MAHATMA GANDHI UNIVERSITY
of
MEDICAL SCIENCES & TECHNOLOGY
JAIPUR

Syllabus

MD – PATHOLOGY (MD12)

(3 Years Post Graduate Degree Course)

Edition- 2022-23

Notice

1. Amendment made by the NMC Rules/Regulations of Post Graduate Medical Courses shall automatically apply to the Rules/Regulations of the Mahatma Gandhi University of Medical Sciences & Technology (MGUMST), Jaipur.

2. The University reserves the right to make changes in the syllabus/books/guidelines, fees-structure or any other information at any time without prior notice. The decision of the University shall be binding on all.

3. The Jurisdiction of all court cases shall be Jaipur Bench of Hon'ble Rajasthan High Court only.

RULES & REGULATIONS

MD PATHOLOGY
(3 Years Post Graduate degree course)

TITLE OF THE COURSE:
It shall be called Doctor of Medicine.

ELIGIBILITY FOR ADMISSION:
No candidate of any category (including Management quota) shall be eligible for admission to MD/MS courses, if he or she has not qualified NEET PG (MD/MS) conducted by National Board of Examinations or any other Authority appointed by the Government of India for the purpose.

(1) General Seats
(a) Every student, selected for admission to postgraduate medical course shall possess recognized MBBS degree or equivalent qualification and should have obtained permanent Registration with the NMC, or any of the State Medical Councils or should obtain the same within one month from the date of his/her admission, failing which the admission of the candidate shall be cancelled;
(b) Completed satisfactorily one year's rotatory internship or would be completing the same before the date announced by the University for that specific year as per NMC rules after passing 3rd professional MBBS Part II Examination satisfactorily.

CRITERIA FOR SELECTION FOR ADMISSION:

1. Out of total seats available for admission to the postgraduate courses 50% seats shall be ear marked for All India Quota and 50% shall be state Quota seats.

2. Out of total seats available for admission to the postgraduate courses 15% shall be management Quota seats. Theses seats shall be part of All India Quota seats.

3. Remaining 35% seats shall be of All India Quota nature.

4. Preference shall be given to state domicile candidates on all categories of seats.

5. Reservation shall be applicable on all category of seats as per the state government policy.

Admissions to the Postgraduate MD/MS Courses shall be made on the basis of the merit obtained at the NEET conducted by the National Board of Examinations or any other Authority appointed by the Government of India for the purpose.
The admission policy may be changed according to the law prevailing at the time of admission.

COUNSELING/INTERVIEW:
(1) Candidates in order of merit will be called for Counseling/Interview and for verification of originaldocuments and identity by personal appearance.
(2) Counseling will be performed and the placement will be done on merit-cum-choice basis after application of roster by the Admission Board.

(3) RESERVATION:
Reservation shall be applicable as per policy of the State Government in terms of scheduled caste, scheduled tribe, back ward class, special back ward class, women and person with disability & EWS

ELIGIBILITY AND ENROLMENT:
Every candidate who is admitted to MD/MS course in Mahatma Gandhi Medical College & Hospital shall be required to get himself/herself enrolled and registered with the Mahatma Gandhi University of

Medical Sciences & Technology after paying the prescribed eligibility and enrolment fees.

The candidate shall have to submit an application to the MGUMST through Principal of College for the enrolment/eligibility along with the following original documents and the prescribed fees within the prescribed period without late fees. Then after, students will have to pay applicable late fees as per prevailing University Rules –

(a) MBBS pass Marks sheet/Degree certificate issued by the University (Ist MBBS to Final MBBS)
(b) Certificate regarding the recognition of medical college by the Medical Council of India.
(c) Completion of the Rotatory Internship certificate from a recognized college.
(d) Migration certificate issued by the concerned University.
(e) Date of Birth Certificate
(f) Certificate regarding registration with Rajasthan Medical Council / NMC/ Other State Medical Council.

REGISTRATION

Every candidate who is admitted to MD/MS course in Mahatma Gandhi Medical College & Hospital shall be required to get himself/herself registered with the Mahatma Gandhi University of Medical Sciences & Technology after paying the prescribed registration fees.

The candidate shall have to submit application to the MGUMST through Principal of College for registration with the prescribed fees within the prescribed period without late fees. Then after, students will have to pay applicable late fees as per prevailing University Rules.

DURATION OF COURSE:

The course shall be of 3 years duration from the date of commencement of academic session.

PERIOD OF TRAINING:

(1) The period of training for obtaining Post graduate degrees (MD/MS) shall be three completed years including the period of examination.

MIGRATION:

No application for migration to other Medical Colleges will be entertained from the students already admitted to the MD/MS course at this Institute.

METHODS OF TRAINING FOR MD/MS:

Method of training for MD/MS courses shall be as laid down by the NMC.

ONLINE COURSE IN RESEARCH METHODS

i. All postgraduate students shall complete an online course in Research Methods to be conducted by an Institute(s) that may be designated by the NMC by way of public notice, including on its website and by Circular to all Medical Colleges. The students shall have to register on the portal of the designated institution or any other institute as indicated in the public notice.
ii. The students have to complete the course by the end of their 2nd semester.
iii. The online certificate generated on successful completion of the course and examination thereafter, will be taken as proof of completion of this course
iv. The successful completion of the online research methods course with proof of its completion shall be essential before the candidate is allowed to appear for the final examination of the respective postgraduate course.
v. This requirement will be applicable for all postgraduate students admitted from the academic year 2019-20 onwards

ATTENDANCE, PROGRESS AND CONDUCT:

(1) Attendance:

(a) 80% attendance in the subject is compulsory. Any one failing to achieve this, shall not be allowed to appear in the University examination.
(b) A candidate pursuing MD/MS course shall reside in the campus and work in the respective

department of the institution for the full period as a full time student. No candidate is permitted to run a clinic/work in clinic/laboratory/ nursing home while studying postgraduate course. No candidate shall join any other course of study or appear for any other examination conducted by this university or any other university in India or abroad during the period of registration. Each year shall be taken as a unit for the purpose of calculating attendance.

(c) Every candidate shall attend symposia, seminars, conferences, journal review meetings, grand rounds, CPC, CCR, case presentation, clinics and lectures during each year as prescribed by the department and not absent himself / herself from work without valid reasons. Candidates should not be absent continuously as the course is a full time one.

(2) Monitoring Progress of Studies- Work diary/Log Book:

(a) Every candidate shall maintain a work diary in which his/her participation in the entire training program conducted by the department such as reviews, seminars, etc. has to be chronologically entered.

(b) The work scrutinized and certified by the Head of the Department and Head of the Institution is to be presented in the University practical/clinical examination.

(3) Periodic tests:

There shall be periodic tests as prescribed by the NMC and/ or the Board of Management of the University, tests shall include written papers, practical/clinical and viva voce.

(4) Records:

Records and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University when called for.

THESIS:

(1) Every candidate pursuing MD/MS degree course is required to carry out work on research project under the guidance of a recognized post graduate teacher. Then such a work shall be submitted in the form of a Thesis.

(2) The Thesis is aimed to train a postgraduate student in research methods & techniques.

(3) It includes identification of a problem, formulation of a hypothesis, designing of a study, getting acquainted with recent advances, review of literature, collection of data, critical analysis, comparison of results and drawing conclusions.

(4) Every candidate shall submit to the Registrar of the University in the prescribed format a Plan of Thesis containing particulars of proposed Thesis work within six months of the date of commencement of the course on or before the dates notified by the University.

(5) The Plan of Thesis shall be sent through proper channel.

(6) Thesis topic and plan shall be approved by the Institutional Ethics Committee before sending the same to the University for registration.

(7) Synopsis will be reviewed and the Thesis topic will be registered by the University.

(8) No change in the thesis topic or guide shall be made without prior notice and permission from the University.

(9) The Guide, Head of the Department and head of the institution shall certify the thesis. Three printed copies and one soft copy of the thesis thus prepared shall be submitted by the candidate to the Principal. While retaining the soft copy in his office, the Principal shall send the three printed copies of the thesis to the Registrar six months before MD/MS University Examinations. Examiners appointed by the University shall evaluate the thesis. Approval of Thesis at least by two examiners is an essential pre-condition for a candidate to appear in the University Examination.

(10) Guide: The academic qualification and teaching experience required for recognition by this University as a guide for thesis work is as laid down by Medical Council of India/Mahatma Gandhi University of Medical Sciences & Technology, Jaipur.

(11) Co-guide: A co-guide may be included provided the work requires substantial contribution from a sister department or from another institution recognized for teaching/training by Mahatma Gandhi University of Medical Sciences & Technology, Jaipur/Medical Council of India. The co-guide shall be a recognized postgraduate teacher.

(12) Change of guide: In the event of a registered guide leaving the college for any reasonor in the event of death of guide, guide may be changed with prior permission from the University.

ELIGIBILITY TO APPEAR FOR UNIVERSITY EXAMINATION:

The following requirements shall be fulfilled by every candidate to become eligible to appear for the final examination:

(1) Attendance: Every candidate shall have fulfilled the requirement of 80% attendance prescribed by the University during each academic year of the postgraduate course. (asper NMC rules)

(2) Progress and Conduct: Every candidate shall have participated in seminars, journal review meetings, symposia, conferences, case presentations, clinics and didactic lectures during each year as designed by the department.

