

MBBS Teaching Time Table

Days/Times	9-10 AM	10-11 AM	11-1 PM	1-2 PM	2-4 PM		4-5 PM
Mon	Physiology (L)	Anatomy (L)	Dissection (B,C) /Histology-A	L U N C H	Practical (Phy.[A,B]/Bio.[C])		Elective/Anatomy
Tue	Anatomy (L)	Physiology (L)	Dissection (A,C) /Histology-B		Practical (Phy.[B,C]/Bio[A])		Elective/ Physiology
Wed	Biochemistry (L)	Anatomy (L)	Dissection (B,C) /Histology-C		Practical (Phy.[C,A]/Bio.[B])		Elective/Biochemistry
Thu	Physiology (L)	Biochemistry (L)	Dissection (A,B,C)		Physiology (Tutorial)	Biochemistry (Tutorial)	Elective/Anatomy
Fri	Biochemistry (L)	Anatomy (L)	Dissection (A,B,C)		Physiology (L)	Biochemistry (Tutorial)	Elective/Physiology
Sat	Anatomy (L)	Physiology (L)	Community Medicine		Anatomy (L)	Elective/Biochemistry	

Roll No. 1-50 (A)

Roll No. 51-100 (B)

Roll No. 101-150 (C)

Syllabus of Anatomy

Anatomy

Goal:

The broad goal of the teaching of undergraduate students in Anatomy aims at providing comprehensive knowledge of the gross and microscopic structure and development of human body to provide a basis for understanding the clinical correlation of organs or structures involved and the anatomical basis for the disease presentations.

Objectives:

A) Knowledge:

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

- a) Comprehend the normal disposition, clinically relevant interrelationships, functional and cross sectional anatomy of the various structures in the body.
- b) Identify the microscopic structure and correlate elementary ultra-structure of various organ and tissues and correlate the structure with the functions as a prerequisite for understanding the altered state in various disease processes.
- c) Comprehend the basic structure and connection of the central nervous system to analyses the integrative and regulative function of the organs and systems. He/She should be able to locate the site of gross lesions according to the deficits encountered.
- d) Demonstrate knowledge of the basic principles and sequential development of the organs and systems, recognize the critical stages of development and the effects of common teratogens, genetic mutations and environmental hazards. He/She should be able to explain the developmental basis of the major variations and abnormalities.

B) Skills:

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

- a) Identify and locate all the structures of the body and mark the topography of the living anatomy.
- b) Identify the organs and tissues under the microscope
- c) Understand the principles of karyotyping and identify the gross congenital anomalies.
- d) Understand principles of newer imaging techniques and interpretation of computerized Tomography (CT) Scan, Sonogram etc.
- e) Understand clinical basis of some common clinical procedures i.e. intramuscular & intravenous injection, lumbar puncture and kidney biopsy etc.

C) Integration:

From the integrated teaching of other basic sciences students should be able to comprehend the regulation and integration of the function of the organs and systems in the body and thus interpret the anatomical basis of disease process.

I Semester
General Anatomy
(7+6 hours)

Learning outcomes:

At the end of the semester the students should be able to..

- Mention briefly about the history of anatomy. To state briefly nomenclature, subdivisions, terms and arrangements of anatomical structures.
- Enlist the different types of skin, fascia and tissues and describe them.
- State the nomenclature, types, parts, attachments and mechanics of muscles.
- Mention different types of blood vessels, capillaries and sinusoids, components and functions of lymphatic system and structure of lymph node.
- Classify the nervous system and describe the structure and types of neurons, neuroglia cells cranial and spinal nerves
- Classify and mention the functions, growth, blood supply and ossification of bones.
- Define, classify and describe movements and structure of joints. To know in detail about the synovial joints.

Lectures (7 hours)

1. Introduction to anatomy-Anatomical terms, positions, (1) skin, fascia, connective tissue(1)
2. General anatomy- Muscles-types, attachments and actions(1)
3. General anatomy-blood vessels and lymphatics (1)
4. Nerves-Plexus, Cranial and spinal nerves, Autonomic Nervous System(1)
5. General anatomy-bones – types, general features, growth, blood supply, ossification, etc (1)
6. General anatomy- joints- classification and structure (1)

Practicals (6 hours)

1. General instructions, introduction to anatomy.
2. General anatomy (4)

General Histology **(14+28 hours)**

Learning outcomes:

At the end of the course the students should be able to...

