

Anatomy Curriculum for MBBS

Objectives

Sl No	Knowledge
1	Describe the general anatomy of structures and organ systems of the human body
2	Describe the normal disposition, interrelationships, innervations, vascular supply and functional anatomy of <i>clinically relevant</i> structures and organs of the human body.
3	Correlate the normal microscopic structure of various organs with their functions (as a prerequisite for understanding the altered state in commonly encountered disease processes).
4	Explain basic principles and sequential development of the organ systems
5	Explain the embryologic basis of the major developmental abnormalities and variations.
6	Explain the basics of medical genetics with respect to common genetic syndromes.
7	Explain the anatomical basis of contraception.
8	Identify various structures, which are commonly diseased, on X-ray plates, ultrasounds, CT & MRI plates.
9.	Demonstrate the Surface Anatomy of commonly diseases organs, viscera & structures.

SI No	Objectives (Skills) (All skills to be performed independently)
1	identify all the major structures, organs & viscera of the body
2	Demonstrate normal movements at various joints.
3	Demonstrate how to test the functioning of different muscles or muscle groups
4	Mark/draw the surface anatomy of all the major structures and organs of the body on a cadaver or a volunteer
5	Locate and palpate arterial pulsations, and identify structures against which arteries can be compressed to stop bleeding.
6	Locate ideal sites for venepuncture.
7	Locate the site for emergency tracheostomy.
8	Locate subcutaneous positions of large nerves.
9	Locate ideal sites for lumbar and sternal puncture, pericardial, intercostal and peritoneal tapping, and biopsies of liver, kidney and spleen.
10	Interpret the sectional anatomy of the human body
11	Identify normal anatomical structures, organs and viscera in Radiographs, Ultrasound images, Computerized Tomograms, Magnetic Resonance Images and the Endoscopic views.
12	Identify the organs and tissues in sections under the light microscope
13	Identify the critical stages in the embryonic development and interpret the effects of common teratogens, genetic mutations and environmental hazards on development
14	Identify and interpret normal karyograms, abnormal karyograms and clinical features of common genetic disorders.

Course Content

General Anatomy	Must know	Desirable to know
Brief history of anatomy as related to medicine, subdivisions of anatomy; cadaver, anatomical position, other positions used in clinical practice, terms of position, terms of movement, colours used in anatomical drawings.	✓	
Structures met with during dissection: skin, superficial fascia – including contents, deep fascia – including its modifications; muscles – parts, origin, insertion, tendon, aponeurosis, bursa, synovial sheath; ligament, artery, vein, lymphatics, lymph node, peripheral nerves.	✓	
General principles of embryology, gestation period, subdivisions, spermatogenesis, structure of sperm, oogenesis, structure of ovum, growth & rupture of the ovarian follicles. Sperm in the male and female genital tracts, activation & capacitation of sperms in the female genital tract.	✓	

Embryology	Must know	Desirable to know
First week of development Fertilization, formation of zygote, cleavage division, formation of morula & blastocyst, implantation, formation of decidua – its subdivisions. Types of implantation & abnormal sites of implantation. Anatomical basis of contraception.	✓	
Second week of development Differentiation of embryoblast & trophoblast, changes in the embryoblast – bilaminar germ disc, changes in trophoblast, formation of cytotrophoblast, syncytiotrophoblast, amniotic membrane, yolk sac, extra-embryonic mesoderm & extra-embryonic celom & connecting stalk, formation of chorion, amniotic cavity, primary yolk sac cavity, appearance of prochordal plate.	✓	
Third week of development Appearance of primitive streak & primitive node, formation of intraembryonic mesoderm resulting in trilaminar germ disc, formation of notochord, buccopharyngeal & cloacal membranes, pericardial bar, paraxial, intermediate & lateral plate mesoderm, secondary yolk sac, intraembryonic celom & allantoic diverticulum, derivatives of ectoderm, mesoderm & endoderm.	✓	
Third to tenth month of development Estimation of age, horizons of development. Maturation of tissues & organs & rapid growth of body.	✓	✓
Placenta Formation of placenta & chorionic villi, deciduas basalis, features & functions of placenta, placental circulation, abnormalities, placental barrier, types of placenta.	✓	
Umbilical cord Formation of umbilical cord, features of umbilical cord.	✓	
Amniotic cavity Amniotic cavity & membrane, amniotic fluid – functions, expansions of amniotic cavity & fusion with chorion, chorion leave with deciduas capsularis, deciduas capsularis with parietalis, obliteration of chorionic & uterine cavities, function of fused fetal membranes to dilate cervical canal.	✓	
Abnormalities, obliteration of chorionic & uterine cavities, abnormalities of chorion.	✓	
Embryological basis of twins.	✓	
Arrangement of fetal membranes.	✓	
Development of face, pharyngeal arches, clefts, pouches, & associated common congenital anomalies	✓	
Teratology Genetic & environmental factors as causative factors for congenital malformations. Mode of actions of teratogens & critical periods.	✓	✓
Postnatal growth & development Meaning of terms like growth, development, principles of growth & development, types of postnatal growth, periods of growth &		✓