(3) Work diary and Logbook: Every candidate shall maintain a work diary for recording his/her participation in the training program conducted in the department. The work diary and logbook shall be verified and certified by the Department Head and Head of the Institution.

(4) Every student would be required to present one poster presentation, to read one paper at a National/State Conference and to have one research paper which should be published/accepted for publication/ sent for publication to an indexed journal during the period of his/her post graduate studies so as to make him/her eligible to appear at the Post Graduate Degree Examination.

(5) Every student would be required to appear in and qualify the Pre-University Post graduate degree Mock examination. Post graduate students who fail to appear in or do not qualify the Pre-University Post graduate degree Mock examination shall not be permitted to appear in the final examination of the University.

The certification of satisfactory progress by the Head of the Department/ Institution shall be based on (1), (2), (3), (4) and (5) criteria mentioned above.

ASSESSMENT:

(1) The progress of work of the candidates shall be assessed periodically by the respective guides and report submitted to the Head of the Institution through the Head of the Department at the end of every six months. The assessment report may also be conveyed in writing to the candidate who may also be advised of his/her shortcomings, if any.

(2) In case the report indicate that a candidate is incapable of continuing to do the work of the desired standard and complete it within the prescribed period, the Head of the Institution may recommend cancellation of his/her registration at any time to the University.

(3) Formative Assessment:

(a) General Principles

i. The assessment is valid, objective, constructive and reliable.
ii. It covers cognitive, psychomotor and affective domains.
iii. Formative, continuing and summative (final) assessment is also conducted.
iv. Thesis is also assessed separately.

(b) Internal Assessment

i. The internal assessment is continuous as well as periodical. The former is based on the feedback from the senior residents and the consultants concerned. Assessment is held periodically.
ii. Internal assessment will not count towards pass/fail at the end of the program, but will provide feedback to the candidate.
iii. The performance of the Postgraduate student during the training period should be monitored throughout the course and duly recorded in the log books as evidence of the ability and daily work of the student.
iv. Marks should be allotted out of 100 as under
    1) Personal Attributes - 20 marks
        a. Behavior and Emotional Stability: Dependable, disciplined, dedicated, stable in emergency situations, shows positive approach.
        b. Motivation and Initiative: Takes on responsibility, innovative, enterprising, does not

shirk duties or leave any work pending.

c. Honesty and Integrity: Truthful, admits mistakes, does not cook up information, has ethical conduct, exhibits good moral values, loyal to the institution.

2) Clinical Work - 20 marks
   a Availability: Punctual, available continuously on duty, responds promptly on calls and takes proper permission for leave.
   b Diligence: Dedicated, hardworking, does not shirk duties, leaves no work pending, does not sit idle, competent in clinical case work up and management.
   c Academic Ability: Intelligent, shows sound knowledge and skills, participates adequately in academic activities and performs well in oral presentation and departmental tests.
   d Clinical Performance: Proficient in clinical presentations and case discussion during rounds and OPD work up. Preparing Documents of the case history/examination and progress notes in the file (daily notes, round discussion, investigations and management) Skill of performing bed side procedures and handling emergencies.
3) Academic Activities - 20 marks
   Performance during presentation at Journal club/ Seminar/Case discussion/Stat meeting and other academic sessions. Proficiency in skills as mentioned in job responsibilities.
4) End of term theory examination - 20 marks
   End of term theory examination conducted at end of 1st, 2nd year and after 2 years 9 months.
5) End of term practical examination - 20 marks
   a. End of term practical/oral examinations after 2 years 9 months.
   b. Marks for personal attributes and clinical work should be given annually by all the consultants under whom the resident was posted during the year. Average of the three years should be put as the final marks out of 20.
   c. Marks for academic activity should be given by the all consultants who have attended the session presented by the resident.
   d. The Internal assessment should be presented to the Board of examiners for due consideration at the time of Final Examinations.
   e. Yearly (end of 1st, 2nd & 3rd year) theory and practical examination will be conducted by internal examiners and each candidate will enter details of theory paper, cases allotted (2 long & 2 short) and viva.
   f. Log book to be brought at the time of final practical examination.

APPOINTMENT OF EXAMINERS:

Appointment of paper setters, thesis evaluators, answer books evaluators and practical & vivavoce examiners shall be made as per regulations of the National Medical Commission .

SCHEME OF EXAMINATION:

Scheme of examination in respect of all the subjects of MD/MS shall be as under :

(1) The examination for MD/MS shall be held at the end of three Academic Years.
(2) Examinations shall be organized on the basis of marking system.
(3) The period of training for obtaining MD/MS degrees shall be three completed years including theperiod of examination.
(4) The University shall conduct not more than two examinations in a year for any subject with an interval of not less than 4 months and not more than 6 months between the two examinations.
(5) The examinations shall consist of:
   (a) Thesis :
      i. Thesis shall be submitted at least six months before the main Theory examinations.
      ii. The thesis shall be examined by a minimum of three examiners – one Internal and two External examiners who shall not be the examiners for Theory and Clinical/Practical.
      iii. In departments where besides the two earmarked practical/clinical examiners no one else is a qualified P.G. teacher, in that case the Thesis shall be sent to the third external examiner who

shall actually be in place of the internal examiner.

iv. Only on the acceptance of the thesis by any two examiners, the candidate shall be eligible to appear for the final examination.

v. A candidate whose thesis has been once approved by the examiners will not be required to submit the Thesis afresh, even if he/she fails in theory and/or practical of the examination of the same branch.

vi. In case the Thesis submitted by a candidate is rejected, he/she should be required to submit a fresh Thesis.

(b) Theory papers:

i. There shall be four theory papers, as below:

(1) **Paper I:** Basic sciences as applied to the subject (general pathology, pathophysiology, immunopathology, and molecular biology).

(2) **Paper II:** (Systemic pathology – surgical and cytopathology).

(3) **Paper III:** (Hematology, transfusion medicine and laboratory medicine including instrumentation and quality control).

(4) **Paper IV:** Recent advances in the subject.

ii. Each theory paper examination shall be of three hours duration.

iii. Each theory paper shall carry maximum 100 marks.

iv. The question papers shall be set by the External Examiners.

v. There will be a set pattern of question papers.
Every question paper shall contain three questions. All the questions shall be compulsory, having no choice.
Question No. 1 shall be of long answer type carrying 20 marks.
Question No. 2 shall have two parts of 15 marks each. Each part will be required to be answered in detail.
Question No. 3 shall be of five short notes carrying 10 marks each.

vi. The answer books of theory paper examination shall be evaluated by two External and two internal examiners. Out of the four paper setters, the two paper setters will be given answer books pertaining to their papers and the answer books of the remaining two papers will be evaluated by two Internal Examiners. It will be decided by the President as to which paper is to be assigned to which Internal Examiner for evaluation.

vii. A candidate will be required to pass theory and practical examinations separately in terms of the governing provisions pertaining to the scheme of examination in the post graduate regulations. The examinee should obtain minimum 40% marks in each theory paper and not less than 50% marks cumulatively in all the four papers for degree examination to be cleared as "passed" at the said Degree examination.

(b) Clinical/ Practical & Oral examinations:

i. Clinical/Practical and Oral Examination of 400 marks will be conducted by at least four examiners, out of which two (50%) shall be External Examiners.

ii. A candidate will be required to secure at least 50% (viz. 200/400) marks in the Practicalincluding clinical and viva voce examinations.

(5) If a candidate fails in one or more theory paper(s) or practical, he/she shall have to reappear in thewhole examination i.e. in all theory papers as well as practical.

GRACE MARKS

No grace marks will be provided in MD/MS examinations.

REVALUATION / SCRUTINY:

No Revaluation shall be permitted in the MD/MS examinations. However, the student can apply for scrutiny of the answer books as per University Rules.

GUIDELINES FOR COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME FOR MD INPATHOLOGY

Preamble

The purpose of PG education is to create specialists who would provide high quality health care and advance the cause of science through research & training.

This programme is meant to standardize Pathology teaching at postgraduate level throughout the country in order to achieve uniformity in teaching and create suitable manpower with appropriate expertise. The postgraduate student in pathology should be sufficiently trained, professionally competent and confident in handling, ~~and~~ processing, and diagnosis related to histopathology (surgical pathology), cytopathology, and hematology with reasonable working knowledge in blood banking, laboratory medicine, medical statistics, and ancillary techniques with understanding of general principles and methodology.

The purpose of this document is to provide teachers and learners illustrative guidelines to achieve defined outcomes through learning and assessment. This document was prepared by various subject-content specialists. The Reconciliation Board cum Expert group of NMC has attempted to render uniformity without compromise to the purpose and content of the document. Compromise in purity of syntax has been made in order to preserve the purpose and content. This has necessitated retention of "domains of learning" under the heading "competencies".

SUBJECT SPECIFIC LEARNING OBJECTIVES

At the end of the MD training programme in Pathology, the student should achieve the following goals:

1. Knowledge of Pathology

1.1. Make a diagnosis based on histopathology (surgical pathology) and cytopathology specimens, blood and bone marrow examination and various tests of Laboratory Medicine (clinical pathology, clinical biochemistry) as well as Blood Banking (Transfusion Medicine).