Microscope and Epithelia:

- Classify the different types of epithelia with examples and labelled diagrams for each.

Connective Tissue:

- Classify connective tissue describe the different components of the connective tissue.
- Classify collagen fibers with examples and describe adipose tissue.
- Draw neat labelled diagrams for collagen, elastic fibers and adipose tissue.

Cartilage:

- Enlist and describe types of cartilages, components with examples for each
- Draw neat labelled diagrams for hyaline, elastic and white fibro cartilage.

Bone:

- Describe structure of compact bone (TS & LS): periosteum, endosteum, lamellae, lacunae, different types of cells of bone; Haversian system/osteon in detail.
- Draw neat labelled diagram for bone TS & LS.

Nervous Tissue:

- Differentiate between myelinated and non myelinated nerve fibers
- Differentiate between PN & CN
- Describe the structure of Optic nerve
- Differentiate between sympathetic and spinal ganglion in detail with examples
- Draw neat labelled diagram of myelinated nerve fiber, optic nerve, spinal and sympathetic ganglion.

Muscle Tissue:

- Differentiate between types of muscle fibers i.e. smooth, skeletal and cardiac muscles with a neat labelled diagram for each.
- Draw neat labelled diagram of muscles microscopically.

Vascular System:

- Differentiate between the types of blood vessels i.e. arteries and veins and their subtypes with examples.
- Draw neat labelled diagram for Elastic and muscular arteries; large and medium size veins,

Lymphatic System:

- Classify the lymphoid tissue and differentiate
- Draw neat labelled diagrams of sections of lymph node, spleen, thymus and tonsil.

Skin:

- Types of skin i.e. thick and thin in detail, their examples and differences between them
- Neat labelled diagrams for thick and thin skin.

Glandular Tissue, Classification:

- Differentiate types of glandular tissue i.e. mucous, serous and mixed salivary glands
- State features, examples and neat labelled diagram for each type.

Umbilical cord and Placenta:

- Describe the structure of umbilical cord
- Mention structure of placenta with different types of villi.

Course content and learning process:**Lecture (14 hours):**

1. Epithelium
2. General Connective tissue
3. Cartilage
4. Bone
5. Nerve Tissue
6. Muscle Tissue
7. Blood Vessels
8. Lymphatic system
9. Glandular Tissue
10. Skin
11. Placenta and umbilical cord

Practical**Learning Outcomes:**

At the end of the semester the students should be able to....

Microscope and Epithelia:

- Identify the different parts of compound microscope and its handling.
- Identify different types of epithelia microscopically.
- Draw neat labelled diagram for collagen, elastic fibers and adipose tissue.

Connective Tissue:

- Identify different type of cartilages microscopically.
- Draw neat labelled diagram for collagen, elastic fibers and adipose tissue.

Cartilage:

- Identify different types of cartilages microscopically.
- Draw neat labelled diagram for hyaline, elastic and white fibro cartilage.

Bone:

- Identify the bone microscopically
- Draw neat labelled diagram for bone TS & LS

Nervous Tissue:

- Identify different types of muscles microscopically
- Differentiate between types of muscle fibers i.e. smooth, skeletal and cardiac muscles with a neat labelled diagram for each.

Vascular System:

- Identify different types of blood vessels microscopically.
- Differentiate between the types of blood vessels i.e. arteries and veins and their subtypes
- Draw neat labelled diagram for Elastic and muscular arteries; large and medium sized veins

Lymphatic System:

- Identify different types of lymphoid organs microscopically and differentiate.
- Draw neat labelled diagrams of sections of lymph node, spleen, thymus and tonsil.

Skin:

- Identify different types of skin microscopically and differentiate between them.
- Draw neat labelled diagram for thick and thin skin.

Glandular tissue, classification:

- Identify different types of glandular tissue microscopically
- Differentiate types of glandular tissue i.e. mucous, serous and mixed salivary glands
- Draw neat labelled diagram for each type.

