

JSS Academy of Higher Education & Research

(Deemed to be University)

Re-Accredited "A*" Grade by NAAC

Sri Shivarathreshwara Nagara Mysuru - 570015, Karnataka

Regulation & Syllabus

MD ANATOMY

2020

MD Anatomy

GOAL: The postgraduate course in MD Anatomy should enable a medical graduate to become a competent specialist, acquire knowledge and skills in educational technology for teaching, medical, dental and health sciences and conduct research in bio-medical sciences.

PROGRAM OUTCOMES

The Program Outcomes express the goals the program has for student learning upon completion of the degree. The Goal of MD Anatomy is to train a doctor to become a competent teacher and researcher in Anatomy.

PO1: Demonstrate the acquisition of knowledge in contemporary advances and developments in the field of Anatomy.

PO2: Demonstrate the capability of acquisition of the competencies pertaining to the subject of Anatomy that are required to be practiced at all levels of health system.

PO3: Demonstrate the ability to educate medical and paramedical professionals.

PO4: Effectively communicate with the students and colleagues from various medical and paramedical fields.

PO5: Demonstrate the capability to integrate anatomy with other disciplines as and when needed.

PO6: Demonstrate the qualities of a good teacher capable of innovations in teaching methodology.

PO7: Demonstrate the acquisition of adequate management skills to lead the team engaged in teaching and research.

PO8: Demonstrate the ability to carry out research and understand the basic research ethics.

PO9: Demonstrate the ability to acquire new knowledge and skills to be a lifelong learner.

COURSE OUTCOMES

Paper I: Gross Anatomy, Embryology, Microscopic Anatomy of human body above the diaphragm with Radiological Anatomy & Body Preservation

CO1: Demonstrate the acquisition of comprehensive knowledge of gross anatomy of human body above the diaphragm

CO2: Apply the analytical skills to correlate the normal microscopic structure of various organs of human body above diaphragm with their functions for understanding the altered state in commonly encountered disease processes

CO3: Demonstrate the acquisition of comprehensive knowledge of the basic principles and sequential development of organ systems above diaphragm and apply analytical thoughts in the major developmental abnormalities and variations

CO4: Demonstrate the acquisition of comprehensive knowledge and practical skills of preservation of human body and its parts

CO5: Demonstrate the acquisition of comprehensive knowledge of sectional anatomy and understanding of the principles of imaging modalities and be able to read the normal radiological images including CT & MRI and apply the analytical skills to interpret the abnormal images for understanding the altered state in commonly encountered disease processes.

Paper II: Gross Anatomy, Embryology, Microscopic Anatomy of human body below the diaphragm with General (Embryology & Microscopic) Anatomy

CO1: Demonstrate the acquisition of comprehensive knowledge of gross anatomy of human body below the diaphragm

CO2: Apply the analytical skills to correlate the normal microscopic structure of various tissues of human body with their functions for understanding the altered state in commonly encountered disease processes

CO3: Demonstrate the acquisition of comprehensive knowledge of the basic principles and sequential development of embryo (first 8 weeks of development) and apply analytical thoughts in the major developmental abnormalities and variations

CO4: Apply the analytical skills to correlate the normal microscopic structure of various organs of human body below diaphragm with their functions for understanding the altered state in commonly encountered disease processes

CO5: Demonstrate the acquisition of comprehensive knowledge of the basic principles and sequential development of organ systems below diaphragm and apply analytical thoughts in the major developmental abnormalities and variations

CO6: Demonstrate the acquisition of comprehensive knowledge and Principles of light, transmission and scanning electron microscopy, confocal, virtual microscopy

Paper III: Neuroanatomy & Genetics

CO1: Demonstrate the acquisition of comprehensive knowledge of gross anatomy of human brain with their functions for understanding the altered state in commonly encountered disease processes

CO2: Demonstrate the acquisition of comprehensive knowledge of principles of genetics and chromosomal aberrations and apply the analytical thoughts of the basics of medical genetics and common genetic syndromes and Cancer Genetics

