiology and biochemistry	Y	Y	-	Y	Y	Y	-	II	III
23	Should be able to plan and execute internal quality control (IQC) Programme for laboratory	Y	Y	Y	Y	Y	Y	-	I	II
24	Should be able to participate in the external quality control (EQC) Programme	Y	Y	Y	Y	Y	Y	-	I	II
25	Should be able to perform blood grouping and Rh typing	Y	Y	-	Y	Y	Y	III	IV	IV
26	Should be able to perform cross matching	Y	Y	-	Y	Y	Y	III	IV	IV

27	Should be able to perform ELISA for infectious disease, Coomb's test (DAT/IAT)	Y	Y	-	Y	Y	Y	I	II	III
28	Should be able to separate blood components and have knowledge of indications of using blood components	Y	Y	-	Y	Y	Y	II	III	IV
29	Should have knowledge of criteria of selection of blood donors	Y	Y	Y	Y	Y	Y	III	IV	IV
30	Should be able to manage adverse donor reactions	Y	Y	Y	Y	Y	Y	I	II	III
31	Should be familiar with FDA regulations of blood bank	Y	Y	-	Y	Y	Y	-	II	III
32	Should be able to investigate a case of mismatched blood transfusion	Y	Y	Y	Y	Y	Y	I	II	III
33	Should be able to participate in multidisciplinary meetings like tumor board, CPCs, Dermatopathological meets. & Conferences	Y	Y	Y	Y	Y	Y	I	II	III
34	Should be able to present oral and poster presentations in conferences, write a research paper	Y	Y	Y	Y	Y	Y	-	II	III
35	Should be able to teach pathology to undergraduates (MBBS), and allied health sciences like BDS, BSc (Nursing), BSc (MLT), BSc (Radiology), etc.	Y	Y	Y	Y	Y	Y	-	II	III
36	Should be able to supervise technicians	Y	Y	Y	Y	Y	Y	-	II	II
37	Should have a thorough knowledge of Biomedical waste disposal	Y	Y	Y	Y	Y	Y	II	III	IV
38	Should be familiar with norms and requirements of NABL, NABH accreditation	Y	Y	Y	Y	Y	Y	-	II	III

**Competencies:** MK: Medical knowledge; PC: Patient care; PBLI: Problem based learning and improvement; SBP: Systems-based practice; P: Professionalism; ICS: Interpersonal and communications kills

**Levels of competence:** Level 1- Knowledge only; Level 2: Can do under strict supervision; Level 3: Can do under loose supervision; Level 4: Can do independently; Level 5: has the expertise to teach others.

### 8.3 Expected outcome during each posting-

Subspeciality/ Domain	1st year	2nd year	3rd year	Modalities
Hematology	Smear preparation Stain of peripheral smear Orientation for Bone marrow techniques Blood grouping and cross matching	Bone marrow aspiration Bone marrow aspiration biopsy Special stains in hematology Flow cytometry Coagulation procedure HPLC procedure	Flow cytometry Coagulation interpretation Bone marrow smears interpretation HPLC interpretation QC in Hematology	Daily reporting sessions Direct Observation of Procedural Skills Seminars Journal clubs Slide Seminars
Clinical Pathology	Urine examination procedure	Semen examination CSF examination Body fluids examination	Special techniques for semen analysis ICC QC in clinical pathology	Year-end assessment: Theory exam
Cytopathology	Perform FNAC procedure Rapid On-site staining Sample processing & staining Cervical Smear interpretation Bethesda system Fluid cytology	Organ specific cytology (FNAC) and reporting systems Cell block preparation ROSE and interpretation ICC	Preparation of cases for final reporting	Practical exam Viva
Histopathology	Histology Basic Grossing Sample Processing H&E staining Frozen sectioning and Staining	Organ specific Pathology, non-neoplastic and neoplastic (FGT, MGT, Skin, GIT, H&N, Bone, Lung, Mediastinum, Liver)	Organ specific pathology (Lymph nodes, Renal, CNS, Soft tissue) QA/QC in Histopathology	