Umbilical cord and Placenta;

- Identify placenta and umbilical cord microscopically
- Draw neat labelled diagram for each

Practicals (28 hours):

1. Microscope & Epithelium
2. General Connective tissue
3. Cartilage
4. Bone
5. Nerve tissue
6. Muscle tissue
7. Blood vessels
8. Lymphatic system
9. Glandular tissue
10. Skin
11. Placenta and Umbilical cord

Upper Limb

(15 + 32 hours)

Learning outcomes:

At the end of the segment the students should be able to...

Pectoral region:

- Describe the origin and course of the cutaneous nerves and mention their area of supply
- Describe the muscles of pectoral region, pectoralis major, Pectoralis minor, Subclavius and Serratus anterior under following headings: attachments, nerve supply and actions. State clinical importance of Serratus anterior.
- Mention the structures piercing Clavipectoral fascia and its attachments.
- Describe the position, extent, structure, relations, supports, blood supply, nerve supply and lymphatic drainage of mammary gland and associated clinical aspects.

Axilla boundaries and contents:

- Describe the boundaries of axilla with its contents, i.e. axillary artery, vein lymph nodes and brachial plexus.
- Elaborate the axillary artery: Its extent parts and immediate relation of each part and branches arising from each part.
- Mention the formation course and termination of the axillary vein
- State the location and areas of drainage of different groups of axillary lymph nodes with clinical importance.
- Describe the formation & subdivisions of brachial plexus with emphasis on their emergence root value, and clinical importance of the brachial plexus.

Shoulder Region:

- Enlist the boundaries and contents of triangular and quadrangular spaces and the details about the muscles forming it.
- Elaborate the course and relation of the axillary nerve and enumerate the structures supplied by it.
- Describe the anastomosis around scapula and its importance

Compartments (Flexor and Extensor) and their contents of arm and cubital fossa:

- Enlist the muscles of arm and mention their attachments, nerve supply and actions
- Describe course of the arteries in arm (brachial artery, profunda brachii artery), forearm (radial and ulnar arteries) and the distribution of the branches.
- Enumerate the arteries anastomosing around elbow joint and the clinical importance of anastomosis.
- Elaborate the course and relation of the musculo cutaneous nerve and enumerate the structures supplied by it.
- Describe the boundaries and contents of cubital fossa.

Forearm and Hand:

- Describe the extent, course and branches of the radial and ulnar arteries
- Mention the fascial spaces of hand especially thenar and midpalmar spaces with clinical importance
- Elaborate the attachments, morphology and functions of the palmar aponeurosis
- State the boundaries, contents and applied anatomy of the carpal tunnel.
- Enlist the attachments and relation of flexor and extensor retinacula
- Elaborate the location formation and branches of the vessels of hand, superficial and deep palmar arches
- Describe the origin, course and distribution of radial, ulnar and median nerves in arm, forearm and hand with applied aspects
- Classify and mention the articular surfaces, ligaments relations, movements and muscles responsible for movements and applied anatomy of the shoulder, Elbow, Radioulnar joints, wrist and first carpometacarpal joint.
- Enumerate segmental innervations of skin of upper limb.
- Different cutaneous nerves supplying skin of pectoral region, axilla, arm, forearm and hand
- Define and state the embryological basis of dermatomes.

Superficial veins:

- Describe the commencement, course, relation and termination and clinical importance of Cephalic, Basilic and Median cubital veins.

Lymphatic drainage of upper limb:

- Elaborate the of axillary, infraclavicular, deltopectoral, supratrochlear lymph nodes

Lectures:

- Pectoral region, Clavipectoral fascia, Mammary gland (2hours)
- Axilla boundaries and contents (2hours)
- Shoulder Region (1hours)
- Compartments (Flexor and Extensor) and their contents of arm and cubital fossa (2hours)
- Forearm and hand (2hours)
- Origin, course and distribution of radial, ulnar and median nerves in arm, forearm and hand with applied aspects (2hours)
- Shoulder joint (1hour)
- Elbow joint, Radioulnar, wrist, first carpometacarpal joints (1hour)
- Segmental innervations of skin of upper limb, superficial veins and lymphatic drainage of upper limb (1hour)
- Histology of mammary gland (1 hour)

Practical (32 hours)**Learning outcome:**

Introduction (2hours)

- Demonstrate the terms of position, terms of movements.
- Appreciate the structures met in dissection (superficial fascia, blood vessels, nerves, brief note of spinal nerve, deep fascia, note on muscles, joints, bones) of the upper limb.