CO3: Demonstrate the acquisition of comprehensive knowledge of reproduction genetics (Male and Female Infertility, Abortuses, Assisted reproduction, Preimplantation genetics, Prenatal diagnosis), Genetic Counseling, Ethics of Genetics, Principles of Gene therapy and its applied knowledge

Paper IV: Recent advances and applied Anatomy in medical sciences

CO1: Demonstrate the acquisition of analytical skills to compare the anatomy of different mammals

CO2: Correlate the structure and functions of human body and comprehend the anatomical basis for commonly encountered clinical problems

CO3: Apply the knowledge of development, structural (microscopy), neuroanatomy to comprehend deviations from normal

CO4: Demonstrate the acquisition of comprehensive knowledge of recent advances in medical sciences which facilitate comprehension of structure function correlations and applications in clinical problem solving.

CO5: Demonstrate the acquisition of comprehensive knowledge of collection, maintenance and application of stem cells, cryobanking and principles of organ donation from recently dead bodies.

OBJECTIVES

The Goal of MD Anatomy is to train a doctor to become a competent teacher and researcher in Anatomy who has acquired competence / skills in:

1. Contemporary advances and developments in the field of Anatomy.
2. Competencies pertaining to the subject of Anatomy that are required to be practiced at all levels of the health system.
3. Educating medical and paramedical professionals.
4. Effectively communicating with the students and colleagues from various medical and paramedical fields.
5. Integrating anatomy with other disciplines as and when needed
6. Being a good teacher capable of innovations in teaching methodology.
7. Being effective leader of the team engaged in teaching and research.

After completing the three year course in MD Anatomy the student should have achieved competence in the following:

1. Knowledge of Anatomy

Acquire competencies in gross and surface anatomy, neuroanatomy, embryology, genetics, histology, radiological anatomy, applied aspects and recent advances of the above mentioned branches of anatomy to clinical practice. These are given in detail in subsequent sections.

2. Practical and Procedural skills

Acquire mastery in dissection skills, embalming, tissue preparation, staining and museum preparation.

3. Training skill in Research Methodology

- Acquire skills in teaching, research methodology, epidemiology & basic information technology.
- Acquire knowledge in the basic aspects of Biostatistics and research methodology.
- Has knowledge to plan the protocol of a thesis, carry out review of literature, execution of research project and preparation of report.
- Has ability to use computer applications Microsoft office (Microsoft word, excel, power point), Internet, Searching scientific databases (e.g. PubMed, Medline, Cochrane reviews).
- Acquire skills in paper & poster preparation, writing research papers and Thesis.

4. Professionalism, attitude and communication skills:

- Develop honest work ethics and empathetic behavior with students and colleagues.
- Acquire capacity of not letting his/her personal beliefs, prejudices, and limitations come in the way of duty.
- Acquire attitude and communication skills to interact with colleagues, teachers and students.

5. Teaching Anatomy

- Practicing different methods of teaching-learning.
- Making presentations of the subject topics and research outputs.

6. Problem Solving

- Demonstrate the ability to identify applied implications of the knowledge of anatomy and discuss information relevant to the problem, using consultation, texts, archival literature and electronic media.
- Demonstrate the ability to correlate the clinical conditions to the anatomical/embryological/hereditary factors.
- Demonstrate the ability to evaluate scientific/clinical information and critically analyze conflicting data and hypothesis.

COMPETENCIES

At the end of the course, the student should have acquired following competencies:

A. Cognitive domain

1. Describe gross anatomy of entire body including upper limb, lower limb, thorax, abdomen, pelvis, perineum, head and neck, brain and spinal cord.
2. Explain the normal disposition of gross structure, and their interrelationship in the human body.
3. Should be able to analyze the integrated functions of organs systems and locate the site of gross lesions according to deficits encountered.

