



KERALA UNIVERSITY OF HEALTH SCIENCES

Syllabus for BACHELOR OF MEDICINE AND BACHELOR OF SURGERY (MBBS) Course

Course Code 001

Vol 1

Anatomy, Physiology and Biochemistry

2019 Academic year onwards



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COURSE CONTENT (Based on Medical Council of India, Competency based Undergraduate curriculum for the Indian Medical Graduate, 2018)		
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Anatomy: Distribution of teaching hours

Teaching method	Hours
Lectures	210
Small group teachings / tutorials / Integrated teaching / Practical	400
Self-directed learning	10
Teaching Hours	620
Early clinical exposure	9
AETCOM- (Attitude Ethics & Communication) 2 modules	6
Formative assessment and term examinations	20

Number	Competency	Core/ Non- Core	Teaching- Learning methods	Vertical Integration (VI) / Horizontal Integration (HI)
Teaching Learning Methods L : Lecture; DOAP Session (Demonstration -Observation - Assistance - Performance); P: Practical; SGT: Small Group Teaching; SGD: Small Group Discussion; GA: Group Activity				
Topic: Anatomical Terminology		Number of Competencies: 2	Number of procedures for certification: (NIL)	
AN 1.1	Demonstrate normal anatomical position, various planes, relation, comparison, laterality & movement in our body	Y	L; DOAP;	
AN 1.2	Describe composition of bone and bone marrow	Y	L;	
Topic: General features of bones & Joints		Number of Competencies: 6	Number of procedures for certification: (NIL)	
AN 2.1	Describe parts, blood and nerve supply of a long bone (To include Ossification of Bone)	Y	L; DOAP;	
AN 2.2	Enumerate laws of ossification	N	L;	
AN 2.3	Enumerate special features of a sesamoid bone	N	L;	
AN 2.4	Describe various types of cartilage with its structure & distribution in body	Y	L;	VI Orthopaedics
AN 2.5	Describe various joints with subtypes and examples	Y	L;	VI Orthopaedics
AN 2.6	Explain the concept of nerve supply of joints & Hilton's law	Y	L;	

Topic: General features of Muscle		Number of Competencies: 3	Number of procedures for certification: (NIL)		
AN 3.1	Classify muscle tissue according to structure & action		Y	L;	HI Physiology
AN 3.2	Enumerate parts of skeletal muscle and differentiate between tendons and aponeuroses with examples		Y	L;	
AN 3.2	Explain Shunt and spurt muscles		N	L;	
Topic: General features of skin and fascia		Number of Competencies: 5	Number of procedures for certification: (NIL)		
AN 4.1	Describe different types of skin & dermatomes in body		N	L; DOAP;	
AN 4.2	Describe structure & function of skin with its appendages		Y	L; DOAP;	VI Dermatology, Venereology & Leprosy
AN 4.3	Describe superficial fascia along with fat distribution in body		Y	L; DOAP;	
AN 4.4	Describe modifications of deep fascia with its functions		Y	L; DOAP;	VI Dermatology, Venereology & Leprosy
AN 4.5	Explain principles of skin incisions		N	L;	VI Dermatology, Venereology & Leprosy
Topic: General features of the cardiovascular system		Number of Competencies: 8	Number of procedures for certification: (NIL)		
AN 5.1	Differentiate between blood vascular and lymphatic system		Y	L;	HI Physiology
AN 5.2	Differentiate between pulmonary and systemic circulation		Y	L;	HI Physiology

AN 5.3	List general differences between arteries & veins	Y	L;	
AN 5.4	Explain functional difference between elastic, muscular arteries and arterioles	Y	L;	
AN 5.5	Describe portal system giving examples	Y	L;	
AN 5.6	Describe the concept Of anastomoses and collateral circulation with significance of end-arteries	Y	L;	VI General Medicine, HI Physiology
AN 5.7	Explain function of meta-arterioles, precapillary sphincters, arterio-venous anastomoses	N	L;	HI Physiology
AN 5.8	Define thrombosis, infarction & aneurysm	N	L;	VI Pathology, HI Physiology
Topic: General Features of lymphatic system		Number of Competencies: 3		Number of procedures for certification: (NIL)
AN 6.1	List the components and functions of the lymphatic system	N	L;	
AN 6.2	Describe structure of lymph capillaries & mechanism of lymph circulation	N	L;	
AN 6.3	Explain the concept of lymphedema and spread of tumours via lymphatics and venous system	N	L;	VI General Surgery
Topic: Introduction to the nervous system Number of Competencies: 8 Number of procedures for certification: (NIL)				
AN 7.1	Describe general plan of nervous system with components of central, peripheral & autonomic nervous systems	Y	L;	
AN 7.2	List components of nervous tissue and their functions	Y	L;	HI Physiology

AN 7.3	Describe parts of a neuron and classify them based on number of neurites, size & function	Y	L;	HI Physiology
AN 7.4	Describe structure of a typical spinal nerve	Y	L;	
AN 7.5	Describe principles of sensory and motor innervation of muscles	N	L;	VI General Medicine
AN 7.6	Describe concept of loss of innervation of a muscle with its applied anatomy	Y	L;	VI General Medicine, HI Physiology
AN 7.7	Describe various type of synapse	N	L;	HI Physiology
AN 7.8	Describe differences between sympathetic and spinal ganglia	N	L;	
Topic: Features of individual bones (Upper Limb)		Number of Competencies: 6		Number of procedures for certification: (NIL)
AN 8.1	Identify the given bone, its side, important features & keep it in anatomical position	Y	DOAP;	
AN 8.2	Identify & describe joints formed by the given bone	Y	L; DOAP;	
AN 8.3	Enumerate peculiarities of clavicle	Y	L; DOAP;	
AN 8.4	Demonstrate important muscle attachment on the given bone	Y	P; DOAP; SGT;	VI Orthopaedics
AN 8.5	Identify and name various bones in articulated hand, Specify the parts of metacarpals and phalanges and enumerate the peculiarities of pisiform	Y	P; DOAP; SGT;	
AN 8.6	Describe scaphoid fracture and explain the anatomical basis of avascular necrosis	N	DOAP;	VI Orthopaedics

Topic: Pectoral region		Number of Competencies: 3	Number of procedures for certification: (NIL)		
AN 9.1	Describe attachment, nerve supply & action of pectoralis major and pectoralis minor	Y	L; P;		
AN 9.2	Breast: Describe the location, extent, deep relations, structure, age changes, blood supply, lymphatic drainage, microanatomy and applied anatomy of breast	Y	P; L;		VI General Surgery
AN 9.3	Describe development of breast	N	L;		
Topic: Axilla, Shoulder and Scapular region		Number of Competencies: 13	Number of procedures for certification: (NIL)		
AN 10.1	Identify & describe boundaries and contents of axilla	Y	P; L; SGD; DOAP;		
AN 10.2	Identify, describe and demonstrate the origin, extent, course, parts, relations and branches of axillary artery & tributaries of vein	Y	P; L; SGD; DOAP;		
AN 10.3	Describe, identify and demonstrate formation, branches, relations, area of supply of branches, course and relations of terminal branches of brachial plexus	Y	P; L; SGD; DOAP;		
AN 10.4	Describe the anatomical groups of axillary lymph nodes and specify their areas of drainage	Y	P; L;		VI General Surgery
AN 10.5	Explain variations in formation of brachial plexus	Y	P; L;		
AN 10.6	Explain the anatomical basis of clinical features of Erb's palsy and Klumpke's paralysis	N	L;		VI General Surgery
AN 10.7	Explain anatomical basis of enlarged axillary lymph nodes	N	L;		VI General Surgery

AN 10.8	Describe, identify and demonstrate the position, attachment, nerve supply and actions of trapezius and latissimus dorsi	Y	P; L; SGD; DOAP;	
AN 10.9	Describe the arterial anastomosis around the scapula and mention the boundaries of triangle of auscultation	N	L;	
AN 10.10	Describe and identify the deltoid and rotator cuff muscles	Y	P; L; SGD; DOAP;	
AN 10.11	Describe & demonstrate attachment of serratus anterior with its action	Y	P; L; SGD; DOAP;	
AN 10.12	Describe and demonstrate shoulder joint for – type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements, muscles involved, blood supply, nerve supply and applied anatomy	Y	P; L; SGD; DOAP;	VI Orthopaedics
AN 10.13	Explain anatomical basis of Injury to axillary nerve during intramuscular injections	N	L;	
Topic: Arm & Cubital fossa		Number of Competencies: 6		Number of procedures for certification: (NIL)
AN 11.1	Describe and demonstrate muscle groups of upper arm with emphasis on biceps and triceps brachia	Y	P; L; SGD; DOAP;	
AN 11.2	Identify & describe origin, course, relations, branches (or tributaries), termination of important nerves and vessels in arm	Y	P; L; SGD; DOAP;	
AN 11.3	Describe the anatomical basis of Venepuncture of cubital veins	Y	P; L;	VI General Surgery
AN 11.4	Describe the anatomical basis of Saturday night paralysis	Y	P; L;	VI Orthopaedics

AN 11.5	Identify & describe boundaries and contents of cubital fossa	Y	P; L; SGD; DOAP;	
AN 11.6	Describe the anastomosis around the elbow joint	N	L;	
Topic: Forearm & hand Number of Competencies: 15 Number of procedures for certification: (NIL)				
AN 12.1	Describe and demonstrate important muscle groups of ventral forearm with attachments, nerve supply and actions	Y	P; L; SGD; DOAP;	
AN 12.2	Identify & describe origin, course, relations, branches (or tributaries), termination of important nerves and vessels of forearm	Y	P; L; SGD; DOAP;	
AN 12.3	Identify & describe flexor retinaculum with its attachments	Y	P; L; SGD; DOAP;	
AN 12.4	Explain anatomical basis of carpal tunnel syndrome	Y	L;	
AN 12.5	Identify & describe small muscles of hand. Also describe movements of thumb and muscles involved	Y	P; L; SGD; DOAP;	
AN 12.6	Describe & demonstrate movements of thumb and muscles involved	Y	P; L; SGD; DOAP;	
AN 12.7	Identify & describe course and branches of important blood vessels and nerves in hand	Y	P; L; SGD; DOAP;	
AN 12.8	Describe anatomical basis of Claw hand	Y	L;	VI General Surgery
AN 12.9	Identify & describe fibrous flexor sheaths, ulnar bursa, radial bursa and digital synovial sheaths	Y	P; L; SGD; DOAP;	

AN 12.10	Explain infection of fascial spaces of palm	N	L;	VI General Surgery
AN 12.11	Identify, describe and demonstrate important muscle groups of dorsal forearm with attachments, nerve supply and actions	Y	P; L; SGD; DOAP;	VI General Surgery
AN 12.12	Identify & describe origin, course, relations, branches (or tributaries), termination of important nerves and vessels of back of forearm	Y	P; L; SGD; DOAP;	VI General Surgery
AN 12.13	Describe the anatomical basis of Wrist drop	Y	L;	VI General Surgery
AN 12.14	Identify & describe compartments deep to extensor retinaculum	Y	P; L; SGD; DOAP;	VI General Surgery
AN 12.15	Identify & describe extensor expansion formation	Y	P; L; SGD; DOAP;	
Topic: General Features, Joints, radiographs surface marking Number of Competencies: 8 Number of procedures for certification: (NIL)				
AN 13.1	Describe and explain Fascia of upper limb and compartments, veins of upper limb and its lymphatic drainage	Y	L;	
AN 13.2	Describe dermatomes of upper limb	N	L;	
AN 13.3	Identify & describe the type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements, blood and nerve supply of elbow joint, proximal and distal radio-ulnar joints, wrist joint & first carpometacarpal joint	Y	P; L; SGD; DOAP;	

AN 13.4	Describe Sternoclavicular joint, Acromioclavicular joint, Carpometacarpal joints & Metacarpophalangeal joint	N	L;	
AN 13.5	Identify the bones and joints of upper limb seen in anteroposterior and lateral view radiographs of shoulder region, arm, elbow, forearm and hand	Y	P; L; SGD; DOAP;	HI Radiodiagnosis
AN 13.6	Identify & demonstrate important bony landmarks of upper limb: Jugular notch, sternal angle, acromial angle, spine of the scapula, vertebral level of the medial end, Inferior angle of the scapula	Y	P; L; SGD; DOAP;	
AN 13.7	Identify & demonstrate surface projection of: Cephalic and basilic vein, Palpation of Brachial artery, Radial artery, Testing of muscles: Trapezius, pectoralis major, serratus anterior, latissimus dorsi, deltoid, biceps brachii, Brachioradialis	Y	P; L; SGD; DOAP;	
AN 13.8	Describe development of upper limb	N	L;	
Topic : Features of individual bones (Lower Limb) Number of Competencies: 4 Number of procedures for certification: (NIL)				
AN 14.1	Identify the given bone, its side, important features & keep it in anatomical position	Y	DOAP;	
AN 14.2	Identify & describe joints formed by the given bone	Y	L; DOAP;	
AN 14.3	Describe the importance of ossification of lower end of femur & upper end of tibia	Y	L;	VI Forensic Medicine & Toxicology
AN 14.4	Identify and name various bones in the articulated foot with individual muscle attachment	N	P; DOAP; SGT;	

Topic: Front & Medial side of thigh Number of Competencies: 5 Number of procedures for certification: (NIL)				
AN 15.1	Describe and demonstrate origin, course, relations, branches (or tributaries), termination of important nerves and vessels of anterior thigh	Y	P; L; SGD; DOAP;	
AN 15.2	Describe and demonstrate major muscles with their attachment, nerve supply and actions	Y	P; L; SGD; DOAP;	
AN 15.3	Describe and demonstrate boundaries, floor, roof and contents of femoral triangle	Y	P; L; SGD; DOAP;	VI General Surgery
AN 15.4	Explain anatomical basis of Psoas abscess & Femoral hernia	N	L; DOAP;	VI General Surgery
AN 15.5	Describe and demonstrate adductor canal with its content	Y	P; L; SGD; DOAP;	
Topic: Gluteal region & back of thigh Number of Competencies: 6 Number of procedures for certification: (NIL)				
AN 16.1	Describe and demonstrate origin, course, relations, branches (or tributaries), termination of important nerves and vessels of gluteal region	Y	P; L; SGD; DOAP;	
AN 16.2	Describe anatomical basis of sciatic nerve injury during gluteal intramuscular injections	Y	L; DOAP;	VI General Surgery
AN 16.3	Explain the anatomical basis of Trendelenburg sign	Y	L; DOAP;	VI General Surgery
AN 16.4	Describe and demonstrate the hamstrings group of muscles with their attachment, nerve supply and actions	Y	P; L; SGD; DOAP;	
AN 16.5	Describe and demonstrate the origin, course, relations, branches (or tributaries), termination of important nerves and vessels on the back of thigh	Y	P; L; SGD; DOAP;	

AN 16.6	Describe and demonstrate the boundaries, roof, floor, contents and relations of popliteal fossa	Y	P; L; SGD; DOAP;	
Topic: Hip Joint Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 17.1	Describe and demonstrate the type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements and muscles involved, blood and nerve supply, bursae around the hip joint	Y	P; L; SGD; DOAP;	
AN 17.2	Describe anatomical basis of complications of fracture neck of femur	N	L;	VI Orthopaedics
AN 17.3	Describe dislocation of hip joint and surgical hip replacement	N	L;	VI Orthopaedics
Topic: Knee joint, Anterolateral compartment of leg & dorsum of foot Number of procedures for certification: (NIL) Number of Competencies: 7				
AN 18.1	Describe and demonstrate major muscles of anterolateral compartment of leg with their attachment, nerve supply and actions	Y	P; L; SGD; DOAP;	
AN 18.2	Describe and demonstrate origin, course, relations, branches (or tributaries), termination of important nerves and vessels of anterior and lateral compartment of leg	Y	P; L; SGD; DOAP;	
AN 18.3	Explain the anatomical basis of foot drop	Y	L; DOAP;	VI General Surgery
AN 18.4	Describe and demonstrate the type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements and muscles involved, blood and nerve supply, bursae around the knee joint	Y	P; L; SGD; DOAP;	

AN 18.5	Explain the anatomical basis of locking and unlocking of the knee joint	Y	SGT;	
AN 18.6	Describe knee joint injuries with its applied anatomy	N	L;	VI Orthopaedics
AN 18.7	Explain anatomical basis of Osteoarthritis	N	L;	VI Orthopaedics
Topic: Back of Leg & Sole Number of Competencies: 7 Number of procedures for certification: (NIL)				
AN 19.1	Describe and demonstrate the major muscles of back of leg and Sole with their attachment, nerve supply and actions	Y	P; L; SGD; DOAP;	
AN 19.2	Describe and Demonstrate the origin, course, relations, branches (or tributaries), termination of important nerves and vessels on back of leg and Sole	Y	P; L; SGD; DOAP;	
AN 19.3	Explain the concept of "Peripheral heart"	Y	L;	VI General Surgery
AN 19.4	Explain the anatomical basis of rupture of calcaneal tendon	N	L;	VI Orthopaedics
AN 19.5	Describe factors maintaining importance arches of the foot with its importance	Y	L;	
AN 19.6	Explain the anatomical basis of Flat foot & Club foot	N	L;	VI Orthopaedics
AN 19.7	Explain the anatomical basis of Metatarsalgia & Plantar fasciitis	N	L;	VI Orthopaedics

Topic: General Features, Joints, radiographs & surface marking Number of Competencies: 10 Number of procedures for certification: (NIL)				
AN 20.1	Describe and demonstrate the type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements and muscles involved, blood and nerve supply of tibiofibular and ankle joint	Y	P; L; SGD; DOAP;	
AN 20.2	Describe the subtalar and transverse tarsal joints	N	L; DOAP;	
AN 20.3	Describe and demonstrate Fascia lata, Venous drainage, Lymphatic drainage, Retinacula & Dermatomes of lower limb	Y	P; L; SGD; DOAP;	
AN 20.4	Explain anatomical basis of enlarged inguinal lymph nodes	N	L;	VI General Surgery
AN 20.5	Explain anatomical basis of varicose veins and deep vein thrombosis	Y	L;	VI General Surgery
AN 20.6	Identify the bones and joints of lower limb seen in anteroposterior and lateral view radiographs of various regions of lower limb	Y	P; L; SGD; DOAP;	VI Radiodiagnosis
AN 20.7	Identify & demonstrate important bony landmarks of lower limb: - Vertebral levels of highest point of iliac crest, posterior superior iliac spines, iliac tubercle, pubic tubercle, ischial tuberosity, adductor tubercle, -Tibial tuberosity, head of fibula, -Medial and lateral malleoli, Condyles of femur and tibia, sustentaculum tali, tuberosity of fifth metatarsal, tuberosity of the navicular	Y	P; L; SGD; DOAP;	

AN 20.8	Identify & demonstrate palpation of femoral, popliteal, post tibial, anti tibial & dorsalis pedis blood vessels in a simulated environment	Y	P; L; SGD; DOAP;	VI General Medicine
AN 20.9	Identify & demonstrate Palpation of vessels (femoral, popliteal, dorsalis pedis, post tibial), Mid inguinal point, Surface projection of: femoral nerve, Saphenous opening, Sciatic, tibial, common peroneal & deep peroneal nerve, Great and small saphenous veins	Y	P; L; SGD; DOAP;	VI General Medicine, General Surgery
AN 20.10	Describe basic concept of development of lower limb	N	L;	
Topic: Thoracic cage Number of Competencies: 11 Number of procedures for certification: (NIL)				
AN 21.1	Identify and describe the salient features of sternum, typical rib, 1st rib and typical thoracic vertebra	Y	L; DOAP;	
AN 21.2	Identify & describe the features of 2nd, 11th and 12th ribs, 1st, 11th and 12th thoracic vertebrae	N	L; DOAP;	
AN 21.3	Describe & demonstrate the boundaries of thoracic inlet, cavity and outlet	Y	P; L; SGD; DOAP;	
AN 21.4	Describe & demonstrate extent, attachments, direction of fibres, nerve supply and actions of intercostal muscles	Y	P; L; SGD; DOAP;	
AN 21.5	Describe & demonstrate origin, course, relations and branches of a typical intercostal nerve	Y	P; L; SGD; DOAP;	
AN 21.6	Mention origin, course and branches/ tributaries of: 1) anterior & posterior intercostal vessels 2) internal thoracic vessels	Y	P; L;	

AN 21.7	Mention the origin, course, relations and branches of 1) atypical intercostal nerve 2) superior intercostal artery, subcostal artery	N	L;	
AN 21.8	Describe & demonstrate type, articular surfaces & movements of manubriosternal, costovertebral, costotransverse and xiphisternal joints	Y	P; L; SGD; DOAP;	
AN 21.9	Describe & demonstrate mechanics and types of respiration	Y	P; L; SGD; DOAP;	HI Physiology
AN 21.10	Describe costochondral and interchondral joints	N	L;	
AN 21.11	Mention boundaries and contents of the superior, anterior, middle and posterior mediastinum	Y	P; L;	
Topic: Heart & Pericardium Number of Competencies: 7 Number of procedures for certification: (NIL)				
AN 22.1	Describe & demonstrate subdivisions, sinuses in pericardium, blood supply and nerve supply of pericardium	Y	P; L; SGD; DOAP;	
AN 22.2	Describe & demonstrate external and internal features of each chamber of heart	Y	P; L; SGD; DOAP;	
AN 22.3	Describe & demonstrate origin, course and branches of coronary arteries	Y	P; L; SGD; DOAP;	
AN 22.4	Describe anatomical basis of ischaemic heart disease	Y	L;	
AN 22.5	Describe & demonstrate the formation, course, tributaries and termination of coronary sinus	Y	P; L; SGD; DOAP;	
AN 22.6	Describe the fibrous skeleton of heart	Y	P; L; SGD; DOAP;	

AN 22.7	Mention the parts, position and arterial supply of the conducting system of heart	Y	L;	
Topic: Mediastinum Number of Competencies: 7 Number of procedures for certification: (NIL)				
AN 23.1	Describe & demonstrate the external appearance, relations, blood supply, nerve supply, lymphatic drainage and applied anatomy of Oesophagus	Y	P; L; DOAP;	VI General Surgery
AN 23.2	Describe & demonstrate the extent, relations tributaries of thoracic duct and enumerate its applied anatomy	Y	P; L; DOAP;	VI General Surgery
AN 23.3	Describe and demonstrate origin, course, relations, tributaries and termination of superior venacava, azygos, hemiazygos and accessory hemiazygos veins	Y	P; L; SGD; DOAP;	
AN 23.4	Mention the extent, branches and relations of arch of aorta & descending thoracic aorta	Y	P; L;	
AN 23.5	Identify & Mention the location and extent of thoracic sympathetic chain	Y	P; L; SGD; DOAP;	
AN 23.6	Describe the Splanchnic nerves	N	L;	
AN 23.7	Mention the extent, relations and applied anatomy of lymphatic duct	Y	L;	VI General Surgery

Topic: Lungs & Trachea Number of Competencies: 6 Number of procedures for certification: (NIL)				
AN 24.1	Mention the blood supply, lymphatic drainage and nerve supply of pleura, extent of pleura and describe the pleural recesses and their applied anatomy	Y	P; L;	VI General Medicine, HI Physiology
AN 24.2	Identify side, external features and relations of structures which form root of lung & bronchial tree and their clinical correlate	Y	P; L; SGD; DOAP;	VI General Medicine, HI Physiology
AN 24.3	Describe a bronchopulmonary segment	Y	L;	VI General Medicine, HI Physiology
AN 24.4	Identify phrenic nerve & describe its formation & distribution	Y	P; L;	
AN 24.5	Mention the blood supply, lymphatic drainage and nerve supply of lungs	Y	L;	
AN 24.6	Describe the extent, length, relations, blood supply, lymphatic drainage and nerve supply of trachea	N	L;	
Topic: Thorax Number of Competencies: 9 Number of procedures for certification: (01)				
AN 25.1	Identify, draw and label a slide of trachea and lung	Y	L; P;	(FOR CERTIFICATION)
AN 25.2	Describe development of pleura, lung & heart	Y	L;	
AN 25.3	Describe fetal circulation and changes occurring at birth	Y	L;	HI Physiology
AN 25.4	Describe embryological basis of: 1) atrial septal defect, 2) ventricular septal defect, 3) Fallot's tetralogy & 4) tracheo-oesophageal fistula	Y	L;	HI Physiology

AN 25.5	Describe developmental basis of congenital anomalies, transposition of great vessels, dextrocardia, patent ductus arteriosus and coarctation of aorta	Y	L;	HI Physiology
AN 25.6	Mention development of aortic arch arteries, SVC, IVC and coronary sinus	N	L;	
AN 25.7	Identify structures seen on a plain x-ray chest (PA view)	Y	P; DOAP;	
AN 25.8	Identify and describe in brief a barium swallow	N	P; DOAP;	
AN 25.9	Demonstrate surface marking of lines of pleural reflection, lung borders and fissures, trachea, heart borders, apex beat & surface projection of valves of heart	Y	P;	HI Physiology
Topic: Skull osteology Number of Competencies: 7 Number of procedures for certification: (NIL)				
AN 26.1	Demonstrate anatomical position of skull, Identify and locate individual skull bones in skull	Y	L; DOAP;	
AN 26.2	Describe the features of norma frontalis, verticalis, occipitalis, lateralis and basalis	Y	L; DOAP;	
AN 26.3	Describe cranial cavity, its subdivisions, foramina and structures passing through them	Y	L; DOAP;	
AN 26.4	Describe morphological features of mandible	Y	L; DOAP;	
AN 26.5	Describe features of typical and atypical cervical vertebrae (atlas and axis)	Y	L; DOAP;	
AN 26.6	Explain the concept of bones that ossify in membrane	N	L;	

AN 26.7	Describe the features of the 7th cervical vertebra	N	DOAP;	
Topic: Scalp Number of Competencies: 2 Number of procedures for certification: (NIL)				
AN 27.1	Describe the layers of scalp, its blood supply, its nerve supply and surgical importance	Y	P; L;	VI General Surgery
AN 27.2	Describe emissary veins with its role in spread of infection from extracranial route to intracranial venous sinuses	Y	L;	
Topic: Face & parotid region Number of Competencies: 10 Number of procedures for certification: (NIL)				
AN 28.1	Describe & demonstrate muscles of facial expression and their nerve supply	Y	P; L; SGD; DOAP;	
AN 28.2	Describe sensory innervation of face	Y	P; L;	
AN 28.3	Describe & demonstrate origin /formation, course, branches /tributaries of facial vessels	Y	P; L; SGD; DOAP;	
AN 28.4	Describe & demonstrate branches of facial nerve with distribution	Y	P; L; SGD; DOAP;	
AN 28.5	Describe cervical lymph nodes and lymphatic drainage of head, face and neck	Y	P; L;	
AN 28.6	Identify superficial muscles of face, their nerve supply and actions	Y	P; L; SGD; DOAP;	
AN 28.7	Explain the anatomical basis of facial nerve palsy	Y	L;	VI General Medicine
AN 28.8	Explain surgical importance of deep facial vein	Y	L;	VI General Surgery