Superficial fascia: No of hours 2

- Identify the superficial veins of upper limb (cephalic, basilic and median cubital veins)
- Identify the cutaneous nerves of upper limb
- Appreciate the deep fascia and its modifications in the upper limb.

Pectoral region (4hours)

- Identify the muscles, vessels and nerves of pectoral region.
- Appreciate the attachments and structures piercing the Clavipectoral fascia

Axilla (hours):

- Demonstrate the boundaries and contents of axilla

Dissection of back (2hours)

- Identify the muscles that attach the scapula to the trunk, movements of scapula and the muscles which produce them
- Locate the triangle of auscultation: its boundaries and significance.

Shoulder region (2hours)

- Demonstrate the muscles attaching humerus to the scapula, i.e. deltoid, supraspinatus infraspinatus, teres minor, teres major, subscapularis: Attachments, nerve supply and actions
- Demonstrate quadrangular and triangular spaces their boundaries and structures passing through them
- Identify the origin, course, branches, distribution of the axillary nerve.

Posterior compartment of the arm (2hours)

- Demonstrate the attachments, nerve supply and actions of Triceps brachii muscle.
- Describe the origin, course and distribution of the profunda brachii artery.
- Demonstrate the radial nerve: Origin, course and distribution.

Cubital fossa and Front of Arm (4hours)

- Identify the boundaries and contents of cubital fossa.
- Front of arm
- Demonstrate the muscles –biceps, coracobrachialis, brachialis- their attachments, nerve supply and action.
- Appreciate the extent course and branches of the brachial artery.

- Recognize the Musculocutaneous nerve, its course and distribution
- Demonstrate the median and ulnar nerves, their course and relations in arm.

Front of the forearm (2hours)

- Identify the cutaneous nerves, superficial & deep flexor muscles (attachments, nerve supply and actions) radial & ulnar arteries (extent, course and branches) median nerve, ulnar nerve superficial branch of radial nerve (course, branches, distributions and applied anatomy)

Hand (4 hours)

- Identify the Cutaneous nerves with area of supply.
- Show the attachments of palmar aponeurosis.
- Demonstrate the flexor retinaculum, its attachments, relations and appreciate the boundaries and contents of the carpal tunnel.
- Demonstrate the situation, formation and branches of the superficial and deep palmar arches.
- Demonstrate the branches and distribution of the Median and ulnar nerves in hand.
- Describe the boundaries of Thenar and Midpalmar spaces.

Extensor compartments of forearm and hand (2hours)

- Identify the cutaneous nerves of forearm
- Demonstrate the superficial & deep extensor muscles (attachments, nerve supply and actions)
- Appreciate the Posterior interosseous artery (extent, course and termination) Posterior interosseous nerve (course, branches, distribution and applied anatomy)
- Identify the cutaneous nerves (area of supply) of the extensor retinaculum
- Mention the boundaries of the anatomical snuff box.

Joints of upper limb (2 hours)

- Demonstrate the articular surfaces, ligaments, relations, nerve supply, movements and muscles responsible for each movement of the shoulder, elbow, Radioulnar joints, wrist joint and joints of hand.

Surface Anatomy (2hours)

- Identify the bones and appreciate the features of bones of collar shoulder arm, forearm, wrist and hand.
- Clavicle, jugular notch, sternal angle, nipple, infraclavicular fossa, axilla
- Scapula, spines of vertebra, iliac crest.
- Bones of upper limb, their parts and bony landmarks at places where they are readily palpable and nature of joints between them and movements taking places at these joints
- Identify the mammary gland microscopically and draw a neat labelled diagram

Content and learning process:

Introduction (2hours)

- Terms of position, terms of movement, structures met in dissection (superficial fascia, blood vessels, nerves, brief note of spinal nerve, deep fascia, note on muscles, joints, bones).
- Introduction to the upper limb.