		Cancer resections grossing TNM staging & Synoptic reporting Special stains Immunohistochemistry Immunofluorescence	Information management systems	
Research	Basic course in Research methodology How to Plan a study/write a research proposal	Study designs commonly employed in Pathology research	Critical appraisal of scientific literature Basic & Translational research in Pathology EBM in Pathology	
Molecular Pathology & Recent advances	-	Principles PCR, RTPCR Principles FISH Principles Microarray Principles Cytogenetics	Sequencing & genomics Diagnostic Organ Specific Molecular Pathology AI & ML in Pathology	
Soft Skills	Patient communication Interaction with Clinical PGs Professionalism & punctuality			

- Above is an indicative timeline to guide Teaching, Training & Assessment of the post graduates in various domains during their MD Pathology course
- It is not meant to be a strict deadline for achieving the desired outcomes, but intended as an instrument to facilitate organized learning and assessment in addition to continuous learning on the job.
- The blue print can be integrated into the PG log book such that
  - PGs can enter the activities under relevant domains
  - Faculty can assess and grade the competency achieved in various domains over the 3-year period.

## 9. EVALUATION

### Continuous Assessment:

- Medical knowledge,
- Patient care, procedural & academic skills,
- Interpersonal skills,
- Professionalism,
- Self-directed learning.
- Ability to practice in the system.

An assessment of knowledge and skills will be done at the end of each rotation in laboratory. Assessment of affective domain will be an ongoing process done by direct observation during patient service and teaching of undergraduates.

Feedback will be given to improve learning, professionalism and communication skills.

An end of posting examination will be taken in each rotational posting on practical skills learnt.

A standardized scheme of evaluation is necessary to train candidates in any teaching program. Both formative and summative evaluations are therefore mandatory.

### 9.1 Internal (Formative) Assessment

Internal Assessment should in reality be done every day to assess the training and to identify the weaknesses as well as the strength of the candidate. Thus, appropriate corrective methods can be adopted at the right time so that a well-trained and competent pathologist worthy of a postgraduate degree is available for the society. However, a formal assessment can be recorded at the end of every posting and reviewed every six months.

9.1.1 A logbook should be maintained recording the duration of posting, the period of absence, if any, skills performed, and remarks if any by the teacher/faculty member. The logbook should also record journal clubs, seminars attended and partaken as well as undergraduate teaching activities the candidate has participated.

9.1.2 Research work should be assessed or reviewed every six months. The protocol and the final results should be presented to the entire department.

9.1.3 Evaluation sheets may be incorporated for the purpose of assessment. The following points may be considered in the scheme for evaluation of presentations such as seminars and journal clubs:

- (i) Choice of article/topic (unless specifically allotted)
- (ii) Completeness of presentation
- (iii) Clarity and cogency of presentation
- (iv) Understanding of the subject and ability to convey the same
- (v) Whether relevant references have been consulted
- (vi) Ability to convey points in favour and against the subject under discussion

(vii) Use of audio-visual aids

(viii) Ability to answer questions

(ix) Time scheduling

(x) Overall performance

In the case of specific postings similar points may be assessed with regard to knowledge and skills. It is also recommended that the candidate be assessed with regard to the following:

- Ability to get along with colleagues
- Conduct with patients and staff

9.1.4 Grading may be done in one of the following ways:

(i) Awarding actual marks

(ii) Awarding scores:

0 = Poor
1 = Below average
2 = Average
3 = Above average
4 = Good

(iii) Awarding grades: A+ = 90% - 100%

A = 80% - 89%

A- = 75% - 79%

B+ = 70% - 74%

B = 60% - 69%

B- = 50% - 59%

C = < 50%

9.1.4.1 The grades must be endorsed by more than one faculty member or an average obtained by pooling the grades of different faculty members. This must be conveyed to the candidate periodically (at-least once in every six months) so that the candidate knows where he or she stands.

*9.1.A. It must be understood that different institutions may have different schemes of internal assessment (including periodical tests). The above scheme is a suggestion that can be modified according to convenience and improved upon. Please see Appendices on page 31 for a sample of some of the Scoring/ Grading schemes*

## 9.2 University (Summative) Assessment

The university or summative examination shall be held at the end of three years of the training programme. This would include assessment of the thesis or dissertation and a formal examination on the theoretical and practical aspects of the speciality of Pathology.