4. Describe the process of gametogenesis, fertilization, implantation and placenta formation in early human embryonic development along with its variation and applied anatomy.
5. Demonstrate knowledge about the sequential development of organs and systems along with its clinical anatomy, recognize critical stages of development and effects of common teratogens, genetic mutations and environmental hazards.
6. Should be able to explain developmental basis of variations and congenital anomalies.
7. Explain the principles of light, transmission and scanning, compound, electron, fluorescent and virtual microscopy.
8. Describe the microscopic structure of various tissues & organs and correlate structure with functions as a prerequisite for understanding the altered state in various disease processes.
9. Demonstrate knowledge about cell and its components, cell cycle, cellular differentiation and proliferation.
10. Describe structure, number, classification, abnormalities and syndromes related to human chromosomes.
11. Describe important procedures in cytogenetics and molecular genetics with its application.
12. Demonstrate knowledge about single gene pattern inheritance, intermediate pattern and multiple alleles, mutations, non-mendelian inheritance, mitochondrial inheritance, genome imprinting and parental disomy.
13. Describe multifactorial pattern of inheritance, teratology, structure gene, molecular screening, cancer genetics and pharmacogenetics.
14. Demonstrate knowledge about reproduction genetics, assisted reproduction, prenatal diagnosis, genetic counseling and ethics in genetics.
15. Explain principles of gene therapy and its applied knowledge.
16. Describe immune system and cell types involved in defense mechanisms of the body. Also explain gross features, cytoarchitecture, functions, development and histogenesis of various primary and secondary lymphoid organs in the body.
17. Demonstrate knowledge about common techniques employed in cellular immunology and histocompatibility testing.
18. Demonstrate applications of knowledge of structure & development of tissue organ system to comprehend deviations from normal.
19. Demonstrate knowledge about recent advances in medical sciences which facilitate comprehension of structure function correlations and applications in clinical problem solving.
20. Explain collection, maintenance and application of stem cells, cryobanking and principles of organ donation from recently dead bodies.
21. Demonstrate knowledge about surface marking of all regions of the body.
22. Able to interpret various radiographs of the body, normal CT Scan, ultrasound and MRI.

23. Demonstrate knowledge about different anthropological traits and use of related instruments.
24. Demonstrate knowledge about outline of comparative anatomy of whole body and basic human evolution
25. Demonstrate knowledge about identification of human bones, determination of sex, age, and height for medico legal application of anatomy
26. Explain the general principles of anatomy act and transplanatation act.
27. Comprehend the ethical aspects of biomedical research.
28. Comprehend the basis of disposal of biomedical waste

B. Affective domain

1. Demonstrate self-awareness and personal development in routine conduct. (Self awareness)
2. Practice selflessness, integrity, responsibility, accountability and respect.
3. Communicate effectively with peers, students and teachers in various teaching learning activities in a manner that encourages participation and shared decision-making. (Communication)
4. Demonstrate ability to communicate adequately, sensitively, effectively and respectfully with body donors and their relatives. (Communication)
5. Demonstrate
 - a. Due respect and follows the correct procedure while handling human body parts, cadavers during dissection & other biological tissues. (Ethics & Professionalism)
 - b. Humane touch while demonstrating living surface marking in subject/patient. (Ethics & Professionalism)
6. Acquire capacity of not letting his/her personal beliefs, prejudices and limitations come in the way of duty.
7. Appreciate the issues of equity and social accountability while exposing students to early clinical exposure. (Equity and social accountability)

C. Psychomotor domain

At the end of the course the student should be able to:

1. Identify, locate and demonstrate surface marking of clinically important structures in the cadaver and correlate it with living anatomy.
2. Acquire mastery in dissection skills, embalming, tissue preparation, staining and museum preparation.
3. Locate and identify clinically relevant structures in dissected cadavers.
4. Locate and identify cells & tissues under the microscope.
5. Identify important structures visualized by imaging techniques, specifically radiographs, computerized tomography (CT) scans, MRI and ultrasonography.

6. Demonstrate various movements at the important joints and actions of various groups of muscles in the human body.
7. Demonstrate anatomical basis of common clinical procedures expected to be performed by a basic medical doctor.
8. Demonstrate different methods of teaching-learning and make presentations of the subject topics and research outputs.