1.2. Interpret clinical and laboratory data with reasonable accuracy and prepare a succinct and lucid report

1.3. Compose reports following standard protocols including synoptic reporting

1.4. Interpret and correlate clinical and laboratory data so that clinical manifestations of diseases can be explained.

1.5. Advise on the selection of appropriate specimens and tests necessary to arrive at a diagnosis in a problematic case including molecular tests.

1.6. Correlate clinical and laboratory findings with pathology findings at autopsy, identify miscorrelations and the causes of death due to diseases (apart from purely metabolic causes).

1.7. Maintain quality control of all tests by being part of Internal Quality Control Monitoring program.

1.8. Make and record observations systematically and maintain accurate records of tests and their results for reasonable periods of time. Identify problems in the laboratory, offer solutions thereof and maintain a high order of quality control.

1.9. Should be aware of safe and effective disposal of laboratory waste and ensure minimization risk of exposure to infection and accidents to laboratory personnel.

2. Teaching and training

2.1. Should be able to teach Pathology to undergraduates, postgraduates, nurses and paramedical staff including laboratory personnel.

2.2. The postgraduate student should be able to teach effectively and assess undergraduate medical and allied health science students so that they become competent healthcare professionals.

3. Research

3.1. Plan, execute, analyze, and present research work independently or as part of a team.

3.2. The postgraduate student in Pathology should acquire knowledge and skills to be able to conduct a research project from the planning to the publication stage and become a life-long learner.

4. Professionalism, Ethics and Communication skills

4.1. The postgraduate student should learn and apply principles of professionalism, ethics, and effective communication in conduct of routine pathology services, research, and routine work.

SUBJECT SPECIFIC COMPETENCIES

A. COGNITIVE DOMAIN

A postgraduate student upon successfully qualifying the MD (Pathology) examination should have acquired the following <u>BROAD</u> theoretical competencies and should be:

- Capable of offering an accurate diagnostic opinion in a given clinical situation with an appropriate and relevant sample of tissue, blood, body fluid, etc. for the purpose of diagnosis.
- Conversant with the standard operating procedures of various laboratories including histopathology, cytopathology, hematology and laboratory medicine
- Able to teach and share his knowledge and competence with others. The student should be imparted training in teaching methods in the subject which may enable the student to take up teaching assignments in Medical Colleges/Institutes.
- Capable of pursuing clinical and laboratory-based research. He/she should be introduced to basic research methodology so that he/she can conduct fundamental and applied research.

At the end of the course, **the student should have acquired the following competencies as a <u>diagnostician:</u>**

Surgical pathology

- Be conversant in the histogenesis and pathophysiological processes associated with various diseases.
- Should be able to identify problems in the histopathology laboratory and offer viable solutions.
- Possess the background knowledge necessary for the evaluation and reporting of Surgical Pathology.
- Conversant with the various equipment used in the histopathology laboratory.
- Should have knowledge of automation and quality assurance in histopathology.

Cytopathology

- Possess the background knowledge necessary for the evaluation and reporting of Cytopathology.

- Demonstrate familiarity with, and guide clinical/radiology residents in keeping with the clinical information on the choice of site, collection, preservation, transport, type of preparation and method of obtaining various cytological specimens.
- Conversant with the various equipment used in the cytopathology laboratory.
- Should have knowledge of automation and quality assurance in cytopathology.

Hematology

- Demonstrate ability to utilize the principles of the practice of Hematology for the planning of tests, interpretation, and diagnosis of diseases of the blood and bone marrow.
- Conversant with the various equipment used in the hematology laboratory.
- Should have knowledge of automation and quality assurance in hematology.

Laboratory medicine

- Demonstrate familiarity with the normal range of values of the chemical content of body fluids, significance of altered values, and interpretation thereof.
- Possess knowledge of the following specialized organ function tests and relative utility and limitations of each and significance of altered values:
  - (i) Renal function test
  - (ii) Liver function test
  - (iii) Endocrine function test
  - (iv) Tests for malabsorption
- Principles, advantage and disadvantages, scope, and limitation of automation in laboratory.
- Learn the principle and methodology of quality control in the laboratory.

Transfusion medicine

- Possess knowledge of basic immunology, ABO and Rh groups, minor blood groups and their clinical significance, transfusion therapy, pre-transfusion testing, transfusion related infections, transfusion reactions and quality control in blood bank.

Autopsy pathology

- Conversant with the technique of autopsy.
- Possess sufficient understanding of the various disease processes so that meaningful clinico-pathological correlation can be made.

Immunopathology

- Demonstrate familiarity with current concepts of structure and function of the immune system, its aberrations, and mechanisms thereof.
- Demonstrate familiarity with the scope, principles, limitations, and interpretations of the results of ELISA techniques, HLA typing, immunofluorescence, and immunoelectrophoresis.

Immunohistochemistry and flow cytometry

- Demonstrate familiarity with the principles and procedures of performing immunohistochemistry including automation in procedure and interpretation.
- Demonstrate familiarity with the principles and procedures of performing flow cytometry.

Cytogenetics and Molecular biology

- Demonstrate familiarity with the principles of molecular biopsy especially related to the understanding of disease processes and its use in various diagnostic tests at least including but not limited to in-situ hybridization, polymerase chain reaction, Sanger Sequencing and Next generation sequencing.

Electron microscopy

- Demonstrate familiarity with the principles and techniques of electron microscopy and the working of the electron microscope.
- Demonstrate familiarity with the tissue processing and staining methods for electron microscopy, including immune-labelling techniques and use of semi-thin sections.

Enzyme histochemistry

- Demonstrate familiarity with the principles, use and interpretations of common enzyme histochemical procedures.

Quality Control

- Demonstrate familiarity with various quality control programmes running in the department, both internal and external quality.
- Demonstrate familiarity with inert and intra assay variations, batch variations, validation of chemicals and instruments.

Laboratory Safety and Good clinical lab practices

- Demonstrate familiarity with good lab practices and safety, record maintenance of capital equipment and consumables, purchase specifications, approximate costs of reagents and equipment, maintenance of store logbooks, etc.

Biomedical Waste Management

- Demonstrate familiarity with disposal methods for each specimen, reagents, instruments, autoclaving techniques, recycling of products and e-waste.

At the end of the course, **the student should have acquired the following competencies as a teacher:**

- Demonstrate familiarity with different modes, methods, and principles of teaching including microteaching.

At the end of the course, **the student should have acquired the following competencies as a researcher:**

- Conversant with the principles of basic and applied research methodology, literature search, study design, sample size estimation, selection of controls, and appropriate application of medical statistics.
- Possess knowledge about the methods of writing thesis and/or a research paper with the prescribed instructions, as expected of international standards.
- Conversant with the use of digital slide imaging, algorithms to evaluate findings in imaging, morphometry, and application of artificial intelligence.

B. AFFECTIVE DOMAIN

1. The student will show integrity, accountability, respect, compassion and dedicated patient care. The student will demonstrate a commitment to excellence and continuous professional development.
2. The student should demonstrate a commitment to ethical principles relating to providing patient care, confidentiality of patient information and informed consent.
3. The student should show sensitivity and responsiveness to patients' culture, age, gender and disabilities.
4. The student should demonstrate a commitment to ethical principles relating to research conduct and research publication.

C. PSYCHOMOTOR DOMAIN

1. Able to perform grossing of biopsy and surgical specimens including gross diagnosis and taking appropriate sections/ samples necessary for diagnosis, comprehensive staging, and ancillary testing.

2. Conversant in histopathology tissue processing techniques and troubleshooting, cutting of paraffin and frozen sections, making imprint smears, and staining, and immunohistochemistry.
3. Able to collect specimens by routinely performing non-invasive out-patient procedures such as venipuncture, finger-prick, fine needle aspiration of superficial lumps and bone-marrow aspirates, making smears and staining, and provide appropriate guidance to colleagues performing procedure such as a biopsy or an imaging guided biopsy including on-site microscopic assessment of specimen adequacy.
4. Perform an autopsy, dissect various organ complexes and display the gross findings.
5. Conversant with the function, handling, and routine care of equipment in the laboratory and quality assurance.
6. Able to teach and share his knowledge and competence with others. The student should be imparted training in teaching methods in the subject which may enable the student to take up teaching assignments in Medical Colleges/Institutes.
7. Able to pursue clinical and laboratory-based research. He/she should be introduced to basic research methodology so that he/she can independently conduct fundamental and applied research.

Syllabus

Course contents:

It is difficult to give a precise outline of the Course Contents for post graduate training. A postgraduate is supposed to acquire not only the professional competence of a well-trained specialist but also academic maturity, a capacity to reason and critically analyze scientific data as well as to keep himself abreast of the latest developments in the field of Pathology and related sciences. The study of Anatomic Pathology includes all aspects of Pathology as encompassed in the branches of General and Systemic Pathology. Only the broad outlines are provided.