AN 28.9	Describe & demonstrate the parts, borders, surfaces, contents, relations and nerve supply of parotid gland with course of its duct and surgical importance	Y	P; L; SGD; DOAP;	VI General Surgery
AN 28.10	Explain the anatomical basis of Frey's syndrome	N	L;	VI General Surgery
Topic: Posterior triangle of neck Number of Competencies: 4 Number of procedures for certification: (NIL)				
AN 29.1	Describe & demonstrate attachments, nerve supply, relations and actions of sternocleidomastoid To include Boundaries and Contents of Posterior Triangle of Neck	Y	P; L; SGD; DOAP;	
AN 29.2	Explain anatomical basis of Erb's & Klumpke's palsy	Y	L;	VI General Surgery
AN 29.3	Explain anatomical basis of wry neck	N	L;	VI General Surgery
AN 29.4	Describe & demonstrate attachments of 1) inferior belly of omohyoid, 2)scalenus anterior, 3) scalenus medius & 4) levator scapulae	N	L; P;	
Topic: Cranial cavity Number of Competencies: 5 Number of procedures for certification: (NIL)				
AN 30.1	Describe the cranial fossae & identify related structures	Y	P; L; SGD; DOAP;	VI General Surgery
AN 30.2	Describe & identify major foramina with structures passing through them	Y	P; L; SGD; DOAP;	VI General Surgery
AN 30.3	Describe & identify dural folds & dural venous sinuses	Y	P; L; SGD; DOAP;	

AN 30.4	Describe clinical importance of dural venous sinuses	Y	L;	
AN 30.5	Explain effect of pituitary tumours on visual pathway	N	L;	VI Ophthalmology
Topic: Orbit Number of Competencies: 5 Number of procedures for certification: (NIL)				
AN 31.1	Describe & identify extra ocular muscles of eyeball	Y	P; L; SGD; DOAP;	
AN 31.2	Describe & demonstrate nerves and vessels in the orbit	Y	P; L; SGD; DOAP;	
AN 31.3	Describe anatomical basis of Horner's syndrome	N	L;	VI Ophthalmology
AN 31.4	Enumerate components of lacrimal apparatus	Y	L;	
AN 31.5	Explain the anatomical basis of oculomotor, trochlear and abducent nerve palsies along with strabismus	Y	L;	VI Ophthalmology
Topic: Anterior Triangle Number of Competencies: 2 Number of procedures for certification: (NIL)				
AN 32.1	Describe boundaries and subdivisions of anterior triangle	Y	P; L;	
AN 32.2	Describe & demonstrate boundaries and contents of muscular, carotid, digastric and submental triangles	Y	P; L; SGD; DOAP;	
Topic: Temporal and Infratemporal regions Number of Competencies: 5 Number of procedures for certification: (NIL)				
AN 33.1	Describe & demonstrate extent, boundaries and contents of temporal and infratemporal fossae	Y	P; L; SGD; DOAP;	

AN 33.2	Describe & demonstrate attachments, direction of fibres, nerve supply and actions of muscles of mastication	Y	P; L; SGD; DOAP;	VI General Surgery
AN 33.3	Describe & demonstrate articulating surface, type & movements of temporomandibular joint	Y	P; L; SGD; DOAP;	
AN 33.4	Explain the clinical significance of pterygoid venous plexus	Y	L;	VI General Surgery
AN 33.5	Describe the features of dislocation of temporomandibular joint	N	L;	VI General Surgery
Topic: Submandibular region Number of Competencies: 2 Number of procedures for certification: (NIL)				
AN 34.1	Describe & demonstrate the morphology, relations and nerve supply of submandibular salivary gland & submandibular ganglion	Y	P; L; SGD; DOAP;	VI General Surgery
AN 34.2	Describe the basis of formation of submandibular stones	N	L;	VI General Surgery
Topic: Deep structures in the neck Number of Competencies: 10 Number of procedures for certification: (NIL)				
AN 35.1	Describe the parts, extent, attachments, modifications of deep cervical fascia	Y	L;	
AN 35.2	Describe & demonstrate location, parts, borders, surfaces, relations & blood supply of thyroid gland	Y	P; L; SGD; DOAP;	VI General Surgery
AN 35.3	Demonstrate & describe the origin, parts, course & branches subclavian artery	Y	P; L; SGD; DOAP;	
AN 35.4	Describe & demonstrate origin, course, relations, tributaries and termination of internal jugular & brachiocephalic veins	Y	P; L; SGD; DOAP;	

AN 35.5	Describe and demonstrate extent, drainage & applied anatomy of cervical lymph nodes	Y	P; L; SGD; DOAP;	VI General Surgery
AN 35.6	Describe and demonstrate the extent, formation, relation & branches of cervical sympathetic chain	Y	P; L; SGD; DOAP;	
AN 35.7	Describe the course and branches of IX, X, XI & XII nerve in the neck	Y	L;	
AN 35.8	Describe the anatomically relevant clinical features of Thyroid swellings	N	L;	VI General Surgery
AN 35.9	Describe the clinical features of compression of subclavian artery and lower trunk of brachial plexus by cervical rib	N	L;	VI General Surgery
AN 35.10	Describe the fascial spaces of neck	N	L;	
Topic: Mouth, Pharynx & Palate Number of Competencies: 5 Number of procedures for certification: (NIL)				
AN 36.1	Describe the 1) morphology, relations, blood supply and applied anatomy of palatine tonsil 2) composition of soft palate (To include Extent, parts, muscles, blood supply and nerve supply of pharynx)	Y	L;	VI ENT
AN 36.2	Describe the components and functions of Waldeyer's lymphatic ring	Y	L;	VI ENT
AN 36.3	Describe the boundaries and clinical significance of pyriform fossa	N	L;	VI ENT
AN 36.4	Describe the anatomical basis of tonsillitis, tonsillectomy, adenoids and peri-tonsillar abscess	N	L;	VI ENT
AN 36.5	Describe the clinical significance of Killian's dehiscence	N	L;	VI ENT

Topic: Cavity of Nose Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 37.1	Describe & demonstrate features of nasal septum, lateral wall of nose, their blood supply and nerve supply	Y	P; L; SGD; DOAP;	VI ENT
AN 37.2	Describe location and functional anatomy of paranasal sinuses	Y	L;	VI ENT
AN 37.3	Describe anatomical basis of sinusitis & maxillary sinus tumours	N	L;	VI ENT
Topic: Larynx Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 38.1	Describe the morphology, identify structure of the wall, nerve supply, blood supply and actions of intrinsic and extrinsic muscles of the larynx	Y	P; L; SGD; DOAP;	VI ENT
AN 38.1	Describe the anatomical aspects of laryngitis	N	L;	VI ENT
AN 38.1	Describe anatomical basis of recurrent laryngeal nerve injury	N	L;	VI ENT
Topic: Tongue Number of Competencies: 2 Number of procedures for certification: (NIL)				
AN 39.1	Describe & demonstrate the morphology, nerve supply, embryological basis of nerve supply, blood supply, lymphatic drainage and actions of extrinsic and intrinsic muscles of tongue	Y	P; L; SGD; DOAP;	
AN 39.2	Explain the anatomical basis of hypoglossal nerve palsy	N	L;	VI ENT
Topic: Organs of hearing and equilibrium Number of Competencies: 5 Number of procedures for certification: (NIL)				

AN 40.1	Describe & identify the parts, blood supply and nerve supply of external ear	Y	P; L; SGD; DOAP;	VI ENT
AN 40.2	Describe & demonstrate the boundaries, contents, relations and functional anatomy of middle ear and auditory tube	Y	P; L; SGD; DOAP;	VI ENT
AN 40.3	Describe the features of internal ear	N	L;	VI ENT
AN 40.4	Explain anatomical basis of otitis externa and otitis media	N	L;	VI ENT
AN 40.5	Explain anatomical basis of myringotomy	N	L;	VI ENT
Topic: Eyeball Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 41.1	Describe & demonstrate parts and layers of eyeball	Y	P; L; SGD; DOAP;	VI Ophthalmology
AN 41.1	Describe the anatomical aspects of cataract, glaucoma & central retinal artery occlusion	N	L;	VI Ophthalmology
AN 41.1	Describe the position, nerve supply and actions of intraocular muscles	N	L;	VI Ophthalmology
Topic: Back Region Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 42.1	Describe the contents of the vertebral canal	Y	P; L; SGD; DOAP;	
AN 42.2	Describe & demonstrate the boundaries and contents of Sub occipital triangle	Y	P; L; SGD; DOAP;	
AN 42.3	Describe the position, direction of fibres, relations, nerve supply, actions of semispinalis capitis and splenius capitis	N	L;	

Topic: Head & neck Joints, Histology, Development, Radiography & Surface marking Number of procedures for certification: (NIL) Number of Competencies: 9				
AN 43.1	Describe & demonstrate the movements with muscles producing the movements of atlanto occipital joint & atlantoaxial joint	Y	P; L; SGD; DOAP;	
AN 43.2	Identify, describe and draw the microanatomy of pituitary gland, thyroid, parathyroid gland, tongue, salivary glands, tonsil, epiglottis, cornea, retina	Y	L; P;	
AN 43.3	Identify, describe and draw microanatomy of olfactory epithelium, eyelid, lip, sclero-corneal junction, optic nerve, cochlea- organ of corti, pineal gland	N	L; P;	
AN 43.4	Describe the development and developmental basis of congenital anomalies of face, palate, tongue, branchial apparatus, pituitary gland, thyroid gland & eye	Y	L;	
AN 43.5	Demonstrate- 1) Testing of muscles of facial expression, extraocular muscles, muscles of mastication, 2) Palpation of carotid arteries, facial artery, superficial temporal artery, 3) Location of internal and external jugular veins, 4) Location of hyoid bone, thyroid cartilage and cricoid cartilage with their vertebral levels	Y	P;	VI General Surgery
AN 43.6	Demonstrate surface projection of- Thyroid gland, Parotid gland and duct, Pterion, Common carotid artery, Internal jugular vein, Subclavian vein, External jugular vein, Facial artery in the face & accessory nerve	N	P;	VI General Surgery

AN 43.7	Identify the anatomical structures in 1) Plain x-ray skull, 2) AP view and lateral view 3) Plain x-ray cervical spine-AP and lateral view 4) Plain x-ray of paranasal sinuses	Y	P;	VI Radiodiagnosis
AN 43.8	Describe the anatomical route used for carotid angiogram and vertebral angiogram	N	P;	VI Radiodiagnosis
AN 43.9	Identify anatomical structures in carotid angiogram and vertebral angiogram	N	P;	VI Radiodiagnosis
Topic: Anterior abdominal wall Number of Competencies: 7 Number of procedures for certification: (NIL)				
AN 44.1	Describe & demonstrate the Planes (transpyloric, transtuberular, subcostal, lateral vertical, linea alba, linea semilunaris), regions & Quadrants of abdomen	Y	P; L; SGD; DOAP;	VI General Surgery
AN 44.2	Describe & identify the Fascia, nerves & blood vessels of anterior abdominal wall	Y	P; L; SGD; DOAP;	
AN 44.3	Describe the formation of rectus sheath and its contents	Y	L;	
AN 44.4	Describe & demonstrate extent, boundaries, contents of Inguinal canal including Hesselbach's triangle.	Y	P; L; SGD; DOAP;	VI General Surgery
AN 44.5	Explain the anatomical basis of inguinal hernia	Y	L;	VI General Surgery
AN 44.6	Describe & demonstrate attachments of muscles of anterior abdominal wall	Y	P; L; SGD; DOAP session	VI General Surgery
AN 44.7	Enumerate common Abdominal incisions	N	L;	VI General Surgery

Topic: Posterior abdominal wall Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 45.1	Describe Thoracolumbar fascia	Y	L;	
AN 45.2	Describe & demonstrate Lumbar plexus for its root value, formation & branches	Y	P; L; SGD; DOAP;	
AN 45.3	Mention the major subgroups of back muscles, nerve supply and action	N	L;	
Topic: Male external genitalia Number of Competencies: 5 Number of procedures for certification: (NIL)				
AN 46.1	Describe & demonstrate coverings, internal structure, side determination, blood supply, nerve supply, lymphatic drainage & descent of testis with its applied anatomy	Y	P; L; SGD; DOAP;	VI General Surgery
AN 46.2	Describe parts of Epididymis	Y	L; P;	
AN 46.3	Describe Penis under following headings: (parts, components, blood supply and lymphatic drainage)	Y	L; P;	
AN 46.4	Explain the anatomical basis of Varicocoele	N	L;	VI General Surgery
AN 46.5	Explain the anatomical basis of Phimosis & Circumcision	N	L;	VI General Surgery
Topic: Abdominal cavity Number of Competencies: 14 Number of procedures for certification: (NIL)				
AN 47.1	Describe & identify boundaries and recesses of Lesser & Greater sac	Y	P; L; SGD; DOAP;	VI General Surgery
AN 47.2	Name & identify various peritoneal folds & pouches with its explanation	Y	P; L; SGD; DOAP;	VI General Surgery

AN 47.3	Explain anatomical basis of Ascites & Peritonitis	N	L;	VI General Surgery
AN 47.4	Explain anatomical basis of Subphrenic abscess	N	L;	VI General Surgery
AN 47.5	Describe & demonstrate major viscera of abdomen under following headings (anatomical position, external and internal features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and applied aspects)	Y	P; L; SGD; DOAP;	VI General Surgery
AN 47.6	Explain the anatomical basis of Splenic notch, Accessory spleens, Kehr's sign, Different types of vagotomy, Liver biopsy (site of needle puncture), Referred pain in cholecystitis, Obstructive jaundice, Referred pain around umbilicus, Radiating pain of kidney to groin & Lymphatic spread in carcinoma stomach	N	L;	VI General Surgery
AN 47.7	Mention the clinical importance of Calot's triangle	N	L;	VI General Surgery
AN 47.8	Describe & identify the formation, course relations and tributaries of Portal vein, Inferior vena cava & Renal vein	Y	P; L; SGD; DOAP;	
AN 47.9	Describe & identify the origin, course, important relations and branches of Abdominal aorta, Coeliac trunk, Superior mesenteric, Inferior mesenteric & Common iliac artery	Y	L;	
AN 47.10	Enumerate the sites of portosystemic anastomosis	Y	L;	VI General Surgery

AN 47.11	Explain the anatomic basis of hematemesis& caput medusae in portal hypertension	Y	L;	VI General Surgery
AN 47.12	Describe important nerve plexuses of posterior abdominal wall	N	L;	
AN 47.13	Describe & demonstrate the attachments, openings, nerve supply & action of the thoracoabdominal diaphragm	Y	P; L; SGD; DOAP;	
AN 47.14	Describe the abnormal openings of thoracoabdominal diaphragm and diaphragmatic hernia	N	L;	VI General Surgery
Topic: Pelvic wall and viscera Number of Competencies: 8 Number of procedures for certification: (NIL)				
AN 48.1	Describe & identify the muscles of Pelvic diaphragm	Y	P; L; SGD; DOAP;	
AN 48.2	Describe & demonstrate the (position, features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and clinical aspects of) important male & female pelvic viscera (To include Morphology, blood supply, nerve supply and lymphatic drainage of Male Urethra)	Y	P; L; SGD; DOAP;	
AN 48.3	Describe & demonstrate the origin, course, important relations and branches of internal iliac artery	Y	P; L; SGD; DOAP;	
AN 48.4	Describe the branches of sacral plexus	Y	L;	

AN 48.5	Explain the anatomical basis of suprapubic cystostomy, Urinary obstruction in benign prostatic hypertrophy, Retroverted uterus, Prolapse uterus, Internal and external haemorrhoids, Anal fistula, Vasectomy, Tubal pregnancy & Tubal ligation	N	L;	VI General Surgery
AN 48.6	Describe the neurological basis of Automatic bladder	N	L;	VI General Surgery
AN 48.7	Mention the lobes involved in benign prostatic hypertrophy & prostatic cancer	N	L;	VI General Surgery
AN 48.8	Mention the structures palpable during vaginal & rectal examination	N	L;	VI Obstetrics & Gynaecology, General Surgery
Topic: Perineum Number of Competencies: 5 Number of procedures for certification: (NIL)				
AN 49.1	Describe & demonstrate the superficial & deep perineal pouch (boundaries and contents)	Y	P; L; SGD; DOAP;	VI Obstetrics & Gynaecology
AN 49.2	Describe & identify Perineal body	Y	P; L; SGD; DOAP;	VI Obstetrics & Gynaecology
AN 49.3	Describe & demonstrate Perineal membrane in male & female	Y	P; L; SGD; DOAP;	
AN 49.4	Describe & demonstrate boundaries, content & applied anatomy of Ischiorectal fossa	Y	P; L; SGD; DOAP;	VI General Surgery
AN 49.5	Explain the anatomical basis of Perineal tear, Episiotomy, Perianal abscess and Anal fissure	N	L;	VI Obstetrics & Gynaecology

Topic: Vertebral column Number of Competencies: 4 Number of procedures for certification: (NIL)				
AN 50.1	Describe the curvatures of the vertebral column	Y	L;	
AN 50.2	Describe & demonstrate the type, articular ends, ligaments and movements of Intervertebral joints, Sacroiliac joints & Pubic symphysis	Y	P; L; SGD; DOAP;	
AN 50.3	Describe lumbar puncture (site, direction of the needle, structures pierced during the lumbar puncture)	Y	L;	VI General Medicine
AN 50.4	Explain the anatomical basis of Scoliosis, Lordosis, Prolapsed disc, Spondylolisthesis & Spina bifida	N	L;	VI Orthopaedics
Topic: Sectional Anatomy Number of Competencies: 2 Number of procedures for certification: (NIL)				
AN 51.1	Describe & identify the cross-section at the level of T8, T10 , T12 and L1 (transpyloric plane)	Y	P; L; SGD; DOAP;	VI Radiodiagnosis
AN 51.2	Describe & identify the midsagittal section of male and female pelvis	Y	P; L; SGD; DOAP;	VI Radiodiagnosis
Topic: Histology & Embryology Number of Competencies: 8 Number of procedures for certification: (NIL)				
AN 52.1	Describe & identify the microanatomical features of Gastro intestinal system: Oesophagus, Fundus of stomach, Pylorus of stomach, Duodenum, Jejunum, Ileum, Large intestine, Appendix, Liver, Gall bladder, Pancreas & Suprarenal gland	Y	L; P;	

AN 52.2	Describe & identify the microanatomical features of: Urinary system: Kidney, Ureter & Urinary bladder Male Reproductive System: Testis, Epididymis, Vas deferens, Prostate & penis Female reproductive system: Ovary, Uterus, Uterine tube, Cervix, Placenta & Umbilical cord	Y	L; P;	
AN 52.3	Describe & identify the microanatomical features of Cardiooesophageal junction, Corpus luteum	N	L; P;	
AN 52.4	Describe the development of anterior abdominal wall	N	L;	
AN 52.5	Describe the development and congenital anomalies of Diaphragm	Y	L;	VI General Surgery
AN 52.6	Describe the development and congenital anomalies of: Foregut, Midgut & Hindgut	Y	L;	VI General Surgery
AN 52.7	Describe the development of Urinary system	Y	L;	VI General Surgery
AN 52.8	Describe the development of male & female reproductive system	Y	L;	VI Obstetrics & Gynaecology
Topic: Osteology Number of Competencies: 4 Number of procedures for certification: (NIL)				
AN 53.1	Identify & hold the bone in the anatomical position, Describe the salient features, articulations & demonstrate the attachments of muscle groups	Y	L; DOAP;	VI General Surgery, Obstetrics & Gynaecology
AN 53.2	Demonstrate the anatomical position of bony pelvis & show boundaries of pelvic inlet, pelvic cavity, pelvic outlet	Y	L; DOAP;	VI Obstetrics & Gynaecology

AN 53.3	Define true pelvis and false pelvis and demonstrate sex determination in male & female bony pelvis	Y	L; DOAP;	VI Obstetrics & Gynaecology
AN 53.4	Explain and demonstrate clinical importance of bones of abdominopelvic region (sacralization of lumbar vertebra, Lumbarization of 1st sacral vertebra, types of bony pelvis & Coccyx)	N	L; DOAP;	
Topic: Radiodiagnosis Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 54.1	Describe & identify features of plain X ray abdomen	Y	L; DOAP;	VI Radiodiagnosis
AN 54.2	Describe & identify the special radiographs of abdominopelvic region (contrast X ray Barium swallow, Barium meal, Barium enema, Cholecystography, Intravenous pyelography & Hysterosalpingography)	Y	L; DOAP;	VI Radiodiagnosis
AN 54.3	Describe role of ERCP, CT abdomen, MRI, Arteriography in radiodiagnosis of abdomen	N	L;	VI Radiodiagnosis
Topic: Surface marking Number of Competencies: 2 Number of procedures for certification: (NIL)				
AN 55.1	Demonstrate the surface marking of; Regions and planes of abdomen, Superficial inguinal ring, Deep inguinal ring, McBurney's point, Renal Angle & Murphy's point	Y	P; L; SGD; DOAP;	VI General Surgery
AN 55.2	Demonstrate the surface projections of: Stomach, Liver, Fundus of gall bladder, Spleen, Duodenum, Pancreas, Ileocaecal junction, Kidneys & Root of mesentery	Y	P; L; SGD; DOAP;	VI General Surgery

Topic: Meninges & CSF Number of Competencies: 2 Number of procedures for certification: (NIL)				
AN 56.1	Describe & identify various layers of meninges with its extent & modifications	Y	P; L; SGD; DOAP;	VI General Medicine
AN 56.2	Describe circulation of CSF with its applied anatomy	Y	L;	VI General Medicine, HI Physiology
Topic: Spinal Cord Number of Competencies: 5 Number of procedures for certification: (NIL)				
AN 57.1	Identify external features of spinal cord	Y	P; L; SGD; DOAP;	
AN 57.2	Describe extent of spinal cord in child & adult with its clinical implication	Y	L;	
AN 57.3	Draw & label transverse section of spinal cord at mid-cervical & midthoracic level	Y	L;	
AN 57.4	Enumerate ascending & descending tracts at mid thoracic level of spinal cord	Y	L;	VI General Medicine, HI Physiology
AN 57.5	Describe anatomical basis of syringomyelia	N	L;	VI General Medicine, HI Physiology
Topic: Medulla Oblongata Number of Competencies: 4 Number of procedures for certification: (NIL)				
AN 58.1	Identify external features of medulla oblongata	Y	L; DOAP;	
AN 58.2	Describe transverse section of medulla oblongata at the level of 1) pyramidal decussation, 2) sensory decussation 3) ION	Y	L;	
AN 58.3	Enumerate cranial nerve nuclei in medulla oblongata with their functional group	Y	L;	HI Physiology

AN 58.4	Describe anatomical basis & effects of medial & lateral medullary syndrome	N	L;	VI General Medicine, HI Physiology
Topic: Pons Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 59.1	Identify external features of pons	Y	L; DOAP;	HI Physiology
AN 59.2	Draw & label transverse section of pons at the upper and lower level	Y	L;	
AN 59.3	Enumerate cranial nerve nuclei in pons with their functional group	Y	L;	
Topic: Cerebellum Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 60.1	Describe & demonstrate external & internal features of cerebellum	Y	P; L; SGD; DOAP;	
AN 60.2	Describe connections of cerebellar cortex and intracerebellar nuclei	Y	L;	
AN 60.3	Describe anatomical basis of cerebellar dysfunction	N	L;	VI General Medicine, HI Physiology
Topic: Mid Brain Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 61.1	Identify external & internal features of midbrain	Y	P; L; SGD; DOAP;	
AN 61.2	Describe internal features of midbrain at the level of superior & inferior colliculus	Y	L;	
AN 61.3	Describe anatomical basis & effects of Benedikt's and Weber's syndrome	N	L;	VI General Medicine, HI Physiology

Topic: Cranial nerve nuclei & Cerebral hemispheres Number of Competencies: 6 Number of procedures for certification: (NIL)				
AN 62.1	Enumerate cranial nerve nuclei with its functional component	Y	L;	
AN 62.2	Describe & demonstrate surfaces, sulci, gyri, poles, & functional areas of cerebral hemisphere	Y	P; L; SGD; DOAP;	VI General Medicine, HI Physiology
AN 62.3	Describe the white matter of cerebrum	Y	L;	VI General Medicine, HI Physiology
AN 62.4	Enumerate parts & major connections of basal ganglia & limbic lobe	Y	L;	HI Physiology
AN 62.5	Describe boundaries, parts, gross relations, major nuclei and connections of dorsal thalamus, hypothalamus, epithalamus, metathalamus and subthalamus	Y	L;	VI General Medicine, HI Physiology
AN 62.6	Describe Blood supply of brain & identify formation, branches & major areas of distribution of circle of Willis	Y	P; L; SGD; DOAP;	VI General Medicine, HI Physiology
Topic: Ventricular System Number of Competencies: 2 Number of procedures for certification: (NIL)				
AN 63.1	Describe & demonstrate parts, boundaries & features of IIIrd, IVth & lateral ventricle	Y	P; L; SGD; DOAP;	HI Physiology
AN 63.2	Describe anatomical basis of congenital hydrocephalus	N	L;	VI Paediatrics, HI Physiology

Topic: Epithelium histology Number of Competencies: 2 Number of procedures for certification: (01)				
AN 65.1	Identify epithelium under the microscope & describe the various types that correlate to its function	Y	L; P;	FOR CERTIFICATION
AN 65.2	Describe the ultrastructure of epithelium	N	L; P;	
Topic: Connective tissue histology Number of Competencies: 2 Number of procedures for certification: (NIL)				
AN 66.1	Describe & identify various types of connective tissue with functional correlation	Y	L; P;	HI Physiology
AN 66.2	Describe the ultrastructure of connective tissue	N	L; P;	VI Pathology
Topic: Muscle histology Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 67.1	Describe & identify various types of muscle under the microscope	Y	L; P;	
AN 67.2	Classify muscle and describe the structure-function correlation of the same	Y	L; P;	HI Physiology
AN 67.3	Describe the ultrastructure of muscular tissue	N	L; P;	
Topic: Nervous tissue histology Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 68.1	Describe & Identify multipolar & unipolar neuron, ganglia, peripheral nerve	Y	L; P;	
AN 68.2	Describe the structure-function correlation of neuron	Y	L; P;	HI Physiology
AN 68.3	Describe the ultrastructure of nervous tissue	N	L; P;	