Practice based Competencies

1. Gross anatomy:

- Procurement, Embalming and Preservation of human cadavers
 - Preparation of tanks for preserving bodies
 - Dissection of cadaver
 - Window dissection of important regions
 - Preparation of specimens for museum with display
- a) soft parts
b) Hard Parts
c) models
d) charts
- 1.6 Preparation and preservation of human bones / skeleton as assigned by the faculty
 - 1.7 Gross anatomy file in which labelled diagrams of important structures of upper limb, lower limb, thorax, abdomen, head & neck and brain should be drawn.

2. Histology

- 2.1 Preparation of common fixatives for embalming fluid, 10% formalin, Bouin's fluid etc.
- 2.2 Making paraffin blocks and section cutting and mounting.
- 2.3 Preparation of staining set for H and E staining and staining paraffin sections with the stain.
- 2.4 Making celloidin, araldite, gelatin blocks and their section cutting.
- 2.5 Processing hard tissues, decalcification of bones, block making and sectioning, preparation of ground sections of calcified bones.
- 2.6 Frozen section cutting on freezing microtome and cryostat.
- 2.7 Honing and stropping of microtome knives, including sharpening by automatic knife sharpener.
- 2.8 Histology file in which LM pictures of all the organs and tissues of the body should be drawn and a small description of salient features written.

3. Histochemical Methods

- Practical classes for staining of glycogen, mucopolysaccharides, alkaline phosphatase, acid phosphatase and calcium

4. Cytogenetics

- 4.1 Preparation of media, different solutions, stains etc.
- 4.2 Preparation of buccal smear for sex chromatin
- 4.3 Human chromosome preparation from peripheral blood and karyotyping.
- 4.4 Banding techniques (G and C)
- 4.5 Making of Pedigree charts for study of patterns of inheritance.
- 4.6 Chromosomal analysis.

5. Neuroanatomy

- 5.1 Dissection of brain and spinal cord for teaching and learning purpose
- 5.2 Preparation of brain and spinal cord macroscopic and microscopic sections and identification of different parts in them.
- 5.3 Discussions on clinical problems related to neurological disorders and anatomical explanation for the same.

Department resources:

Course content

Part I:Gross anatomy

Gross Anatomy of entire body including upper limb, lower limb, thorax, abdomen, pelvis, perineum, head and neck, brain and spinal cord

Part II:Developmental anatomy/embryology

1. General embryology: gametogenesis, fertilization, implantation and placenta, early human embryonic development.
2. Systemic embryology: development of organ systems and associated common congenital abnormalities with teratogenesis.
3. Physiological correlations of congenital anomalies.

Part III: Histology and histochemistry

1. Cell Structure: Cytoplasm - cytoplasmic matrix, cell membrane, cell organelles, cytoskeleton, cell inclusions, cilia and flagella. Nucleus - nuclear envelope, nuclear matrix, DNA and other components of chromatin, protein synthesis, nucleolus, nuclear changes indicating cell death. Cell cycle - mitosis, meiosis, cell renewal. Cellular differentiation and proliferation.

2. Microscopic structure of the body: Principles of light, transmission and scanning, electron, fluorescent, confocal and virtual microscopy. The systems/organs of body - Cellular organization, light and electron microscopic features, structure - function correlations, and cellular organization.

Part IV: Neuroanatomy:

Brain and its environment, Development of the nervous system, Neuron and Neuroglia, Somatic sensory system, Olfactory and optic pathways, Cochleovestibular and gustatory pathways, Motor pathways, Central autonomic pathways, Hypothalamo-hypophyseal system, Limbic system, Basal ganglia, Reticular system, Cranial nerves, Ventricular system, Cross Sectional anatomy of brain and spinal cord. Detailed structure of the central nervous system and its applied aspect.