A. COGNITIVE DOMAIN

A) General Pathology:

Normal cell and tissue structure and function:

- The changes in cellular structure and function in diseases.
- Causes of disease, its pathogenesis, reaction of cells, tissues, organ systems, and the body to various sub lethal and lethal injuries.
- Cellular adaptation, cell injury, and cell death.

- Mechanism, morphology and examples of cell injury, necrosis, apoptosis, autophagy, and newer forms of cell death including necroptosis and pyroptosis.
- Sub cellular and cellular responses and adaptation to injury.
- Intracellular and intercellular accumulations, pathological calcification, and cell aging.

Acute and chronic inflammation:

- Vascular and cellular events in acute inflammation, chemical mediators, outcome, and morphological patterns of acute inflammation.
- Chronic inflammation with special reference to granulomatous inflammation.
- Systemic effects and effects of deranged inflammation.
- Tissue renewal and repair: Regeneration healing and fibrosis.
- Control of normal cell proliferation and tissue growth, mechanism of tissue regeneration, repair by healing and fibrosis.
- Extracellular matrix and cell matrix interactions.

Hemodynamic disorders, thromboembolic disease, and shock:

- Edema, hyperemia, congestion, and hemorrhage.
- Normal Hemostasis, thrombosis, DIC, embolism, infarction, and shock.

Genetic Disorders

- Principles of genetics, normal karyotyping.
- Mutations, Mendelian disorders, disorders with multifactorial inheritance cytogenetic disorders involving autosomes and sex chromosomes.
- Single gene disorders with nonclassic inheritance.
- Diagnosis of genetic disorders involving molecular and genetic techniques.

Neoplasia

- Definition, nomenclature, and biology of tumor growth
- Molecular basis of cancer with special reference to carcinogenic agents and molecular basis of multistep carcinogenesis.
- Epidemiology and clinical features of tumors.
- Grading, staging and laboratory diagnosis of cancer.

Infectious Diseases

- Pathology and general principles of microbial pathogenesis, special techniques for diagnosing bacterial, fungal, parasitic, and viral infections.

Environmental and nutritional pathology

- Common environmental and occupational exposures leading on to diseases.
- Nutritional deficiencies and obesity related disorders.

Disease of Infancy and Childhood

- Congenital anomalies, birth injuries, diseases of neonates, inborn errors of metabolism, tumor, and tumor like lesions of infancy and childhood.

Immunopathology

- Innate immunity- Role of phagocytic cells, complement, mast cells & humoral mechanisms.
- Specific Acquired Immunity- Details about antibody production & action, Brief principles about memory, Ag specificity & vaccination.
- Cell involved in Immune response- T- Lymphocytes, B-lymphocytes, macrophages, dendritic cells, and natural-killer cells.
- Cytokines with details about their properties and functions.
- Structure and function of histocompatibility molecules and disease association.
- Disorders of the immune system.
- All hypersensitivity reactions.
- Autoimmune disorders with special reference to SLE, Rheumatoid arthritis, Sjogren's syndrome, systemic sclerosis, polyarteritis nodosa and other vasculitides, Mixed connective tissue disorders and inflammatory disorders.
- Immunodeficiency syndrome – Acquired with emphasis on AIDS.
- Amyloidosis including pathogenesis, special stains & clinical correlation.
- Transplant rejection in detail.
- Graft vs Host Disease.

B) Systemic Pathology:

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

Blood vessels, lymphatic and veins

- Normal morphology, congenital anomalies, atherosclerosis, hypertensive vascular disease.
- Inflammatory and neoplastic diseases of all the vessels.

Heart

- Normal morphology, its blood supply and effect of aging on heart.
- Ischemic, Hypertensive, valvular, congenital heart diseases.
- Cardiomyopathies
- Myocardial disorders
- Pericardial diseases.
- Tumors of the heart.

Lungs and Mediastinum

- Congenital anomalies
- Obstructive and restrictive pulmonary diseases
- Diseases of vascular origin
- Infections of Lung
- Infections of Mediastinum
- Tumors of lung
- Lung transplantation
- Diseases of pleura
- Thymus – Developmental, autoimmune, and inflammatory disorder and tumors.

Head and Neck

- Oral cavity: - inflammatory disease, Preneoplastic lesions and tumors.
- Diseases of teeth and supporting structures.
- Upper airways and ear – congenital anomalies, infections, and tumors.
- Salivary glands – Infections autoimmune disorders and tumors.

Gastrointestinal Tract

- Congenital anomalies, infections, inflammatory and vascular disorders and tumors of esophagus, stomach, small and large intestines, appendix, and anal canal.
- Diseases of the peritoneum, Omentum and Mesentery Retroperitoneum.
- Inflammatory and neoplastic lesions.

Liver

- Normal morphology with general features of hepatic disease including LFTs.
- Infectious, autoimmune drug induced metabolic and circulatory disorders of liver.
- Hepatic diseases associated with pregnancy, neonates, organ and bone marrow transplantation.
- Liver transplantation pathology.
- Cysts, Nodules, and tumors of liver.

Biliary tract

- Congenital anomalies, injuries, Infection, inflammation, of Gallstones and tumors of gall bladder and extra hepatic bile ducts. Pancreas.
- Congenital anomalies, pancreatitis, and neoplasms of pancreas.

Kidney

- Clinical manifestations of renal diseases
- Congenital anomalies
- Diseases affecting glomeruli, tubules, interstitium and blood vessels.

- Cystic diseases of kidney
- Nephrolithiasis
- Tumors of kidney
- Kidney Transplant pathology

Lower urinary tract and male genital system

- Congenital anomalies, inflammation and tumors of bladder, ureter, urethra, penis, testis, epididymis, and Scrotum.
- Inflammation, enlargement, and tumors of prostate.

Female genital tract

- Physiology, cytology and histology of female genital tract, menstrual disorders, and hormonal abnormalities.
- Congenital anomalies, inflammation, preneoplastic and neoplastic lesions of vulva, vagina, cervix, uterus, fallopian tubes, ovaries and mesonephron.
- Gestational and placental disorders.

Breast

- Inflammations, benign epithelial lesions, and tumors of the breast.
- Diseases of male breast.

Endocrine System

- Normal hormonal levels and functions of all the endocrine glands.
- Hypo and hyperactivity of glands of endocrine system i.e., pituitary, thyroid, parathyroid, pancreas, adrenals, and pineal gland.
- Autoimmune diseases, inflammations and tumors affecting these glands,
- Neuroendocrine tumors,

Skin and Subcutaneous tissue

- Disorders of pigmentation and melanocytes,
- Inflammatory, vesiculobullous, and infectious disease,
- Proliferative lesions and Tumors of the epidermis, dermis, and skin appendage.

Musculoskeletal system

- Bone Modelling, growth, and development, genetic and acquired abnormalities in bone cells, matrix and structure, factures, necrosis and infections of bones, tumors and tumor-like lesions,
- Joints: Arthritis, tumor, and tumor-like lesions.
- Soft tissue: Tumors and tumor=like lesions.

Peripheral nerves and skeletal muscles

- General reactions of motor units.

- Inflammatory, infectious, hereditary, metabolic, and traumatic neuropathies.
- Atrophy, dystrophy, myopathies of the skeletal muscles.
- Diseases of neuromuscular junction.
- Tumors of peripheral nerves and skeletal muscles.

Skull and Central Nervous System

- Degenerative, metabolic, toxic, demyelinating, infectious, cerebrovascular malformations, and traumatic injuries.
- Tumors.

Eye and Orbit

- Infections, inflammatory, congenital diseases and neoplasms of orbit, eyelid, conjunctiva sclera, uvea, cornea, retina, and optic nerves.

C) Hematology and Transfusion medicine

The study of Hematology 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.

Biology of stem cell and Hematopoiesis

- Overview of stem cell biology and cellular biology of hematopoiesis.
- Transcription factors and humoral regulation in normal and malignant hematopoiesis.
- Interaction between hematopoietic stem cells, progenitor cell and stromal compartment of bone marrow.
- Stem cell homing & mobilization.

Erythroid maturation, differentiation, and abnormality

- Pathobiology of human erythrocyte & Hemoglobin Anemia.
- Approach to anemia in adults and children in: Clinical correlation & diagnostic modalities.
- Classification of anemias (Morphological, pathophysiological, and based on erythropoiesis i.e., proliferative vs non-proliferative).
- Iron deficiency anemia including iron metabolism and differential diagnosis from other microcytic hypochromic anemias.
- Disorder of iron metabolism including iron overload.
- Anemia of chronic disorders with special reference to infections, collagen vascular disorders, inflammation etc.
- Megaloblastic anemia and other causes of megaloblastosis.
- Definition, approach, and classification of hemolytic anemia.
- Lab diagnosis of Hemoglobin disorders and hereditary anemia like Thalassemia and related hemoglobinopathies, sickle cell anemia.
- Hemoglobin associated with altered Oxygen affinity.

- Red blood cell enzymopathy, membrane disorder, autoimmune hemolytic anemia, non-immune hemolytic anemia, paroxysmal nocturnal hemoglobinuria.
- Approach to Pancytopenia/ Cytopenia.
- Bone marrow failure syndrome.
- Porphyria.