Topic: Blood Vessels Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 69.1	Identify elastic & muscular blood vessels, capillaries under the microscope	Y	L; P;	
AN 69.2	Describe the various types and structure-function correlation of blood vessel	Y	L; P;	HI Physiology
AN 69.3	Describe the ultrastructure of blood vessels	Y	L; P;	
Topic: Glands & Lymphoid tissue Number of Competencies: 2 Number of procedures for certification: (NIL)				
AN 70.1	Identify exocrine gland under the microscope & distinguish between serous, mucous and mixed acini	Y	L; P;	VI Pathology
AN 70.2	Identify the lymphoid tissue under the microscope & describe microanatomy of lymph node, spleen, thymus, tonsil and correlate the structure with function	Y	L; P;	VI Pathology
Topic: Bone & Cartilage Number of Competencies: 2 Number of procedures for certification: (NIL)				
AN 71.1		Y	L; P;	VI Pathology
AN 71.2		Y	L; P;	VI Pathology
Topic: Integumentary System Number of Competencies: 1 Number of procedures for certification: (NIL)				
AN 72.1	Identify the skin and its appendages under the microscope and correlate the structure with function	Y	L; P;	

Topic: Chromosomes Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 73.1	Describe the structure of chromosomes with classification	Y	L;	
AN 73.2	Describe technique of karyotyping with its applications	Y	L;	
AN 73.3	Describe the Lyon's hypothesis	Y	L;	
Topic: Patterns of Inheritance Number of Competencies: 4 Number of procedures for certification: (NIL)				
AN 74.1	Describe the various modes of inheritance with examples	Y	L;	VI General Medicine, Paediatrics
AN 74.2	Draw pedigree charts for the various types of inheritance & give examples of diseases of each mode of inheritance	Y	L;	VI General Medicine, Paediatrics
AN 74.3	Describe multifactorial inheritance with examples	Y	L;	VI General Medicine
AN 74.4	Describe the genetic basis & clinical features of Achondroplasia, Cystic Fibrosis, Vitamin D resistant rickets, Haemophilia, Duchene's muscular dystrophy & Sickle cell anaemia	N	L;	VI General Medicine, Paediatrics
Topic: Principle of Genetics, Chromosomal Aberrations & Clinical Genetics Number of procedures for certification: (NIL) Number of Competencies: 5				
AN 75.1	Describe the structural and numerical chromosomal aberrations	Y	L;	VI Paediatrics
AN 75.2	Explain the terms mosaics and chimeras with example	N	L;	VI Paediatrics

AN 75.3	Describe the genetic basis & clinical features of Prader Willi syndrome, Edward syndrome & Patau syndrome	N	L;	VI Paediatrics
AN 75.4	Describe genetic basis of variation: polymorphism and mutation	Y	L;	VI Paediatrics
AN 75.5	Describe the principles of genetic counselling	Y	L;	VI Paediatrics, Obstetrics & Gynaecology
Topic: Introduction to embryology Number of Competencies: 2 Number of procedures for certification: (NIL)				
AN 76.1	Describe the stages of human life	Y	L;	
AN 76.2	Explain the terms- phylogeny, ontogeny, trimester, viability	Y	L;	
Topic: Gametogenesis and fertilization Number of Competencies: 2 Number of procedures for certification: (NIL)				
AN 77.1	Describe the uterine changes occurring during the menstrual cycle	Y	L;	VI Obstetrics & Gynaecology
AN 77.2	Describe the synchrony between the ovarian and menstrual cycles	Y	L;	VI Obstetrics & Gynaecology
AN 77.3	Describe spermatogenesis and oogenesis along with diagrams	Y	L;	VI Obstetrics & Gynaecology
AN 77.4	Describe the stages and consequences of fertilisation	Y	L;	VI Obstetrics & Gynaecology
AN 77.5	Enumerate and describe the anatomical principles underlying contraception	Y	L;	VI Obstetrics & Gynaecology

AN 77.6	Describe teratogenic influences; fertility and sterility, surrogate motherhood, social significance of "sex-ratio"	N	L;	VI Obstetrics & Gynaecology
Topic: Second week of development Number of Competencies: 5 Number of procedures for certification: (NIL)				
AN 78.1	Describe cleavage and formation of blastocyst	Y	L;	
AN 78.2	Describe the development of trophoblast	Y	L;	
AN 78.3	Describe the process of implantation & common abnormal sites of implantation	Y	L;	VI Obstetrics & Gynaecology
AN 78.4	Describe the formation of extra-embryonic mesoderm and coelom, bilaminar disc and prochordal plate	Y	L;	
AN 78.5	Describe in brief abortion; decidual reaction, pregnancy test	Y	L;	VI Obstetrics & Gynaecology
Topic: 3rd to 8th week of development Number of Competencies: 6 Number of procedures for certification: (NIL)				
AN 79.1	Describe the formation & fate of the primitive streak	Y	L;	
AN 79.2	Describe formation & fate of notochord	Y	L;	
AN 79.3	Describe the process of neurulation	Y	L;	
AN 79.4	(To include Intraembryonic mesoderm)Describe the development of somites and intra-embryonic coelom (To include Folding of Embryo and Derivatives of the three Germ layers)	Y	L;	VI Obstetrics & Gynaecology

AN 79.5	Explain embryological basis of congenital malformations, nucleus pulposus, sacrococcygeal teratomas, neural tube defects	N	L;	VI Obstetrics & Gynaecology
AN 79.6	Describe the diagnosis of pregnancy in first trimester and role of teratogens, alpha-fetoprotein	N	L;	VI Obstetrics & Gynaecology
Topic: Fetal membranes Number of Competencies: 7 Number of procedures for certification: (NIL)				
AN 80.1	Describe formation, functions & fate of-chorion: amnion; yolk sac; allantois & decidua	Y	L;	
AN 80.2	Describe formation & structure of umbilical cord	Y	L;	
AN 80.3	Describe formation of placenta, its physiological functions, foetomaternal circulation & placental barrier	Y	L;	VI Obstetrics & Gynaecology
AN 80.4	Describe embryological basis of twinning in monozygotic & dizygotic twins	Y	L;	VI Obstetrics & Gynaecology
AN 80.5	Describe role of placental hormones in uterine growth & parturition	Y	L;	VI Obstetrics & Gynaecology
AN 80.6	Explain embryological basis of estimation of fetal age	N	L;	VI Obstetrics & Gynaecology
AN 80.7	Describe various types of umbilical cord attachments	N	L;	VI Obstetrics & Gynaecology
Topic: Prenatal Diagnosis Number of Competencies: 3 Number of procedures for certification: (NIL)				
AN 81.1	Describe various methods of prenatal diagnosis	Y	L;	VI Obstetrics & Gynaecology

AN 81.2	Describe indications, process and disadvantages of amniocentesis	Y	L;	VI Obstetrics & Gynaecology
AN 81.3	Describe indications, process and disadvantages of chorion villus biopsy	Y	L;	VI Obstetrics & Gynaecology
Topic: Ethics in Anatomy Number of Competencies: 1 Number of procedures for certification: (NIL)				
AN 82.1	Demonstrate respect and follow the correct procedure when handling cadavers and other biologic tissue	Y	GA;	VI AETCOM



Sl No.	TOPIC - List of Lectures	Duration
	GENERAL ANATOMY	11 hrs
1	Anatomical Terminology	1 hr
2	Bone: Classification, Ossification, Parts , Blood supply and Nerve supply of Long bones	2 hrs
3	Cartilage : Classification , structure, Distribution	1 hr
4	Joints : Classification, features, nerve supply etc.	2 hrs
5	Muscles : Classification, tendon, aponeuroses	1 hr
6	Skin and Appendages, fascia and modifications , synovial sheaths and bursae	1 hr
7	Cardiovascular system	1 hr
8	Lymphatic System	1 hr
9	Nervous system	1 hr
	GENERAL HISTOLOGY	12 hrs
1	Microanatomy of Epithelium including Glands	2 hrs
2	Microanatomy of Connective Tissue	2 hrs
3	Microanatomy of Cartilage	1 hr
4	Microanatomy of Bone	1 hr
5	Microanatomy of Muscular Tissue	1 hr
6	Microanatomy of Vascular Tissue	1 hr
7	Microanatomy Nervous Tissue	1 hr
8	Microanatomy of Lymphatic System	2 hrs
9	Microanatomy of Skin	1 hr
	UPPER LIMB	16 hrs
1	Pectoral region	1 hr
2	Breast IL	1 hr
3	Brachial Plexus IL	1 hr
4	Boundaries and Contents of Axilla , Axillary vessels, Axillary nodes IL	1 hr
5	Deltoid muscle and Axillary Nerve	1 hr
6	Shoulder joint IL	1 hr
7	Anterior and Posterior compartments of Arm	1 hr
8	Cubital fossa and Flexor compartment of forearm	1 hr
9	Flexor and Extensor Retinacula , Palmar aponeuroses, Fibrous Flexor sheath and Dorsal digital expansion	1 hr
10	Intrinsic muscles and Vessels of Hand	1 hr
11	Fascial Spaces of Hand	1 hr
12	Radial Nerve	1 hr
13	Median Nerve	1 hr
14	Ulnar Nerve	1 hr

15	Venous drainage , Lymphatic drainage and Dermatomes of Upper Limb	1 hr
16	Elbow and Radioulnar Joints	1 hr
	LOWER LIMB	15 hrs
1	Femoral triangle and Femoral Hernia IL	1 hr
2	Deep fascia of lower limb and its modifications	1 hr
3	Adductor Region and Obturator Nerve IL 1 hr	1 hr
4	Gluteus Maximus and Structures under cover of it IL	1 hr
5	Popliteal Fossa	1 hr
6	Sciatic Nerve IL	1 hr
7	Hip Joint	1 hr
8	Common Peroneal Nerve, foot drop, IL	1 hr
9	Back of leg, Tibial Nerve , Peripheral heart	1 hr
10	Arches of Foot IL	2 hrs
11	Knee Joint IL	1 hr
12	Venous Drainage of Lower Limb IL	1 hr
13	Lymphatic drainage and Dermatomes of Lower Limb IL	1 hr
14	Inversion Eversion of Foot and related Joints	1 hr
	THORAX	20 hrs
1	Thoracic Cage, Intercostal spaces, Joints , Movements and Mechanism of respiration, Thoracic Inlet Syndrome	2 hrs
2	Mediastinum : Boundaries and contents	1 hr
3	Pleura IL	1 hr
4	Lungs, Bronchopulmonary segments, and Development IL	1 hr
5	Pericardium IL	1 hr
6	Heart : External and Internal features	2 hrs
7	Blood supply of heart and Case based learning	2 hrs
8	Fibrous skeleton and Conducting system of heart	1 hr
9	Oesophagus IL	1 hr
10	Azygos Vein and Thoracic duct IL	1 hr
11	Arch of Aorta and Superior vena cava	1 hr
12	Development of Heart and congenital anomalies	3 hrs
13	Fetal circulation IL	1 hr
14	Development of Aortic arches	1 hr
15	Microanatomy of Lung and Trachea	1 hr
	Abdomen, Pelvis & Perineum	43 hrs
1	Anterior abdominal wall IL	1 hr
2	Rectus sheath	1 hr
3	Inguinal canal IL	1 hr

4	Testis epididymis IL	1 hr
5	Penis	1 hr
6	Peritoneum & its recesses	2 hrs
7	Stomach IL	1 hr
8	Spleen	1 hr
9	Liver	1 hr
10	Pancreas	1 hr
11	Extra hepatic biliary apparatus	1 hr
12	Duodenum	1 hr
13	Jejunum, ileum & Mesentery	2 hrs
14	Caecum, Appendix & large intestine	1 hr
15	Portal Vein, Portosystemic anastomosis & anatomical basis of portal hypertension	1 hr
16	Kidneys & Renal vessels	1 hr
17	Thoraco abdominal diaphragm, Development & its congenital anomalies	1 hr
18	Thoracolumbar fascia and lumbar plexus, Abdominal aorta, IVC, Blood vessels and nerves of Pelvis	2 hrs
19	Urinary Bladder	1 hr
20	Prostate Gland & Vas deferens	1 hr
21	Male urethra	1 hr
22	Uterus	1 hr
23	Rectum & Anal canal	1 hr
24	Superficial & Deep perineal pouches, Perineal body, Perineal membrane	1 hr
25	Boundaries, Contents & Applied anatomy of ischio rectal Fossa	1 hr
26	Vertebral column, Lumbar puncture	1 hr
27	Development and congenital anomalies of GIT	3 hrs
28	Development of urinary system and its congenital anomalies	1 hr
29	Development & congenital anomalies of Male & Female reproductive systems	1 hr
30	Microscopic structure of GIT-An overview, Microscopic structure of Oesophagus & Stomach	1 hr
31	Microscopic structure of Duodenum, Jejunum, ileum	1 hr
32	Microscopic structure of large intestine, Appendix	1 hr
33	Microscopic structure of Liver, Gall Bladder	1 hr
34	Microscopic structure of Kidney, Ureter, Urinary Bladder	1 hr
35	Microscopic structure of Male reproductive system	2 hrs
36	Microscopic structure of female reproductive system, Mammary gland	2 hrs
	Head & Neck	48 hrs

1	Scalp and emissary veins Cases based learning	1 hr
2	Vessels, nerves and lymphatic drainage of face	1 hr
3	Parotid gland & Frey's syndrome Case based learning	2 hrs
4	Facial Nerve, Case based learning	2 hrs
5	Posterior triangle & Sternocleidomastoid IL	1 hr
6	Cranial dura and dural folds, dural venous sinuses IL	1 hr
7	Cavernous sinus Case based learning	1 hr
8	Pituitary gland	1 hr
9	Extra ocular muscles case based learning	1 hr
10	III cranial Nerve, Ciliary ganglion	1 hr
11	IV & VI cranial nerves	1 hr
12	Lacrimal apparatus & eyelids	1 hr
13	Anterior triangle	1 hr
14	Infratemporal fossa , muscles of mastication	1 hr
15	Trigeminal Nerve Case based learning	1 hr
16	TM Joint	1 hr
17	Submandibular gland relations of hyoglossus	2 hrs
18	Deep cervical fascia and fascial spaces in the neck IL	1 hr
19	Thyroid gland & its development	1 hr
20	Lymph nodes and lymphatic drainage of head and neck IL	1 hr
21	Cervical sympathetic chain IL	1 hr
22	IX cranial nerve & X cranial nerve in the neck	1 hr
23	XI & XII cranial nerve IV	1 hr
24	Pharynx IL	2 hrs
25	Palatine tonsils and soft palate IL	1 hr
26	Nasal cavity	1 hr
27	Paranasal air sinuses & auditory tube IL	1 hr
28	Larynx IL	2 hrs
29	Tongue & its development	1 hr
30	External & middle ear IL	2 hrs
31	Internal ear IL	1 hr
32	Eyeball IL	1 hr
33	Pharyngeal arches, pouches & clefts	2 hrs
34	Development of face & Palate	2 hrs
35	Development of eye IL	1 hr
36	Microscopic anatomy of Salivary Glands	1 hr
37	Microscopic anatomy of Tongue	1 hr
38	Microscopic anatomy of Pituitary, Thyroid & parathyroid glands(Endocrine 1)	1 hr
39	Microscopic anatomy of Suprarenal Glands and Pancreas(Endocrine 2)	1 hr
40	Microscopic anatomy of Cornea & retina	1 hr

	BRAIN	25 hrs
1	Meninges and modifications	1 hr
2	Circulation of CSF, Congenital Hydrocephalus	1 hr
3	Spinal cord	2 hrs
4	External features of Medulla, Anatomical basis of medial and lateral medullary syndrome	1 hr
5	Transverse section at 3 levels, Cranial nerve nuclei with functional group	1 hr
6	Pons , External features, section at upper and lower levels, cranial nerve nuclei	1 hr
7	Cerebellum, external and internal features	1 hr
8	Connections of Cerebellar cortex, nuclei and cerebellar dysfunction	1 hr
9	Midbrain, external and internal features, sections at colliculi, Webers and Benedicts syndrome	1 hr
10	Functional components of cranial nerve nuclei	1 hr
11	Sulci, Gyri and functional areas of cerebral hemispheres IL	2 hrs
12	White matter of Cerebrum IL	1 hr
13	Basal Ganglia IL	1 hr
14	Parts and connections of Limbic lobe	1 hr
15	Dorsal Thalamus, hypothalamus , epithalamus and epithalamus IL	1 hr
16	Visual Pathway	1 hr
17	Blood supply of brain, Circle of Willis	1 hr
18	Third Ventricle	1 hr
19	Fourth Ventricle	1 hr
20	Lateral Ventricle	1 hr
21	Development of neural tube, spinal cord, medulla, pons , midbrain	1 hr
22	Development of cerebral hemispheres and cerebellum, Open neural tube defects with embryological basis	1 hr
23	Microscopic structure of cerebrum, cerebellum and spinal cord	1 hr
	GENERAL EMBRYOLOGY	15 hrs
1	Stages of human life; Phylogeny, Ontogeny , Trimester	1 hr
2	Menstrual cycle, and synchrony with ovarian cycle	1 hr
3	Spermatogenesis and Oogenesis	1 hr
4	Fertilisation , contraception, surrogacy, sex- ratio	1 hr
5	Cleavage, implantation	1 hr
6	Extraembryonic mesoderm and coelom, bilaminar germ disc	1 hr

7	Abortion, pregnancy tests, diagnosis of pregnancy in first trimester	1 hr
8	Formation and fate of primitive streak, sacrococcygeal teratoma, Intraembryonic mesoderm and coelom, Somites, Formation and fate of notochord, nucleus pulposus	2 hrs
9	Folding of embryo,	1 hr
10	Neurulation, neural tube defects alpha fetoprotein	1 hr
11	Foetal membranes, Umbilical cord	1 hr
12	Placenta , placental hormones, types of umbilical cord attachment	1 hr
13	Twinning, estimation of foetal age, prenatal diagnosis, Amniocentesis, Chorionic villus sampling	1 hr
14	Microscopic structure of placenta and umbilical cord	1 hr
	GENETICS	5 hrs
1	Structure and classification of chromosome, Lyon's hypothesis	1 hr
2	Karyotyping with its application, Various modes of inheritance	1 hr
3	Pedigree chart with examples, multifactorial inheritance, Genetic basis of some diseases	1 hr
4	Structural and numerical chromosomal aberration, Mosaics and Chimera	1 hr
5	Mutation, polymorphism , Genetic counselling	1 hr
TOTAL		210 HOURS

LIST OF DIAGRAMS – ANATOMY

UPPER LIMB

1. Typical spinal nerve
2. Axillary artery and its branches
3. Brachial plexus
4. Sagittal section through shoulder joint
5. Intermuscular spaces
6. Scapular anastomosis
7. Cross section through the middle of arm
8. Boundaries and contents of cubital fossa
9. Anastomosis around elbow joint
10. Superficial and deep palmar arches
11. Cutaneous innervation of palmar surface of hand
12. Cutaneous innervation of dorsum of hand
13. Oblique Section through hand to show Palmar spaces of hand

LOWER LIMB

1. Femoral triangle
2. Adductor canal
3. Obturator nerve and branches
4. Structures under cover of gluteus maximus
5. Blood supply of head and neck of femur
6. Structures surrounding hip joint
7. T.S through middle of thigh
8. T.S of knee joint
9. Popliteal fossa - boundaries and contents

10. T.S through middle of leg
11. Cutaneous innervation of dorsum and sole of foot
12. Arches of foot, medial and lateral longitudinal and transverse

ABDOMEN

1. Structures posterior to the stomach (stomach bed)
2. Relations of anterior surface of right and left kidneys
3. Relations of posterior surface of right and left kidneys
4. Relations of visceral surface of liver
5. Extrahepatic biliary apparatus
6. Horizontal section through abdomen at the level of T8 vertebra
7. Horizontal section through abdomen at the level of T10 vertebra
8. Horizontal section through abdomen at the level of T12 vertebra
9. Horizontal section through abdomen at the level of L1 vertebra
10. Abdominal aorta and its branches
11. Inferior vena cava and its tributaries
12. Sites of porto caval anastomosis

PELVIS PERINEUM

1. Sagittal section through male pelvis
2. Sagittal section through female pelvis
3. Interior of anal canal
4. Sagittal section of uterus with anteflexion and anteversion
5. Ischio rectal fossa
6. Contents of superficial perineal pouch in male and female

7. Contents of deep perineal pouch in male and female

NEUROANATOMY

1. T.S of spinal cord at thoracic level showing ascending and descending tracts
2. T.S of medulla at the level of decussation of pyramid
3. T.S of medulla at the level of sensory decussation
4. T. S of medulla at the level of inferior olivary nucleus
5. T.S at the level of lower part of pons
6. T.S at the level of upper part of pons
7. T.S of midbrain at the level of inferior colliculus
8. T.S of midbrain at the level of superior colliculus
9. Floor of fourth ventricle
10. Circle of Willis
11. Horizontal section of cerebral hemisphere at the level of inter ventricular foramen
13. Blood supply of superolateral surface of cerebrum
14. Blood supply of medial surface of cerebrum
15. Blood supply of inferior surface of cerebrum

HEAD AND NECK

1. Sensory nerve supply of face
2. Boundaries and contents of posterior triangle
3. Components of lacrimal apparatus
4. Ansa cervicalis
5. Structures passing through superior orbital fissure
6. Transverse section of neck at the level of cricoid cartilage / C6 level
7. Relations and structures passing through cavernous sinus

8. Relations of hyoglossus muscle
9. Features of interior of nasopharynx
10. Tonsillar bed
11. Features on the lateral wall of nose
12. Components of nasal septum
13. Waldeyer's ring
14. Interior of larynx
15. Diagrammatic section of eyeball
16. Medial wall of middle ear

THORAX

1. Contents of typical intercostal space as seen in a vertical section.
2. Mediastinal surface of the Right and Left Lung
3. Bronchopulmonary segments of Right and Left Lung
4. Contents of Posterior Mediastinum
5. Interior of Right Atrium
6. Arteries supplying the heart - anterior and posterior view
7. Venous Drainage of Heart
8. Azygous vein- Formation, Tributaries and Termination
9. C.S through Thorax at the level of T4
10. Surface marking of heart borders and valves

Theory Question Paper Pattern (100 marks) each

Paper I: General Anatomy, General Histology, General Embryology, Genetics

Upper limb, Head and Neck, Neuroanatomy, and related Systemic Histology and Embryology

Paper II: Lower limb, Thorax, Abdomen, Pelvis & Perineum, related Systemic Histology & Embryology

1 Long essays: 1 Case based & 1 non case-based structured essay $2 \times 10 = 20$

2. Short essays 6×6 marks = 36

3. Short answers 5×4 marks = 20

Draw neat labelled diagram of: 1×4 marks = 04

MCQ: $1 \times 20 = 20$ marks

Practical I: Gross Anatomy: (50 marks)

- Spotters: 13×2 marks = 26
- OSPE: 1×4 marks = 04
- Discussion: 2 specimens (Above & below diaphragm) 2×10 marks = 20

Practical II: Histology: (30 marks)

- Spotters: 15×1 mark = 15
- OSPE: 1×5 marks = 05
- Discussion: 2 slides (1 general + 1 systemic) 2×5 marks = 10

Viva: 4 stations (Osteology, embryology, radiology, surface marking)

4×5 marks = 20

Grand Total 100 marks

The topics to different paper are generally evaluated under those sections. However, a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics

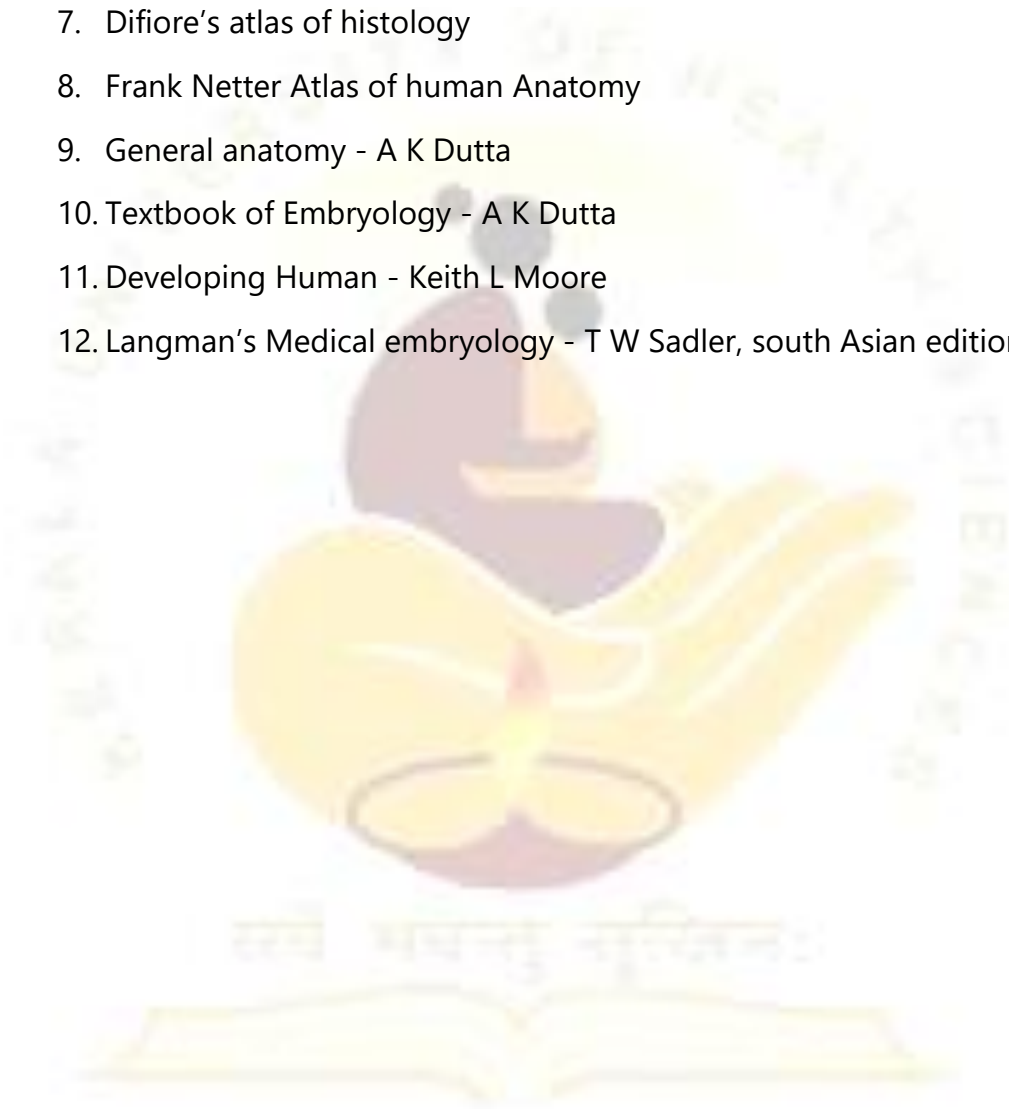
Prescribed text books (Latest editions of the books are to be followed)