Superficial fascia:

- Superficial veins of upper limb (cephalic, basilica and median cubital veins).
- Cutaneous nerves of upper limb.
- Deep fascia and its modifications.
- Pectoral region (4 hours)
- Axilla (4hours)
- Dissection of back (2hours)
- Shoulder region (2hours)
- Posterior compartment of the arm (2hours)
- Cubital fossa and front of Arm (4hours)
- Front of the forearm (2 hours)
- Hand (4hours)
- Extensor compartment of forearm and hand (2hours)
- Extensor retinaculum, Anatomical snuff box.

Joints (2hours)

- Shoulder joint
- Elbow joint
- Radioulnar joints, wrist joint, joints of hand: Classification and movements

Surface of Anatomy (2hours)

- Osteology of bones of collar, shoulder, arm forearm, wrist and hand.
- Surface anatomy of upper limb
- Clavicle, jugular notch, sternal angle, nipple, infraclavicular fossa, axilla.
- Surface Anatomy of back: scapula, spines of vertebra, iliac crest
- Free upper limb: bones of upper limb, their parts and bony landmarks at places where they are readily palpable and nature of joints between them and movements taking places at these joints.
- History of mammary gland: 1 hour

General Embryology and Basics of Genetics

(10 hours+4 hours)

Learning outcomes:

At the end of the portion the students should be able to...

Introduction:

- Define embryology and describe the process of development in gestation period: Pre-embryonic period, embryonic period and fetal period.
- Describe cell division: a) Mitosis: b) Meiosis-different stages
- Parts of male and female reproductive system
- Define the female reproductive cycle (menstrual cycle)
- Discuss its different phases
- Interpret the hormonal control of menstrual cycle
- Correlate the ovarian cycle and with menstrual cycle

Gametogenesis:

- Define Gametogenesis
- Describe the stages of spermatogenesis, spermiogenesis, structure of spermatozoon, oogenesis, ovarian follicle, ovulation, structure and fate of ovum, function and fate of corpus luteum, transport of gametes.

Fertilization:

- Define fertilization and mention the site of fertilization. Elaborate capacitation, acrosomal reaction, zona pellucid (Formation and functions) fusion of spermatozoan and ovum an phases of fertilization.
- **Cleavage:** Define and describe the stages of cleavage, Morula: mention formation, structure and its fate.
- **Implantation:** Elaborate formation and structure of Blastocyst. Elaborate on normal and abnormal sites of implantation and applied aspects.
- **Twinning:** Define and describe twinning.
- Mention formation of bilaminar embryonic disc.
- Describe formation and functions of Amnion
- Elaborate on source, functions and clinical correlation of amniotic fluid.
- Describe formation of yolk sac and its fate
- **Allantois:** Mention formation and function of allantois and its fate
- **Umbilical cord:** Elaborate structure development, extent and functions of umbilical cord
- Extraembryonic mesoderm and coelom: Formation and fate of extraembryonic mesoderm and coelom.
- **Primitive streak:** Describe the development and fate of primitive streak
- **Notochord:** Mention the extent, development and fate of notochord

- State the formation of trilaminar embryonic disc (ectoderm, endoderm and mesoderm structures derived from three germ layers).
- Describe neurulation, formation and derivatives of neural crest cells and neural tube defects.
- **Foldings of embryo:** Elaborate the formation of head, tail and lateral folds and formation of gut.
- Placenta: Illustrate development, structure circulation and functions of placenta. Enlist the structures forming placental barrier, enumerate and describe anomalies of placenta.

Genetics (4 hours):

- Define teratology and teratogens and enlist the principles of teratology
- Classify chromosomes, mention location number of chromosomes, autosomes and sex chromosomes, size and shapes structure.
- Describe karyotyping, chromosomal banding, sex chromatin. State Lyon's hypothesis
- Elaborate the numerical and structural abnormalities of autosomes and sex chromosomes mosaicism and chimerism

Lectures (10hours)

- Introduction to embryology, cell division, parts of male and female reproductive system menstrual and ovarian cycles
- Gametogenesis
- Fertilization, Cleavage, Morula, Blastocyst, Implantation, Twinning.
- Bilaminar germ disc, Amnion, Yolk sac, Allantois, Umbilical cord, Extraembryonic coelom.
- Formation and fate of germ layers: trilaminar germ disc, primitive streak, Notochord
- Formation and fate of Neural tube neural crest cells
- Foldings of embryo
- Placenta

Practical: Demonstration of embryology models (2hours)

Thorax

(15 hours+24 hours)

Learning outcomes:

The students should be able to...