WBC disorders, complement and immunoglobin biology

- Normal granulopoiesis.
- Acquired and congenital disorders of phagocytosis (neutrophil, monocyte, eosinophil, and macrophages.
- Disorder of leukocyte number, function, and morphology.

Storage disorder

Hematological responses to Infections

- Viral disorders - Infectious mononucleosis, Hepatitis, and dengue.
- Parasitic infections - Malaria, Kala azar.

Hematological malignancies

- Conventional & molecular cytogenetic and immunohistochemical basis of hematological malignancies.
- Classification (WHO, ICC).
- Their basis and diagnostic approach to various hematological malignancies.
- Pathophysiology, prognostic factors, cytochemistry, cytogenetics of various leukemias.
- Pathophysiology and classification of MDS, MPN/MDS, myeloproliferative disorders.
- Pathophysiology of Non-Hodgkin's lymphoma, Clinical staging of Hodgkin's lymphoma.
- Role of molecular cytogenetics and immunohistochemistry in Hodgkin's and Non-Hodgkin's lymphoma and lymphoproliferative disorders.
- AIDS related and Transplant related lymphomas.
- Plasma cell dyscrasias and gammopathies.
- Mastocytosis.
- Role of chemotherapy and antineoplastic agents based on molecular mechanism of hematological malignancies, clinical use of hematopoietic growth factors.

Hematopoietic stem cell transplantation

- Role and indications of HST, immunodeficiency state, hematological Malignancies and Non-hematological disorders.
- Practical aspect of umbilical cord stem cells transplantation.
- Peripheral stem cell collection.
- Role of stem cell in tissue repair.

- Complications of Hematopoietic stem cell transplant.
- Gene therapy and genetic engineering.

Prenatal diagnosis of genetic hematological diseases

Hemostasis & Thrombosis

- Megakaryocyte and platelet structure.
- Molecular basis of platelet function, activation.
- Role of blood vessel, coagulation system and fibrinolytic system in hemostasis.
- Clinical and lab evaluation of bleeding and coagulation disorders.
- Clinical & diagnostic aspects of factor deficiencies including hemophilia, von Willebrand disease, DIC, Vitamin K deficiency.
- Thrombotic and non-thrombotic purpura.
- Hereditary and acquired platelet disorders and its management.
- Thrombophilia (Inherited & acquired).
- Lab evaluation and management of hypercoagulable states.

Human blood group antigen and antibody and Immuno-hematology

- Selection of donor and screening..
- Principle, indication and storage of red blood cells, WBC, platelet, and plasma transfusion.
- Various methods of component separation and plasma derivatives with special reference to Fresh frozen plasma, cryo-precipitates, platelet concentrate, single donor plasma, albumin, and Immunoglobulin.
- Graft Rejection, GVH diseases, Transfusion Reactions, Blood grouping & cross matching.
- Blood bank audit.
- Apheresis

Hematological manifestations of systemic diseases

- Liver disorders, renal disorders, infections, cancers, parasitic diseases, AIDS, pregnancy, and surgical patients.

Spleen and its disorders

D) Laboratory Medicine (Clinical Pathology including Parasitology)

- Principles of testing, indications, values with ranges in normal and diseased states in relation to:
    - Liver function tests
    - Renal function tests
    - Endocrine function tests

- Body fluid analysis including stool, urine, semen, CSF, etc.

- Principles of laboratory automation, trouble shooting, and quality assurance.

D) Special techniques

The student is expected to acquire a general acquaintance of techniques and principles and to interpret data in the following fields:

- Immunopathology,
- Electron microscopy,
- Histochemistry,
- Immunohistochemistry,
- Cytogenetics and in-situ hybridization,
- Molecular Biology,
- Digital Pathology and image analysis,
- Maintenance of records,
- Information retrieval, use of Computer and Internet in medicine.

E) Instrumentation and automation

- Principles, indications, working, maintenance, and troubleshooting of equipment used in various laboratories:
    - Histopathology laboratory – Histopathology tissue processor, microtome, water batch, embedding station, Stainer, IHC Stainer, ultramicrotome, etc.
    - Microscopes – Immunofluorescence, FISH, Confocal, Electron, etc.
    - Cytopathology Laboratory – Centrifuge, Cytocentrifuge, Cytospin apparatus, liquid-based cytology, etc.
    - Hematology Laboratory – automated cell counter, flow cytometer, coagulometer, HPLC, Electrophoresis apparatus, immunoblot, etc.
    - Clinical Pathology –Photoelectric colorimeter, Spectrophotometer, pH meter, Centrifuge, Electrophoresis apparatus, ELISA Reader, chemiluminescence, etc.
    - Digital pathology – Whole slide scanners
    - Molecular pathology – PCR, Sanger sequencer, NGS sequencers, etc.
- Automation in Pathology.
- Good lab practices and safety, record maintenance of capital equipment and consumables, purchase specifications, approximate costs of reagents and equipment, maintenance of store logbooks, etc.

F) Quality assurance program

- Internal and external quality assurance methods.
- Intra assay variations, batch variations, validation of chemicals and instruments.

G) Establishment Act and Rules and regulations formed by Govt. or regulatory bodies

H) Biomedical Waste management

- Disposal methods for each specimen, reagents, instruments, autoclaving techniques, recycling of products and e-waste.

I) Biostatistics, Research Methodology and Clinical Epidemiology

J) Ethics and Medico legal aspects relevant to Pathology

K) Current topics and recent advances in pathology

B. PSYCHOMOTOR DOMAIN

Demonstrate following predominant Psychomotor domain competencies		
Sr. No.	Competency	Perform under supervision/ perform independently/ Observation only
I.	HISTOPATHOLOGY (SURGICAL PATHOLOGY)	
1.	Given the clinical and operative data, identify and systematically and accurately describe the chief gross anatomic alterations in the surgically removed specimens and be able to correctly diagnose common lesions received on an average day from the surgical service of an average teaching hospital	Independently
2.	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.	Independently
3.	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 correlate with the clinical data to diagnose routine surgical material received on an average day.	Independently

4.	Identify common problems in histopathology processing techniques (poor fixation, delayed fixation, poor staining, etc.,) including automated tissue processing machine troubleshooting and rectify common problems	Independently
5.	Operate and maintain common equipment in the histopathology laboratory such as microtome, water bath, cryostat, tissue processor, auto Stainer, etc.	Perform under supervision
6.	Process a tissue, make a paraffin block and cut sections of good quality on a rotary microtome	Perform under supervision
7.	Stain paraffin sections with hematoxylin and eosin stain and common special stains needed for diagnosis	Independently
8.	Cut a frozen section, stain and interpret the slide in correlation with the clinical data provided	Independently
9.	Standardize and validate new antibodies for immunohistochemistry with understanding of controls, clones, and dilutions	Independently
10.	Perform immunohistochemistry on paraffin sections using manual method	Independently
11.	Identify common problems in immunohistochemistry procedure (artifacts, inadequate retrieval, section floating, IHC failure, etc.,) and rectify such problems	Independently
12.	Decide on the appropriate immunohistochemical panels for diagnosis, prognosis and predictive purposes in common disease conditions based on standard recommendations and interpret their results	Independently
13.	Write histopathology reports, including synoptic reports, wherever needed, following protocols and international standards. The reports should be succinct and lucid, with clinical notes and advice, as necessary.	Independently
II	CYTOPATHOLOGY	
1.	Perform fine needle aspiration of superficial lumps and make good quality smears including collection of material for cell block preparation and decide on the type of fixative and stain in a given case	Independently

2.	Prepare and stain good quality smears for cytopathological examination	Independently
3.	Provide appropriate guidance to colleagues performing procedure such as a biopsy or an imaging guided biopsy including on-site microscopic assessment of specimen adequacy.	Independently
4.	Decide on the technique of collection, preservation, transport and concentration of various exfoliative cytology specimens (such as filters, centrifuge, liquid-based cytology, cytospin, etc.)	Independently
5.	Perform on-site adequacy assessment in image guided sampling procedures and decide on sample triage for routine diagnosis (type of preparation, stain, etc.) and ancillary tests including microbiological and molecular tests	Independently
6.	Diagnose common cases received in a routine cytopathology laboratory and categorize them into negative, inconclusive and positive, using the correct technique of screening and dotting the slides for suspicious cells, correctly identify the type of tumor, if present, and the presence of organisms, fungi and parasites, if present	Independently
7.	Perform preparations (cytospin smears, liquid-based cytology, cell blocks, etc.) of common cytological samples using equipment such as centrifuge, cytocentrifuge and liquid based cytology apparatus	Observation only
III	HEMATOLOGY	
1.	Perform venipuncture for peripheral blood collection and decide on appropriate collection tubes, storage, and anticoagulant based on indication	Independently
2.	Prepare good quality peripheral blood smears, stain and report peripheral blood counts and other findings including reticulocyte and platelet counts on cell counter and manually	Independently
3.	Perform bone marrow aspirates and biopsy, prepare good quality smears and imprints	Perform under supervision
4.	Perform bone marrow aspirate staining including stain for iron	Independently
5.	Perform cytochemical characterization of leukemia with special stains on bone marrow aspirates	Perform under supervision

