

Program and Course Structure

School of Medical Science and Research

**MS (Anatomy)
Session:2020-23**

1. Standard Structure of the Program at University Level

1.1 Vision, Mission and Core Values of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship.

Mission of the University

1. Transformative educational experience
2. Enrichment by educational initiatives that encourage global outlook
3. Develop research, support disruptive innovations and accelerate entrepreneurship
4. Seeking beyond boundaries

Core Values

- Integrity
- Leadership
- Diversity
- Community

1.2 Vision and Mission of the School

Vision of the School

To serve the society by being a premier institute that promotes a comprehensive approach to human health through excellence in academics, research and clinical care

Mission of the School

- Provide a transformative educational experience in Medical Science
- Develop skills and competencies to create global leaders in clinical care
- Promote innovative and collaborative research through intellectual and technological advancement
- Establish a center for excellence in preventive, promotive and curative health care

Core Values

- Integrity
- Leadership
- Ethics
- Community Health

1.3 Program Educational Objectives (PEO)

1.3.1 Writing Program Educational Objectives (PEO)

A post graduate student having qualified the MS (Anatomy) examination should:

PEO 1: Be aware of contemporary advances and developments in the field of Anatomy.

PEO 2: Have acquired the competencies pertaining to the subject of Anatomy that are required to be practiced at all levels of health system.

PEO 3: Be able to discharge responsibilities and participate in National Health Education Programs.

PEO 4: Be oriented to the principles of research methodology.

PEO 5: Have acquired skills in educating medical and paramedical professionals.

PEO 6: Have acquired skills in effectively communicating with the students and colleagues from various medical and paramedical fields.

PEO 7: Have acquired skills of integrating anatomy with other disciplines as and when needed.

PEO 8: Have acquired qualities of a good teacher capable of innovations in teaching methodology.

PEO 9: Have been able to demonstrate adequate management skills to function as an effective leader of the team engaged in teaching and research.

1.3.2 Map PEOs with Mission Statements:

PEO Statements	School Mission 1	School Mission 2	School Mission 3	School Mission 4
PEO1	3	2	3	3
PEO2	3	3	3	3
PEO3	3	3	1	3
PEO4	3	3	3	-
PEO5	3	3	1	3
PEO6	3	3	3	3
PEO7	3	3	3	3
PEO8	3	3	-	3
PEO9	3	3	2	3

1.3.3 Program Outcomes (PO's)

A. Cognitive Domain

PO1: Acquire competencies in gross and surface anatomy, neuroanatomy, embryology, genetics, histology, radiological anatomy, applied aspects and recent advances of these branches of anatomy to clinical practice.

B Affective domain

PO2: Demonstrate self-awareness and personal development in routine conduct. (Self-awareness)

PO3: Communicate effectively with peers, students and teachers in various teaching-learning activities. (Communication)

PO4: Due respect in handling human body parts & cadavers during dissection (Ethics & Professionalism) n

PO5: Humane touch while demonstrating living surface marking in subject/patient (Ethics & Professionalism)

C. Psychomotor Domain

PO6: Acquire mastery in dissection skills, embalming, tissue preparation, staining and museum preparation.

PO7: Has ability to use computer applications Microsoft office (Microsoft word, excel, power point), Internet, Searching scientific databases (e.g. PubMed, Medline, Cochrane reviews).

PO8: Acquire skills in paper & poster preparation, writing research papers and Thesis.

At the end of the program, the student should have acquired following competencies(PSOs):

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; She/He should be able to analyze the integrated functions of organs systems and locate the site of gross lesions according to deficits encountered.
3. Describe the process of gametogenesis, fertilization, implantation and placenta formation in early human embryonic development along with its variation and applied anatomy.
4. 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. She/He should be able to explain developmental basis of variations and congenital anomalies.