- State the extent and surface land marks of the thorax. Enlist the constituents of the thoracic wall
- Describe the anatomy of the thoracic cavity, the pleura, its reflections, the mediastinum, and their applied anatomy.
- Describe the location, dimensions, external and internal features, relations, blood supply, lymphatic drainage, nerve supply and applied anatomy of the various thoracic organs.
- Mention the attachments, openings blood supply, nerve supply, development and applied anatomy of the diaphragm.
- State the major blood vessels and describe their origin, course, termination, relations, branches/tributaries and areas of supply/drainage.
- Describe the cross sectional anatomy of the thorax at various vertebral levels
- Describe the histological features of the various organs of thorax
- Sequential development of the organs and systems and its correlation with the abnormalities.

Lectures (15hours)

- Introductions to thoracic wall, typical intercostals space
- Pleura-pleural cavity and recesses
- Lungs with bronchopulmonary segments
- Pericardium-sinuses
- Heart-
 - External features
 - Internal features, interior of right atrium in detail
 - Heart blood supply-arterial and venous, nerve supply of heart
- Mediastinum-subdivisions, superior mediastinum structures- arch of aorta
- Posterior mediastinum – thoracic duct, sympathetic chain, esophagus, cross sectional study of thorax at T3, T4 and T5 levels.
- The diaphragm.
- Development of Heart
- Development of arteries, veins and foetal circulation
- Histology- Trachea and lungs

The students should be able to...

- Appreciate the extent and surface land marks of the thorax. To identify the structures which constitute the thoracic wall.
- Identify the anatomy of the thoracic cavity, pleura its reflections and the structures present in the mediastinum.

- Appreciate the location, dimensions, external and internal features, relation, blood supply lymphatic drainage and nerve supply of heart and lungs.
- Recognize the attachments, openings, blood supply and nerve supply of the diaphragm.
- Identify the major blood vessels-their origin, course, termination, relations, branches/tributaries and area of supply/drainage.
- Appreciate the cross sectional anatomy of the various organs of thorax and draw a neat labelled diagram.
- Demonstrate various embryology models of the organs and systems.
- Identify the bone and appreciate its parts features and attachments.
- Identify the radiographs both plain and contrast pertaining to the thorax and identify the structure present in it.
- Demonstrate the surface marking of the various organs and structures of the thoracic cavity

Practicals (18+2+2+2=24 hours):

- Thoracic wall, intercostals spaces, cavity of thorax, pleura, lungs
- Pericardium, heart
- Mediastinum
- Histology- Trachea and lungs
- Osteology- Thoracic Vertebrae
- Osteology- Sternum
- Osteology- Ribs
- X-ray and surface marking of thorax

Lower Limb (12+24 hours)

Learning outcomes:

The students should be able to...

- State the parts, compartments and surface landmarks of the lower limb
- Mention the general layout of the fascia of lower limb
- Enlist the muscles, nerves, blood vessels along with the applied anatomy
- Emphasis on the concept of the venous drainage of the lower limb along with its clinical correlation.
- Mention the lymphatic drainage of lower limb with its applied anatomy
- Describe the gross and applied anatomy of various joints of lower limb
- State the anatomy of arches of foot and correlate with deformities of foot
- Mention the histological features of the various structures

Lecture (12hours)

- General layout of muscles of front of thigh, fascia lata, Saphenous opening, iliotibial tract.
- Femoral triangle, femoral sheath, femoral canal, hernia
- Femoral nerve and vessels, profunda femoris artery, cruciate anastomosis
- Adductor canal, Adductor magnus, Obturator nerve.
- Gluteal region- Gluteus maximus, medius and minimus, other muscles, and sciatic nerve.
- Hip joint.
- Knee joint.
- Tibial nerve, common peroneal nerve- superficial and deep peroneal nerves.
- Venous and lymphatic drainage of lower limb.
- Retinacula around the ankle, dorsum of foot, Anterior and posterior tibial arteries, dorsalis pedis artery
- Sole of foot - layers, lateral planter nerve and plantar arch.
- Ankle joint with spring and deltoid ligament, Tibiofibular joints.
- Subtalar joint, inversion and eversion.
- Arches of foot and foot deformities.