Section	Book title with author
Dissection Manual	1. Cunninghams Manual of practical Anatomy- Rachel Koshi Vol I, II & III 2. Grants Dissector - Allan J Detton
Gross anatomy	1. Textbook of Anatomy Vol I, II & III - Vishram Singh 2. R C Grays Anatomy for students Vol I & II - Raveendranath Veeramani
Histology	1. Inderbir Singh's Textbook of Human Histology - Pushpalatha 2. Histology: text & atlas - Brijesh Kumar 3. Textbook of Human Histology - Yogesh Sontakke
Neuroanatomy	1. Textbook of clinical neuroanatomy - Vishram Singh 2. Textbook of Human Neuroanatomy - Inderbir Singh
Embryology	1. Inderbir Singh's Human Embryology, V Subhadra Devi 2. Textbook of clinical Embryology - Vishram Singh 3. Textbook of Human Embryology - Yogesh Sontakke
Osteology	1. Inderbir Singh's Textbook of human osteology - Sushil Kumar 2. General Anatomy - Vishram Singh
Radiology	1. Surface & Radiological Anatomy - A Halim
Genetics	1. Human Genetics - S D Gangane 2. Medical Genetics - G P Pal

Reference books

1. Essentials of Human Anatomy - A K Dutta Vol I, II, III
2. Grays anatomical basis of clinical practice - Susan Standring

3. Clinical Anatomy – a problem solving approach Vol 1 & 2 - Neeta V Kulkarni
4. Snell's anatomy by regions
5. Keith L Moore clinically oriented anatomy, Vol 1 & 2.
6. Snell's Clinical Neuroanatomy
7. Difiore's atlas of histology
8. Frank Netter Atlas of human Anatomy
9. General anatomy - A K Dutta
10. Textbook of Embryology - A K Dutta
11. Developing Human - Keith L Moore
12. Langman's Medical embryology - T W Sadler, south Asian edition





PHYSIOLOGY

Physiology: Distribution of teaching hours

Teaching method	Hours
Lectures	130
Small group teachings / tutorials / Integrated teaching / Practical	300
Self-directed learning	10
Teaching Hours	440
Early clinical exposure	9
AETCOM- 3 modules	15
Formative assessment and term examinations	20

	General Physiology (9 competencies: 8 hours)			
Competency No.	competency	Core / Noncore (Y/N)	Horizontal / vertical integration (HI/VI)	Suggested TL method
PY 1.1	Describe structure and function of a mammalian cell	Y		Lecture /small group discussions
PY1.2	Describe and discuss the principles of homeostasis	Y		
PY1.3	Describe intercellular communications	Y		
PY1.4	Describe -apoptosis-programmed cell death	Y	VI -pathology	
PY1.5	Describe and discuss transport mechanisms across cell membranes To include channel blockers & channelopathies	Y		
PY1.6	Describe the fluid compartments of the body, its ionic composition and measurements To include - changes in ionic composition during vomiting, diarrhoea etc - Principles of intravenous fluid therapy	Y	HI biochemistry	

PY1.7	Describe the concept of PH and buffer systems in body	Y	HI biochemistry	
PY1.8	Describe and discuss the molecular basis of resting membrane potential and action potential in excitable cells	Y		
PY 1.9	Demonstrate the ability to describe and discuss the methods used to demonstrate the functions of cells and its products, its communications and their applications in clinical care and research	Y		
	Haematology (13 competencies :15hrs)			
Competency No.	Competency	Core / Noncore (Y/N)	Horizontal / vertical integration (HI/VI)	Suggested TL method
PY 2.1	Describe the composition and function of blood components To include: List the properties of blood giving normal values (specific gravity, viscosity, pH etc) & its variations	Y		Lecture /small group discussion
PY2.2	Discuss the origin, forms, variations and functions of plasma proteins	Y	HI -Biochemistry	

	To include: List the conditions causing variations in plasma protein concentration			
PY2.3	Describe and discuss the synthesis and functions of haemoglobin and explain its breakdown. Describe variants of haemoglobin To include: - Outline the basic structure & types of Hb (HbA, HbA2 & HbF) - Variations in haemoglobin levels in various physiological conditions	Y	HI- Biochemistry	
PY2.4	Describe RBC formation (erythropoiesis and its regulation) and its functions To include: Factors influencing erythropoiesis and blood indices	Y		
PY2.5	Describe different types of anaemia and jaundice To include: - Diagnosis and treatment of anemia & jaundice - polycythemia	Y	HI -Biochemistry VI -Pathology	
PY 2.6	Describe WBC formation and its regulation.	Y		

	To include: Discuss the monocyte macrophage system			
PY 2.7	Describe the formation of platelets, functions and variations	Y		
PY 2.8	Describe the physiological basis of haemostasis and anticoagulants. Describe bleeding and clotting disorders To include: Anticlotting mechanisms in the body	Y	VI-Pathology	
PY2.9	Describe different blood groups and discuss the clinical importance of blood grouping, blood banking and transfusion	Y	VI-Pathology	Lecture/small group discussion/ECE visit to blood bank
PY2.10	Define and classify different types of immunity. Describe the development of immunity and its regulation To include: - Formation, circulation and function of lymph - Pathophysiology of oedema	Y		
	Nerve and muscle physiology (18 competencies :11 hrs)			

Competency No.	Competency	Core / Noncore (Y/N)	Horizontal / vertical integration (HI/VI)	Suggested TL method
PY 3.1	Describe the structure and functions of a neuron and neuroglia; Discuss Nerve Growth Factor & other growth factors/cytokines	Y	HI -Anatomy	Lecture/small group discussion
PY 3.2	Describe the types, functions & properties of nerve fibers	Y		
PY 3.3	Describe the degeneration and regeneration in peripheral nerves	Y	VI -General medicine	
PY 3.4	Describe the structure of neuro-muscular junction and transmission of impulses	Y	VI Anaesthesiology	
PY 3.5	Discuss the action of neuro-muscular blocking agents	Y	VI Anaesthesiology Pharmacology	
PY 3.6	Describe the pathophysiology of Myasthenia gravis	Y	VI -Pathology	
PY 3.7	Describe the different types of muscle fibres and their structure	Y	HI -Anatomy	
PY 3.8	Describe action potential and its properties in different muscle types (skeletal & smooth)	Y		

PY 3.9	Describe the molecular basis of muscle contraction in skeletal and in smooth muscles	Y		
PY 3.10	Describe the mode of muscle contraction (isometric and isotonic)	Y		
PY 3.11	Explain energy source and muscle metabolism	Y	HI -Biochemistry	
PY 3.12	Explain the gradation of muscular activity	Y	VI -General medicine	
PY 3.13	Describe muscular dystrophy: myopathies	Y	HI -Anatomy VI General medicine	
PY 3.17	Describe Strength-duration curve	Y		
	Gastrointestinal physiology (10 competencies :13hrs)			
Competency No.	Competency	Core / Noncore (Y/N)	Horizontal / vertical integration (HI/VI)	Suggested TL method
PY 4.1	Describe the structure and functions of digestive system.	Y	HI -Anatomy	
PY 4.2	Describe the composition, mechanism of secretion, functions, and regulation of saliva, gastric, pancreatic, intestinal juices and bile secretion	Y	HI -Biochemistry	
PY 4.3	Describe GIT movements, regulation and functions. Describe defecation reflex. Explain role of dietary fibre	Y		

PY 4.4	Describe the physiology of digestion and absorption of nutrients	Y	HI-Biochemistry	Lecture/small group discussion
PY 4.5	Describe the source of GIT hormones, their regulation and functions	Y		
PY 4.6	Describe the Gut-Brain Axis	Y		
PY 4.7	Describe & discuss the structure and functions of liver and gall bladder	Y	HI-Biochemistry	
PY 4.8	Describe & discuss gastric function tests, pancreatic exocrine function tests & liver function tests	Y	HI-Biochemistry	
PY 4.9	Discuss the physiology aspects of: peptic ulcer, gastroesophageal reflux disease, vomiting, diarrhoea, constipation, Adynamic ileus, Hirschsprung's disease	Y	HI-Biochemistry VI General medicine	
Cardiovascular physiology (16 competencies :21hrs)				
Competency No.	Competency	Core / Noncore (Y/N)	Horizontal / vertical integration (HI/VI)	Suggested TL method
PY 5.1	Describe the functional anatomy of heart including chambers, sounds; and Pacemaker tissue and conducting system.	Y	HI-Anatomy	Lecture/small group discussion

PY5.2	Describe the properties of cardiac muscle including its morphology, electrical, mechanical and metabolic functions	Y		
PY 5.3	Discuss the events occurring during the cardiac cycle To include: wiggers chart	Y		
PY 5.4	Describe generation, conduction of cardiac impulse	Y		
PY 5.5	Describe the physiology of electrocardiogram (E.C.G), its applications and the cardiac axis	Y	VI-General medicine	
PY 5.6	Describe abnormal ECG, arrhythmias, heart block and myocardial Infarction	Y	HI-Anatomy VI-General medicine	
PY 5.7	Describe and discuss haemodynamic of circulatory system	Y		
PY 5.8	Describe and discuss local and systemic cardiovascular regulatory mechanisms	Y		
PY 5.9	Describe the factors affecting heart rate, regulation of cardiac output & blood pressure	Y		
PY 5.10	Describe & discuss regional circulation including microcirculation, lymphatic circulation, coronary, cerebral, capillary, skin, foetal, pulmonary and splanchnic circulation	Y	VI-General medicine	

PY 5.11	Describe the patho-physiology of shock, syncope and heart failure	Y		
	Respiratory physiology (10 competencies -15hrs)			
Competency No.	Competency	Core / Noncore (Y/N)	Horizontal / vertical integration (HI/VI)	Suggested TL method
PY 6.1	Describe the functional anatomy of respiratory tract	Y		Lecture/small group discussion
PY6.2	Describe the mechanics of normal respiration, pressure changes during ventilation, lung volume and capacities, alveolar surface tension, compliance, airway resistance, ventilation, V/P ratio, diffusion capacity of lungs	Y		
PY 6.3	Describe and discuss the transport of respiratory gases: Oxygen and Carbon dioxide To include: Describe and discuss the regulation of respiration- neural and chemical	Y		
PY 6.4	Describe and discuss the physiology of high altitude and deep sea diving	Y		
PY 6.5	Describe and discuss the principles of artificial respiration, oxygen therapy, acclimatization and decompression sickness.	Y		

PY 6.6	Describe and discuss the pathophysiology of dyspnoea, hypoxia, cyanosis asphyxia; drowning, periodic breathing	Y		
PY 6.7	Describe and discuss lung function tests & their clinical significance	Y		
	Renal physiology (9 competencies: 8hrs)			
Competency No.	Competency	Core / Noncore (Y/N)	Horizontal / vertical integration (HI/VI)	Suggested TL method
PY 7.1	Describe structure and function of kidney To include: renal circulation	Y		
PY 7.2	Describe the structure and functions of juxta glomerular apparatus and role of renin-angiotensin system	Y		
PY7.3	Describe the mechanism of urine formation involving processes of filtration, tubular reabsorption & secretion; concentration and diluting mechanism	Y		
PY7.4	Describe & discuss the significance & implication of Renal clearance	Y		

PY 7.5	Describe the renal regulation of fluid and electrolytes & acid-base balance	Y		
PY 7.6	Describe the innervations of urinary bladder, physiology of micturition and its abnormalities	Y		
PY 7.7	Describe artificial kidney, dialysis and renal transplantation	Y	VI -General medicine	
PY 7.8	Describe & discuss Renal Function Tests	Y	HI - Biochemistry	
PY 7.9	Describe cystometry and discuss the normal cystometrogram	Y		
	Endocrine physiology (6 competencies :14hrs)			
Competency No.	Competency	Core/ Noncore (Y/N)	Horizontal/vertical integration (HI/VI)	Suggested TL method
PY 8.1	Describe the physiology of bone and calcium metabolism	Y		Lecture /small group discussions
PY 8.2	Describe the synthesis, secretion, transport, physiological actions, regulation and effect of altered (hypo and hyper) secretion of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas and hypothalamus	Y		
PY 8.3	Describe the physiology of Thymus & Pineal Gland	Y		

PY 8.4	Describe function tests: Thyroid gland; Adrenal cortex, Adrenal medulla and pancreas	Y	HI-Biochemistry	
PY 8.5	Describe the metabolic and endocrine consequences of obesity & metabolic syndrome, Stress response. Outline the psychiatry component pertaining to metabolic syndrome.	Y		
PY 8.6	Describe & differentiate the mechanism of action of steroid, protein and amine hormones	Y		
	Reproductive physiology (12 competencies :7hrs)			
Competency No.	Competency	Core / Noncore (Y/N)	Horizontal / vertical integration (HI/VI)	Suggested TL method
PY 9.1	Describe and discuss sex determination; sex differentiation and their abnormalities and outline psychiatry and practical implication of sex determination	Y	HI-Anatomy	
PY9.2	Describe and discuss puberty: onset, progression, stages; early and delayed puberty and outline adolescent clinical and psychological association.	Y		
PY 9.3	Describe male reproductive system: functions of testis and control of spermatogenesis & factors modifying it and outline its association with psychiatric illness	Y		

PY 9.4	Describe female reproductive system: (a) functions of ovary and its control; (b) menstrual cycle - hormonal, uterine and ovarian changes	Y		
PY 9.5	Describe and discuss the physiological effects of sex hormones	Y		
PY 9.6	Enumerate the contraceptive methods for male and female. Discuss their advantages & disadvantages	Y	VI- OBG	
PY 9.7	Describe and discuss the effects of removal of gonads on physiological functions	Y		
PY 9.8	Describe and discuss the physiology of pregnancy, parturition & lactation and outline the psychology and psychiatry-disorders associated with it.	Y	VI- OBG	
PY 9.9	Interpret a normal semen analysis report including (a) sperm count, (b) sperm morphology and (c) sperm motility, as per WHO guidelines and discuss the results	Y		
PY 9.10	Discuss the physiological basis of various pregnancy tests	Y	VI- OBG	
PY 9.11	Discuss the hormonal changes and their effects during perimenopause and menopause	Y	VI- OBG	
PY 9.12	Discuss the common causes of infertility in a couple and role of IVF in managing a case of infertility	Y	VI- OBG	
	Neurophysiology (20 competencies: 41hrs)			

Competency No.	Competency	Core / Noncore (Y/N)	Horizontal / vertical integration (HI/VI)	Suggested TL method
PY 10.1	Describe and discuss the organization of nervous	Y	HI-Anatomy	Lecture/small group discussions
PY10.2	Describe and discuss the functions and properties of synapse, reflex, receptors	Y	HI-Anatomy	
PY 10.3	Describe and discuss somatic sensations & sensory tracts	Y	HI-Anatomy	
PY10.4	Describe and discuss motor tracts, mechanism of maintenance of tone, control of body movements, posture and equilibrium & vestibular apparatus To include: Lesions of motor tracts	Y	HI-Anatomy	
PY 10.5	Describe and discuss structure and functions of reticular activating system, autonomic nervous system (ANS)	Y	HI-Anatomy	
PY 10.6	Describe and discuss Spinal cord, its functions, lesion & sensory disturbances	Y	HI-Anatomy	
PY 10.7	Describe and discuss functions of cerebral cortex, basal ganglia, thalamus, hypothalamus, cerebellum and limbic system and their abnormalities	Y	HI-Anatomy VI-Psychiatry	

PY10.8	Describe and discuss behavioural and EEG characteristics during sleep and mechanism responsible for its production	Y	VI-Psychiatry	
PY10.9	Describe and discuss the physiological basis of memory, learning and speech	Y	VI-Psychiatry	
PY10.10	Describe and discuss chemical transmission in the nervous system. (Outline the psychiatry element).	Y		
PY10.12	Identify normal EEG forms	Y	VI-Psychiatry	
PY 10.13	Describe and discuss perception of smell and taste sensation	Y	VI-ENT	
PY 10.14	Describe and discuss patho-physiology of altered smell and taste sensation	Y	VI-ENT	
PY10.15	Describe and discuss functional anatomy of ear and auditory pathways & physiology of hearing	Y	VI-ENT	Lecture/small group discussion
PY10.16	Describe and discuss pathophysiology of deafness. Describe hearing tests	Y	VI-ENT	
PY10.17	Describe and discuss functional anatomy of eye, physiology of image formation, physiology of vision including colour vision, refractive errors, colour blindness, physiology of pupil and light reflex	Y	VI-Ophthalmology	

PY 10.18	Describe and discuss the physiological basis of lesion in visual pathway	Y	VI-Ophthalmology	
PY10.19	Describe and discuss auditory & visual evoked potentials	Y	VI-Ophthalmology	
	Integrated physiology (14 competencies :8hrs)			
Competency No.	Competency	Core / Noncore (Y/N)	Horizontal / vertical integration (HI/VI)	Suggested TL method
PY 11.1	Describe and discuss mechanism of temperature regulation	Y		Lecture /small group discussion
PY 11.2	Describe and discuss adaptation to altered temperature (heat and cold)	Y		
PY 11.3	Describe and discuss mechanism of fever, cold injuries and heat stroke	Y		
PY 11.4	Describe and discuss cardio-respiratory and metabolic adjustments during exercise; physical training effects	Y		
PY 11.5	Describe and discuss physiological consequences of sedentary lifestyle	Y		
PY 11.6	Describe physiology of Infancy	N	VI-Paediatrics	

PY11.7	Describe and discuss physiology of aging; free radicals and antioxidants	N		
PY11.8	Discuss & compare cardio-respiratory changes in exercise (isometric and isotonic) with that in the resting state and under different environmental conditions (heat and cold)	Y		
PY 11.9	Interpret growth charts	N	VI-Paediatrics	
PY 11.10	Interpret anthropometric assessment of infants	N	VI-Paediatrics	
PY 11.11	Discuss the concept, criteria for diagnosis of Brain death and its implications	Y		
PY 11.12	Discuss the physiological effects of meditation	N		

CBME – practical – Physiology syllabus

Competency no.	Competency	Suggested T/L method Assessment method
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Haematology practical		
PY 2.11	Estimate Hb, RBC, TLC, RBC indices, DLC, Blood groups, BT/CT	DOAP practical/OSPE
PY 2.12	Describe tests for ESR, Osmotic fragility, Hematocrit. Note the findings and interpret the test results	DOA practical/OSPE/Viva voce
PY2.13	Describe steps for reticulocyte and platelet count	Demonstration Viva voce
Human experiments		
PY 3.14	Perform Ergography	DOA practical/OSPE/Viva voce
PY3.15	Demonstrate effect of mild, moderate & severe exercise and record changes in cardiorespiratory parameters	DOA practical/OSPE/Viva voce
PY 3.16	Demonstrate Harvard step test and describe the impact on induced physiologic parameters in a stimulated environment	DOA practical/OSPE/Viva voce
PY 5.12	Record blood pressure & pulse at rest and in different grades of exercise and postures in a volunteer or simulated environment	DOA practical/OSPE/Viva voce
PY5.13	Record and interpret normal ECG in a simulated environment	DOA practical/OSPE/Viva voce
PY 5.14*	Observe cardiovascular autonomic function tests in a volunteer or simulated environment	DOAP Skill assessment/Viva voce
PY 5.16*	Record arterial pulse tracing using finger plethysmography in a volunteer or simulated environment	DOAP, computer assisted learning modules practical/OSPE/Viva voce

PY 6.8	Demonstrate the correct technique to perform & interpret spirometry	DOAP Skill assessment/Viva voce
PY 6.10	Demonstrate the correct technique to perform measurement of PEFR in a normal volunteer	DOA practical/OSPE/Viva voce
PY 9.9	Interpret a normal sperm analysis report including 1) sperm count 2) sperm morphology 3) sperm motility As per WHO guidelines and discuss the results	Lecture /SGD OSPE/Viva voce
PY 10.12	Identify normal EEG forms	SGD OSPE/Viva voce
PY 11.14	Demonstrate basic life support in a simulated environment	DOAP OSCE
PY 11.9*	Interpret growth charts	SGD OSPE/Viva voce
PY 11.10*	Interpret anthropometric assessment of infants	SGD OSPE/Viva voce

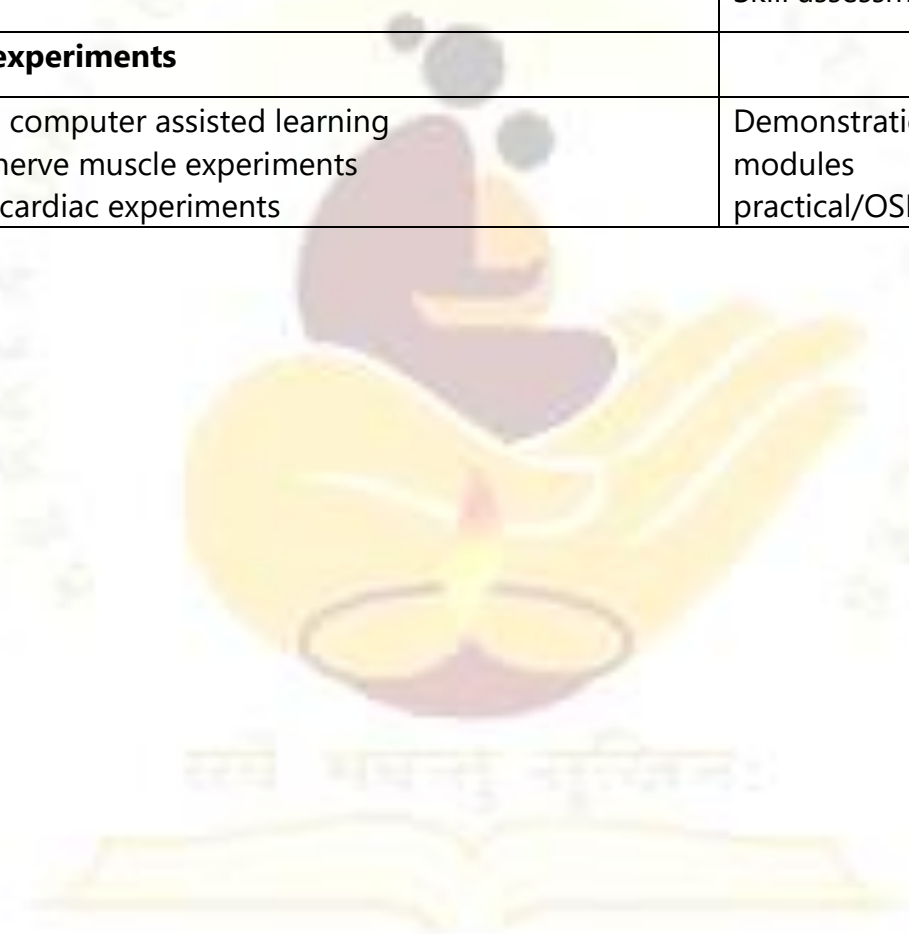
Clinical examination - practical

Competency no.	Competency	T/L methods & assessment
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PY 4.10	Demonstrate the correct clinical examination of the abdomen in a normal volunteer or simulated environment	DOAP Skill assessment /viva voce/OSCE/practical
PY 5.15	Demonstrate the correct clinical examination of the cardiovascular system in a normal volunteer or simulated environment	DOAP Skill assessment /viva voce/OSCE/practical
PY 6.9	Demonstrate the correct clinical examination of the respiratory system in a normal volunteer or simulated environment	DOAP Skill assessment /viva voce/OSCE/practical
PY 10.11	Demonstrate the correct clinical examination of the nervous system: 1) Higher functions 2) Sensory system 3) Motor system 4) Reflexes 5) Cranial nerves in a normal volunteer or simulated environment	DOAP Skill assessment /viva voce/OSCE/practical
PY 10.20	Demonstrate 1) Testing for Visual acuity, colour vision & field of vision 2) Testing for smell 3) Taste sensation	Skill assessment /viva voce/OSCE/practical

	in a normal volunteer or simulated environment	
PY 11.13	Obtain history and perform general examination in the volunteer /simulated environment	DOAP Skill assessment /viva voce/OSCE/practical
	Amphibian experiments	
PY 3.18	Observe with computer assisted learning i)amphibian nerve muscle experiments ii)amphibian cardiac experiments	Demonstration, computer assisted learning modules practical/OSPE/Viva voce

*Noncore competency



Distribution of topics in physiology	
Paper I	
1	Haematology
2	Cardiovascular system
3	Respiratory system
4	Renal Physiology
5	Environmental physiology
6	Gastrointestinal system
7	Skin & Temperature regulation

Paper II	
1	General physiology
2	Neurophysiology
3	Special Senses
4	Nerve & Muscle Physiology
5	Endocrine Physiology
6	Reproductive Physiology
7	Growth & Development

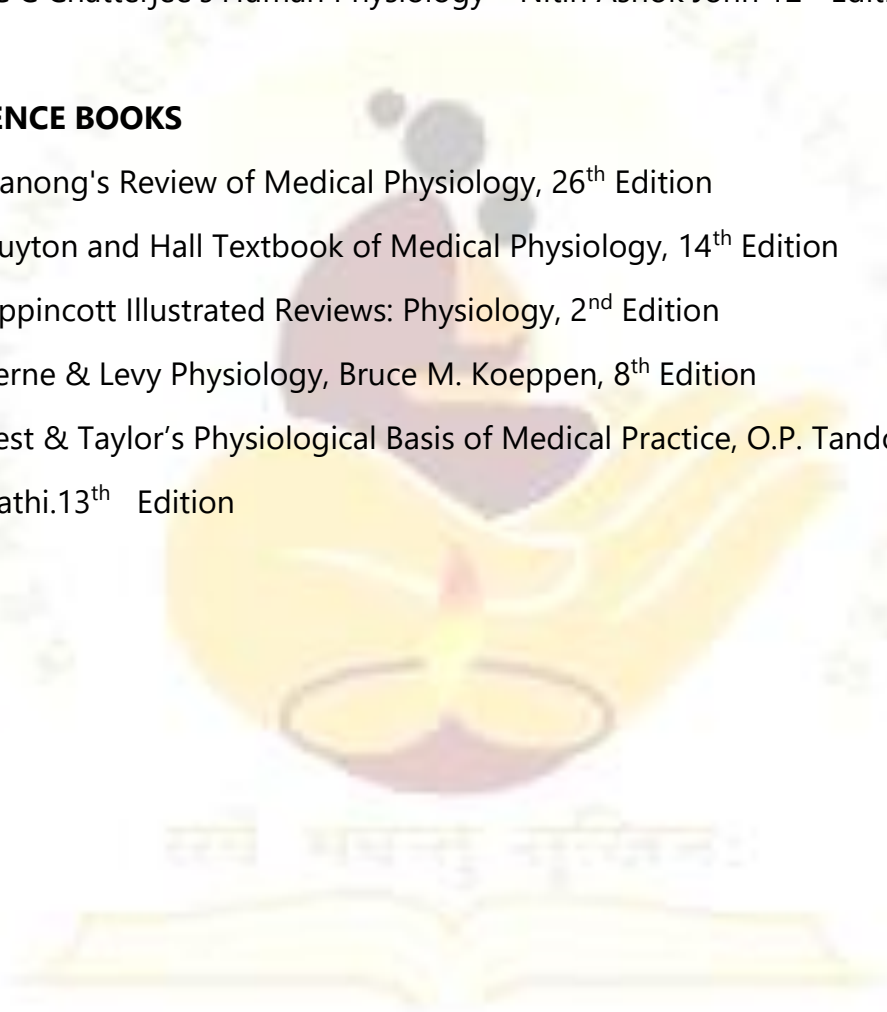
The topics to different paper are generally evaluated under those sections. However, a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics

RECOMMENDED BOOKS

1. Guyton and Hall Textbook of Medical Physiology, Third South Asian Edition
2. Textbook of Medical Physiology. GK PAL. 4th edition
3. Human Physiology for Medical Students. N Geetha. 2nd Edition
4. Medical Physiology for Undergraduate Students, Indu Khurana, 3rd edition
5. Human Physiology- From cells to systems. Laurelee Sherwood 9th Edition
6. C C Chatterjee's Human Physiology – Nitin Ashok John 12th Edition

REFERENCE BOOKS

1. Ganong's Review of Medical Physiology, 26th Edition
2. Guyton and Hall Textbook of Medical Physiology, 14th Edition
3. Lippincott Illustrated Reviews: Physiology, 2nd Edition
4. Berne & Levy Physiology, Bruce M. Koeppen, 8th Edition
5. Best & Taylor's Physiological Basis of Medical Practice, O.P. Tandon, Y. Tripathi. 13th Edition



Theory and practical exam pattern for physiology

Theory: Total marks: 100

10m x 2 = 20 marks (clinical scenario based (1) & structured essay (1))

6m x 6 = 36 marks (short essay)

4m x 6 = 24 marks (physiological basis -3 questions) Diagrams -3 questions)

1m x 20 = 20 marks (multiple choice questions)

1. One Clinical scenario based having five sub questions – 5m
2. Assertion reasoning -5m
3. Multiple response -5m
4. Single response -5m

Total number of questions: 14 +20 MCQ

Practical: total marks: 100

Practical I: 40m

10 m: Minor haematology

10 m: Human experiments

20m: OSPE 4 stations (5m each)

1. Amphibian graphs (draw /interpret)
2. Interpreting clinical conditions
- * 3. Haematology: skill assessment & calculation/interpret test results
- * 4. clinical and communication skill assessment

(*3 & *4 should be manned stations with checklists)

Practical II: 40m

20m: clinical examination

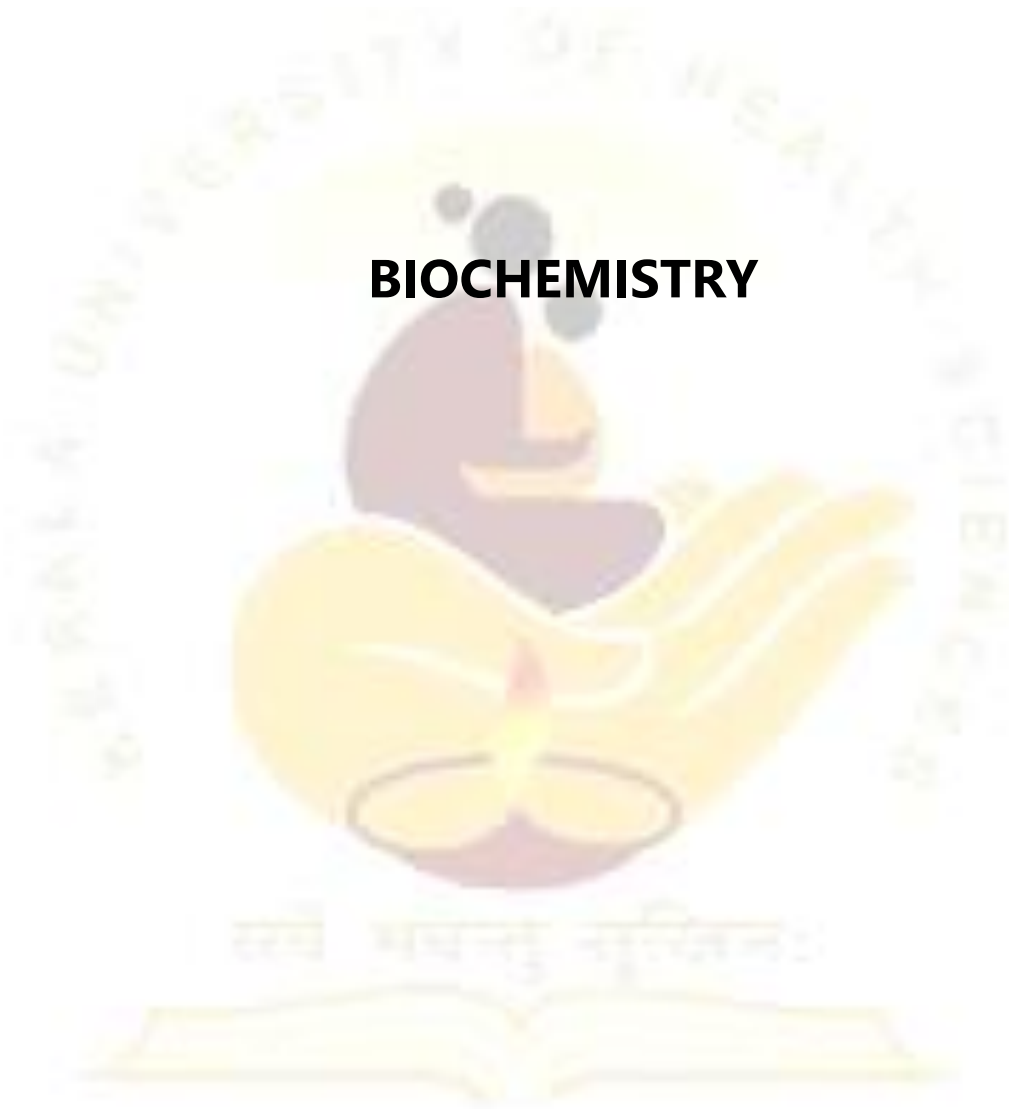
20m: Major Haematology

Viva voce: 20m (5m X 4stations)

Four stations:

- (1) laboratory data interpretation
- (2) Clinical scenario discussion
- (3) Instruments discussion
- (4) Common investigative data interpretation e.g.: ECG, spirometry

BIOCHEMISTRY



Competencies:

The learner must demonstrate an understanding of:

- Biochemical and molecular processes involved in health and disease, Importance of nutrition in health and disease,
- Importance of nutrition in health and disease
- Biochemical basis and rationale of clinical laboratory tests' and ability to demonstrate the ability to interpret these in clinical context

b. Broad subject specific objectives:**Knowledge:**

At the end of the course, the student shall be able to

- Enlist and describe the cell organelles with their molecular and functional organization.
- Delineate structure, function and interrelationships of various biomolecules and consequences of deviation from the normal.
- Understand basic enzymology and emphasize on its clinical applications wherein regulation of enzymatic activity is disturbed.
- Describe digestion and assimilation of nutrients and consequences of malnutrition.
- Describe and integrate metabolic pathways of various biomolecules with their regulatory mechanisms.
- Explain the biochemical basis of inherited disorders with their associated sequelae.
- Describe mechanisms involved in maintenance of water, electrolyte and acid base balance and consequences of their imbalances.
- Outline the molecular mechanisms of gene expression and regulation, basic principles of biotechnology and their applications in medicine

c. Skills

At the end of the course, the student shall be able to:

- Make use of conventional techniques / instruments to perform biochemical analysis relevant to clinical screening and diagnosis;
- Analysis and interpret investigative data;
- Demonstrate the skills of solving scientific and clinical problems and decision making.

Biochemistry: Distribution of teaching hours

Teaching method	Hours
Lectures	78
Small group teachings / tutorials / Integrated teaching / Practical	144
Self-directed learning	10
Teaching Hours	232
Early clinical exposure	9
AETCOM- 3 modules	6
Formative assessment and term examinations	20

Competency No	Topics	Core	Suggested Teaching learning methods*	Suggested Assessment Method	Vertical Integration(VI) /Horizontal Integration(HI)
	Basic Biochemistry: 2 hours Number of competencies: (01)				
BI 1.1.1	Cell: Molecular and functional organization of cell and subcellular component, Disorders associated with(in brief)	Y	Lecture/SGL	Written / Viva	Physiology HI
BI 1.1.2	Cell membrane: Fluid mosaic model of membrane (Structure and functions only. Transport will be discussed in physiology)	Y	Lecture/SGL	Written / Viva	Physiology (HI)
	Enzymes: 11 hours Number of competencies: (07)				
BI 2.1 .1	Definition, Classification of enzymes with examples as per IUBMB nomenclature, Active site, Allosteric site,	Y	Lecture/SGL	Written / Viva	
BI 2.1.2	Co enzymes & co factors, Specificity of enzymes.	Y	Lecture/SGL	Written / Viva	
BI 2.3.3	Factors affecting enzyme activity(definition and significance of Km and V max)	Y	Lecture/SGL	Written / Viva	
BI 2.3.4	Regulation of enzyme activity:	Y	Lecture/SGL	Written / Viva	

	Coarse regulation (induction, repression and de-repression) Fine regulation(covalent modification, Allosteric regulation, feedback regulation, compartmentalization)				
BI 2.4.5	Competitive, Non-competitive and Uncompetitive inhibition with suitable examples	Y	Lecture/SGL	Written / Viva	Pharmacology (VI)
BI 2.4.6	Allosteric, Feedback and suicidal inhibition with examples.	Y	Lecture/SGL	Written / Viva	
BI 2.5.7	Iso enzymes: Definition & salient features of Iso enzymes, Iso enzymes of LDH, CPK & ALP with their features and clinical significance. Clinical utility of various enzymes as markers: Functional & Non-functional enzymes. Hepatic markers: E.g. ALP, AST, ALT, GGT, 5'Nucleotidase.	Y	Lecture/SGL	Written / Viva	General Medicine (VI) Physiology
BI 2.5.8	Cardiac markers: E.g. CK, LDH, SGOT, Troponins, Serum myoglobin	Y	Lecture/SGL	Written / Viva	General Medicine(VI)
BI 2.5.9	Pancreatic markers (Amylase, Lipase) Prostatic markers: E.g. Acid phosphatase, PSA Muscle markers: E.g. CPK, AST, Aldolase Bone markers: E.g. ALP	Y	Lecture/SGL	Written / Viva	General Medicine(VI)

BI 2.6	Uses of enzymes in laboratory investigations (Enzyme based assays) e.g. ELISA & DNA Technology Therapeutic use of enzymes.	Y	Lecture/SGL	Written / Viva	
BI 2.7	Interpret laboratory results of enzyme activities and describe the clinical utility of enzymes as markers of pathological condition	Y	Lecture/SGL	Written / Viva	
Chemistry and Metabolism of Carbohydrates: 22 hours Number of competencies: (10)					
BI 3.1.1	Chemistry of carbohydrates: Definition, Biomedical importance, classification, isomerism, reactions	Y	Lecture/SGL	Written / Viva	
BI 3.1.2	Monosaccharides & their derivatives: Examples with biological significance in human body, Glucose, Fructose, Mannose, Galactose, Uronic acid, Amino sugars, Sorbitol, Mannitol. Disaccharides: Examples with biological significance in human body Lactose, Maltose, Sucrose (Composition and significance)	Y	Lecture/SGL	Written / Viva	
BI 3.1.3	Polysaccharides: Examples with biological significance in human body -Glycogen, Starch, Cellulose, Dextran.	Y	Lecture/SGL	Written / Viva	
BI 3.1.4	Glycosaminoglycan and disorders related (brief) : Importance of glycoproteins	Y	Lecture/SGL	Written / Viva	
BI 3.2 BI 3.3	Digestion of carbohydrates Absorption of carbohydrates, Glucose transporters	Y	Lecture/SGL	Written / Viva	Physiology (HI)

BI 3.4.1	Glycolysis: Site, significance, reactions, regulations & energetics .Inhibitors of glycolysis E.g. Fluoride	Y	Lecture/SGL	Written / Viva	No
BI 3.4.2	Glycolysis: Rapaport-Leubering cycle and its significance, Cori's cycle, Fate of pyruvate under aerobic and anaerobic conditions	Y	Lecture/SGL	Written / Viva	
BI 3.4.3	Gluconeogenesis :Definition, Site, significance, substrates, reactions, regulation, glucose-alanine cycle	Y	Lecture/SGL	Written / Viva	
BI 3.4.4	Glycogenesis ,Glycogenolysis , regulation	Y	Lecture/SGL	Written / Viva	
BI 3.4.5	Glycogen storage disorders	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics(VI)
BI 3.4.6	HMP pathway: Significance of HMP. {Steps till the formation of 6-phosphogluconic acid} Glucose 6 phosphate dehydrogenase deficiency	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics(VI)
BI 3.4.7	Metabolism of fructose and Galactose. Polyol pathway, uronic acid pathway Disorders related (hereditary fructose intolerance, Fructosuria, galactosemia)	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics (VI)
BI 3.5	Describe and discuss the regulation, functions and integration of carbohydrates along with associated diseases/disorders	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics (VI)
BI 3.6.1	TCA cycle: Reactions, significance, regulations, inhibitors	Y	Lecture/SGL	Written / Viva	

BI 3.6 BI .3.7	TCA cycle: Energetics, anaplerotic and amphibolic role of TCA cycle. Describe the common poisons that inhibit crucial enzymes of carbohydrate metabolism (Eg:Flouride,Arsenate)	Y	Lecture/SGL	Written / Viva	
BI 3.8.1	Interpret the results of analytes related to disorders of carbohydrate metabolism	Y	Lecture/SGL	Written / Viva	Pathology General Medicine(VI)
BI 3.9.1	Regulation of blood glucose: Mechanism and significance of blood glucose regulation in health and disease Role of organs, enzymes and hormones (insulin, glucagon, growth hormone, catecholamine and glucocorticoids) in regulation of glucose	Y	Lecture/SGL	Written / Viva	
BI 3.9.2	Insulin: Structure, receptor, mechanism of release of insulin, action. Insulin resistance	Y	Lecture/SGL	Written / Viva	
BI 3.9.3	Diabetes Mellitus: Aetiology, biochemical basis & clinical features	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics (VI)
BI 3.9.5	Biochemical basis of Acute Complications of Diabetes Mellitus	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics(VI)

BI 3.9.6	Biochemical basis of Chronic complications of Diabetes Mellitus	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics (VI)
BI 3.10.1	Biochemical basis of Investigations of diabetes mellitus - Diagnosis and monitoring Interpret the results of blood glucose levels and other laboratory investigations	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics (VI)
	Chemistry and Metabolism of Lipids: 21 hours Number of competencies: (07)				
BI 4.1.1	Classification and functions of lipids, Saturated and unsaturated fatty acids(MUFA&PUFA) Essential fatty acids (clinical relevance)	Y	Lecture/SGL	Written / Viva	
BI 4.1.2	Triglycerides Glycerophospholipid (functions, composition and biomedical importance)	Y	Lecture/SGL	Written / Viva	
BI 4.1.3	Sphingolipids (functions, composition and biomedical importance) Liposomes, Micelle. Cholesterol: functions, composition and biomedical importance.	Y	Lecture/SGL	Written / Viva	
BI 4.2.4	Digestion of lipids Role of bile salts in lipid digestion. Absorption of lipids and disorders (Steatorrhea)	Y	Lecture/SGL	Written / Viva	Physiology (HI)
BI 4.2.5	Fatty acid synthesis: Transport of acetyl CoA to cytoplasm and formation of malonyl CoA. Regulation of fatty acid synthesis. Fatty acid synthase complex and detailed steps not required.	Y	Lecture/SGL	Written / Viva	

BI 4.2.6	Beta-oxidation of fatty acid , role of carnitine in fatty acid transport:	Y	Lecture/SGL	Written / Viva	
BI 4.2.7	Regulation of fatty acid oxidation Oxidation of odd chain fatty acids, alpha and peroxisomal oxidation, disorders related to oxidation of fatty acids	Y	Lecture/SGL	Written / Viva	
BI 4.2.8	Metabolism of adipose tissue (Triglyceride synthesis and degradation) White and brown adipose tissue	Y	Lecture/SGL	Written / Viva	
BI 4.2.9	Ketone body synthesis and utilization	Y	Lecture/SGL	Written / Viva	No
BI 4.2.10	Ketosis in Starvation and Diabetes Mellitus	Y	Lecture/SGL	Written / Viva	General Medicine(VI)
BI 4.2.11	Liver-adipose tissue axis,Role of liver in fat metabolism Biochemical basis of Fatty Liver Disease and its management Lipotropic factors: examples and their role in prevention of fatty liver	Y	Lecture/SGL	Written / Viva	Pathology & General Medicine(VI)
BI 4.2.12	Cholesterol synthesis (up to mevalonate in detail and mention important intermediates from mevalonate to cholesterol with flow chart) Regulation of synthesis and fate of cholesterol	Y	Lecture/SGL	Written / Viva	No
BI 4.2.13	Formation & fate of bile salts, other compounds formed from cholesterol	Y	Lecture/SGL	Written / Viva	No
BI 4.3.1	Classification, structure and functions of lipoproteins,Apolipoproteins	Y	Lecture/SGL	Written / Viva	General Medicine(VI)

BI 4.3.2	Chylomicron metabolism	Y	Lecture/SGL	Written / Viva	General Medicine(VI)
BI 4.3.3	VLDL metabolism & LDL metabolism	Y	Lecture/SGL	Written / Viva	General Medicine(VI)
BI 4.3.4	HDL metabolism	Y	Lecture/SGL	Written / Viva	General Medicine(VI)
BI 4.4	Role of lipoprotein in atherosclerosis: Etiopathogenesis, metabolic changes, clinical features and complications of atherosclerosis, Biochemical basis of management and preventive measures	Y	Lecture/SGL	Written / Viva	Pathology(VI)
BI 4.5	Normal fasting Lipid profile and its significance in health and disease Interpret the laboratory results of analytes associated with lipoprotein metabolism ,Hyper lipoproteinemias & Hypo lipoproteinemias	Y	Lecture/SGL	Written / Viva	General Medicine(VI)
BI 4.6	Eicosanoids: Definition and classification with biological functions Key features of synthesis of eicosanoids. Inhibitors of eicosanoid synthesis Uses of eicosanoid synthesis inhibitors in various diseases	Y	Lecture/SGL	Written / Viva	No

BI 4.7	Interpret the laboratory results of analytes associated with lipid metabolism	Y	Lecture/SGL	Written / Viva	General Medicine(VI)
	Chemistry and Metabolism of Proteins and inborn errors related :20 Hours Number of competencies: (05)		Lecture/SGL		
BI 5.1.1	Proteins:- Classification based on structure, functions and nutritional value	Y	Lecture/SGL	Written / Viva	No
BI 5.1.2	Structural organization of proteins: Bonds stabilizing protein structure Primary and secondary structure, Tertiary Lecture/SGL and quaternary structure with examples	Y	Lecture/SGL	Written / Viva	No
BI 5.2.1	Describe and Discuss the functions of protein and structure function relationship in relevant areas like haemoglobin and selected hemoglobinopathies	Y	Lecture/SGL	Written / Viva	Physiology (HI)
BI 5.2.2	Amino acids: Classification based on structure, metabolic fate and nutritional importance.	Y	Lecture/SGL	Written / Viva	
BI 5.2.3	Properties of amino acids: Ionic properties and buffering actions Isoelectric pH, Amphoteric nature, Optical activity of amino acids Peptide bond. Biologically important peptides.	Y	Lecture/SGL	Written / Viva	
BI 5.2.4	Plasma proteins: Normal reference levels of plasma proteins Functions of plasma proteins:	Y	Lecture/SGL	Written / Viva	

BI 5.2.5	Albumin, Brief description of other plasma proteins Acute phase proteins	Y	Lecture/SGL	Written / Viva	
BI 5.3	Digestion of proteins Mechanism of absorption of amino acids from GIT & Disorders related.	Y	Lecture/SGL	Written / Viva	
BI 5.4.1	General reactions of amino acids: Transamination, Trans-methylation, Trans-deamination, Deamination and their significance.	Y	Lecture/SGL	Written / Viva	
BI 5.4.2	Formation and disposal of ammonia Hyperammonemia	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics (VI)
BI 5.4.3	Glycine metabolism: Specialized compounds formed from glycine. Disorders related. Mention alanine and beta alanine	Y	Lecture/SGL	Written / Viva	No
BI 5.4.4	Metabolism of sulphur containing amino acids & disorders related. One carbon metabolism	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics (VI)
BI 5.4.5	Metabolism of phenylalanine and tyrosine (Specialised compounds formed from phenylalanine and their importance)	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics (VI)
BI 5.4.6	Disorders of phenylalanine and tyrosine metabolism	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics (VI)

BI 5.4.7	Metabolism of Tryptophan (Synthesis of serotonin, melatonin and their importance)Disorders related (Hartnup disease & Carcinoid syndrome)	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics(VI)
BI 5.4.8	Metabolism of branched chain amino acids (first two steps only and the end products. Maple syrup urine disease.	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics(VI)
BI 5.4.9	Metabolism of Serine, Threonine (Important compounds formed only and functions)	Y	Lecture/SGL	Written / Viva	
BI 5.4.10	Metabolism of Glutamic acid, Aspartic acid, Glutamine &Asparagine(Important compounds formed only and functions)	Y	Lecture/SGL	Written / Viva	
BI 5.4.11	Metabolism of Histidine, Arginine, lysine, polyamines (Important compounds formed and functions)	Y	Lecture/SGL	Written / Viva	
BI 5.5.1	Interpret the laboratory results of analytes associated with metabolism of proteins and aminoacid	Y	Lecture/SGL	Written / Viva	General Medicine(VI)
Integration of metabolism and Homeostasis :56 Hours Number of competencies: (15)					
BI 6.1.1	Integration of metabolism at organ level (liver,muscle,adipose tissue & brain) in fed state	Y	Lecture/SGL	Written / Viva	
BI 6.1.2	Integration of metabolism at organ level (liver,muscle,adipose tissue & brain) in fasting state	Y	Lecture/SGL	Written / Viva	
BI 6.2.1	Chemistry of purines, Pyrimidines, nucleosides & nucleotides.	Y	Lecture/SGL	Written / Viva	

	Functions of nucleotides: Purines, Pyrimidines Nucleotide analogues and their use in medicine				
BI 6.2.2	Purine biosynthesis: Sources of carbon and nitrogen atoms of purine ring. Purine biosynthesis, First two steps (up to formation of phosphoribosylamine)	Y	Lecture/SGL	Written / Viva	
BI 6.2.3	Purine biosynthesis : Formation of AMP & GMP from IMP: Formation of diphosphates and triphosphates from monophosphates: formation of deoxyribo nucleotides: regulation and inhibitors of purine biosynthesis	Y	Lecture/SGL	Written / Viva	
BI 6.2.4	Synthesis of Pyrimidines and Inhibitors of pyrimidine synthesis. Disorders associated with.(Degradation of Pyrimidines -not required)	Y	Lecture/SGL	Written / Viva	
BI 6.3	Salvage pathways: Lesch-Nyhan syndrome; Degradation of purines Gout(aetiology, manifestations and biochemical basis of clinical features), Hyperuricemia , Hypouricemia	Y	Lecture/SGL	Written / Viva	General Medicine (VI)
BI 6.4	Discuss the laboratory results of analytes associated with gout and Lesch-Nyhan syndrome	Y	Lecture/SGL	Written / Viva	General Medicine VI)
BI 6.5.1	Vitamins: definition, difference between water and fat-soluble vitamins	Y	Lecture/SGL	Written / Viva	
BI 6.5.2	Vitamin A: different clinical forms, dietary sources, RDA, biochemical functions of vitamin A, Wald's visual cycle	Y	Lecture/SGL	Written / Viva	

BI 6.5.3	Vitamin A: Deficiency manifestations and prevention; Hypervitaminosis	Y	Lecture/SGL	Written / Viva	
BI 6.5.4	Vitamin D: Chemical nature, dietary sources & RDA. Active form of vitamin D: its formation and actions Deficiency manifestations of vitamin D in children, adults and prevention.	Y	Lecture/SGL	Written / Viva	General Medicine (VI)
BI 6.5.5	Vitamin K: Chemical forms, dietary sources, biochemical functions, RDA & Deficiency manifestations	Y	Lecture/SGL	Written / Viva	
BI 6.5.6	Vitamin E: Chemical forms, biochemical functions, (lipid peroxidation and antioxidant function in brief) & deficiency manifestations	Y	Lecture/SGL	Written / Viva	
BI 6.5.7	Thiamine: Chemical nature, dietary sources, RDA, coenzyme form, biochemical functions & deficiency manifestations	Y	Lecture/SGL	Written / Viva	
BI 6.5.8	Pyridoxine: Chemical nature, dietary sources, RDA, coenzyme form, biochemical functions & deficiency manifestations	Y	Lecture/SGL	Written / Viva	
BI 6.5.9	Niacin: Chemical nature, dietary sources, RDA, coenzyme form, biochemical functions & deficiency manifestations	Y	Lecture/SGL	Written / Viva	General Medicine Pediatrics Dermatology(VI)