5. Explain the principles of light, transmission and scanning, compound, electron, fluorescent and virtual microscopy.
6. 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.
7. Demonstrate knowledge about cell and its components, cell cycle, cellular differentiation and proliferation.
8. Describe structure, number, classification, abnormalities and syndromes related to human chromosomes.
9. Describe important procedures in cytogenetics and molecular genetics with its application.
10. Demonstrate knowledge about single gene pattern inheritance, intermediate pattern and multiple alleles, mutations, non-mendelian inheritance, mitochondrial inheritance, genome imprinting and parental disomy.
11. Describe multifactorial pattern of inheritance, teratology, structure gene, molecular screening, cancer genetics and pharmacogenetics.
12. Demonstrate knowledge about reproduction genetics, assisted reproduction, prenatal diagnosis, genetic counseling and ethics in genetics.
13. Explain principles of gene therapy and its applied knowledge.
14. 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.
15. Demonstrate knowledge about common techniques employed in cellular immunology and histocompatibility testing.
16. Demonstrate applications of knowledge of structure & development of tissueorgan system to comprehend deviations from normal.
17. Demonstrate knowledge about recent advances in medical sciences which facilitate comprehension of structure function correlations and applications in clinical problem solving.
18. Explain collection, maintenance and application of stem cells, cryobanking and principles of organ donation from recently dead bodies.
19. Demonstrate knowledge about surface marking of all regions of the body.
20. Able to interpret various radiographs of the body, normal CT Scan, ultrasound and MRI.
21. Demonstrate knowledge about different anthropological traits and use of related instruments.
22. Demonstrate knowledge about outline of comparative anatomy of whole body and basic human evolution
23. Demonstrate knowledge about identification of human bones, determination of sex, age, and height for medico legal application of anatomy

B. Affective domain

24. Demonstrate self-awareness and personal development in routine conduct. (Self-awareness)

25. Communicate effectively with peers, students and teachers in various teaching-learning activities. (Communication)
26. Demonstrate
 - a. Due respect in handling human body parts & cadavers during dissection. (Ethics & Professionalism)
 - b. Humane touch while demonstrating living surface marking in subject/patient. (Ethics & Professionalism)
27. Acquire capacity of not letting his/her personal beliefs, prejudices and limitations come in the way of duty.
28. Appreciate the issues of equity and social accountability while exposing students to early clinical exposure. (Equity and social accountability)

C. Psychomotor domain

29. Identify, locate and demonstrate surface marking of clinically important structures in the cadaver and correlate it with living anatomy.
30. Acquire mastery in dissection skills, embalming, tissue preparation, staining and museum preparation.
31. Locate and identify clinically relevant structures in dissected cadavers.
32. Locate and identify cells & tissues under the microscope.
33. Identify important structures visualized by imaging techniques, specifically radiographs, computerized tomography (CT) scans, MRI and ultrasonography.
34. Demonstrate various movements at the important joints and actions of various groups of muscles in the human body.
35. Demonstrate anatomical basis of common clinical procedures expected to be performed by a basic medical doctor.
36. Demonstrate different methods of teaching-learning and make presentations of the subject topics and research outputs

1.3.4 Mapping of Program Outcome Vs Program Educational Objectives

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6	PEO7	PEO8	PEO9
PO1	3	3	2	-	-	-	3	-	-
PO2	3	3	2	-	-	-	3	-	-
PO3	3	3	-	-	2	-	2	3	-
PO4	2	3	-	3	-	2	3	-	2
PO5	2	3	-	3	-	2	3	-	2
PO6	1	1	3	3	3	3	3	3	3
PO7	3	3	-	3	3	3	3	3	3
PO8	-	-	-	-	-	3		3	3

School: SMSR		Batch:
Program: MS Anatomy		Current Academic Year: 2019-20
1	Programme Code	SMS0301

1.4 Syllabus

A post graduate student, after three years of training in M.D. (Anatomy) should have acquired knowledge in the following aspects of anatomy:

1.4.1 Gross anatomy

Section - I Gross Anatomy of entire body including upper limb, lower limb, thorax, abdomen, pelvis, perineum, head and neck, brain

and spinal cord

Section - 2Developmental anatomy/embryology

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

Section - 3 Histology and histochemistry Cell Biology:

- 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.

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.

Section – 4Neuroanatomy:

- 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, Cross Sectional anatomy of brain and spinal cord.
- Detailed structure of the central nervous system and its applied aspect.•

Section - 5 Genetics

- Human Chromosomes - Structure, number and classification, methods of• chromosome preparation banding patterns. Chromosome abnormalities, Autosomal and Sex chromosomal abnormalities syndromes, Molecular and Cytogenetics.