Embryology	Must know	Desirable to know
development & factors influencing them. Assessment of growth & development.		
Milestones of development, growth & development during adolescence.	✓	

General Histology	Must know	Desirable to know
General Histology: Introduction including importance of studying histology in patient care, Epithelium, Surface specializations, Connective tissue - definition, cells, fibres, ground substance, Classification and features of different types of connective tissues, Cartilage, Bone, Muscle, Nerve tissue, General account of glands.	✓	
Basement membrane, Junctional complexes.	✓	

Integumentary System	Must know	Desirable to know
Skin and its appendages, superficial fascia, deep fascia, development and microscopic and applied anatomy.	✓	

Osteology	Must know	Desirable to know
Constituents of skeleton, types of bones, classification of bones with examples, names of bones, general features of different bones, colours used for marking origin and insertion of muscles, attachment of joint capsule, aponeurosis, ligaments, fascia, reflection of synovial membrane etc. of the body & their position, development & common congenital anomalies, microscopic anatomy of bone, common sites of fractures, general pattern of blood supply, ossification of bones of limbs for age determination and applied anatomy.	✓	
Process of the repair of bone.		✓

Muscular system	Must know	Desirable to know
Classification & identification of muscles of body, main attachments, nerve supply & action, microscopic anatomy, development of muscles and applied anatomy.	✓	
Mechanism of movement caused by muscle/muscles & various forces exerted by them, nerve terminations.		✓

Arthrology	Must know	Desirable to know

Arthrology	Must know	Desirable to know
Classification of joints, general features of different types of joints, detailed study of major joints of body & movements, a brief account of other joints. Applied anatomy of major joints.	✓	
Range of movement in major joints, microscopic anatomy of articular cartilage, maintenance of articular cartilage, blood supply.		✓

Cardiovascular system	Must know	Desirable to know
Position and parts of heart, names of blood vessels & their distribution in the body, normal development of heart, common congenital anomalies, microscopic anatomy of heart & blood vessels, gross anatomy of major blood vessels of the body, pericardium, pericardial cavity, concept of precordium and applied anatomy. Parts of conducting system of heart & its blood supply	✓ ✓	
Developmental anomalies, valvular defects & their effects.	✓	

Respiratory system	Must know	Desirable to know
Position, parts, relations, blood supply, lymphatic drainage, microscopic anatomy, normal development & congenital anomalies of various components of respiratory tract, thoracic cage, superficial and deep cardiac dullness, and movements of thorax during respiration, pleura, pleural cavity and applied anatomy.	✓	
Blood air barrier, cell population in the respiratory tract.		✓

Gastrointestinal system	Must know	Desirable to know
Position, parts, relations, blood supply, nerve supply, lymphatic drainage, normal development & congenital anomalies, microscopic anatomy, sphincters of the gastrointestinal system. Peritoneum, peritoneal cavity, fossae & folds and applied anatomy.	✓	
Sphincteric action & mechanism. Peptic ulcer, Peyer's patches, positions of appendix, marginal artery of Drummond.		✓

Genitourinary system	Must know	Desirable to know
Parts, position, relations, blood supply, nerve supply, lymphatic drainage, normal development & congenital anomalies, microscopic anatomy of Genito-urinary system. Normal sites of constrictions in the urinary passage. Prostate gland, Skene's tubules and applied anatomy.	✓	