6.	Perform and interpret coagulation profile including PT, APTT and FDP	Independently
7.	Perform and interpret sickling test and osmotic fragility test	Independently
8.	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 common cases referred to the Hematology clinic, given the relevant clinical data	Independently
9.	Given the clinical data, interpret the results of i. Red cell indices ii. Plasma hemoglobin iii. Hemosiderin in urine iv. Hemolytic anemia profile including HPLC, Hb electrophoresisetc. v. Hemoglobin and serum protein electrophoresis vi. Clotting time and other point of care tests for bleeding vii. G6PD enzyme estimation viii. Platelet function tests including platelet aggregation andadhesion and PF3 release ix. Russell's viper venom time (RVVT) x. Coagulation Factor assays xi. Serum Fibrinogen xii. Screening for coagulation factor inhibitor, Bethesda Assay, xiii. Fibrin Degradation Products (FDP), D-Dimers xiv. Monitoring of anti-coagulant therapy xv. Thrombophilia profile (Lupus anticoagulant (LAC), Anticardiolipin Antibody (ACA), Activated Protein C Resistance (APCR), Protein C (Pr C), Protein S (Pr S) and Antithrombin III (AT III)) xvi. Serum ferritin, Serum iron and total iron binding capacity	Independently
10.	Interpret flow cytometry findings in the immunophenotyping of leukemia, CD34 enumeration, CD 3/CD 19 enumeration, PNH workup, etc.	Independently
11.	Interpret results of cytogenetics and molecular diagnostics in the work up of hematological diseases	Independently

12.	Prepare samples as appropriate for the indication, and operate equipment such as automated cell counter, flow cytometry, coagulometers, HPLC and electrophoresis apparatus	Observation only
IV	LABORATORY MEDICINE	
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; be able to correctly interpret the laboratory data of such studies, and discuss their significance with a view to arrive at a diagnosis.	Independently
2.	Perform urine analysis including physical, chemical and microscopic, examination of the sediment as well as by Dipstick methods.	Independently
3.	Perform macroscopic and microscopic examination of feces and identify the ova and cysts of common parasites.	Independently
4.	Perform a complete examination: physical, chemical and cell content of Cerebrospinal Fluid (C.S.F), pleural and peritoneal fluid	Independently
5.	Perform semen analysis and interpret results in the context of clinical and hormone findings	Independently
6.	Perform quantitative estimation of blood/serum by automated techniques for common biochemical tests	Independently
7.	Prepare standard solutions and reagents relevant to common biochemical tests including the preparation of normal solution, molar solution and buffers	Independently
8.	Interpret and report common laboratory biochemical tests (LFT, KFT, endocrine function tests) with understanding of clinical implications	Independently
9.	Operate, maintain and troubleshoot common equipment used such as photoelectric colorimeter, Spectrophotometer, pH meter, Centrifuge, Electrophoresis apparatus, ELISA Reader, PCR, chemiluminescence, etc.	Perform under supervision
V	TRANSFUSION MEDICINE	
1.	Perform selection and bleeding of donors, ABO and Rh grouping and cross match, antibody screening and titer, selection of blood for exchange transfusion	Independently
2.	Resolve ABO grouping problems and outline measures for investigation of transfusion medicine	Independently

3.	Perform and interpret anti-globulin test in antenatal and neonatal work up	Independently
4.	Prepare blood components such as cryoprecipitate, platelet concentrates, fresh frozen plasma, single donor plasma, red blood cell concentrates, etc. and test blood for presence of pathogens including HBV, HCV, HIV, VDRL, Malaria, etc.	Observation only
VI	AUTOPSY	
1.	Perform an autopsy, dissect various organ complexes, and display the gross findings (Note: 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	Independently
	improvised autopsies may be discussed by each candidate during the entire duration of the course)	
2.	Provide Provisional and Final Anatomic Diagnosis report, major findings correctly and systematically at autopsy, and the Autopsy Protocol as per prescribed instructions.	Independently
VII	MOLECULAR BIOLOGY	
1.	Interpret results of Polymerase Chain Reaction (PCR), real time PCR, Sanger Sequencing in a given clinical context.	Independently
2.	Interpret results of in-situ hybridization (fluorescent and chromogenic) in a given clinical context	Independently
3.	Prepare sample by appropriate methods and perform Polymerase Chain Reaction (PCR), real time PCR, Sanger Sequencing, and in-situ hybridization including troubleshooting	Observation only
VIII	IMMUNOPATHOLOGY	
1.	Interpret direct/ indirect immunofluorescence results in the context of common diseases of the skin, medical renal diseases and autoimmune diseases	Independently
2.	Prepare sample by appropriate methods and perform indirect immunofluorescence on a frozen section from skin/ renal biopsy	Perform under supervision
IX	ELECTRON MICROSCOPY	

1.	Interpret transmission electron microscopy results in common non-neoplastic and neoplastic diseases	Independently
2.	Prepare specimen by appropriate methods and process tissue for electron microscopy, interpret semi-thin sections and view ultra-thin sections under electron microscope	Observation only
X.	DIGITAL PATHOLOGY	
1.	Navigate and annotate whole slide scanned images	Independently
2.	Select and scan slides for digitalization and perform basic image analysis functions such as length measurements, enumeration, etc.	Observation only
XI.	TEACHING	
1.	Demonstrate different methods of teaching-learning and assessments	Independently
2.	Engage and teach undergraduates and paramedical staff in the form of small group teaching and demonstrations	Independently
3.	Engage in peer teaching in the form of presenting seminars and journal clubs and be able to use different modes of teaching including PowerPoint projections and charts	Independently
XII.	RESEARCH	
1.	Write the thesis (and/or a scientific paper) in accordance with the prescribed instructions, as expected of international standards	Independently

TEACHING AND LEARNING METHODS

General principles

Acquisition of competencies being the keystone of doctoral medical education, such training should be skills oriented. Learning in the program, essentially autonomous and self-directed, and emanating from academic and clinical work, shall also include assisted learning. The formal sessions are meant to supplement this core effort.

All students joining the postgraduate (PG) courses shall work as full-time (junior) residents/demonstrators during the period of training, attending not less than 80% of the training activity during the calendar year, and participating in all assignments and facets of the educational process. They shall maintain a logbook for recording the training they have undergone, and details of the procedures done during laboratory and clinical postings in real time. Maintenance of e-records of such procedures is encouraged.

The three-year training programme for the MD 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 36 months with breaks only for examinations and mandatory postings. Posting schedules may be modified depending on needs, feasibility and exigencies. For facilities not available in the parent institution as well as for additional knowledge and skill, extramural postings may be undertaken. Departments may vary the postings slightly based on the clinical profile of the hospital, within the time period bands given below, however at least the lower limit for each of the four main components of the course must be covered during postings.

Posting schedule is given below:

S. No	Section/ Subject	Duration in months
(i)	Surgical Pathology, Autopsy, Immunohistochemistry	11-16
(ii)	Hematology, Laboratory Medicine, and Blood bank	8-10
(iii)	Cytopathology	6-9
(iv)	Basic Sciences, Immunopathology, Cytogenetics, Electron microscopy, Molecular Biology etc. and Research Techniques including Thesis	2-6
	Total	**36 (including exam)**

Teaching-Learning methods

This should include a judicious mix of demonstrations, symposia, journal clubs, clinical meetings, seminars, small group discussion, case-based learning, simulation-based teaching, self-directed learning, integrated learning, interdepartmental meetings, and any other collaborative activitywith the allied departments. Methods with exposure to the applied aspects of the subject relevant to basic/clinical sciences should also be used. **The suggested examples of teaching-learning methods are given below but are not limited to these. The frequency of various below mentioned teaching-learning methods can vary based on the subject's requirements, competencies, workload and overall working schedule in the concerned subject. The Pathology resident is expected to sit in reporting every day, having seen the slides the previous day with written descriptions, which should be evaluated daily by the reporting faculty. This is the mainstay of training in all disciplines of Pathology.**

A. Lectures: Didactic lectures should be used sparingly. A minimum of 10 lectures per year in the concerned PG department is suggested. Topics to be selected as per subject requirements all postgraduate trainees will be required to attend these lectures. Lectures can cover topics such as:

1. Subject related important topics as per specialty requirement
2. Recent advances
3. Research methodology and biostatistics
4. Salient features of Undergraduate/Postgraduate medical curriculum
5. Teaching and assessment methodology.

Topic numbers 3, 4, 5 can be done during research methodology/biostatistics and medical education workshops in the institute.

B. Journal club: Minimum of once in 1-2 weeks is suggested.

Topics will include presentation and critical appraisal of original research papers published in peer reviewed indexed journals. The presenter(s) shall be assessed by faculty and grades recorded in the logbook.

C. Student Seminar: Minimum of once every 1-2 weeks is suggested.

Important topics should be selected as per subject requirements and allotted for in-depth study by a postgraduate student. A teacher should be allocated for each seminar as faculty moderator to help the student prepare the topic well. It should aim at comprehensive evidence-based review of the topic. The student should be graded by the faculty and peers.