The students should be able to...

- Identify the parts, compartments and surface landmarks of the lower limb.
- Appreciate the general layout of the fascia of lower limb.
- Recognize the muscles, nerves and blood vessels of the lower limb.
- Describe the venous drainage of the lower limb.
- Describe the lymphatic drainage of lower limb.
- Appreciate the anatomy of various joints of lower limb.
- Identify the histological features of the various structures and draw a neat labelled diagram.
- Identify the bone and appreciate its parts, features and attachments.

- Recognize the radiographs of the lower limb and identify the structures present in it.
- Identify the surface marking of important structures of lower limb.

Practicals (24 hours)

- Front of thigh, femoral triangle, adductor canal
- Adductor compartment, Gluteal region, Hip joint, back of thigh
- Popliteal fossa, Back of leg, Knee joint, Lateral compartment of leg
- Anterior compartment of leg and dorsum of foot, Sole of foot
- Osteology – Hip bone
- Osteology – Femur
- Osteology- Tibia and fibula
- Osteology- Tarsal bones, articulated foot and patella
- X-ray and surface marking

II Semester Head and Neck

(25+3+5) =33; (62+5+2) =69 hours

At the end of the course the students should be able to-

Scalp:

- State the layers, blood supply, nerve supply and applied anatomy.

Face:

- To enlist the facial muscles and describe in detail about orbicularis oculi, Orbicularis oris, Buccinator.
- To mention the blood supply of face and describe the origin, course, branches, termination of Facial artery.
- To state the venous drainage and nerve supply (motor and sensory innervation) of face.
- To mention the lymphatic drainage of face and its applied anatomy.
- To describe the lacrimal apparatus and mention the parts, relations, nerve supply of lacrimal gland; lacrimal canaliculi, lacrimal sac, nasolacrimal duct.

Cervical fascia, Posterior triangle:

- To state the general arrangement of neck structures and describe the deep cervical fascia its layers, attachments, tracings and applied anatomy.
- To mention the posterior triangle its boundaries, subdivision, contents and applied anatomy.
- To describe the sternocleidomastoid muscle its origin, insertion, action and applied significance.

Cranial cavity-dural folds, dural venous sinuses, arachnoid villi and granulations

- To enlist the meninges and mention about arachnoid villi and granulations
- To describe about dural folds (Falx Cerebri, Falx cerebelli, Tentorium cerebelli, diaphragma sellae) with their attachments.
- To enlist the dural venous sinuses. Define and classify them. And describe their location, boundaries, extent, relations, structures passing through, tributaries, communications and applied anatomy.

Pituitary gland, blood supply, development and applied anatomy

- To mention the situation, presenting parts and describe the relations, development, microanatomy, Blood supply, nerve supply and applied anatomy of the pituitary gland.

Orbit, bulbar fascia, extra ocular muscles- their attachments, nerve supply and actions, arteries and nerves of the orbit, ciliary ganglion

- To state the boundaries and contents of orbit.
- To mention the structures passing through the superior and inferior orbital fissures
- To describe the fascia bulbi
- To mention the extra ocular muscles and describe their attachments, nerve supply and actions.

- To enlist the nerves of the orbit and describe the optic nerve, Oculomotor nerve, trochlear nerve, abducent nerve branches of ophthalmic nerve; Ciliary ganglion.
- To describe the ophthalmic artery and veins.

Parotid gland, duct and applied anatomy:

- To state the coverings of parotid gland, mention the parts and describe the relations and structures passing through the Parotid gland its nerve supply, Blood supply, lymphatic drainage and applied anatomy.