Genitourinary system	Must know	Desirable to know
Anatomical basis of family planning measures.		✓

Endocrine system	Must know	Desirable to know
Organs, location, relations, blood supply, nerve supply, lymphatic drainage, microscopic anatomy & normal development & congenital anomalies and applied anatomy. Glandular system: Classification of glands, parts, location, relations, blood supply, nerve supply, lymphatic drainage, microscopic anatomy, normal development, congenital anomalies, applied anatomy of pituitary, pineal, lacrimal, salivary, thyroid, parathyroid, thymus, liver, pancreas, spleen & suprarenal glands.	✓ ✓	
Nervous system	Must know	Desirable to know
Parts of nervous system, meninges, neuroglia, cortex, functional cortical areas, basal ganglia, corpus striatum, white matter, ventricles, cerebellum, brain stem, motor & sensory pathways, cranial nerves, normal development, microscopic anatomy of neurons, motor & sensory cortex, blood supply and applied anatomy.	✓	
Reticular formation, Limbic system, Extrapyramidal system, correlation of microscopic anatomy with function, developmental anomalies, anatomical basis of common neurological disorder / syndromes, nerve terminals.		✓

Autonomic Nervous system	Must know	Desirable to know
Sympathetic, parasympathetic systems, cortical control, peripheral plexuses, common associated disorders and syndromes.	✓	

Special sensory organs	Must know	Desirable to know
Introduction to the eyeball and internal ear, gross anatomy of middle ear, nose & tongue and applied anatomy.	✓	
Lymphatic system	Must know	Desirable to know
Gross anatomy of major groups of lymph nodes of body & their drainage areas. Gross anatomy of major lymphatics, specially thoracic duct, jugular, subclavian and mediastinal lymph trunks. Microscopic anatomy of lymph nodes and applied anatomy.	✓	
Gross anatomy, development, blood supply and applied anatomy of thymus, spleen & palatine tonsil.	✓	

Medical Genetics	Must know	Desirable to know
Morphology of human chromosomes, amniocentesis and other methods to procure tissue/cells for the genetic study, karyogram, anomalies of chromosomes – structural and numerical, introduction to the common genetic disorders like – Mongolism, Meta female (Super female), Turner syndrome, Klinefelter syndrome.	✓	

Imaging Anatomy	Must know	Desirable to know
Identification of normal anatomical features in some commonly used skiagrams (plain & contrast), CT scan, ultrasound, MRI and Endoscopy.	✓	

Surface Anatomy	Must know	Desirable to know
Surface marking of those structures, organs and viscera of the body which are commonly affected in various disease processes.	✓	

Sectional Anatomy	Must know	Desirable to know
Gross / sagittal / coronal sections of thorax, abdomen, pelvis, limbs, head & neck and brain to understand interrelations of organs and interpret CTs & MRIs.	✓	

ADDITION SUGGESTED:

1. Knowledge of ultrastructure of the cell should be **included**
2. Basement membrane and junctional complexes should be in **must know**
3. Include cell and organelles, cell division under **must know**
4. Include cell surface modification, tissue processing, microtomy, staining, microscopy under **desirable to know**
5. Functional Microscopic anatomy of tonsil, thymus, lymph node and spleen should be **included**
6. Knowledge of attachments of all the muscles & fascia is **not** needed
7. Range of movements and blood supply of major joints should under '**must know**'
8. Details of microstructure and maintenance of cartilage can be under '**desirable to know**'
9. Muscles & joints of thorax and diaphragm should be under **must know**
10. Peyer's patches and marginal artery should be under **must know**
11. External & internal features of spinal cord with blood supply and meninges should be specified
12. Limbic system: parts, position and main connections should be included in **must know**
13. Fundamentals of Autonomic Nervous System should be under **must know**
14. Orbit, extraocular and intraocular muscles should be under **must know**
15. Sclerocorneal junction should be under **desirable to know**
16. Introduction to different imaging modalities, principles behind them and their importance should be included
17. Surface anatomy of structures examined during clinical physical examination should be included
18. Sectional anatomy of the body at important levels only should be included
19. Reticular formation, limbic system, extra pyramidal system, corelation of microscopic anatomy with function, developmental anomalies, anatomical basis of common neurological disorders/syndromes, nerve terminals should be in **must know**
20. Mendelian laws and basic principles of inheritance should be under **must know**
21. Basic knowledge of cytogenetics, cell culture and karyotyping should be **included**
22. Integumentary system: include applied anatomy of dermatomes under **desirable to know**
23. Delete ossification of bones from **must know** category
24. Include disorders of bone marrow & ossification under **desirable to know**