D. Student Symposium: Minimum of once every 3 months.

A broad topic of significance should be selected, and each part shall be dealt by one postgraduate student. A teacher moderator should be allocated for each symposium and moderator should track the growth of students. The symposium should aim at an evidence-based exhaustive review of the topic. All participating postgraduates should be graded by the faculty and peers.

E. Laboratory work/ Interactive slide and gross sessions: Minimum - once every 1-2 weeks.

Laboratory work, slide and gross specimen teaching sessions should be coordinated and guided by faculty from the department. Various methods like case-based discussions, oral or written quiz, etc. are to be used. Faculty from the department should participate in moderating the teaching-learning sessions.

F. Interdepartmental colloquium

Faculty and students must attend monthly meetings between the main Department and other department/s on topics of current/common interest or clinical cases. This includes institutional activities such as clinical combined rounds (CCR), clinic-pathological correlation conferences (CPC), and departmental activities like autopsy conferences.

G. a. Rotational clinical / community / institutional postings

Depending on local institutional policy and the subject specialty needs, postgraduate trainees may be posted in relevant departments/ units/ institutions. The aim would be to acquire more in-depth knowledge as applicable to the concerned specialty. Postings would be rotated between various units/departments and details to be included in the specialty-based Guidelines. Few examples are listed below:

- Laboratory-based specialty units/departments e.g. Biochemistry / Microbiology/ Infection control unit/Laboratory Medicine, Hematology, Blood bank, Transplantation Immunology, Forensic Medicine, Proteomics, etc.
- Medical Education Unit (MEU) or Department of Medical Education (DOME): optional

G. b. Posting under "District Residency Programme" (DRP):

All postgraduate students pursuing MS/MS in broad specialties in all Medical Colleges/Institutions shall undergo a compulsory rotation of three months in District Hospitals/District Health System as a part of the course curriculum, as per the Postgraduate Medical Education (Amendment) Regulations (2020). Such rotation shall take place in the 3rd or 4th or 5th semester of the Postgraduate programme and the rotation shall be termed as "District Residency Programme" and the PG medical student undergoing training shall be termed as "District Resident".

Every posting should have its defined learning objectives. It is recommended that the departments draw up objectives and guidelines for every posting offered in conjunction with the collaborating department/s or unit/s. This will ensure that students acquire expected competencies and are not considered as an additional helping hand for the department / unit in which they are posted. The PG student must be tagged along with those of other relevant departments for bedside case discussion/basic science exercises as needed, under the guidance of an assigned faculty.

Opportunities to present and discuss infectious disease cases through bedside discussion and ward/grand rounds with specialists / clinicians in different hospital settings must be scheduled to address antimicrobial resistance issues and strategies to deal with it.

H. Teaching research skills

Writing a thesis should be used for inculcating research knowledge and skills. All postgraduate students shall conduct a research project of sufficient depth to be presented to the University as a postgraduate thesis under the supervision of an eligible faculty member of the department as guide and one or more co-guides who may be from the same or other departments.

In addition to the thesis project, every postgraduate trainee shall participate in at least one additional research project that may be started or already ongoing in the department. It is preferable that this project will be in an area different from the thesis work. For instance, if a clinical research project is taken up as thesis work, the additional project may deal with community/field/laboratory work. Diversity of knowledge and skills can thereby be reinforced.

I. Training in teaching skills

MEU/DOME should train PG students in education methodologies and assessment techniques. The PG students shall conduct UG classes in various courses and a faculty shall observe and provide feedback on the teaching skills of the student.

J. Logbook

During the training period, the postgraduate student should maintain a Logbook indicating the duration of the postings/work done in Wards, OPDs, Casualty and other areas of posting. This should indicate the procedures assisted and performed and the teaching sessions attended. The logbook entries must be done in real time. The logbook is thus a record of various activities by the student like: (1) Overall participation & performance, (2) attendance, (3) participation in sessions, (4) record of completion of pre-determined activities, and (5) acquisition of selected competencies.

The purpose of the Logbook is to:

a. Help maintain a record of the work done during training,

b. Enable Faculty/Consultants to have direct information about the work doneand intervene, if necessary,

c. Provide feedback and assess the progress of learning with experience gainedperiodically.

The Logbook should be used in the internal assessment of the student, should be checked and assessed periodically by the faculty members imparting the training. The PG students will be required to produce completed logbook in original at the time of final practical examination. It should be signed by the Head of the Department. A proficiency certificate from the Head of Department regarding the clinical competence and skillful performance of procedures by the student will be submitted by the PG student at the time of the examination.

The PG students shall be trained to reflect and record their reflections in logbook particularly of the critical incidents. Components of good teaching practices must be assessed in all academic activity conducted by the PG student and at least two sessions dedicated for assessment of teaching skills must be conducted every year of the PG program. The teaching faculty are referred to the NMC Logbook Guidelines uploaded on the Website.

K. Course in Research Methodology

All postgraduate students shall complete an online course in Research Methodology within six months of the commencement of the batch and generate the online certificate on successful completion of the course.

Other aspects

- The Postgraduate trainees must participate in the teaching and training program of undergraduate students and interns attending the department.
- Trainees shall attend accredited scientific meetings (CME, symposia, and conferences) at least once a year.
- Department shall encourage e-learning activities.
- The Postgraduate trainees should undergo training in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS).
- The Postgraduate trainees must undergo training in information technology and use of computers.

During the training program, patient safety is of paramount importance; therefore, relevant clinical skills are to be learnt initially on the models, later to be performed under supervision followed by independent performance. For this purpose, provision of skills laboratories in medical colleges is mandatory.

ASSESSMENT

FORMATIVE ASSESSMENT, i.e., assessment to improve learning

Formative assessment should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self-directed learning and ability to practice in the system.

General Principles

Internal Assessment should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills. The Internal Assessment should be conducted in theory and practical/clinical examination, should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills.

Quarterly assessment during the MD training should be based on:

- Case presentation, case work up, case handling/management : once a week
- Laboratory performance : twice a week
- Journal club : once a week
- Seminar : once a fortnight
- Case discussions : once a fortnight/month
- Interdepartmental case or seminar : once a month

Note: These sessions may be organized and recorded as an institutional activity for all postgraduates.

- Attendance at Scientific meetings, CME programmes (at least 02 each)

The student to be assessed periodically as per categories listed in appropriate (non-clinical/clinical) postgraduate student appraisal form (Annexure I).

SUMMATIVE ASSESSMENT, i.e., assessment at the end of training

Essential pre-requisites for appearing for examination include:

1. **Logbook** of work done during the training period including rotation postings, departmental presentations, and internal assessment reports should be submitted.

2. At least **two presentations** at state/national level conference. One paper (thesis or non-thesis related work) should be published /accepted/publication draft in an indexed journal.

The summative examination would be carried out as per the Rules given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS. The theory examination shall be held in advance before the Clinical and Practical examination, so that the answer books can be assessed and evaluated before the commencement of the clinical/Practical and Oral examination**.**

The postgraduate examination shall be in three parts**:**

1. **Thesis**

   Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A post graduate student in broad specialty shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners**.**

2. **Theory examination**

   The examinations shall be organized based on 'Grading 'or 'Marking system' to evaluate and to certify post graduate student's level of knowledge, skill, and competence at the end of the training, as given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS. Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing examination. The examination for M.D./ M.S shall be held at the end of 3rd academic year.

   There shall be four theory papers (as per PG Regulations).

   Paper I: Basic sciences as applied to the subject (general pathology, pathophysiology, immunopathology, and molecular biology).

   Paper II: (Systemic pathology – surgical and cytopathology).

   Paper III: (Hematology, transfusion medicine and laboratory medicine including instrumentation and quality control).

   Paper IV: Recent advances in the subject.

The papers should have ideally one (01) structured long answer question which will evaluate comprehensive in-depth knowledge and 6-8 short answer questions.

3. Practical/clinical and Oral/viva voce examination

Practical examination

Practical examination should be spread at least over **two** days for each student and include various major components of the syllabus focusing mainly on the psychomotor domain.

Oral/Viva voce examination on defined areas should be conducted by each examiner separately. Oral examination shall be comprehensive enough to test the post graduate student's overall knowledge of the subject focusing on psychomotor and affective domain.

The final clinical examination in broad specialty clinical subjects should include:

- Cases pertaining to major systems (e.g., one long case and three short cases),
- Stations for laboratory, procedural and communication skills,
- Logbook Records and reports of day-to-day observation during the training,
- It is emphasized that Oral/viva voce examination shall be comprehensive enough to test the post graduate student's overall knowledge of the subject.

The practical examination in Pathology should follow general guidelines outlined below which may be modified according to local university guidelines and should be spread over at least two days. The following marks distribution is suggested:

Practical 500 marks (including 100 marks for internal assessment)

Section I: Histopathology: 150 marks

- Slides (12-15)
- Grossing/autopsy
- Long case (write a full description with clinical information provided) and/or 2 biopsy cases with ancillary tests reporting (written work only, no viva)

Section II: Cytopathology and histo/cyto techniques: 80 marks

- Slides (5-8)
- Histo/Cyto techniques
- Special stain exercise

- Immunopathology, OSPE, EM

Section III: Hematology, transfusion medicine and clinical pathology: 120 marks

- Slides
- Exercises
- Case study
- Blood bank
- Clinical pathology exercises and OSPE

Section IV: Viva, basic sciences, and communication skills: 50 marks

- Pedagogy/thesis presentation
- Oral viva
- Basic Sciences

Details of exercises in individual sections are given below:

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 including at least one clinical pathology exercise like CSF, pleural tap etc. analysis and complete urinalysis.