Part V: Genetics:

1. Human Chromosomes - Structure, number and classification, methods of chromosome preparation banding patterns. Chromosome abnormalities, Autosomal and Sex chromosomal abnormalities syndromes, Molecular and Cytogenetics.
2. Single gene pattern inheritance: Autosomal and Sex chromosomal pattern of inheritance, Intermediate pattern and multiple alleles, Mutations, Non Mendelian inheritance, Mitochondrial inheritance, Genome imprinting, parental disomy.
3. Multifactorial pattern of inheritance: Criteria for multifactorial inheritance, Teratology, Structure gene, Molecular Screening,
4. Cancer Genetics - Haematological malignancies, Pharmacogenetics.
5. Reproduction Genetics - Male and Female Infertility, Abortuses, Assisted reproduction, Preimplantation genetics, Prenatal diagnosis, Genetic Counseling and Ethics of Genetics. Principles of Gene therapy and its applied knowledge.

Part VI: Immunology:

Immune system and the cell types involved in defense mechanisms of the body. Gross features, cytoarchitecture, functions, development and histogenesis of various primary and secondary lymphoid organs in the body. Biological and clinical significance of the major histocompatibility complex of man including its role in transplantation, disease susceptibility/resistance and genetic control of the immune response. Common techniques employed in cellular immunology and histocompatibility testing. Molecular hybridization and PCR technology in immunology research particularly mechanism of antigen presentation, structural and functional relevance of the T cell receptor, genetic control of the immune response, molecular basis of susceptibility to disease.

Part VII: Applied anatomy and recent advances

- Clinical correlations of structure and functions of human body. Anatomical basis and explanations for clinical problems.
- Applications of knowledge of development, structural (microscopy), neuroanatomy to comprehend deviations from normal.

- Recent advances in medical sciences which facilitate comprehension of structure function correlations and applications in clinical problem solving.
- Collection, maintenance and application of stem cells, cryobanking and principles of organ donation from recently dead bodies.

Part VIII: Surface Marking and Radiology

Surface marking of all regions of the body. Interpretation of normal radiographs of the body including special contrast procedures including barium studies, cholecystography, pyelography, salphingography. Normal CT Scan, MRI and Ultrasound.

Part IX: Miscellaneous

- **Anthropology:** Different anthropological traits, Identification and use of Anthropological instruments.
- [Outline of comparative anatomy of the whole body and basic human](#)

Part X: Forensic Medicine:

- Identification of human bones from their remains and determination of sex, age, and height. for medico legal application of Anatomy.

Certifiable Skills

Demonstrate following predominant Psychomotor domain competencies

Perform Independently:

- Identify, locate and demonstrate surface marking of clinically important structures in the cadaver and correlate it with living anatomy
- Acquire mastery in dissection skills including window dissection of important regions
- Acquire mastery in embalming the human body
- Tissue preparation for histology and staining techniques
- Honing and Stropping of microtome knives, including sharpening by automatic knife sharpener
- Preparation of common fixatives embalming fluid 10% formalin, Bouin's fluid etc
- Demonstrate the mounting of specimen in the museum
- Locate and identify clinically relevant structures in dissected cadavers.
- Locate, identify and demonstrate cells & tissues under the microscope.
- Identify the anatomical structures visualized by imaging techniques, specifically radiographs, computerized tomography (CT) scans, MRI and ultrasonography in normal individuals
- Demonstrate various movements at the important joints and actions of various groups of muscles in the human body

- Demonstrate different methods of teaching-learning and assessments.
- Make presentations of the subject topics for teaching and research outputs. Independently
- Prepare buccal smear for sex chromatin. independently

Perform Under Supervision:

- Demonstrate anatomical basis of common clinical procedures expected to be performed by a basic medical doctor
- Prepare Human chromosome from peripheral blood and karyotyping. Under supervision
- Demonstrate Banding techniques (G and C) and Chromosomal Analysis Under supervision
- Demonstrate use of different anthropological instruments

Observation:

- Prepare tanks for preserving bodies

DEPARTMENT RESOURCES

1. Histology lab
2. Immunology
3. Electron microscopy / Fluorescence microscopy / confocal and other forms of microscopy laboratories
4. Cytogenetics
8. Imaging technique for Radiological Anatomy

TEACHING & LEARNING METHODS

A. Lectures: Topics in gross anatomy, surface and cross sectional anatomy, Histology, embryology, neuroanatomy, histochemistry, Recent advances in microanatomy and genetics taught by faculty members.