25. Delete mechanism of movements in muscular system
26. Include motor end plate, muscle spindle, prime movers, fixators, antagonists and synergists under **must know**
27. Delete valvular defects and their effects from Cardiovascular system
28. Include gradient of BP in different levels, arteriosclerosis, ischemia, infarction
29. Include Kartagener's syndrome and Hyaline membrane disease in Respiratory system
30. Include microscopic anatomy of peripheral nerve, motor and sensory ganglia and myelination in Nervous system
31. Lymphatic system: Include microscopic anatomy of thymus, spleen and palatine tonsil.
32. Development of face, pharyngeal arches and pouches
33. Histology of blood vessels to be included
34. GIT: Peyer's patches and positions of appendix to be included in **must know**
35. Nervous system: Diencephalon and visual pathway to be included.

Teaching/Learning Methods

1. Lectures - not more than 1/3rd of the total teaching hours.
2. e-mode learning of some of the topics.
3. Small group teaching – such as:
 - a) Demonstrations.
 - b) Tutorials.
 - c) Seminars.
 - d) Problem Based Learning.
4. Dissection / Prosected parts demonstrations / Instructions on Mannequins.
5. Skills Lab with CDs of various stages of Dissection.
6. Histology Lab.
7. Surface marking.
8. Imaging anatomy Lab.
9. Visit to the Museum.
10. Preparation of scientific article.
11. Preparation of Gross Anatomy Practical Drawing Book
12. Preparation of Histology Practical Drawing Book.

Practicals

Gross Anatomy:

Dissection/Demonstration of Prosected parts

Dissection of the whole body, at least once or Prosected part demonstration or Skill lab with CD of dissection stages and adequate number of Mannequins depending on the number of students.

Upper limb: demonstration: pectoral & scapular regions, shoulder region, axilla, arm, forearm, hand: palm & dorsum, joints of upper limb.

Thorax: demonstration: chest wall, diaphragm, mediastinum, lungs, **heart, blood vessels & nerves.**

Abdomen Proper: demonstration: anterior abdominal wall, inguinal region, organs / viscera & posterior abdominal wall.

Pelvis: demonstration: pelvic viscera, wall, blood vessels and nerves.

Perineum: external genitalia, perineal pouches and anal triangle including ischioanal fossa.

Lower limb: demonstration: gluteal region, thigh: anterior, medial, posterior compartments, popliteal fossa, leg: anterior, lateral and posterior compartments, Foot: dorsum, sole. Joints of lower limb.

Head & Neck: demonstration: scalp, superficial & deep dissection of face & neck, parotid region, cranial cavity, contents of orbit, **external nose**, triangles of neck, introduction to the eyeball, submandibular region, temporal & infratemporal fossa, **submandibular region**, oral cavity, **palate & nasal cavity**, pharynx, larynx, ear, thyroid & parathyroid gland, oesophagus, trachea, blood vessels and cranial nerves, vertebral canal and contents.

Brain: Sections & prosected specimens of Brain to demonstrate meninges, (**borders, poles, lobes, sulci gyri**) blood supply, functional cortical areas, ventricles, visual pathways, auditory pathways, basal ganglia, corpus striatum, cerebellum and sections of the brain

stem.

Demonstrations:

Bones, Sectional anatomy, Radiological anatomy & Ultrasonography, CT & MRI scan and Endoscopic anatomy.

Microscopic Anatomy:

Stained slides of all the clinically relevant tissues, organs and viscera.

Developmental anatomy:

Models / specimens to demonstrate various stages of fertilization, implantation, formation of embryo, development of fetus and development of various organs & systems. Commonly encountered congenital defects.