BI 6.5.10	Pantothenic acid, Riboflavin, Biotin :Chemical nature, dietary sources, RDA, coenzyme form, biochemical functions & deficiency manifestations	Y	SDL	Written / Viva	General Medicine Pediatrics Dermatology(VI)
BI 6.5.11	Folic acid: Chemical nature, dietary sources, RDA, coenzyme form, biochemical functions & deficiency manifestations	Y	Lecture/SGL	Written / Viva	General Medicine Pediatrics Dermatology(VI)
BI 6.5.12	Vitamin B 12 : Chemical nature, dietary sources, RDA, coenzyme form, biochemical functions & deficiency manifestations, Lab investigations to differentiate from folic acid deficiency.	Y	Lecture/SGL	Written / Viva	General Medicine(VI)
BI 6.5.13	Vitamin C: Chemical nature, dietary sources, RDA, coenzyme form, biochemical functions & deficiency manifestations: Antivitamins	Y	Lecture/SGL	Written / Viva	Paediatrics(VI)
BI 6.6.1	Biological Oxidation: high energy compounds , substrate level phosphorylation, ETC Components	Y	Lecture/SGL	Written / Viva	
BI 6.6.2	Oxidative phosphorylation & inhibitors of ETC	Y	Lecture/SGL	Written / Viva	
BI 6.7.1	Acid, Bases, pH, Buffers	Y	SDL	Written / Viva	Physiology(HI)
BI 6.7.2	Buffering capacity, Significance of Henderson Hassel Balch equation	Y	Lecture/SGL	Written / Viva	Physiology(HI)
BI 6.7.3	Role of body buffers in regulation of blood pH	Y	Lecture/SGL	Written / Viva	Physiology(HI)

BI 6.7.4	Respiratory and renal regulation of blood pH	Y	Lecture/SGL	Written / Viva	Physiology(HI)
BI 6.7.5	Anion gap, Acid base disturbance- Metabolic acidosis and Metabolic alkalosis	Y	Lecture/SGL	Written / Viva	General medicine(VI) Physiology (HI)
BI 6.7.6	Acid base disturbance continued -Respiratory acidosis and respiratory alkalosis	Y	Lecture/SGL	Written / Viva	General medicine (VI) Physiology (HI)
BI 6.7.7	Water and electrolyte balance : Distribution of water and electrolytes in ICF and ECF	Y	SDL	Written / Viva	Physiology (HI)
BI 6.7.8	Osmolality: Definition, Normal reference value Regulation of osmolality: Regulation of fluid and electrolyte in various body compartments	Y	Lecture/SGL	Written / Viva	Physiology (HI)
BI 6.7.9	Derangements in fluid electrolyte balance: Dehydration & over hydration	Y	Lecture/SGL	Written / Viva	General Medicine Physiology (HI)
BI 6.8	Blood gas analysis: Principle and use of Blood gas analyser	Y	Lecture/SGL	Written / Viva	
BI 6.9.1	Discuss and interpret the results of Arteria Blood Gas analysis in various disorders	Y	Lecture/SGL	Written / Viva	General Medicine (VI)
BI 6.10.1	Classification of minerals based on RDA. Iron: dietary sources, RDA, Functions of Iron and iron containing proteins .	Y	Lecture/SGL	Written / Viva	General Medicine (VI)
BI 6.10.2	Absorption Transport and Storage of Iron. Iron deficiency Anaemia and Hereditary hemochromatosis	Y	Lecture/SGL	Written / Viva	General Medicine(VI) Physiology (HI)
BI 6.10.3	Calcium: Biochemical functions, RDA, Sources, homeostasis of calcium, Hypercalcemia and Hypocalcaemia.	Y	Lecture/SGL	Written / Viva	General Medicine (VI)Physiology (HI)

BI 6.10.4	Phosphorus: Biochemical functions, sources, disorders related.	Y	Lecture/SGL	Written / Viva	General Medicine(VI) Physiology (HI)
BI 6.10.5	Copper: Biochemical functions and disorders related(Wilson disease and Menke's kinky hair syndrome)	Y	Lecture/SGL	Written / Viva	General Medicine & Paediatrics (VI) Physiology (HI)
BI 6.10.6	Magnesium, Iodine: Dietary sources, biochemical functions, Disorders related	Y	SDL	Written / Viva	
BI 6.10.7	Sodium, Potassium, Chloride, Sulphur: Dietary sources, biochemical functions, Disorders related	Y	SDL	Written / Viva	General Medicine(VI) Physiology (HI)
BI 6.10.8	Zinc, Selenium: Dietary sources, biochemical functions, Disorders related	Y	SDL	Written / Viva	General Medicine(VI) Physiology (HI)
BI 6.10.9	Fluoride, Manganese, Molybdenum, Cobalt, Chromium : Dietary sources, biochemical functions, Disorders related	Y	SDL	Written / Viva	General Medicine(VI) Physiology (HI)
BI 6.11.1	Haemoglobin: Structure and functions	Y	SDL	Written / Viva	Physiology (HI)
BI 6.11.2	Biosynthesis of heme and its regulation.	Y	Lecture/SGL	Written / Viva	Physiology (HI)
BI 6.11.3	Porphyria: definition, classification, biochemical features of different porphyria and its lab diagnosis	Y	Lecture/SGL	Written / Viva	General Medicine, Pathology & Paediatrics(VI)

BI 6.11.4	Heme catabolism: formation of bilirubin and biliverdin from heme, transport, conjugation, excretion	Y	Lecture/SGL	Written / Viva	Physiology (HI)
BI 6.11.5	Congenital and acquired Hyperbilirubinemia- Physiological and pathological jaundice in newborns Haemolytic, Hepatic and Obstructive jaundice in children and adults Explain the basis and rationale of biochemical tests done in jaundice	Y	Lecture/SGL	Written / Viva	General Medicine, & Paediatrics(VI) Physiology (HI)
BI 6.12.1	Embryonic haemoglobin (brief), Haemoglobin derivatives (Methemoglobin, Carboxyhemoglobin), Abnormal haemoglobin (HbS)	Y	Lecture/SGL	Written / Viva	Physiology (HI)
BI 6.12.2	Molecular basis, diagnosis and management of hemoglobinopathy	Y	Lecture/SGL	Written / Viva	General Medicine, Pathology & Paediatrics(VI)
BI 6.12.3	Molecular basis, diagnosis and management of Thalassemia	Y	Lecture/SGL	Written / Viva	General Medicine, Pathology & Paediatrics(VI)
BI 6.13.1	Liver function tests: LFT based on synthetic, metabolic, detoxification, excretory and storage functions of liver.	Y	Lecture/SGL	Written / Viva	General Medicine, Pathology & Paediatrics (VI) Physiology,Anatomy (HI)

BI 6.13.2	Renal function tests: RFT based on glomerular and tubular function.	Y	Lecture/SGL	Written / Viva	General Medicine, & Paediatrics Physiology, Anatomy (HI)
BI 6.13.3	Markers of GFR: clearance tests (Creatinine clearance in detail) Renal tubular functions: Urine concentration tests, Urine dilution tests	Y	Lecture/SGL	Written / Viva	General Medicine, & Paediatrics (Nesting) Physiology (HI)
BI 6.13.4	Thyroid function tests	Y	Lecture/SGL	Written / Viva	Physiology Anatomy (HI) General Medicine & Endocrinology (VI)
BI 6.13.5	Adrenal function tests	Y	Lecture/SGL	Written / Viva	Physiology, Anatomy (HI) General Medicine & Endocrinology (VI)
Molecular biology: 24 Hours Number of competencies: (07)					
BI 7.1.1	Structure of DNA & RNA. Different types of RNA , Organization of DNA & Mitochondrial DNA	Y	SDL	Written / Viva	
BI 7.1.1	Cell cycle and its regulation	Y	Lecture/SGL	Written / Viva	
BI 7.2.1	Replication : Replication in prokaryotes and eukaryotes	Y	Lecture/SGL	Written / Viva	

BI 7.2.2	Telomere, Inhibitors of replication: DNA repair & diseases associated with DNA repair mechanism	Y	Lecture/SGL	Written / Viva	
BI 7.2.3	Describe the transcription in prokaryotes and eukaryotes and how it differs in eukaryotes	Y	Lecture/SGL	Written / Viva	
BI 7.2.4	Post transcriptional modification, Inhibitors of transcription, Ribozymes & Reverse transcriptase	Y	Lecture/SGL	Written / Viva	
BI 7.2.5	Characteristics of Genetic Code	Y	SDL	Written / Viva	
BI 7.2.6	Describe the process of translation in prokaryotes and eukaryotes	Y	Lecture/SGL	Written / Viva	
BI 7.2.7	Post translational modification and inhibitors of translation	Y	Lecture/SGL	Written / Viva	
BI 7.3.1	Regulation of gene expression in prokaryotes: Induction, repression & de-repression: lac operon model	Y	Lecture/SGL	Written / Viva	
BI 7.3.2	Regulation of gene expression in eukaryotes: Hormone Responsive elements, Enhancers, transcription factors, Gene amplification, gene switching, Gene rearrangement, RNA Processing, RNA editing, RNA interference, Epigenetics	Y	Lecture/SGL	Written / Viva	
BI 7.3.3	Mutation- definition, causes, types, consequences with examples: Mutagens.	Y	Lecture/SGL	Written / Viva	Pediatrics(VI)
BI 7.4.1	Recombinant DNA technology : Applications, Vectors, Techniques, Restriction endonucleases	Y	Lecture/SGL	Written / Viva	Pediatrics General Medicine(VI)
BI 7.4.2	Gene therapy, Gene library	Y	Lecture/SGL	Written / Viva	

BI 7.4.3	DNA hybridization technique: Isolation and purification of DNA, Gene probes,	Y	Lecture/SGL	Written / Viva	
BI 7.4.4	Southern blotting, Northern blotting, Western blotting, FISH	Y	Lecture/SGL	Written / Viva	
BI 7.4.5	Polymerase chain reaction, Anti sense therapy,	Y	Lecture/SGL	Written / Viva	
BI 7.4.6	RFLP, DNA finger printing, DNA sequencing, Microarrays.	Y	Lecture/SGL	Written / Viva	
BI 7.5.1	Phase 1 detoxification reactions(oxidation, reduction, hydrolysis)	Y	Lecture/SGL	Written / Viva	Pharmacology (VI)
BI 7.5.2	Phase 2 detoxification reactions(conjugation), role of cytochrome p-450 in detoxification	Y	Lecture/SGL	Written / Viva	Pharmacology (VI)
BI 7.6.1	Free radicals: definition, types, sources and generation of free radicals.	Y	Lecture/SGL	Written / Viva	
BI 7.6.2	Effects of free radicals, defence mechanism against free radicals (lipid peroxidation)	Y	Lecture/SGL	Written / Viva	
BI 7.6.3	Antioxidants: definition & classification	Y	Lecture/SGL	Written / Viva	
BI 7.7	Role of oxidative stress in pathogenesis of cancer, atherosclerosis and diabetes mellitus	Y	Lecture/SGL	Written / Viva	General Medicine Pathology(VI)
	Nutrition: 16 Hours Number of competencies: (05)				
BI 8.1.1	Energy content of different food items: Calorific value of foods, respiratory quotient of foodstuffs	Y	Lecture/SGL	Written / Viva	
BI 8.1.2	BMR - Definition, Normal values, Factors affecting and biomedical importance.	Y	Lecture/SGL	Written / Viva	

BI 8.1.3	Specific Dynamic Action- Definition, SDA for different foods and significance.	Y	Lecture/SGL	Written / Viva	
BI 8.1.4	Dietary sources and nutritional importance of carbohydrates	Y	SDL	Written / Viva	
BI 8.1.5	Dietary fibre: definition, examples & importance.	Y	Lecture/SGL	Written / Viva	General medicine Pediatrics Pathology(VI)
BI 8.1.6	Nutritional Importance of Lipids: essential fatty acids, their functions, sources and deficiency manifestations.	Y	SDL	Written / Viva	
BI 8.1.7	Nutritional Importance of Dietary proteins	Y	SDL	Written / Viva	
BI 8.1.8	Assessment of nutritive value of proteins: Protein efficiency ratio, biological value & Net protein utilization	Y	Lecture/SGL	Written / Viva	
BI 8.2.1	PEM: Classification of PEM, (WHO terminology MAM, SAM): Causes, occurrence, clinical features, biochemical basis of manifestations and treatment of Kwashiorkor.	Y	Lecture/SGL	Written / Viva	Paediatrics(VI)
BI 8.2.2	Aetiology, occurrence, clinical features, biochemical manifestations and treatment of Marasmus	Y	Lecture/SGL	Written / Viva	Paediatrics(VI)
BI 8.3.1	Recommended dietary allowances	Y	Lecture/SGL	Written / Viva	General Medicine Pediatrics, Community Medicine (VI)

BI 8.3.2	Balanced diet- definition and composition.	Y	Lecture/SGL	Written / Viva	General Medicine Pediatrics,Community Medicine(VI)
BI 8.3.4	Glycaemic index: definition, calculation, importance	Y	Lecture/SGL	Written / Viva	
BI 8.4.1	Obesity: Definition, grading based on BMI & causes (including dietary habits) of Obesity /Overweight	Y	Lecture/SGL	Written / Viva	General Medicine Pathology(VI)
BI 8.4.2	Metabolic changes, complications and health risks due to obesity /overweight	Y	Lecture/SGL	Written / Viva	General Medicine (VI)
BI 8.5	Summarise the nutritional importance of commonly used food items including fruits and vegetables	Y	Lecture/SGL	Written / Viva	General Medicine(VI) Pediatrics , Community Medicine (VI)
	Extra cellular matrix: 3 Hours Number of competencies: (03)				
BI 9.1	Composition and functions of extra cellular matrix: Collagen, Elastin, Keratin, contractile proteins.	Y	Lecture/SGL	Written / Viva	
BI 9.2	Extra cellular matrix in health and diseases: eg Osteogenesis imperfecta, Ehler-Danlos syndrome ,Mucopolysaccharadosis	Y	Lecture/SGL	Written / Viva	General Medicine (VI)
BI 9.3	Describe protein targeting and sorting along with its associated disorders	N	Lecture/SGL	Written / Viva	
	Oncogenesis and Immunity: 12 Hours (5 L+7 SGL)				No

	Number of competencies: (05) Number of procedures that require certification: (NIL)				
BI 10.1.1	Aetiology of cancer (Role of chemical carcinogens, radiation and viruses in carcinogenesis).	Y	Lecture/SGL	Written / Viva	Pathology(VI)
BI 10.1.2	Molecular basis of carcinogenesis (Initiation ,promotion)	Y	Lecture/SGL	Written / Viva	Pathology(VI)
BI 10.1.3	Oncogenes & Tumour suppressor genes and their role in carcinogenesis.	Y	Lecture/SGL	Written / Viva	Pathology (VI)
BI 10.1.4	Apoptosis	Y	Lecture/SGL	Written / Viva	Pathology (VI)
BI 10.2.4	Tumour markers: definition, classification, clinical significance.	Y	Lecture/SGL	Written / Viva	Oncology(VI)
BI 10.2.4	Biochemical basis of cancer therapy: role of alkylating agents, antimetabolites, antibiotics, receptor blockers, radiotherapy and monoclonal antibodies in cancer therapy.	Y	Lecture/SGL	Written / Viva	Oncology(VI)
BI 10.3.1	Cell mediated and Humoral immunity	Y	Lecture/SGL	Written / Viva	Microbiology(VI)
BI 10.3.2	Immunoglobulin: structure, types and functions of immunoglobulin, disorders associated.	Y	Lecture/SGL	Written / Viva	Microbiology(VI)
BI 10.4.1	Immune response (Primary and secondary) Innate and adaptive immunity	Y	Lecture/SGL	Written / Viva	Microbiology(VI)
BI 10.4.2	Describe innate and adaptive immunity, Self / non self-recognition and the role T Cell and B cell in immune response	Y	Lecture/SGL	Written / Viva	Microbiology(VI)

	Cytokines				
BI 10.4.3	Describe antigens and concepts in vaccine development	Y	Lecture/SGL	Written / Viva	Microbiology(VI)
BI 10.4.4	Antigen antibody reactions & Use of antigen antibody reactions in laboratory(ELISA, Radioimmunoassay)	Y	Lecture/SGL	Written / Viva	Microbiology(VI)
	Biochemical Laboratory tests: 54 hours Number of competencies: (24) Number of procedures that require certification: (05)				
BI 11.1.1	Principles and applications of the following instruments: Semi-automatic analyser, Fully automatic analyser, Spectrophotometer, ISE	Y	Lecture		
BI 11.1.2	Principle, Types and uses of chromatography	Y	Lecture		
BI 11.1.3	Principles and applications of the following instruments: Electrophoretic apparatus	Y	Lecture		
BI 11.1.4	Principles and applications of the following instruments: ELISA and Immuno analysers	Y	Lecture		
	Part 1: Qualitative experiments-Introduction and Urine analysis-				
BI 11.1.5	Good safe laboratory practice and Biomedical waste disposal, commonly used lab equipment, glassware and reagents	Y	SGL	Viva	

BI 11.2	Preparation of buffers and estimation of pH using pH meter	Y	SGL	Viva	
BI 11.3	Describe the chemical components of urine	Y	SGL	Viva	
	Analysis of Normal urine- Physical properties, organic constituents of urine Certifiable procedure	Y	DOAP	Skill assessment- OSPE/Spott er	
BI 11.4 BI 11.20	Abnormal Constituents of Urine – Routine 1) Physical properties 2) Chemical tests- Glucose/ Reducing substances, Ketone bodies, Blood, Protein, Bile salts, Bile pigments 3) Urine Dipstick analysis	Y	DOAP-	Skill assessment- Qualitative experiments /OSPE	
BI 11.4 BI 11.20	Abnormal Constituents of Urine – Routine (Clinical Scenario Based-Glycosuria, ketonuria, jaundice, proteinuria, hematuria etc) Certifiable procedure	Y	DOAP-	Skill assessment- Qualitative experiments /OSPE	
BI 11.5	Abnormal Constituents of Urine -clinical scenario based 1) Physical properties 2) Chemical tests screening tests for - Metabolic disorders and inborn errors of metabolism – Phenyl ketonuria, MSUD, Hartnup's disease, Hereditary fructose intolerance, Galactosemia, Pentosuria etc 3) Urine Dipstick analysis	Y	DOAP	Skill assessment –Qualitative experiment/ OSPE/Spott er	

	Part 2: Quantitative Experiments	Y			
BI 11.6 & BI 11.18 BI 11.21	Principles of Colorimetry, Spectrophotometry and their application	Y	SGL	Viva	
BI 11.21	Estimation of plasma glucose by enzymatic method Certifiable procedure	Y	DOAP	Skill assessment – Quantitative analysis	
BI 11.21	GTT: Indications, contraindications, precautions, procedure, types of graph, Glycosuria	Y	SGL	Written/Viva /OSPE/Spotter	
BI 11.21	Estimation of blood urea and BUN Certifiable procedure	Y	DOAP	Skill assessment-Quantitative analysis	
BI 11.7 BI 11.21 BI 11.22	Estimation of serum and urine creatinine by Jaffe's method, Creatinine clearance Certifiable procedure	Y	DOAP	Skill assessment - Quantitative analysis	
BI 11.8 BI 11.21 BI 11.22	Estimation of Total protein and albumin in serum and AG ratio Certifiable procedure	Y	DOAP	Skill assessment - Quantitative analysis	

BI 11.9, BI 11.10	Estimation of Total Cholesterol and HDL, Estimation of Triglycerides, Lipid Profile	Y	DOAP	Principles and clinical relevance may be assessed by OSPE/Spotter	
BI 11.11 BI 11.12	Estimation of Calcium and Phosphorus Estimation of serum Bilirubin	Y	DOAP	Principles and clinical relevance may be assessed by OSPE/Spotter	
BI 2.2 BI 11.13 & BI 11.14	Estimation of ALT,AST& ALP	Y	DOAP	Principles and clinical relevance may be assessed by OSPE/Spotter	
	Part 3: Demonstrations				
BI 11.16.1	Proper filling of request form Specimen collection and pre analytic errors in clinical laboratory Sample collection- Phlebotomy technique, colour coded blood collection tubes, anti-	Y	Demonstration-	Skill assessment- OSPE/Spotter	

	coagulants, order of draw, changes on keeping, Sample processing, preservation and transport				
BI 11.16.2	Observe the use of commonly used equipment in the clinical laboratory – centrifuge, pH meter, Automated chemistry analyzer, Immunoanalyzer ,Estimation of serum electrolytes by ISE & Blood gas analysis using ABG analyser, Quality Control	Y	Demonstration	Skill assessment – OSPE/Spotter	
BI 11.16.3	POCT- Glucometer and Blood Gas analyzer, Urine dipstick	Y	Demonstration	OSPE	
BI 11.1 .4 BI 11.1 .5	Serum protein electrophoresis and applications Paper Chromatography/TLC of amino acids/sugars	Y	Demonstration	Skill assessment – OSPE/Spotter	
BI 11.16.7	Principle, Procedure and applications of ELISA, Immunodiffusion, Blotting techniques, PAGE Principle, DNA isolation, Procedure and applications of PCR	Y	Demonstration	Skill assessment – OSPE/Spotter	
BI 11.17.1 BI 3. 8. 2 BI 3.10.2 BI 4 . 5 BI 4 . 7 BI 5.5.1	Interpret the laboratory results related to disorders of carbohydrate, lipid and proteins, minerals, homeostasis, endocrine and genetic disorders, organ dysfunction - Clinical scenario based chart discussion	Y	SGL	Skill assessment/ Viva	

BI 6.9.1 BI 6.10					
BI 11.17.2	The basis and rationale of biochemical tests done in the following conditions: - diabetes mellitus, dyslipidaemia, myocardial infarction, renal failure, gout, Proteinuria, nephrotic syndrome, oedema, jaundice, liver diseases, pancreatitis, disorders of acid- base balance, thyroid and adrenal disorders, disorders associated with metabolism of carbohydrate, lipid ,proteins and nucleotide Clinical scenario based chart discussion	Y	SGL	Skill assessment/ Viva	General Medicine Pathology(VI)
BI 11.15	Describe and discuss the composition of CSF	Y	SGL	Written/Viva /Spotter	
BI 11.23 BI 11.24	Nutrition- Nutritional importance of commonly used food items Calculate energy content of different food Items, food items with high and low glycaemic index and explain the importance of these in the diet Enumerate the advantages and disadvantages of unsaturated, saturated and trans fats in the diet	Y	SGL	Written/Viva /Spotter	
BI 8.3.5	Provide dietary advice for optimal health – Children, adults and Pregnancy And in disease conditions like Diabetes mellitus and Coronary heart disease	Y	SGL	Written/Viva /Spotter	

***Suggested Teaching Learning Method-**This is a general guideline. The faculty have the liberty choose the teaching Learning method- Lecture/SGL /SDL/ECE/Home assignments/Library assignments etc according to the available resources in their institution but within the guideline given by NMC& KUHS



RECOMMENDED BOOKS

1. Text book of Biochemistry for Medical students (latest Edition) – Dr. DM Vasudevan, Dr. Sreekumari. S, Dr. Kannan Vaidyananthan.
2. Text book of Medical Biochemistry (latest edition) – Dr. Rajinder Chawla, Dr. Tarek H. El Metwally, Dr. Suchanda Sahu.
3. Text book of Medical Biochemistry (latest edition)- Dr. Dinesh Puri.
4. Text book of Biochemistry for Medical Students (latest edition) – Dr. Rafi M D
5. Biochemistry (latest edition) -Dr. Satya Narayana.
6. Biochemistry (latest edition) - Dr. Pankaj Naik.

Reference Books

1. Harper's Illustrated Biochemistry (latest edition)- Victor W Rodwell
2. Lippincott Illustrated Reviews – Biochemistry (latest edition) –Richards
3. Lehninger Principles of Biochemistry (latest Edition)-David L Nelson
4. Text book of Biochemistry with Clinical co-relation (latest edition)-Thomas M Devlin
5. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics (latest Edition - Nader Rifai
6. Clinical Chemistry: Principles, Techniques and Correlations Hardcover – Michael L. Bishop

Topic division for Paper I and Paper II

	Topic for paper 1
1	Cell
2	Enzyme
3	Carbohydrate metabolism and related topics
4	Lipid metabolism and related topics
5	Protein metabolism and related topics
6	Minerals
7	Vitamins
8	Biological oxidation
9	Integration of metabolism
10	Nutrition

	Topic for paper 2
1	Nucleotide chemistry and metabolism
2	Acid Base and Fluid Electrolyte Balance
3	Hemoglobin , Heme metabolism and related topics
4	Function Tests
5	Molecular Biology
6	Detoxification
7	Free radicals
8	Extra Cellular Matrix
9	Immunology
10	Laboratory Tests
	The topics to different paper are generally evaluated under those sections. However, a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics

BIOCHEMISTRY PRACTICAL EXAMINATION PATTERN

Practical - 80 marks, Viva - 20 marks, Total - 100 marks

A. Practical Examination -Include -4 Components –Quantitative experiments, Qualitative experiments, OSPE, Spotter (20 marks Each -Total -80 marks)

I Qualitative Analysis

20 Marks

- Questions only from Abnormal urine analysis (Sugar, Ketone body, Protein, blood, Bile salts, Bile pigments)
- Clinical history to be given and the student asked to:
 - decide the relevant tests including both physical and chemical tests
 - do all the physical tests and two relevant chemical tests for confirmation of the provisional diagnosis

Mark division

Physical tests - **4 marks** (for performing all tests and indicating the relevant physical test findings)

Demonstrate two relevant positive/ negative chemical tests and document the procedure, observation and principle and inference –**5 marks each** (Selection of relevant test-1, procedure -1 marks, observation -1 mark and principle and inference -2 mark) **5x2 = 10 marks**

Discussion - **6 marks**

Examples of cases that can be given- Diabetes Mellitus, Diabetic Ketoacidosis, Diabetic Nephropathy, Obstructive, Hepatocellular and Hemolytic Jaundices, Acute Glomerulonephritis, Nephrotic Syndrome etc.

II Quantitative Analysis**20****Marks**

A) Clinical history is to be given and the student asked to:

1. Write 4 relevant laboratory tests to be done in the given case & its biological reference interval

- 4 marks

2. Write the principle (3 marks) & procedure (3 marks) of the prescribed estimation

-6 marks

(Estimation of B. glucose, B. Urea, S. Creatinine, S. Total Protein and S. Albumin)

(1 and 2 may be collected after 15 minutes of giving the question)

3. Do the prescribed estimation correctly within the permissible error limits

-4 marks

4. Discussion

-6

Marks

Note: The students are not required to memorize the quantities of reagents. This may be provided at the exam hall. However, the entire procedure will **not** be provided (only the volumes of the reagents will be provided).

III Spotting**20****Marks**

Ten spotters two marks each with sub-questions (one or two)/each spotter -1 minute -Based on chemical tests/Nutrition /Instruments/ Reference intervals/Electrophoretic pattern/ chromatogram/Picture/ Graphs/Clinical condition or case scenario.