B. Practical training:

Gross anatomy:

- Procurement, Embalming and Preservation of human cadavers
- Preparation of tanks for preserving bodies.
- Dissection of cadaver, Window dissection of important regions.
- Dissection of brain and spinal cord for teaching and learning purpose. Preparing macroscopic and microscopic sections of brain and spinal cord and identification of different parts in them.
- Preparation of specimens for museum with display - soft parts, models & charts. Preparation and preservation of human bones / skeleton

Histology:

- Preparation of common fixatives embalming fluid 10% formalin, Bouin's fluid etc.
- Making paraffin blocks and section cutting and mounting
- Preparation of staining set for H and E staining and staining paraffin sections with the stain
- Making celloidin, araldite, gelatin blocks and their section cutting
- Processing hard tissues, decalcification of bones, block making and sectioning, preparation of ground sections of calcified bones.
- Frozen section cutting on freezing microtome and cryostat
- Honing and Stropping of microtome knives, including sharpening by automatic knife sharpener
- Histology file in which LM and EM pictures of all the organs and tissues of the body should be drawn and a small description of salient features written
Techniques in microanatomy, neuroanatomy, gross anatomy, embryology, histochemistry, genetics, and microscopy.
- Practical classes for staining of glycogen, mucopolysaccharides, alkaline phosphatase acid phosphatase, and calcium

Embryo (chick embryo) mounting, serial sections & stain it with haematoxyline & eosin.

3. Research methodology and biostatistics.

4. Salient features of Undergraduate/Postgraduate medical curriculum.

5. Teaching and assessment methodology.

C. Journal club: Minimum of 2 journal clubs per month and 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.

D. Student Seminar: Minimum of 2 seminars per month. A teacher will be allocated for each seminar as faculty moderator. The student should be graded by the faculty and peers.

E. Student Symposium: Once every 3 months. A broad topic of significance will be selected, and each part shall be dealt by one postgraduate student. A teacher moderator will be allocated for each symposium and moderator should track the growth of students. All participating postgraduates should be graded by the faculty and peers.

E. Laboratory work: Hands-on experience on various techniques and procedures in microanatomy, histochemistry, genetics, embalming & preparation of museum specimens **F.**

F. Interdepartmental colloquium: Monthly meetings between departments on topics of current/common interest

G. a. Rotational clinical / community / institutional postings: Every posting will have its defined learning objectives.

Sl no	Year	Department	Duration in Weeks
1	I	Medical Education Unit- Training. (Research methodology and biostatistics, /Postgraduate medical curriculum and Teaching and assessment methodology)	01
2		Pathology	02
3		Radiodiagnosis	02
4		Surgery	02
5	II	ENT	01
6		Ophthalmology	01
7		Obstetrics & Gynecology	01
9		Pediatrics	01
10	III	Genetics	02

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

Students shall undergo a compulsory rotation of three months in District Hospitals/District Health System as a part of the course curriculum during 2nd year, as per the Postgraduate Medical Education (Amendment) Regulations (2020). Rotation shall take place and the rotation shall be termed as “District Residency Programme” and the PG medical student undergoing training shall be termed as “District Resident”.

H. Research/Dissertation: 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.

- Present one poster & one oral presentation at state/ national conference.
- One research paper should be published/ accepted/ sent for publication.
- During the course of study every candidate has to prepare a dissertation individually, on a selected topic under the direct guidance and supervision of a recognized postgraduate teacher as per JSSAHER regulations.

- Hands on Workshop on synopsis & dissertation writing, paper & poster presentation skills & writing research papers.

I. Training in Teaching skills: Participate in the teaching and training programme of undergraduate students. Preparation of Audio Visual aids for teaching, posters/manuscripts for presentation in conferences/workshops and publication in journals. Comprehend horizontal integration of various subdivisions of anatomy with relevant physiology and biochemistry. Participation in formulating evaluation methods: Setting objective questions, Short Answer Questions, Multiple Choice Questions and Objective Structured Practical Examination (OSPE).