- Single gene pattern inheritance: Autosomal and Sex chromosomal pattern of inheritance, Intermediate pattern and multiple alleles, Mutations, NonMendelian inheritance, Mitochondrial inheritance, Genome imprinting, parental disomy.
- Multifactorial pattern of inheritance: Criteria for multifactorial inheritance, Teratology, Structure gene, Molecular Screening, Cancer Genetics - Haematological malignancies, Pharmacogenetics. 8 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.

Section - 6

- Immunology
 - Immune system and the cell types involved in defence 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.

Section - 7

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, cry banking and principles of organ donation from recently dead bodies.

Section - 8

- 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.

- Anthropology: Different anthropological traits, Identification and use of Anthropological instruments.
- Forensic Medicine: Identification of human bones from their remains and determination of sex, age, and height. for medico legal application of Anatomy.

Outline of comparative anatomy of the whole body and basic humanevolution

1.4.2 Specific practice based competencies:

Name/Description of practice based competencies

1. Gross anatomy:

1.1 Procurement, Embalming and Preservation of human cadavers

1.2 Preparation of tanks for preserving bodies

1.3 Dissection of cadaver

1.4 Window dissection of important regions

1.5 Preparation of specimens for museum with display

a) soft parts

b) models

c) charts

1.6 Preparation and preservation of human bones / skeleton as assigned by the faculty

2. Histology

2.1 Preparation of common fixatives 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 and EM pictures of all the organs and tissues of the body should be drawn and a small description of salient features written

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3. Histochemical Methods

3.1 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

Human chromosome preparation from peripheral blood and karyotyping.

4.3 Banding techniques (G and C)

4.4 Making of Pedigree charts for study of patterns of inheritance.

4.5 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.

1.5 ASSESSMENT

1.5.1 FORMATIVE ASSESSMENT:

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

During the three year training period,

A record of all theoretical, practical and experimental work done by the post graduate student and its assessment will be kept and shall be available for examiners at the time of the final practical and viva voce examination and

There will be periodical examinations during the course of training. The prefinal theory and practical examination will be conducted by the faculty of the 11 concerned college. During last six months the post graduate student will have weekly assessment tutorials conducted by the faculty. All activities will be evaluated.

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.

Quarterly assessment during the MS training should be based on:

1. Journal based / recent advances learning
2. Patient based /Laboratory or Skill based learning
3. Self directed learning and teaching
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities / CMEs

The student to be assessed periodically as per categories listed in postgraduate student appraisal form (Annexure I).

1.5.2 SUMMATIVE ASSESSMENT: The summative examination would be carried out as per the Rules given in POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000.

The Post Graduate examination will be in three parts:

1. **Thesis:** Every post graduate student shall carry out work on an assigned research project under the guidance of a recognised Post Graduate Teacher, the result of which shall be written up and submitted in the form of a Thesis. Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the post graduate student to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature. 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 12 and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. **Theory** The examinations shall be organised on the basis of ‘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. Obtaining a minimum of 50% marks in ‘Theory’ as well as ‘Practical’ separately shall be mandatory for passing examination as a whole. The examination for M.D./ MS shall be held at the end of 3rd academic year. An academic term shall mean six month's training period.

There shall be four theory papers.

Paper I: Gross Anatomy

Paper II: Embryology, Microscopic Anatomy and Genetics

Paper III: Neuroanatomy

Paper IV: Applied Human Anatomy and recent advances in anatomical Sciences Theory Papers

Paper I: Gross Anatomy

a). Gross Anatomy of whole human body i.e. upper limb, lower limb thorax, abdomen, pelvis, head and neck b). Method of preservation of human body and its parts, radiological anatomy, sectional anatomy.

Paper II: Embryology, Microscopic Anatomy and genetics

a). General Principles of genetics, Cytogenetic as applicable to medicine and different genetic disorders, gene therapy. b). General Embryology, Systemic Embryology, methods of experimental embryology, clinically oriented embryology and teratology c). Histology (including fine structure) of tissues and organs of the body. d) Principles of light, transmission and scanning electron microscopy, confocal, virtual microscopy.

Paper III: Neuroanatomy Neuroanatomy - gross and applied aspects

Paper IV: Applied Human Anatomy and recent advances in medical sciences

(a) Clinical and applied aspect of Anatomy (b) Recent advances in the application of knowledge of anatomy on human 13 body (c) Collection, maintenance and uses of stem cells (d) Cryobanking (e) Basics of principles of organ donation from recently dead bodies.