IV OSPE (4 stations/2-5 minutes- 5 marks each)

20 Marks

2 Performance Stations and 2 Response stations (Performance station should be a manned station with check list). One of the performance stations should be for the assessment of AETCOM competencies

OSPE- Performance stations- (TWO)

1. Tests for organic constituents of Normal urine- Urea, Uric acid, Creatinine urobilinogen

(OR)

2. Tests for metabolic screening- Screening tests for carbohydrates (e.g.: Benedict's test, Seliwanoff's test) Screening tests for amino acidurias (e.g. Color reactions specific of Amino acid, DNPH test, Ferric Chloride test etc)

AND

3. Demonstrate the use of glucometer to simulated patients **(AETCOM)**

(OR)

4. Demonstrate the ability to give proper instruction for doing biochemical investigations regarding diet restrictions and other advices using simulated patients – OGTT, 24-hour urine for protein, VMA, etc. **(AETCOM)**

Note: Skills competencies acquired during the Professional Development Programme (AETCOM module) shall be tested during practical and viva.

OSPE Response stations

Response station 1- Must be based on the following.

Principles and Clinical Applications of any one of the following Serum:

Total Cholesterol, TGL, HDL-C, Calcium, Phosphorus, Bilirubin, SGOT, SGPT, ALP

Response station 2 - Based on any one of the following.

- a. Give clinical scenario and ask the student to fill the investigation form provided, correctly writing the relevant investigations and other details.
- b. Clinically relevant biochemical calculations and ratios (Clearance and eGFR, PC ratio, BUN, Anion gap, Lipid profile etc.)
- c. Questions based on Graphs- GTT, MI, Enzyme graphs etc.
- d. Clinical scenario-based questions.

B. Viva - 20 marks

Charts based on clinical scenarios and laboratory findings given and questions asked.

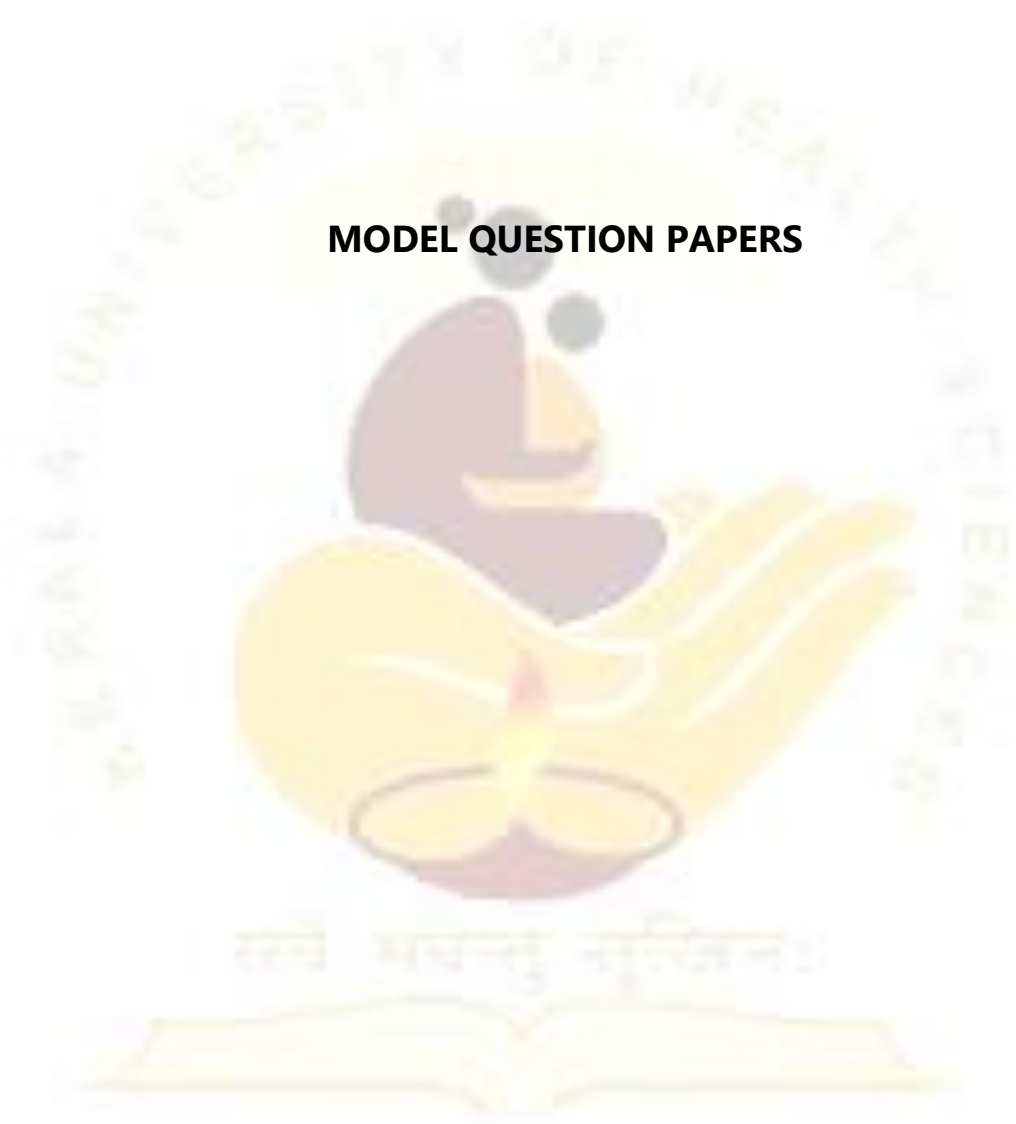
Each examiner may ask two charts. Topics to be divided between four examiners.

for equal representation and to avoid overlapping.

(Each examiner- 2 charts -5 marks/chart= 10 marks.

Add to 40 and can be converted to twenty)

1. Examiner 1 -Function tests, Acid base disorders, Clinical enzymology
2. Examiner 2-Metabolic disorders, Nutritional disorders, Disorders associated with vitamins, minerals, In-born errors of metabolism.
3. Examiner 3 -Commonly used equipment and techniques in Biochemistry, sample collection, preservation, transport and processing Pre and post analytical errors quality control
4. Examiner 4- Genetic disorders, Molecular biology techniques etc.

MODEL QUESTION PAPERS

Model Question Paper

QP code: xxxxxx

RegNo.....

First professional MBBS degree R/S Examinations 2024

Human Anatomy -Paper I (2019 Scheme)

General Anatomy, General Histology, General Embryology, Genetics, Upper limb, Head and Neck, Neuroanatomy, & related Systemic Histology and Embryology

Time: 3 Hrs

Max mark: 100

1. Multiple Choice Questions

(1x20=20)

Question numbers (i-v) are single response type questions.

- i. Which of the following is a powerful supinator in a semi flexed elbow
 - a) Brachialis
 - b) Supinator
 - c) Brachioradialis
 - d) Biceps Brachii
- ii. Which of the following exhibit metachromasia with toluidine blue
 - a) Fibroblast
 - b) Histocyte
 - c) Mast cell
 - d) Plasma cell
- iii. Which of the following actions demonstrate disrespect to the cadavers?
 - a) wrapping undissected parts of the cadaver with a cloth
 - b) leaving dissection wastes on the cadaver
 - c) replacing the cadaver in formalin tanks every weekend
 - d) using carbolic acid to remove fungus from cadaver
- iv. Which of the myotomes gives rise to the muscles of the tongue?
 - a) Pre-occipital
 - b) Occipital
 - c) Cervical
 - d) Otic
- v. The following are intracerebellar nuclei except
 - a) Globosus
 - b) Trapezoid
 - c) Fastigii
 - d) Dentatus

Question numbers (vi-x) are case scenario-based questions.

A 48-year-old female court stenographer is admitted to the orthopaedic clinic with symptoms of carpal tunnel syndrome, with which she has suffered for almost a year.

- vi. Which muscles most typically become weakened in this condition?
 - a) Dorsal interossei
 - b) Lumbricals III & IV
 - c) Thenar
 - d) Palmar interossei
- vii. Which is the nerve likely to be compressed here?
 - a) Median
 - b) Ulnar
 - c) Radial
 - d) Musculocutaneous
- viii. What is the sensory loss in this patient?
 - a) Over the anatomical snuff box
 - b) Over the lateral 3 1/2 digits
 - c) Over medial 1 1/2 digits
 - d) Over the lateral part of palm
- ix. The bones taking part in carpal tunnel are all except

- a) Scaphoid
 - b) Lunate
 - c) Triquetral
 - d) First metacarpal
- x. The clinical effects in carpal tunnel syndrome are all except
- a) Paralysis of thenar muscles
 - b) Paralysis of 3rd & 4th lumbricals
 - c) Weakness in flexing and abducting thumb
 - d) Vasomotor changes in lateral 3 1/2 fingers

Question numbers (xi-xv) consists of two statements-Assertion (A) and reason (R). Answer these questions by selecting the appropriate options given below.

- xi. (A) In the surgical exposure of Radial nerve in spiral groove of humerus, lateral head of triceps brachii need to be divided.
(R) Lateral head of triceps brachii originates from posterior surface of humerus above spiral groove and overlaps radial nerve.
- a) Both A and R are true, and R is the reason for A
 - b) Both A and R are true, and R is not the reason for A
 - c) A is correct but R is incorrect
 - d) A is incorrect but R is correct
- xii. (A) Median cubital vein is chosen for venepuncture
(R) Median cubital vein shunts blood from cephalic vein to basilic vein.
- a) Both A and R are true, and R is the reason for A
 - b) Both A and R are true, and R is not the reason for A
 - c) A is correct but R is incorrect
 - d) A is incorrect but R is correct
- xiii. (A) The circumvallate papillae is innervated by Chorda tympani nerve
(R) The circumvallate papillae develops from cranial part of hypobranchial eminence derived from 3rd pharyngeal arch.
- a) Both A and R are true, and R is the reason for A
 - b) Both A and R are true, and R is not the reason for A
 - c) A is correct but R is incorrect
 - d) A is incorrect but R is correct
- xiv. (A) A stab injury at supraclavicular fossa may result in venous air embolism.
(R) External jugular vein at 2.5cm above clavicle is tightly adherent to deep cervical fascia and is unable to retract upon injury.
- a) Both A and R are true, and R is the reason for A
 - b) Both A and R are true, and R is not the reason for A
 - c) A is correct but R is incorrect
 - d) A is incorrect but R is correct
- xv. (A) Choroid plexus is responsible for production of cerebrospinal fluid.
(R) Tela choroidea refers to pial element of choroid plexus.
- a) Both A and R are true, and R is the reason for A
 - b) Both A and R are true, and R is not the reason for A
 - c) A is correct but R is incorrect
 - d) A is incorrect but R is correct

Question numbers (xvi –xx) are multiple response type questions. Read the statements & mark the answers appropriately.

- xvi. Which of the following statement/s is /are true about allantois?
- i. it is represented by median umbilical ligament in adults.
 - ii. it is involved in the development of urinary bladder.
 - iii. it involutes to form urachus before birth.
 - iv. its persistence can result in occurrence of Meckel's diverticulum.
- a) i, ii, iii
b) i, iii, iv
c) i, ii, iv
d) ii, iii
- xvii. Which of the following statement/s is /are true about osteocytes?
- i. they represent osteoblasts trapped in lacunae due to matrix around.
 - ii. They are located within lacunae and their processes lie in canaliculi
 - iii. They are the precursors of osteoblasts
 - iv. Their processes do not communicate with that of other osteocytes.
- a) i, ii, iii
b) i, iii, iv
c) ii, iii
d) i, ii
- xviii. Which of the following statement/s is /are examples of denoted epiphyses?
- i. Pressure epiphysis: lower end of fibula
 - ii. Aberrant epiphysis: upper end of humerus
 - iii. Traction epiphysis: olecranon process of ulna
 - iv. Atavistic epiphysis: coracoid process of scapula
- a) i, ii, iii
b) i, iii, iv
c) i, ii, iv
d) ii, iii
- xix. Which of the following artery/arteries supply Medulla Oblongata?
- i. Superior cerebellar
 - ii. Anterior spinal
 - iii. Posterior spinal
 - iv. Labyrinthine artery
- a) i, ii, iii
b) i, iii, iv
c) ii, iii
d) i, ii
- xx. Which of the following statement/s is /are true about Trochlear nerve?
- i. It is the only cranial nerve emerging from dorsal aspect of brainstem
 - ii. It is having longest intracranial course
 - iii. Its nucleus lie in superior colliculus of the midbrain
 - iv. It innervates inner ear
- a) i, ii, iii
b) i, iii, iv
c) i, ii, iv
d) i, ii

Long Essays:

(2x10=20)

2. A 34-year-old woman came to the hospital with a nodular swelling in the midline of the neck. The swelling moved with swallowing. On examination, it was found that she had slight tremors on outstretched hands, her pulse rate was 100 per minute and there was slight bulging of the eyes. Blood levels of T3 and T4 were high and TSH level was low. With your knowledge in anatomy, answer the following:
- a) Name the structure that is responsible for midline swelling in the neck.

- b) Give anatomical reason for the movement of swelling with swallowing.
- c) Describe parts and relations of the structure with a diagram.
- d) Describe the clinical importance of the capsules of the structure.
- e) Write briefly on the development of the structure. (1+2+3+2+2=10)

- 3. Describe radial nerve under the headings: origin, course, branches, clinical effect of its injury at various levels. (1+3+2+4=10)

Short Essays:

(6 X 6 =36)

- 4. Describe parts, relations & fibres within Internal capsule. (1+1+4=6)
- 5. Describe stratified epithelium with site of occurrence of each type. (2+2+2=6)
- 6. Describe the formation and anomalies of placenta. (4+2=6)
- 7. Explain karyotyping and its clinical applications. (4+2=6)
- 8. Describe the extent & lymphatic drainage of mammary gland. (2+4=6)
- 9. Describe the location, relations & clinical importance of cavernous sinus. (1+3+2=6)

Short Notes:

(6 X 4 =24)

- 10. Distinguish the microscopic features of hyaline & elastic cartilage.
- 11. Describe Circle of Willis.
- 12. Describe first pharyngeal arch.
- 13. Describe the anatomical basis of Frey's Syndrome.
- 14. Construct a detailed plan of action to emphasise respecting cadavers and derive a protocol for handling biological tissues
- 15. Draw a neat labelled diagram of sagittal section through the Shoulder joint.

Model Question Paper

QP code:xxxxx

RegNo.....

First professional MBBS degree R/S Examinations 2024

Human Anatomy- Paper II

**Thorax, Abdomen & Pelvis, Lower Limb with Concerned Embryology & Histology
(2019 Scheme)**

Time: 3 Hrs

Max. Marks: 100

1. Multiple Choice Questions

(1x20=20)

Question numbers (i-v) are single response type questions.

- i. Locking of knee is produced by
 - a) Quadriceps Femoris
 - b) Popliteus
 - c) Biceps Femoris
 - d) Semimembranosus
- ii. During a pleural tap, the needle pierces the following structures except
 - a) External intercostal muscle
 - b) Internal intercostal muscle
 - c) Innermost intercostal muscle
 - d) Pulmonary pleura
- iii. Which of the following is considered equivalent to vagina in males?
 - a) Seminal colliculus
 - b) Urethral crest
 - c) Prostatic utricle
 - d) Prostatic sinus
- iv. The largest of the spermatogenic cells in seminiferous tubules of testis is
 - a) Spermatogonium
 - b) Primary spermatocyte
 - c) Secondary spermatocyte
 - d) Spermatid
- v. In which year the Anatomy act of India was enacted?
 - a) 1899
 - b) 1900
 - c) 1948
 - d) 1977

Question numbers (vi-x) are case scenario-based questions.

A 58-year-old woman complained of dysphagia (difficulty in swallowing) for the duration of one month. Barium swallow and esophagoscopy were performed. A biopsy taken from the lesion in the lower-third of oesophagus confirmed the diagnosis of malignancy.

- vi. The vertebral extent of oesophagus is
 - a) C5-T11
 - b) C6-T11
 - c) C4-T10
 - d) C3-T10
- vii. All are the structures producing constrictions of oesophagus except
 - a) cricopharyngeus muscle
 - b) left bronchus
 - c) left pulmonary artery
 - d) arch of aorta
- viii. The artery supplying abdominal part of oesophagus is

- a) Inferior phrenic
 - b) Left gastric
 - c) Left gastroepiploic
 - d) right gastric
- ix. The oesophagus develops from
- a) hindgut
 - b) midgut
 - c) foregut
 - d) allantois
- x. The histological feature differentiating lower 1/3 of oesophagus from rest of it is
- a) mucous glands are seen in submucosa
 - b) lining epithelium of lower 1/3 is simple columnar and that of rest of the wall is non-keratinised stratified squamous
 - c) muscularis externa consists of smooth muscles only in lower 1/3 whereas skeletal muscle is seen in rest of the wall
 - d) serous glands are seen in upper part of oesophagus

Question numbers (xi-xv) consists of two statements - Assertion (A) and reason (R).

Answer these questions by selecting the appropriate options given below.

- xi. A. The Ischial head of adductor magnus is grouped under hamstrings
 R: Adductor magnus is inserted to adductor tubercle & tibial collateral ligament of knee joint is its degenerated tendon.
- a) Both A and R are true, and R is the reason for A
 - b) Both A and R are true, and R is not the reason for A
 - c) A is correct but R is incorrect
 - d) A is incorrect but R is correct
- xii. A. Rib cage is formed by sternum, ribs & thoracic vertebra
 R: Bones of the limbs along with girdle constitute appendicular skeleton
- a) Both A and R are true, and R is the reason for A
 - b) Both A and R are true, and R is not the reason for A
 - c) A is correct but R is incorrect
 - d) A is incorrect but R is correct
- xiii. A. Menisci are devoid of blood supply
 R: Menisci are made up of fibrocartilage
- a) Both A and R are true, and R is the reason for A
 - b) Both A and R are true, and R is not the reason for A
 - c) A is correct but R is incorrect
 - d) A is incorrect but R is correct
- xiv. A. Oesophagus is likely to be compressed in left atrial hypertrophy
 R: Oesophagus lies posterior to left atrium
- a) Both A and R are true, and R is the reason for A
 - b) Both A and R are true, and R is not the reason for A
 - c) A is correct but R is incorrect
 - d) A is incorrect but R is correct
- xv. A. The spread of cancer between Prostate & rectum is rare
 R: Denonviller's fascia separates prostate from rectum
- a) Both A and R are true, and R is the reason for A
 - b) Both A and R are true, and R is not the reason for A
 - c) A is correct but R is incorrect
 - d) A is incorrect but R is correct

Question numbers (xvi –xx) are multiple response type questions. Read the statements & mark the answers appropriately.

- xvi. Which of the following statement/s is /are true about Left phrenic nerve?
I. arise from ventral rami of C2, C3, C4
ii. descends between mediastinal pleura and fibrous pericardium
iii. passes through vena caval opening of diaphragm
iv. provides motor supply to diaphragm and carries sensation from central part of diaphragm
a) i, ii, iii
b) i, iii, iv
c) i, ii, iv
d) ii, iii
- xvii. Which of the following statement/s is /are true about inferior vena cava?
i. Passes through diaphragm at 8th thoracic vertebra
ii. Left suprarenal vein directly drains into it
iii. It forms posterior boundary of epiploic foramen
iv. It lies anterior to right renal artery
a) i,ii,iii
b) i,iii,iv
c) i,ii,iv
d) ii,iii
- xviii. Which of the following statement/s is /are true about Vas deferens?
i. terminal part is dilated to form ampulla
ii. it hooks around inferior epigastric artery at deep inguinal ring
iii. related to posterior wall of urinary bladder
iv. it crosses ureter in the region of sacral promontory
a) i, ii, iii
b) i, iii, iv
c) i, ii, iv
d) ii, iii
- xix. Which of the following statement/s is /are true about effects of tibial nerve injury?
I. paralysis of extensor digitorum longus and brevis
ii. Dorsiflexion of foot at ankle joint
iii. sensory loss in posterior calf region
iv. sensory loss along medial border of foot
a) i, ii, iii
b) i, iii, iv
c) i, ii, iv
d) ii, iii
- xx. The structure/s injured while resecting the free edge of lesser omentum is / are?
i. Hepatic artery
ii. portal vein
iii. Hepatic vein
iv. common bile duct
a) i, ii, iii
b) i, iii, iv
c) i, ii, iv
d) ii, iii

Long Essays

(2x10=20)

2. A 30-year-old man was brought to the casualty with a bleeding stab wound in left loin. There was marked swelling in the left renal angle. Plain X-ray of abdomen revealed fracture

of left 11th and 12th ribs. Urine specimen showed frank blood. With your knowledge in anatomy, answer the following:

- a. Which organ is injured detailing anatomical basis for its involvement.
- b. Describe the coverings of the organ.
- c. Describe the anterior relations of the organ.
- d. Describe the development of the organ.

(2+3+3+2=10)

3. Describe hip joint under following headings: articular surfaces, ligaments, relations & movements.

(1+2+3+=10)

Short Essay

(6x6= 36)

4. Describe the origin, course & branches of right coronary artery. (1+2+3=6)
5. Describe the rotation of midgut & developmental anomalies. (4+2=6)
6. Describe the microscopic features of different phases of uterus. (3+3=6)
7. Describe the formation, course, termination & clinical importance of great saphenous vein (1+2+1+2=6)
8. Describe the bronchopulmonary segments & its clinical significance. (4+2=6)
9. Describe the Lymphatic drainage & blood supply of stomach. (3+3=6)

Short Answer

(4x6=24)

10. Distinguish Direct & indirect inguinal hernia
11. Describe the anatomical basis of vomiting of blood (haematemesis) in portal hypertension
12. Describe features in the interior of anal canal.
13. Describe the boundaries & contents of popliteal fossa
14. Reflect on the statement "Cadaver as our first teacher"
15. Draw a neat labelled diagram of Mediastinal surface of right lung

Model Question Paper

QP code: xxxxxx

RegNo.....

First professional MBBS degree R/S Examinations 2024

Physiology -paper-I (2019 Scheme)

Time: 3 Hrs

Max. Marks: 100

1. Multiple Choice Questions

(1x20=20)

Question numbers (i-v) are case scenario-based questions.

A chronic smoker with long –standing bronchial asthma has difficulty in breathing. He was advised to stop smoking and perform pulmonary function tests for further assessment and treatment. Answer the following questions based on this clinical scenario.

- i. He wishes to know which pulmonary function test would be most reproducible and reliable to assess the severity of the disorder.
 - a) FEV1
 - b) FEV2
 - c) FRC
 - d) VC
- ii. Which of the following is true regarding this patient
 - a) Surfactant levels are decreased
 - b) Work of breathing is reduced
 - c) Lung compliance decreases
 - d) Airway resistance is reduced
- iii. Name the type of respiratory disorder seen here
 - a) Restrictive lung disorder
 - b) Histotoxic hypoxia
 - c) Sleep apnea syndrome
 - d) Obstructive lung disorder
- iv. The type of breathing pattern seen here is
 - a) Slow, deep breathing
 - b) Kussmaul's breathing
 - c) Cheyne- Stokes breathing
 - d) Rapid, shallow breathing
- v. Which of the following is the most appropriate treatment for this patient
 - a) Diuretics
 - b) Bronchodilators
 - c) Hyperbaric oxygen therapy
 - d) Arterio-venous shunts

For Questions (vi-x), there are 2 statements marked as Assertion (A) and Reason (R). Mark your answer as per the options provided.

- vi. (A)- Coronary blood flow is more during systole
(R)- Coronary arteries undergo extramural compression
 - a) Both A & R are correct and R is the reason for A
 - b) Both A& R are correct but R is not reason for A
 - c) A is correct R is incorrect
 - d) A is incorrect R is correct
- vii. (A)- Apnoea is seen during deglutition

(R)- Swallowing centre inhibits respiratory centre during deglutition

- a) Both A & R are correct and R is the reason for A
- b) Both A & R are correct but R is not reason for A
- c) A is correct R is incorrect
- d) A is incorrect R is correct

viii. (A)- von Willebrand factor deficiency causes clotting time prolongation

(R)- von Willebrand factor helps in platelet adhesion.

- a) Both A & R are correct and R is the reason for A
- b) Both A & R are correct but R is not reason for A
- c) A is correct R is incorrect
- d) A is incorrect R is correct

ix. (A)-Hypercapnia stimulates central chemoreceptors

(R)-Stimulation of potassium channels cause chemoreceptor stimulation

- a) Both A & R are correct and R is the reason for A
- b) Both A & R are correct but R is not reason for A
- c) A is correct R is incorrect
- d) A is incorrect R is correct

x. (A)- Flare reaction is a feature of Axon reflex

(R)- Arteriolar dilatation is due to orthodromic conduction

- a) Both A & R are correct and R is the reason for A
- b) Both A & R are correct but R is not reason for A
- c) A is correct R is incorrect
- d) A is incorrect R is correct

Question numbers (xi –xv) are multiple response type questions. Read the statements & mark the answers appropriately.

xi. If a drug that blocks sodium reabsorption is taken, it will cause-

- 1. Decrease in water reabsorption
 - 2. Decrease in amino acid reabsorption
 - 3. Increase in glucose reabsorption
 - 4. Decrease in chloride reabsorption
- a) 1, 2 and 3
 - b) 2, 3 and 4
 - c) 1, 3 and 4
 - d) 1, 2 and 4

xii. Heterometric regulation of cardiac output is determined by

- 1. Respiratory rate
 - 2. Heart rate
 - 3. Blood volume
 - 4. Stroke volume
- a) 1, 2 and 3
 - b) 2, 3 and 4
 - c) 1, 3 and 4
 - d) 1, 2 and 4

xiii. Pitting oedema can be caused by-

- 1. Hepatic dysfunction
- 2. Hypothyroidism

3. Hypertension

- a) 1, 2 and 3
- b) 2, 3 and 4
- c) 1, 3 and 4
- d) 1, 2 and 4

4. Congestive cardiac failure

xiv. With respect to ABO blood group system, following are true-

- 1. Follows autosomal dominant inheritance
 - 2. Found in saliva
 - 3. Antibodies to A and B antigens are complete antibodies
 - 4. Attached to plasma proteins
- a) 1, 2 and 3
 - b) 2, 3 and 4
 - c) 1, 3 and 4
 - d) 1, 2 and 4

xv. Features of WPW syndrome include:

- 1. Elevated ST interval
 - 2. Shortened PR interval
 - 3. Delta wave
 - 4. Widening of QRS complex
- a) 1, 2 and 3
 - b) 2, 3 and 4
 - c) 1, 3 and 4
 - d) 1, 2 and 4

Question numbers (xvi-xx) are single response type questions.

xvi. Normal Serum albumin level is

- a) 3-5g%
- b) 5-10g%
- c) 4-6g%
- d) 7-9 g%

xvii. Oxygenation of Haemoglobin lowers its affinity for CO₂. This is called-

- a) Bainbridge effect
- b) Haldane effect
- c) Bohr effect
- d) Herring- Breur effect

xviii. Which of the following has the highest pH-

- a) Small intestinal juice
- b) Gastric juice
- c) Hepatic bile
- d) Pancreatic juice

xix. As part of cardiac adjustments in exercise, the blood vessels of skeletal muscles show

- a) Sympathetic vasoconstriction
- b) Sympathetic vasodilatation
- c) Parasympathetic vasoconstriction
- d) Parasympathetic vasodilatation

xx. Tachycardia in hypertension is stimulated by-

- a) Increase in vagal tone
- b) Beta-1 adrenergic receptors
- c) Sino-aortic reflex
- d) Renin-angiotensin-aldosterone mechanism

Long Essays**(2x10=20 Marks)**

2. A 45-year-old business man was brought to the emergency medicine department after a road traffic accident. He had a broken femur and deep wound on the legs, was disoriented and irritable. On examination, his BP was 70/40mm Hg, respiratory rate was 24/minute and pulse rate was 150 beats /minute. His ECG did not show any abnormalities
 - a. What is the most probable diagnosis?
 - b. Describe the physiological basis of the features mentioned above.
 - c. Add a note on baroreceptor reflex. (1+4+5)
3. Explain the enteric nervous system and its components. Add a note on the movements of large intestine. Write briefly on the skills needed to convey the clinical condition of Hirschsprung's disease in a child to the family. (2+3+5)

Short Essay**(6x6= 36)**

4. Explain the intrinsic pathway of blood coagulation.
5. Give the differentiating features between different types of hypoxia.
6. Describe the body's mechanisms of response to cold.
7. Counter current multiplier system.
8. Describe the factors affecting erythropoiesis.
9. Describe glucose reabsorption. Add a note on TMG.