J. Log Book: Every student should maintain a logbook in which a record of the practical exercises completed, Seminars & journal clubs details, Conferences/ workshops/ CME details, teaching learning activities etc should be entered. The Log books shall be checked and assessed periodically by the faculty members imparting the training. Duly scrutinized and certified by the head of the department and to be submitted to the external examiner during the final examination.

K. Record Book: A practical record of work done in histology and gross anatomy with an emphasis on cross sectional anatomy has to be maintained by the candidate and duly scrutinized and certified by the head of the department and to be submitted to the external examiner during the final examination.

ASSESSMENT

Formative assessment: Periodical examinations during the course of training. Assessment should be frequent, cover all domains of learning and provide feedback to improve learning; it should also cover professionalism and communication skills.

The Internal Assessment in theory and practical examination during 1st, 2nd and 3rd year.

Quarterly assessment during the MD training should be based on: Annexure I

- Dissection presentation : 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

Summative Assessment:

The examination for M.D shall be held at the end of 3rd academic year. It will be 3 parts- Thesis, Written exam and Practical with Viva Voce. Obtaining a minimum of 50% marks in ‘Theory’ as well as ‘Practical’ separately shall be mandatory for passing examination as a whole.

Essential pre-requisites for appearing for examination include:

1. **Log book** 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 national level conferences. One research paper should be published / accepted in an indexed journal.

University Examination pattern:

MD (Anatomy) Examination	Theory	Practical	Viva-voce (Pedagogy & Thesis discussion)	Total
Maximum marks	400	200	100	700

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 shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. **Written Exam: Theory - 400 marks**

The written examination consists of four papers, with maximum marks of 100 for each paper. Each paper will be of three hours duration.

Paper I: Gross Anatomy, Embryology, Microscopic Anatomy of human body above the diaphragm with Radiological Anatomy & Body Preservation

- a) Gross Anatomy of human body above the diaphragm i.e. upper limb, thorax, head and neck.
- b) Embryology & Microscopic anatomy of tissues and organs above the diaphragm.
- c) Methods of preservation of human body and its parts, radiological anatomy, sectional anatomy

Paper II: Gross Anatomy, Embryology, Microscopic Anatomy of human body below the diaphragm with General (Embryology & Microscopic) Anatomy

- a) Gross Anatomy of human body below the diaphragm i.e. lower limb, abdomen, pelvis.
- b) Embryology & Microscopic anatomy of tissues and organs below the diaphragm.
- c) General Histology, General Embryology

d) Principles of light, transmission and scanning electron microscopy, confocal, virtual microscopy.

Paper III: Neuroanatomy & Genetics

- a) Neuroanatomy - gross and applied aspects.
- b) General principles of genetics, cytogenetics as applicable to medicine and different genetic disorders, gene therapy.

Paper IV: Recent advances and applied Anatomy in medical sciences

- a) Comparative and evolutionary anatomy
- b) Clinical and applied aspect of Anatomy
- c) Recent advances in the application of knowledge of anatomy on human body
- d) Basics of principles of organ donation from recently dead bodies

Each Theory paper consists of:

Sl No	Type of Question	Marks
1	Long Essay (2)	2 X 20= 40
2	Short Essay (6)	6 X 10= 60
Total		100 marks

3. Practical's: 200 marks (Gross Anatomy - 100 marks, Histology - 100 marks) Spread over a minimum of 2 days

1st day: Gross anatomy and histology practicals

2nd day: Microteaching, Thesis presentation and grand viva

A. Gross Anatomy:

Dissection of the topic allotted on a human cadaver and display for discussion. Time allotted will be 03 hrs.

Distribution of Marks:

Sl NO	Topics	Marks
1	Surface Anatomy	10
2	Dissection	40
3	Discussion	50
Total		100

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B. Histology:

Identification and discussion of 10 stained sections which includes neuroanatomy, embryology and human genetics. Preparation of paraffin blocks, serial section cutting of the given block and staining the given slide with H and E stain, followed with discussion.