9.2.1 The thesis/dissertation should be evaluated by at-least two external examiners well versed in the topic studied. It is therefore recommended that thesis/dissertation be submitted for evaluation six months prior to the theory and practical examinations. The results of the evaluation should be available prior to the practical examinations. If necessary, grades may be awarded as given under 9.1.4.

9.2.2 For the formal examinations there should be two external and two internal examiners.

9.2.3 The Theory Papers shall be set preferably by the external examiner suitably moderated by the internal examiners.

9.2.4 There shall be four theory papers:

Paper I: General pathology, immunopathology & Cytopathology

Paper II: Systemic pathology & applied aspects

Paper III: Hematology, Transfusion Medicine (Blood Banking), Laboratory medicine, Clinical pathology

Paper IV: Recent advances, Molecular pathology

9.2.5 Each paper should have ten short answer questions (SAQ) or one long answer question (LAQ) and six to eight short answer questions (SAQ).

9.2.6 Practical Examination should be conducted over a minimum period of two days. The following is a guideline of the aspects to be covered:

(i) Clinical Pathology:

- Discussion of a clinical case history
- Plan relevant investigations of the above case and interpret the biochemistry findings
- Two investigations should be performed at least one biochemistry exercise/ clinical pathology like CSF/Pleural tap etc. analysis.
- Complete urinalysis

(ii) Haematology:

- 10 hematology slides
- Discuss Haematology cases given the relevant history
- Plan relevant investigations
- Perform atleast two tests preferably including coagulation exercise
- Identify electrophoresis strips, osmotic fragility charts etc with interpretation of data from autoanalyzer/HPLC/flow cytometry.
- Examine, report and discuss ten cases given the history and relevant blood

smears and/ or bone marrow aspirate smears/biopsy.

(iii) Transfusion medicine:

- Perform blood grouping
- Perform the necessary exercise given a relevant history
- Coomb's test and gel card interpretation.

(iv) Histopathology & Cytology:

- Examine, report and discuss 15 histopathology and 05 cytopathology cases given the relevant history and slides
- Perform a H & E stain and any special stain on a paraffin section
- Report on a frozen section
- Should be conversant with histopathology techniques.

(v) Autopsy:

- Given a case history and relevant organs (with or without slides) give a list of anatomical diagnosis in a autopsy case.

(vi) Gross Pathology:

- Describe findings of gross specimens, give diagnosis, perform the grossing with sections to be processed.

(vii) Basic Sciences:

- Identify electron micrographs
- Identify gels, results of PCR, immunological tests including staining for direct/indirect immunofluorescence
- Identify histochemical and immunohistochemistry stains
- Teaching exercise of 10 mins

9.2.7 *Viva-voce* is expected to be conducted at every stage of the practical examination. Additionally, a formal “grand” *viva-voce* may be held at the end of the practical examination. Questions on the thesis/dissertation may be asked at this time. All practical exercises are to be evaluated jointly by all the examiners.

9.2.8 Marking may be done by any of the methods suggested in 9.1.4. Grading rather than actual marking is to be preferred because in a post-graduate examination, which is currently subjective to a large extent, it may be extremely difficult to differentiate performance differences within ranges of 1% to 5%.

	1 <sup>st</sup> internal exam	2 <sup>nd</sup> internal exam	3 <sup>rd</sup> internal exam	Total internal marks	Final exam	Total marks #
Time	End of 1 <sup>st</sup> year	End of 2 <sup>nd</sup> year	2 months before final exam	Avg of 3 internal exams		

Theory*	80^	80^	80^	80	320	400
Practical**	80^	80^	80^	80	320	400

\*Theory- one long question & 6 short notes

\*\*Practical exam – 10 slide hematology, 05 slides cytology, 15 slides from histopathology, one clinical case, one hematology case, gross, autopsy, 5-10 OSPE, Pedagogy, histotechnique, routine and special staining, Scientific paper, Thesis evaluation, viva, & log book.

^ 20 marks will be from monthly assessments / section posting exam as per Model Evaluation sheet.

#The weightage of internal assessment and summative/final exam towards the total marks would be calculated as per Extant rules of AIIMS, Kalyani from time to time.