Short Answer**(4x6=24)**

10. Give the physiological basis of bleeding in obstructive jaundice.
11. Draw a neat labelled diagram of the oxygen dissociation curve.
12. Give the physiological basis of myocardial infarction on rapid ascent from deep sea.
13. Describe with a neat labelled diagram the juxta glomerular apparatus.
14. Give the physiological basis of antibiotic treatment in peptic ulcer.
15. Explain the aortic pressure changes with a neat labelled diagram.

Model Question Paper

QP code:xxxxx

RegNo.....

First professional MBBS degree R/S Examinations 2024

Physiology- paper-II (2019 Scheme)

Time: 3 Hrs

Max. Marks: 100

1. Multiple Choice Questions

(1x20=20)

Question numbers (i-v) are case scenario-based questions.

A 35-year-old woman came to OPD with complaints of double vision, difficulty in chewing, swallowing and talking as well as weakness affecting mainly her upper limbs that become worse towards evening. After her blood test results and a physical exam, she was diagnosed with Myasthenia Gravis and neostigmine was prescribed.

- i. True about Myasthenia Gravis
 - a) Autosomal dominant
 - b) Antibodies are formed against muscarinic Ach receptor
 - c) Tolerance of acquired immune system to one's tissue is depressed
 - d) Pseudohypertrophy of calf muscles
- ii. Which of the following symptoms is NOT commonly associated with Myasthenia Gravis?
 - a) Fatigue
 - b) Resting tremor
 - c) Drooping of eyelids
 - d) Diplopia
- iii. End plate potential
 - a) Obeys All or none law
 - b) Hyperpolarizing potential
 - c) Can be Propagated
 - d) Can be Summated
- iv. Neostigmine helps to improve the symptoms associated with myasthenia gravis by
 - a) Activating acetyl choline
 - b) Increasing the destruction of acetyl choline
 - c) Activating choline esterase
 - d) Inhibiting acetylcholine esterase
- v. Curare
 - a) Inhibits release of acetylcholine from presynaptic membrane
 - b) Compete with acetylcholine for the same receptors on post synaptic membrane
 - c) Cause persistent depolarization
 - d) Inhibit choline esterase

**For Questions (vi-x), there are 2 statements marked as Assertion (A) and Reason (R).
Mark your answer as per the options provided**

- vi. (A): Oral rehydration solution (ORS) is used to treat dehydration caused by diarrhoea
(R): Glucose stimulates sodium and fluid reabsorption from intestine
 - a) Both A & R are correct and R is the reason for A
 - b) Both A & R are correct but R is not reason for A
 - c) A is correct R is incorrect
 - d) A is incorrect R is correct
- vii. (A): Chronaxie is an index of the excitability of a tissue
(R): Chronaxie is the minimum strength of current which when applied for an adequate time produce a response.

- a) Both A & R are correct and R is the reason for A
 - b) Both A& R are correct but R is not reason for A
 - c) A is correct R is incorrect
 - d) A is incorrect R is correct

- viii. (A): Classical contraceptive pill prevents fertility without inhibiting ovulation
(R): Classical contraceptive pill contains orally active progesterone and small amounts of estrogen.
 - a) Both A & R are correct and R is the reason for A
 - b) Both A& R are correct but R is not reason for A
 - c) A is correct R is incorrect
 - d) A is incorrect R is correct

- ix. (A): Spinal shock refers to the acute loss of motor, sensory, and reflex functions below the level of spinal cord transection
(R): Neurogenic shock results in loss of sympathetic stimulation to the blood vessels and unopposed vagal activity.
 - a) Both A & R are correct and R is the reason for A
 - b) Both A& R are correct but R is not reason for A
 - c) A is correct R is incorrect
 - d) A is incorrect R is correct

- x. (A): Cushing syndrome can cause hypertension, impaired glucose tolerance and dyslipidemia
(R): Aldosterone causes salt and water retention increasing blood volume and therefore blood pressure.
 - a) Both A & R are correct and R is the reason for A
 - b) Both A& R are correct but R is not reason for A
 - c) A is correct R is incorrect
 - d) A is incorrect R is correct

Question numbers (xi –xv) are multiple response type questions. Read the statements & mark the answers appropriately.

- xi. Correct statements regarding stretch reflex
 - 1) Monosynaptic reflex
 - 2) Receptor is extrafusal fibre
 - 3) Control body posture
 - 4) Highly developed in antigravity muscles
 - a) 1, 2 and 3
 - b) 2, 3 and 4
 - c) 1, 3 and 4
 - d) 1, 2 and 4

- xii. Olfactory receptors are
 - 1) Chemoreceptors
 - 2) G protein coupled receptors
 - 3) Slowly adapting receptors
 - 4) in direct contact with external environment
 - a) 1, 2 and 3
 - b) 2, 3 and 4
 - c) 1, 3 and 4
 - d) 1, 2 and 4

- xiii. Somatostatin is produced in
- 1) Stomach
 - 2) Pancreatic islets
 - 3) Thalamus
 - 4) Hypothalamus
- a) 1, 2 and 3
b) 2, 3 and 4
c) 1, 3 and 4
d) 1, 2 and 4
- xiv. Human chorionic gonadotropin
- 1) Produced primarily by syncytiotrophoblastic cells of the placenta
 - 2) Stimulates the corpus luteum to produce progesterone to maintain the pregnancy
 - 3) Not absolutely specific for pregnancy
 - 4) Maximum production during third trimester of pregnancy
- a) 1, 2 and 3
b) 2, 3 and 4
c) 1, 3 and 4
d) 1, 2 and 4
- xv. Secretion of oxytocin is increased by
- 1) Milk ejection
 - 2) Prolactin
 - 3) Dilation of cervix
 - 4) Suckling
- a) 1, 2 and 3
b) 2, 3 and 4
c) 1, 3 and 4
d) 1, 2 and 4

Question numbers (xvi-xx) are single response type questions.

- xvi. EEG rhythm having lowest frequency
- a) Alpha
 - b) Beta
 - c) Delta
 - d) Theta
- xvii. All the following statements are true EXCEPT
- a) Spermatogonia and Leydig cells are present in seminiferous tubules
 - b) Sertoli cell provide nutrition to germ cell
 - c) Leydig cell secrete androgens
 - d) Small blood vessels are present along Leydig cells
- xviii. Examination of a patient with cerebellar lesion revealed slurred speech, dysmetria on left side with finger-to-nose testing. His gait was normal. The site of lesion will be
- a) Cerebellar vermis
 - b) Flocculonodular lobe
 - c) Left cerebellar hemisphere
 - d) Right fastigial nucleus
- xix. Somatomedin mediates
- a) Protein synthesis
 - b) Lipolysis
 - c) Gluconeogenesis
 - d) Decreased glucose uptake by cells
- xx. Neurotransmitter involved in presynaptic inhibition
- a) Dopamine
 - b) Glutamate
 - c) Glycine
 - d) GABA

Long Essays**(2x10=20 Marks)**

2. A 45-year-old female came to OP with complaints of progressive weight gain in 1 year, fatigue, deepening of her voice, somnolence, dry skin, constipation and cold intolerance. O/E Temperature is 96.40F, Pulse 58/mt, BP 110/86 mm Hg. She had puffy face with pale, cool, dry and thick skin. Deep tendon reflexes are delayed.
- What is your probable diagnosis?
 - Explain the physiological basis of the symptoms and physical findings that made you consider that diagnosis.
 - List the lab data that will support the diagnosis. (1 + 7 + 2)
3. Draw and label corticospinal tract showing its origin, course and termination. List the differences between upper motor neuron and lower motor neuron lesion. (5 + 5)

Short Essay**(6x6= 36)**

- With the help of a flow chart, explain the mechanism of skeletal muscle contraction.
- Describe passive transport mechanisms across cell membrane.
- Describe the functions of middle ear.
- Explain the ovarian changes during menstrual cycle giving its hormonal basis.
- List 8 functions of hypothalamus and explain any one function.
- Differentiate the actions of parathyroid hormone and Vitamin D in calcium metabolism.

Short Answer**(4x6=24)**

- Draw and label nerve action potential giving its ionic basis.
- Physiological basis of lactational amenorrhea.
- Draw and label light reflex pathway.
- Physiological basis of main symptoms of diabetes mellitus.
- Explain positive and negative feedback regulation giving suitable examples.
- Enumerate and describe professional qualities and roles of a physician.

Model Question Paper-2019 scheme

QP code:XXXXXX

Reg No:.....

First professional M.B.B.S degree R /S Examinations 2024

Biochemistry- Paper I

Time: 3hrs

Max. marks: 10

1. Multiple Choice Questions

(1x20=20marks)

Question numbers (i-v) are single response type questions.

- (i) The product of oxidation of odd chain fatty acids is
- Aceto Acetyl CoA
 - Malonyl CoA
 - Propionyl CoA
 - Fumaryl CoA
- (ii) Pulses are deficient in
- Lysine
 - Threonine
 - Methionine
 - Tryptophan
- (iii) Main lipid component of lung surfactant is
- Dipalmitoyl Phosphatidyl Choline
 - Dipalmitoyl Phosphatidyl serine
 - Phosphatidyl ethanolamine
 - Phosphatidyl inositol
- (iv) The enzyme which act on the specified peptide bond
- Gly Ala Val Ile Lys Phe Trp Ser His leu- Arg Tyr Gly coo-
- Trypsin
 - Pepsin
 - Elastase
 - Chymotrypsin
- (v) Aldolase belongs to the following enzyme class
- Class 2
 - Class 3
 - Class 4
 - Class 5

Question numbers (vi –x) are multiple response type questions. Read the statements & mark the answers appropriately.

- (vi) Regarding creatine kinase (CK) as a marker for myocardial infarction (MI) choose the correct statements
- Level starts to rise within 3-6 hours of MI
 - Level peaks by 3-72 hours
 - Remains elevated for 7-10 days post MI
 - Normal level of CK MB is less than 5% of total CK
- 1,2 and 3
 - 2,3 and 4
 - 3&4
 - 1,2 &4

(vii) The false statements about beta-oxidation of palmitic acid are

- 1) Activation of fatty acid is the rate-limiting enzyme
 - 2) Carnitine acyl transferase I is inhibited by malonyl Co A
 - 3) Net energy yield is 108 ATP
 - 4) Ketotic hypoglycemia is a feature of Long chain fatty acyl CoA dehydrogenase deficiency
- a) 1&2
 - b) 2&3
 - c) 3&4
 - d) 1,3&4

(viii) True about RBC metabolism

- 1) RBCs depend solely on Glycolysis for energy
 - 2) End product of glycolysis in RBC is acetyl Co A
 - 3) GLUT 3 is the glucose transporter
 - 4) 30% of glucose is utilized for HMP shunt pathway
- a) 1,2 &3
 - b) 2,3&4
 - c) 1,3&4
 - d) 1,2&4

(ix) Choose the correct statement about protein complexes of Electron transport chain

- 1) Arranged in the order of decreasing redox potential
 - 2) Located in the soluble matrix of mitochondria
 - 3) Connected by two mobile carriers Coenzyme Q and Cytochrome oxidase
 - 4) Barbiturates inhibit Complex I
- a) 1,2 &3
 - b) 2,3&4
 - c) 1,3&4
 - d) 3&4

(x) In iron deficiency anemia

- 1) Serum ferritin level is decreased
 - 2) Transferrin level is increased
 - 3) Soluble transferrin receptor level is decreased
 - 4) TIBC is decreased
- a) 1,2 &3
 - b) 2,3&4
 - c) 1,3&4
 - d) 1,2&4

Question numbers (xi-xv) consists of two statements - Assertion (A) and reason (R). Answer these questions by selecting the appropriate options given below.

(xi) Assertion (A): Antituberculosis treatment with isonicotinic acid Hydrazide(INH) causes vitamin B6 deficiency

Reason (R) : INH inhibit absorption of pyridoxine

- a) Both A and R are correct but R is not the reason for A
- b) A correct R incorrect
- c) A incorrect R Correct
- d) Both A and R are incorrect

(xii) Assertion (A): Vitamin B12 deficiency causes folate deficiency

Reason (R). Conversion of methyl THFA to THFA require vitamin B12

- a) Both A and R are correct, R is the reason for A
- b) A Correct R incorrect
- c) A incorrect R Correct

d) Both A and R incorrect

(xiii) Assertion (A) Blood sample for glucose estimation is collected in Fluoride tubes

Reason(R). Fluoride inhibit aldolase

- a) Both A and R are correct but R is not the reason for A
- b) A correct R incorrect
- c) A incorrect R Correct
- d) Both A and R incorrect

(xiv) Assertion (A). Muscle will release glucose to blood during fasting (R). Muscle lacks glycogen synthase enzyme

- a) Both A and R are correct but R is not the reason for A
- b) A correct R incorrect
- c) A incorrect R Correct
- d) Both A and R incorrect

(xv) Assertion (A) Alpha helix is generally right handed. Reason (R) Amino acids present in proteins are of L variety

- a) Both A and R are correct but R is not the reason for A
- b) A incorrect R Correct
- c) Both A and R incorrect
- d) Both A and R are correct, R is the reason for A

Question numbers (xvi-xx) are case scenario-based questions.

A 42-year-old man working as CEO of a corporate company came for a routine health checkup his fasting lipid profile levels are as follows. Total Cholesterol -380 mg/dl, Triglycerides-150mg/dl, HDL C-45mg/dl. His father died at the age of 52 due to myocardial infarction and his elder brother also had undergone angioplasty for Ischemic heart disease. His physical examination is remarkable for bilateral Achilles tendon thickening/xanthomas and a right carotid bruit

(xvi) The most likely molecular defect in the above case

- a) Apo CII deficiency
- b) Lipoprotein lipase deficiency
- c) LDL receptor defect
- d) Apo E defect

(xvii) What is the LDL-C level in this patient calculated by friedewald's formula

- a) 185 mg/dl
- b) 335mg/dl
- c) 305 mg/dl
- d) 230mg/dl

(xviii) Recommended LDL-C level for this patient is

- a) < 100mg/dl
- b) <130mg/dl
- c) < 150mg/dl
- d) < 200mg/dl

(xix) You decide to treat a patient who has very high levels of serum cholesterol with the statin drug atorvastatin. Statins are competitive inhibitors of

- a) HMG CoA synthase.
- b) HMG CoA lyase.
- c) HMG CoA reductase.
- d) HMG CoA oxidase

(xx) The recommended dietary modifications for this patient will include all the following EXCEPT

- a) Reduced intake of saturated fat
- b) Increased consumption of simple carbohydrates
- c) Increased consumption of dietary fibre
- d) Reduced intake of dietary cholesterol

Long Essays

(2x10=20marks)

2. 2-week-old infant was presented with refusal to feed, vomiting and recurrent episodes of convulsions. The baby was lethargic and the laboratory investigations revealed high levels of ammonia and glutamine, low urea level in blood and high levels of glutamine and orotic acid in urine
 - 1) Identify the enzyme defect (1 mark)
 - 2) Describe the sources of ammonia formation and various mechanisms for the detoxification and disposal of ammonia (3+6 =9 marks)
3. Delineate the pathway of synthesis of glucose from lactate. Explain the mechanisms of regulation of the pathway. Calculate the energy requirement for the synthesis of a molecule of glucose (5+3+2=10 marks)

Short Essays

(6x6=36 marks)

4. A 36-year-old male came with high grade fever and chills. He gave history of travelling to northeast states of India. He was diagnosed with malaria. He was prescribed with anti-malarial drugs. Next day he reported with passing of high colored urine. On further investigation the person is found to have low G6PD levels which resulted in drug induced hemolysis
 - 1) Explain the mechanism of drug induced hemolysis in G6PD deficiency (3marks)
 - 2) Discuss the physiological significance of HMP shunt pathway (3 marks)
5. Differentiate between kwashiorkor and marasmus
6. Substantiate LDL is proatherogenic and HDL is antiatherogenic
7. Explain the biochemical basis of clinical and laboratory findings in Von Gierk's disease
8. Summarise the functions of prostaglandins and validate their therapeutic applications
9. Compare and contrast competitive and non-competitive enzyme inhibition

Short answers

(6x4=24 marks)

10. Describe the tertiary structure of protein with suitable example
11. Causes of Steatorrhea
12. Describe the compounds synthesized from Glycine
13. Give reason-
 - a) Mousy odour of sweat and urine in phenyl ketonuria
 - b) Niacin deficiency is common in population with maize as staple diet
14. Describe the Biochemical basis of –
 - a) Bleeding manifestations in scurvy
 - b) Congenital cataract in galactosemia
15. As a primary care physician what are the dietary advises you will give to a newly diagnosed Type 2 diabetic patient

Model Question Paper-2019 scheme

QP code:XXXXXX

Reg No:.....

First professional M.B.B.S degree R/S Examinations 2024

Biochemistry -Paper II

Time: 3hrs

Max. marks: 100

1. Multiple Choice Questions

(1x20=20marks)

Question numbers (i-v) are single response type questions.

- (i)** Which is a Nucleotide
 - a) Nitrogenous base + Sugar
 - b) Nitrogenous base + Phosphate.
 - c) Nitrogenous base + Phosphate+ Sugar
 - d) Nucleoside + sugar
- (ii)** Amino acid involved in both purine and pyrimidine synthase
 - a) Glycine
 - b) Glutamine
 - c) Aspartic acid
 - d) Glutamic acid
- (iii)** Predominant Immunoglobulin of primary response is
 - a) Ig A
 - b) Ig D
 - c) Ig G
 - d) Ig M
- (iv)** Hemolysed samples give falsely high value for all EXCEPT
 - a) Potassium
 - b) Magnesium
 - c) LDH
 - d) Bilirubin
- (v)** Best suited anticoagulant for biochemical estimations is
 - a) Heparin
 - b) EDTA
 - c) Citrate
 - d) Oxalate

Question numbers (vi –x) are multiple response type questions. Read the statements & mark the answers appropriately.

- (vi)** Regarding Bence- Jones protein in multiple myeloma choose the correct statements
 - 1) Monoclonal light chains excreted through urine
 - 2) Formed due to synchronous production of L & H chain
 - 3) Precipitate between 45-60 degree C
 - 4) Seen in 80% patients with multiple myeloma
 - a) 1,2 and 3
 - b) 2,3 and 4
 - c) 3&4
 - d) 1 ,3 & 4
- (vii)** Factors affecting Electrophoresis are
 - 1) Net charge of the particle

- 2) Mass and size
- 3) Temperature
- 4) pH of the medium
- a) 1&2,
- b) 2&3
- c) 1,3&4
- d) 1 &4

(viii) Select the incorrect pair

- 1) Ataxia telangiectasia – Double strand break repair
- 2) Xeroderma pigmentosa - Nucleotide excision repair
- 3) Cockayne syndrome - Mismatch repair
- 4) Lynch syndrome-Base Excision repair
- a) 1,2 &3
- b) 2,3&4
- c) 1,3&4
- d) 1,2&4

(ix) Choose the correct statement about DNA polymerases (DNAP) of eukaryotes

- 1) DNAP alpha has the primase activity
- 2) DNAP Delta is responsible for lagging strand synthesis
- 3) DNAP Beta synthesize the leading strand
- 4) DNAP epsilon involved in DNA repair
- a) 1,2 &3
- b) 2,3&4
- c) 1,3&4
- d) 1,2&4

(x) Choose the correct statement about thyroid function test

- 1) TSH is decreased and T3 and T4 decreased in secondary hypothyroidism
- 2) TSH increased and T3 and T4 increased in secondary hyperthyroidism
- 3) TSH decreased and T3 and T4 increased in primary hyperthyroidism
- 4) TSH increased and T3 and T4 decreased in primary hypothyroidism
- a) 1,2 &3
- b) 2,3&4
- c) 1 &4
- d) 1,2,3, &4

Question numbers (xi-xv) consists of two statements - Assertion (A) and reason (R). Answer these questions by selecting the appropriate options given below.

(xi) Assertion (A): In sickle cell anemia, sickling of RBCs occur due to polymerization of hemoglobin molecules in the oxygenated state

Reason (R): In HbS glutamic acid in the 6th position of beta chain of HbA is replaced by valine

- a) Both A and R are correct but R is not the reason for A
- b) A incorrect R Correct
- c) Both A and R are incorrect
- d) Both A and R are correct, R is the reason for A

(xii) Assertion (A): Ammonia excretion is decreased in acidosis

Reason (R): Glutaminase is suppressed by acidosis

- a) Both A and B are correct but R is not the reason for A
- b) A Correct R incorrect
- c) A incorrect R Correct
- d) Both A and R incorrect

(xiii) Assertion (A) Hyperventilation causes tingling and paresthesia

Reason (R). Hyperventilation causes alkalosis which favors binding of calcium with protein

- a) Both A and R are correct but R is not the reason for A
- b) A incorrect R Correct
- c) Both A and R incorrect
- d) Both A and R are correct, R is the reason for A

(xiv) Assertion (A). Lead poisoning causes anemia

Reason (R). Lead inhibit PBG deaminase

- a) Both A and R are correct but R is not the reason for A
- b) A correct R incorrect
- c) A incorrect R Correct
- d) Both A and R are correct, R is the reason for A

(xv) Assertion (A): Alcohol precipitate gouty attack

Reason(R): Alcohol causes lactic acid accumulation

- a) Both A and R are correct but R is not the reason for A
- b) A correct R incorrect
- c) A incorrect R Correct
- d) Both A and R are correct, R is the reason for A

Question numbers (xvi-xx) are case scenario-based questions.

A 19-year-old female was admitted to the emergency department with acute abdominal pain. Finding on abdominal examination is nonspecific. Ultra sound examination of abdomen was normal. Laboratory tests revealed normal blood counts, but elevated serum and urine ALA and porphobilinogen levels

(xvi) The most likely enzyme defect in the above case

- a) UPG -1 synthase
- b) UPG III Co synthase
- c) UPG decarboxylase
- d) CPG III oxidase

(xvii) Test to detect the presence of PBG in urine

- a) Silver nitroprusside test
- b) Cyanide nitroprusside test
- c) DNPH test
- d) Watson-Schwartz test

(xviii) Following clinical manifestation is NOT observed in the above condition

- a) Peripheral neuropathy
- b) Psychiatric symptoms
- c) Photosensitivity
- d) Clear urine when freshly voided

(xix) All are precipitating factors for the above condition EXCEPT

- a) Barbiturate
- b) High carbohydrate diet
- c) Alcohol
- d) Steroid hormones

(xx) The specific treatment for this condition to give intravenous heme infusion to suppress the activity of the following enzyme

- a) ALA synthase
- b) ALA dehydratase
- c) PBG deaminase
- d) UPG co synthase

Long Essays

(2x10=20marks)

2. A 45-year-old overweight female reported abdominal pain, loss of appetite, tiredness, nausea, passage of clay-coloured stool, dark yellow urine and intolerance to fatty food. On examination, she has tenderness in the right hypochondrium, liver enlargement and yellowish discolouration of skin and sclera. Lab reports reveal the following: Serum bilirubin- Total 12 mg/dl, Indirect -3 mg/dl, Serum ALT- 90 U/L Serum AST-106 U/L Serum Alkaline phosphatase -680U/L
 - a) What is the type of jaundice? Substantiate with relevant clinical and laboratory findings (2 marks)
 - b) Differentiate different types of jaundice based on the laboratory investigations (4 marks)
 - c) Briefly describe the formation and excretion of bilirubin (4 marks)
3. Compare the process of transcription in prokaryotes and eukaryotes. Add a note on post transcriptional modification (6+4=10 marks)

Short Essays

(6x6=36 marks)

4. A 38-year-old male reported with excruciating pain and swelling of first metatarsal joint. He gave history of attending a party in the previous night where he had taken pretty large quantity of alcoholic drinks. On examination his uric acid levels were elevated. He was diagnosed with gout
 - a) Explain the biochemical basis of why alcohol precipitate a gouty attack
 - b) Discuss the other causes of gout and biochemical basis management of gout
5. Describe the types of mutation with suitable examples
6. Describe the principles and applications of PCR
7. Explain the role of oncogenes in carcinogenesis with examples
8. Analyze the structure –function relation of collagen
9. Explain the role of kidney in the regulation of acid base balance in health and disease

Short answers

(6x4=24 marks)

10. List any four reactions generating reactive oxygen species
11. Orotic aciduria
12. Write four examples of phase 2 detoxification reactions
13. Give reason-
 - a. Hyperventilation in metabolic acidosis
 - b. Blood sample for cortisol estimation should be collected before 8AM
14. Biochemical basis of
 - a. Phototherapy in neonatal jaundice
 - b. Methotrexate resistance in cancer therapy
15. You are working as an intern in the paediatric department. One of your patients is a 4-year-old child admitted with nephrotic syndrome, need 24-hour urine protein estimation. Prepare the instructions to be given to the mother of this patient