Sl NO	Topics	Marks
1	Identification and discussion of 10 slides	40
2	Preparation of a paraffin block	10
3	Taking serial sections from blocks provided	10
4	Staining of the given section with H & E and Discussion	20
5	Discussion on histological techniques	20
Total		100

C. Viva –Voce & Pedagogy: 100 marks

Viva Voce(80 Marks): On dissected parts of the whole human body including nervous system, and Embryology models, teratology, skeletal system including short bones, embalming techniques and genetics, radiographs, MRI, CT & ultrasonography.

A short synopsis of the thesis work should be presented by the post graduate student and discussion on the topic.

Pedagogy(20 Marks): Demonstration of teaching skill / techniques. Microteaching of a short topic to assess teaching skills

RECOMMENDED READING

Gross Anatomy: Books Latest editions

1. Susan Strandring: Gray's Anatomy: The anatomical basis of clinical practice, Churchill Livingstone Elsevier.
2. Dutta A.K. Human Anatomy vol. I-III Current publisher.
3. Dutta A.K. Principle of General Anatomy. Current Publisher.

4. Romanes. Cunningham's Manual of Practical Anatomy vol. I-III Oxford.
5. Keith and Moore Clinical Oriented Anatomy. Lippincott Williams and Wilkins.
6. R.S Snell. Clinical Anatomy by regions. Lippincott Williams and Wilkins.
7. J.V. Basmajin. Grant's Method of Anatomy. Williams and Wilkins.
8. R.J. Last. Anatomy Regional and Applied. Churchill Livingstone.
9. Lee McGregor's Synopsis of Surgical Anatomy, Varghese Publishing House.
10. Snell. Clinical anatomy by regions. Lippincotts, Williams and Wilkins.
11. Hollinshed W Henry. Anatomy for surgeons. Vol. I-III Lippincotts, Williams and Wilkins.
12. Vishram Singh. Clinical and Surgical Anatomy. Elsevier. Vol I-III
13. Vishram Singh. Textbook of general anatomy. Elsevier.
14. Frank H. Netter. Atlas of Human Anatomy. Saunders Elsevier.

Histology

1. Young B. and Heath J. Wheater's Functional Histology. Churchill Livingstone.
2. M.H. E Ross. Histology: A textbook and atlas. Williams and Wilkins.
3. Difiore's. Atlas of histology with functional co-relation.
4. Junqueira Basic histology - Text book and Atlas
5. Bloom and Fawcett. Text book of histology.
6. Carlton's. Histology Technique.
7. E.C. Clayden. Practical of section cutting and staining.
8. D W Cormack. Ham's Histology. Lippincotts, Williams and Wilkins.

Genetics

1. J.S Thompson and Thompson . Genetics in medicine. W.B. Saunders and Co. Philadelphia, London.
2. George Fraser and Oliver Mayo. Text book of Human Genetics. Blackwell Scientific Publications London, Oxford Edinburg, Melbourne.
3. Hann Sellwerger and Jame Simpson. Chromosomes of Man. Sparscher's International Medical Publications.

Embryology

1. Hamilton, Boyd. and Mossman. Human Embryology.
2. TW Sadler. Langman's Medical Embryology. Lippincotts, Williams and Wilkins.
3. Keith L Moore and T.V.N. Persaud. The Developing Human. Saunders.
4. Larsen's Human embryology Schoenwolf, Bleyl, Brauer, Francis-West
5. AK Datta Essentials of Human embryology
6. Vishram singh Textbook of clinical Embryology

Neuroanatomy

1. Richard S. Snell. Clinical Neuroanatomy for Medical Students. Williams and Wilkins.

2. A. Parent. Carpenter's Human neuroanatomy. Williams and Wilkins.
3. Vishram Singh. Clinical Neuroanatomy. Elsevier.
4. A. K. Dutta. Essentials of Neuroanatomy. Current books international.
5. John A. Kiernan. Barr's the human nervous system, Lippincott, Williams and Wilkins.

[illegible]

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?	Yes				No				
	If not explain.									
	Name and Signature of the assessee									
	Name and Signature of the assessor									
	Date									