*9.2.A. The above are guidelines only. It is appreciated that individual universities/institutions may have well-laid out and time-tested methods of examinations. It is recommended that attempts be made to ensure that examinations be as objective as possible. The introduction of structured short answers, multiple choice questions and objective-structured practical examinations (OSPE) may be considered. Nevertheless the value of long answer questions in evaluating a candidate's ability to comprehend and systematically explain scientific literature cannot be undermined. Similarly viva-voce, though subjective allows an in-depth examination of the candidate's strengths and weaknesses in the subject.*

## 10. CRITERIA FOR DEPARTMENTS TRAINING STUDENTS

It is recommended that any department that wishes to train a candidate leading to the award of the post-graduate degree in MD (Pathology) should fulfil the following criteria.

- 10.1 The department should be part of a teaching hospital attached or affiliated to a Medical College and/or University or should be a deemed university or autonomous institution recognised by appropriate authorities including the Medical Council of India.
- 10.2 The institution should have various departments encompassing different medical (includes all aspects of medical sciences and not merely the subject of medicine) specialties and super-specialties so that there is no dearth of clinical material, there is adequate scope of interaction with different departments, and overall training of the candidate as given earlier.
- 10.3 The department should be of minimum of three years standing performing all routine activities as is necessary to fulfil the training requirements of MD (Pathology).
- 10.4 For the first candidate, there should be a minimum of three faculty members of which one has a minimum of five years and the other two a minimum of three years teaching experience after MD (Pathology) or any such degree recognised by the Medical Council of India.
- 10.5 It is recommended that a maximum of two candidates be admitted for every Professor, three for every two Additional Professors/ Readers/Associate Professors and one for every Assistant Professor/ Lecturer (with three years' experience after the requisite qualification). In case

there is only one Additional Professor/ Reader/Associate Professor then two candidates may be selected. It must be emphasized that this is a guideline for the calculation of total MD (Pathology) students at any given time in a department.

10.6 It is expected that all the faculty members are full-time employees of the institution concerned.

10.7 Every thesis/dissertation shall have one Guide/Supervisor and at least one Co-guide/Co-supervisor from the department. Co-guides/Co-supervisors from other departments may be opted as necessary. In the event of the Guide/Supervisor leaving or retiring, the senior-most Co-guide/ Co-Supervisor from the department shall take over as the Guide/Supervisor. Institutional/ University guidelines are to be followed regarding the appointment of Guides/Supervisors. It is recommended that at any given time one Faculty member should not be the Guide/Supervisor for more than five candidates. No such limit can be applied to Co-guides/Co-supervisors.

*10.A. It must be emphasized that the above are only guidelines and it is necessary to apply the rules and regulations as approved by the Medical Council of India, concerned Universities and the institution.*

## 11. 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 utilize 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.

### 11.1 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
- BMC journals
- 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 tumour. 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.

## 11.2 Books

- 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* WBSaunders 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 DM 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
- WHO classification of tumors, IARC, WHO.
- Cytology reporting system- Thyroid (Bethesda), Salivary gland (Milan), Breast (Yokohama), Cervical cytology (Bethesda), Pancreas (Bethesda), Urine (Paris). *Springer*
- Greenfield's Neuropathology. *J Hume Adams (Ed)* Edward Arnold, London.
- Russell & Rubeinstein's Pathology of the Tumours of the Nervous System. *Darrell D Bigner, 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-I Chun 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*, ChurchillLivingstone, Edinburgh

- Histotechnology – A Self Instructional Text, *Carson 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 N-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 EGD*, Butterworth Heinemann, Oxford
- Wintrobe's Clinical Hematology, *Lee GR, Foerster J, Luepus 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 DM, 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.