3. Practicals: spread over a minimum of 2 days

First Day Practical: (a): Gross Anatomy Dissection and related viva voce (b): Histology Spotting (10 spots) and viva voce Techniques paraffin block making, section cutting. Staining (H and E) stain) with related viva

Second Day Practical: a) Microteaching of a short topic to assess teaching skills b) A short synopsis of the thesis work should be presented by the post graduate student c) Grand viva including Gross anatomy, cross sectional anatomy, radiological Anatomy, Surface Anatomy, Embryology

Practical and Oral/Viva-Voce Examination

Practical Examination to be organized as per details given below:

Dissection on cadaver

Histology spotting

Histological techniques

Surface Marking Radiology

Teaching ability

Thesis presentation

Oral/Viva-voce Examination

Grand viva 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

&ultrasonographs.

1..6 Recommended reading:

Books (latest edition)

Gross Anatomy: 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. Lippincot Williams and Wilkins. 6. R.S Snell. Clinical Anatomy by regions. Lippincot Williams and Wilkins. 7. J.V. Basmajin. Grant's Method of Anatomy. Williams and Wilkins. 8. R.J. Last. Anatomy Regional and Applied. Churchill Livingston. 10. Lee McGregor. Surgical Anatomy. K.M. Varghese. 11. A.G. R Deckeg, D.J du Pless Lee. Mc Gregor's Synopsis of Surgical Anatomy. Varghese Publishing House. 12. Snell. Clinical anatomy by regions. Lippincotts, Williams and Wilkins. 13. S. Chummy Sinnatanmy. Last's Anatomy Regional and Applied. Churchill Livingston. 14. Hollinshed W Henry. Anatomy for surgeons. Vol. I-III Lippincotts, Williams and Wilkins. 15. Vishram Singh. Clinical and Surgical Anatomy. Elsevier. 16. Vishram Singh. Textbook of general anatomy. Elsevier. 17. 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. V. Bharihoke. Text book of human histology. Delhi AITBS. 4. Difiore's. Atlas of histology with functional co-relation. 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 Wilikins. 9. Bloom and Fawcett. Textbook of Histology.

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. Sparshe's International Medical Publications.

Embryology 1. Hamilton, Boyd. and Mossman. Human Embryology. 2. TW Sadler. Langman's Medical Embryology. Lippincotts, Williams and Wilikins. 3. Keith L Moore and T.V.N. Persaud. The Developing Human. Saunders. 4. Rani Kumar. Text book of embryology. I.K. International New Delhi

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.

Statistics 1. David E. Matthews and Vernon T. Farewell. Using and Understanding Medical Statistics. Karger.

Radiology 1. T.B. Moeller et.al. Sectional Anatomy CT and MRI Vol. I, II, III New York. Theme Stuttgart. 2. J.B.

Walter et.al. Basic Atlas of Sectional Anatomy with correlated imaging. Saunders Elsevier.

Surface anatomy 1. SP John, Lumley editors. Surface Anatomy, The Anatomical basis of clinical examination.

London: Churchill Livingstone. 2. A. Halim. and A.C. Das. Surface Anatomy Lucknow. ASI, KGMC.

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

Annexure I

Postgraduate Students Appraisal Form Pre / Para /Clinical Disciplines

Name of the Department/Unit :

Name of the PG Student :

Period of Training : FROM.....TO.....

Sr. No.	PARTICULARS	Not Satisfactory	Satisfactory	More Than Satisfactory	Remarks
		1 2 3	4 5 6	7 8 9	
1	Journal based / recent advances learning				
2	. Patient based /Laboratory or Skill based learning				
3	Self directed learning and teaching				
4	Departmental and interdepartmental learning activity				
5	External and Outreach Activities /				
6	CMEs				
7	Thesis / Research work				
8	Log Book Maintenance				

Publications

Yes/ No

Remarks* _____

*REMARKS: Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation must be suggested. Individual feedback to postgraduate student is strongly recommended.

SIGNATURE OF ASSESSEE

SIGNATURE OF CONSULTANT

SIGNATURE OF HOD