II. Haematology:

- Discuss hematology cases given the relevant history. Plan relevant investigations.
- Perform complete hemogram and at least two tests preferably including one coagulation exercise.
- Identify electrophoresis strips, osmotic fragility charts etc., interpretation of data from auto analyzers, HPLC and flow cytometry.
- Examine, report, and discuss around ten cases given the history and relevant blood smears and/or bone marrow aspirate smears and bone marrow biopsy interpretation.

III. Transfusion Medicine:

- Perform blood grouping
- Perform the necessary exercise like cross matching.
- Coomb's test, gel cards interpretation.

IV. Histopathology and cytopathology:

- Examine, report, and discuss 12-15 cases histopathology and 5-8 cytopathology cases, given the relevant history and slides.
- Perform a Hematoxylin and Eosin stain and any special stain on a paraffin section. Should be conversant with histopathology techniques including cryostat.
- Long case (write a full description with clinical information provided) and/or 2 biopsy cases with ancillary tests reporting

V. Autopsy:

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

VI. Gross Pathology

- Describe findings of gross specimens, give diagnosis, and identify the sections to be processed. The post graduate student should perform grossing in front of the examiners for evaluation.

VII. Basic Sciences:

- 10-15 spots based on basic sciences be included
- Identify electron micrographs
- Identify gels, results of PCR, immunological tests including interpretation of Immunofluorescence pictures, etc.
- Identify histochemical and immuno-histochemistry stains

VIII. Teaching exercise

- Teach on a small topic for about 10 min or present dissertation and research
- General Viva-Voce (Grand Viva) – structured viva may be done separately or combined with above exercises

Recommended Reading:

Books (latest edition)

1. Histology for Pathologists. Stephen S. Sternberg (Ed), Raven Press, New York.
2. Robbin's Pathologic Basis of Disease Ramzi S.Cotran, Vinay Kumar, Stanley L Robbins WB Saunders Co., Philadelphia.
3. Ackerman's Surgical Pathology. Juan Rosai Mosby. St. Louis.
4. Diagnostic Surgical Pathology. Stephen S Sternberg. Lippincott, William Wilkins. Philadelphia.

5. Diagnostic Histopathology of Tumours. Christopher DM Fletcher (Ed). Churchill Livingstone. Edinburgh.
6. Manual & Atlas of Fine Needle Aspiration Cytology. Svante R Orell, et al London.
7. Theory and Practice of Histological Techniques, Bancroft JD, Stevens A, Turner DR, Churchill Livingstone, Edinburgh.
8. Diagnostic Cytology and its Histopathologic Basis, Koss LG, J.B. Lippincott, Philadelphia.
9. Comprehensive Cytopathology, Bibbo M, W.B. Saunders Co., Philadelphia.
10. Wintrobe's Clinical Hematology, Lee GR, Foerster J, Lupeus J, Paraskevas F, Gveer JP, Rodgers GN, Williams & Wilkins, Baltimore.
11. Atlas and Text of Hematology 4th edition. Singh T. Avichal Publishing Company.
12. Dacie and Lewis Practical Hematology, Bain BJ, Bates I, Laffan MA. Elsevier.
13. Bone Marrow Pathology, Bain BJ, Clark DM, Lampert IA, Blackwell Science, Oxford.
14. Henry's clinical diagnosis and management by laboratory methods.
15. WHO classification of tumors. IARC Lyon.

Journals

03-05 International Journals and 02 national (all indexed) journals.

Annexure I

Student appraisal form for broad specialty non-clinical disciplines

	Elements	Less than Satisfactory			Satisfactory			More than satisfactory			Comments
		1	2	3	4	5	6	7	8	9	
1	**Scholastic aptitude and learning**										
1.1	Has knowledge appropriate for level of training										
1.2	Participation and contribution to learning activity (e.g., Journal Club, Seminars, CME etc)										
1.3	Conduct of research and other scholarly activity assigned (e.g Posters, publications etc)										
1.4	Documentation of acquisition of competence (eg Log book)										
1.5	Performance in work based assessments										
1.6	Self-directed Learning										
2	**Work related to training**										
2.1	Practical skills that are appropriate for the level of training										
2.2	Respect for processes and procedures in the work space										
2.3	Ability to work with other members of the team										
2.4	Participation and compliance with the quality improvement process at the work environment										

2.5	Ability to record and document work accurately and appropriate for level of training										
3	**Professional attributes**										
3.1	Responsibility and accountability										
3.2	Contribution to growth of learning of the team										
3.3	Conduct that is ethically appropriate and respectful at all times										
4	**Space for additional comments**										
5	**Disposition**										
	Has this assessment pattern been discussed with the trainee?	Ye s	No								
	If not explain.										
	Name and Signature of the assesse										
	Name and Signature of the assessor										
	Date										

Subject Expert Group members for preparation of REVISED Guidelines for competency based postgraduate training programme for MD in Pathology

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MODEL *PAPER*

MD12301 **Patho.-I**

MD Examination Month Year
PATHOLOGY
Paper-I

(Basic sciences as applied to the subject (general pathology, pathophysiology, immunopathology, and molecular biology).

Time: Three Hours
Maximum Marks:
100

Attempt all questions
All the parts of one question should be answered at one place in sequential order.
Draw diagrams wherever necessary

Q.1 Enumerate autoimmune diseases. Describe etipatho genesis, pathology and laboratory diagnosis of SLE. 20

Q.2 Write in detail 2x15=30

a) Discuss viral carcinogenesis with suitable examples.

b) Discuss pathogenesis of disease associated with human papilloma virus (HPV) infection and molecular testing of HPV.

Q.3 Write short notes on- 5x10=50

a) Mast cell in acute inflammation

b) Familial hypercholesterolemia.

c) Fibronectins.

d) Stem cells in tissue homeostasis.

e) Pathways for initiation of apoptosis.

MODEL PAPER

MD12302 **Patho.-II**

MD Examination Month Year
PATHOLOGY
Paper-II

(Systemic pathology– surgical and cytopathology)

Time: Three Hours
Maximum Marks: 100

Attempt all questions
All the parts of one question should be answered at one place in sequential order.
Draw diagrams wherever necessary

Q.1 Discuss the role of renal biopsy in the diagnosis of glomerular lesions. 20

Q.2 Write in detail 2x15=30

a) Indication and interpretation of Muscle biopsy.

b) Protocol for diagnosis and management of carcinoma cervix.

Q.3 Write short notes on- 5x10=50

a) Pathological effects of radiation therapy and chemotherapy in breast carcinoma.

b) Giant cell lesions of bone.

c) Inflammatory Bowel Disease.

d) Immunohistochemistry and molecular markers of lung tumors.

e) Milan system for reporting salivary gland cytopathology.

MODEL PAPER

MD12303 **Patho.-III**

MD Examination Month Year
PATHOLOGY
Paper-III

(Hematology, transfusion medicine and laboratory medicine including instrumentation and quality control)

Time: Three Hours
Maximum Marks: 100

Attempt all questions
All the parts of one question should be answered at one place in sequential order.
Draw diagrams wherever necessary

Q.1 Define Hemolytic Anaemia. Enumerate the various causes. Discuss in detail Sickle cell Anaemia. 20

Q.2 Write in detail 2x15=30

a) Classify Blood Transfusion reactions. Discuss in detail its pathogenesis, complications and laboratory approach.

b) Discuss pathogenicity, causes, clinical manifestation and lab findings of DIC.

Q.3 Write short notes on- 5x10=50

a) Hairy cell Leukaemia.

b) Factor 5 Leiden mutation.

c) Causes, pathophysiology and diagnostic guidelines for Haemophagocytic lymphohistiocytosis (HLH).

d) Enumerate various infections diagnosed in blood & bone marrow. Describe haematological findings in HIV infection.

e) Enumerate MPN & associated driver mutations.

MODELPAPER

MD12304 **Patho. -IV**

MD Examination Month, Year

PATHOLOGY

Paper-IV

Recent advances in the subject

Time: Three Hours Maximum Marks: 100

Attempt all questions
All the parts of one question should be answered at one place in sequential order.
Draw diagrams wherever necessary

Q.1 List the recent WHO Classification (2022) of B-cell Lymphoid neoplasms. Discuss the majorupdates in this classification in comparison to WHO 2016. 20

Q.2 Write in detail 2x15=30

a) What are the diagnostic criteria of Intraductal carcinoma of prostate (IDC-P)? Enumerate the morphological and molecular features to distinguish it from high grade0intraprostatic neoplasia (HGPIN).

b) Fibrosing interstitial lung diseases.

Q.3 Write short notes on- 5x10=50

a) Role of a histopathologist in stratified medicine for cancer.
b) Embryonal brain tumors in children.
c) Liquid based cytology.
d) Artificial intelligence in pathology.
e) Pathogenesis of acute lung injury.