*Note: Recent edition books are to be followed and list of books may vary/change from time to time.*

## 12. APPENDICES

### Sample of scoring/grading schemes

<b>Awarding actual marks:</b>	Maximum marks	= 100%
	Distinction marks	= Optional
	Class	= First / Second / Pass Class (Optional)
	Pass marks	= 50%

- **Awarding scores:**

0. Poor
1. Below average
2. Average
3. Above average
4. Good

- **Awarding grades:**

Awarding grades	Percentage	Assessment
<b>A+</b>	90-100%	Excellent
<b>A</b>	80-89%	Very good
<b>A-</b>	75- 79%	--
<b>B+</b>	70- 74%	Good
<b>B</b>	60-69%	Average
<b>B-</b>	50-59%	Below average
<b>C</b>	<50%	Poor

**Annexure I-**  
**Six monthly Progress Report for Postgraduate Students**

**SECTION I**

**Name of the PG student:** \_\_\_\_\_

**Department:** \_\_\_\_\_

**Admitted in (Month and Year):** \_\_\_\_\_

**Name of the PG Guide:** \_\_\_\_\_

**Report for the period:** \_\_\_\_\_ to \_\_\_\_\_

**Attendance:** \_\_\_\_\_ days out of \_\_\_\_\_ days ( \_\_\_\_\_ %)

**SECTION II**

**Grading as per performance**

Grade	Percentage
A	80% and above
B	65% to 79%
C	50% to 64%
D	Below 50%

<b>1) Daily reporting:</b>	<b>2) Lab skills:</b>
<b>3) Self-Directed learning:</b>	<b>4) Department assigned work:</b>
<b>5) Emergency duties:</b>	<b>6) Teaching assignments:</b>

### **Section III**

#### **Progress of Dissertation**

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### **Section IV**

#### **1. Slide seminar:**

Sr. No.	Case	Date	Faculty I/C	Marks

#### **2. Subject seminar:**

Sr. No.	Topic	Date	Faculty I/C	Marks

#### **3. Journal Clubs:**

Sr. No.	Journal	Title of Paper	Date	Faculty I/C	Marks

#### **4. Marks obtained in tests:**

Sr. No.	Date	Theory / Practical	Marks obtained

#### **5. Any other academic activity conducted:**

## Section V

### 1. Papers presented

Sr. No.	Title of Paper	Authors	Event	Date

### 2. Posters presented

Sr. No.	Title of Poster	Authors	Event	Date

### 3. Publications

*(Note: Mention only those publications that are published or are accepted for publication during the said period only)*

Sr. No.	Title of Paper	Authors	Journal	Year/ Vol/ Issue	Page Nos	Indexed/ Non- Indexed	Status

## **Section VI**

**Any other significant achievement:**

### **Certificate by the PG Guide and Head of Unit**

This is to certify that Dr. \_\_\_\_\_, has an attendance of \_\_\_\_\_, %, during the period \_\_\_\_\_ to \_\_\_\_\_

**Overall Grading:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Name and Signature of PG Guide:**

**Name and Signature of Head of Unit:**

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### **Certificate by the Head of Department**

This is to certify that the performance of Dr. \_\_\_\_\_, during the period \_\_\_\_\_ To \_\_\_\_\_, has been **satisfactory/ average / unsatisfactory**.

**Name and Signature of HOD:**

**Department Of Pathology & Laboratory Medicine**  
**ALL INDIA INSTITUTE OF MEDICAL SCIENCES(AIIMS)**  
**KALYANI, WEST-BENGAL-741245**



**Log Book - MD Pathology & Laboratory medicine**

**Name:** \_\_\_\_\_

**Batch:** \_\_\_\_\_

## **Fact file of Postgraduate Student**

Name:

Paste a recent  
photograph

Month and Year of Joining:

Address (Local):

Address (Permanent):

Contact Number: Telephone:

Email:

Registration Number:

Signature of Student

Signature of HOD

## Table of contents

Sl no	Posting	Comments
1.	Histopathology	
2.	Cytopathology	
3.	Hematopathology	
4.	Autopsy training record	
5.	Clinical pathology and super specialty lab	
6.	Blood bank posting	
7.	Slide conferences	
8.	Gross conferences	
9.	Journal club	
10.	Subject seminars	
11.	Technique's discussion	
12.	Research activities	
13.	Emergency duties	
14.	Special posting	
15.	Miscellaneous activities	
16.	Teaching activities	
17.	Details of leave taken	
18.	Internal assessment	
19.	Comments by faculty in charge and HOD	

## **PATHOLOGY RECORD FORMAT**

1<sup>st</sup> Posting      From ..... to .....

Date	Procedure		Slides studied	Special Techniques (specify)	Frozen sections	Sig S/R

Comments of faculty

.....

.....

.....

Signature of Consultant