Medical Genetics:

Demonstration of normal karyogram. Clinical picture, features and karyogram of the common genetic conditions.

Visit to the museum:

At least once a week to study specimens, models, charts etc.

Areas for integrated teaching

Anatomical basis of birth control measures	O&G, Surgery
Postnatal growth & development	Pediatrics & Community Medicine
Antenatal growth & development	O&G
Genetic disorders	Various clinical departments
Neuroanatomy	Physiology & Medicine
Kinesiology – movements at joints	Orthopedics
Embryological basis of important & common congenital anomalies	Pediatrics, O&G

Ward posting

Evening, once / twice a week from third month onwards, besides visits to the community settings.

Assessment methods & tools

REVISED ASSESSMENT IN ANATOMY – MBBS

Total Marks : 400

Theory : 200

Practical

& Viva : 200

THEORY :

200 MARKS

Internal Assessment : 40

University Exam : 160

Theory papers – 2 of 80 marks each.

No optional questions.

Each paper having Part A & B

UNIVERSITY EXAMINATION

SYSTEM / ORGAN APPROACH

Paper – 1 Part – A of 40 marks (SAQ, 30 marks, PBL based question 10 marks)

Part – B of 40 marks (40 MCQs of 1 mark each)

Part A : Contents

Special embryology, special histology, gross and applied anatomy of –
General Embryology, Osteology, Arthrology, myology, Post Natal Growth, Neurology,
Endocrinology, Special Sense organs, Sectional Anatomy.

Part B : Contents

MCQs 40 in no. on contents of Part A

Paper – II - Part A of 40 marks

Part B of 40 marks

Part A – contents

General Histology, special embryology, special histology, gross and applied anatomy of
Gastro Intestinal system, Genito Urinary system, Cardio Vascular System, Respiratory
system, Endocrine, Lymphatic system, Medical Genetics, Sectional Anatomy.

Part B – contents

MCQs 40 in no. on contents of Part B.

REGIONAL APPROACH

Paper – 1 Part A of 40 marks (SAQ 30 marks, PBL based question 10 marks)

Part B of 40 marks (40 MCQs of 1 mark each)

Part A – contents

General Embryology, Post Natal Development, Special embryology, special histology,
gross and applied Anatomy of superior extremity, Head and neck and Brain.

Part – B - contents

MCQs on contents of Part A.

Paper – II

Part A of 40 marks (SAQ 30 marks, PBL based question 10 marks)

Part B of 40 marks (40 MCQs of 1 mark each)

Part – A – contents

General Histology, Genetics, Special Embryology, Special Histology, Gross and applied
Anatomy of Inferior Extremity, Abdomen and Pelvis and Thorax.

Part – B – contents

MCQs on contents of Part A.

PRACTICAL AND VIVA VOCE

200 marks

(Both approaches)

Internal Assessment	:	40
University Exam	:	160 (for Regional and system / organ approach)
OSPE	100	
Viva	60	

Contents :

Spotting
Gross anatomy
Imaging Anatomy
Surface Anatomy
Histology slides
Embryology

Part A and B of each paper to be evaluated by separate examiners.

(a) Part A and B of each paper to be answered in separate answer books.

INTERNAL ASSESSMENT

1. REGIONAL APPROACH

Theory 40 marks through MCQs.

- Embryology, Post Natal Growth and Development.
- Stage assessment.
- Part completion assessment
- Histology lab assessment
- Medical Genetics
- Scientific paper assessment

Practical and Viva Voce 40 marks through OSPE +VIVA

- Stage assessment
- Part completion assessment
- Histology Lab assessment
- Gross Anatomy Practical Note Book assessment
- Histology Practical Note Book assessment
- Marks on attendance

75% attendance - 75% marks
100% attendance - 100% marks

- Imaging Anatomy
- Surface Anatomy

2. SYSTEM / ORGAN APPROACH

Theory – 40 marks – MCQs

Embryology, Post Natal Development
Histology
System assessment
Medical Genetics
Scientific Paper assessment

Practical and Viva Voce

Embryology, Post Natal Development
Histology lab assessment
Imaging Anatomy
Surface anatomy
Gross Anatomy Practical Note Book assessment
Histology Practical Note Book assessment

Marks on attendance

75% attendance - 75% marks
100% attendance - 100% marks

Learning Resource Materials

Recommended books:

I Gross Anatomy

1. Cunningham's Manual of Practical Anatomy Vols. I,II & III
15th Edition 1996
By G.J. Romanes
Oxford University Press
2. Clinical Anatomy for Medical Student
8th Edition 2008
By R.S. Snell
Lippincott Williams & Wilkins
3. Grants Atlas of Anatomy
11th Edition 2004
By A. Agur, M. Lec
4. Clinical Oriented Anatomy, 5th Ed, 2006 by K L Moore and Dalley.
5. Latest edition of Text Book of Hollinshead
6. Last's Applied Anatomy
7. Developmental Anatomy by Moore and Persaud

II. Histology

2. Histology: A text & atlas
4th Edition 2002
By M.H. Ross
G.I. Kaye, W. Pawlina
Lippincott Williams & Wilkins
2. DiFiore's- Atlas of Histology with
Functional correlations
10th Edition 2004
By V. Eroschenko
International Edition
3. Textbook of Histology
5th Edition 1995
Leeson C. Ronald
Papara A.
W.B. Saunders Co.,
Philadelphia

III Developmental Anatomy

1. Langman's- Medical Embryology
with Simbryo Version 1CD-ROM
9th Edition 2003
T. Sadler
Lippincott, Williams and Wilkins

IV Neuroanatomy

1. Barr's The Human Nervous system
An Anatomical View Point with CD
8th Edition 2004
J Kiernan
Harper & Row

2. Neuroanatomy An Illustrated Colour Text. 2nd Edition 2001 By AR Crossman and D Neary
Churchill Livingstone

Reference books:

I Gross Anatomy:

1. Gray's Anatomy 39th Edition By Susan Standring
Churchill Livingstone (1600 + 2260 pages)

II Histology

1. Basic Histology (Text & Atlas) 10th Edition 2003(with CD ROM) By Luis C. Junqueira
Carneiro
Appleton and Lange
3. Wheaters Functional Histology 4th Edition 2000 Edited by B, Young and J. Heath
Churchill Livingstone

III Developmental Anatomy

1. Human Embryology 3rd Edition 2001 William J. Larsen
Churchill Livingstone
www.med.uc.edu/embryology

IV Genetics

1. Thompson & Thompson Genetics in Medicine 6th Edition 2001
Revised reprint March 2004 Nussbaum, McInnes & Willard
W.B. Saunders & Co.
Philadelphia, London
2. Essential Medical Genetics 5th Edition 1997 J.M. Connor
M.A. Ferguson Smith
Blackwell Scientific Publication

V Neuroanatomy

1. Human Neuroanatomy 9th Edition 1996 Andre Parent, Malcolm B Carpenter
Williams and Wilkins
2. Clinical Neuroanatomy for Medical Students 5th Edition 2001 By Richard S. Snell
Lippincott, William and Wilkins
3. Clinical Neuroanatomy and related Neuroscience 4th Edition 2002 By MJT Fitzgerald
WB Saunders and Co.

CDs & Internet:

1. A.D.A.M. (Animated Dissection of Anatomy for Medicine) Comprehensive for Windows.
Publisher: A.D.A.M. Software Inc.
2. A.D.A.M. Interactive Anatomy, Publisher: A.D.A.M. Software Inc.
3. Cardioviewer 3D: CD-ROM, ISBN: 0-8151-3106-2, publication date: 1996
Imprint: MOSBY (Marketed by Elsevier)
4. Histology/pathology slides: <http://www.virtualslides.psu.edu/listSlides.jsp>
5. Collection of Links to Anatomical resources on the internet:
<http://www.west.asu.edu/jbuenke/medicine/anatomy.html>

Suggested topics for e-learning in Anatomy
(Recommended to assist and supplement teaching)

1. Fertilization
2. Cleavage
3. Implantation
4. Post Natal Growth and Development
5. Development of Pharyngeal arches, clefts, pouches.
6. Descending tracts of Central Nervous System
7. Ascending tracts of Central Nervous system
8. Medical Genetics – common syndromes
10. Visual pathways and visual areas
11. Major Joints & movements