Anterior triangle and subdivisions

- To state the boundaries, sub divisions, contents of Anterior triangle.
- To mention the boundaries and contents of carotid triangle
- To describe the carotid sheath; Common carotid artery, internal jugular vein; Ansa cervicalis and their applied anatomy.

Infratemporal fossa, mandibular nerve, otic ganglion, maxillary artery, muscles of mastication, Temporomandibular joint, maxillary nerve and pterygopalatine ganglion

- To enlist the boundaries and contents of the Infratemporal fossa;
- To state the origin and describe the course, relations and branches of mandibular nerve and otic ganglion.
- To mention the origin and describe the course, relations and branches of maxillary artery.
- To enlist the muscles of mastication and describe their attachments and actions.
- To state the articular surfaces and ligaments of Temporomandibular joint and describe the relations, blood supply, nerve supply, movements and its applied anatomy.
- To describe the maxillary nerve and its branches and mention the location, relations, connections and branches of pterygopalatine ganglion.

Submandibular region, Submandibular salivary gland

- To mention the origin, insertion, relation, nerve supply, of muscles of the region.
- To state the neurovascular structures in the Submandibular area.
- To describe the situation, surface marking, parts, relation, duct, blood supply and applied anatomy of Submandibular gland.
- To enlist the tracings and connections of Submandibular ganglion.

Thyroid and parathyroid glands

- To describe the situation, extent, covering, parts, relations, blood supply, innervations and applied aspects of the thyroid gland.
- To state the location and relation of parathyroid glands

Great vessels of the neck, Cranial nerve (9, 10, 11, 12), cervical sympathetic chain

- To mention the origin, course and branches of great vessels like Common carotid artery, External carotid artery, Subclavian artery and Internal jugular vein with its tributaries and applied aspects.

- To state the origin, course, distribution and applied aspects of 9, 10, 11, 12th cranial nerves.
- To describe the formation, situation and number of ganglion of the cervical part of the sympathetic chain.

Pharynx, soft palate, Tonsil-Sag. Sectional study

- To mention the location, extension, boundaries, parts, blood supply, innervations and applied aspects of the pharynx
- To enlist the structures seen in lateral wall of the nasopharynx and describe the parts, relations and applied aspects of the auditory tube.
- To describe the Palatine tonsil in oropharynx and mention about pharyngeal isthmus and Waldeyer's ring.
- To mention the boundaries and contents piriform fossa in the laryngopharynx and its importance.
- To enlist the muscles of pharynx and describe their attachments, action nerve supply and structures passing between the pharyngeal muscles.
- To describe the muscular components of the soft palate, their action and nerve supply.

Nasal cavity and Paranasal air sinuses:

- To state the composition, gross features, blood and nerve supply of the medial and lateral walls of the nasal cavity in detail.
- To describe the Paranasal sinuses.

Larynx-external features, interior, muscles:

- To mention the salient features of the cartilages, extrinsic and intrinsic membranes & ligaments of larynx, intrinsic muscles, interior of larynx, nerve supply and its applied aspects.

Tongue- muscles and nerve supply

- To state the external features and parts of the tongue and to describe the papillae, muscles of tongue, nerve supply, lymphatic drainage and applied aspects.

External Ear, Middle ear and facial nerve:

- To enlist the parts of the ear and describe about tympanic membrane and middle ear.
- To mention in brief about external and internal ear.
- To state the course and relations of facial nerve in relation to middle ear.

Eyeball:

- To describe the layers, cavities, chambers of eyeball and applied aspects.

Systemic Histology - I

Thyroid and parathyroid glands:

- Structural details of follicular cells, parafollicular cells, principal and oxyphil cells, functional mechanisms of T3, T4 disorders- hypo and hyper secretion of hormones.
- **Pituitary gland-** difference between Chromophobes and chromophils, cell type's secretion and their functions, hypophyseal portal circulation, common endocrine disorders.

Tongue

- Lining epithelium, different types of papillae, taste buds, muscles, glands

Cornea and retina

Learning outcomes:

- Layers, epithelium and structure of cornea;
- Retina- Layers, functions of all cells, pigment epithelium, retinal detachment

Systemic embryology - I

(5+2 hours)

Development of the face, nose, palate

- Face and nose develops from frontonasal, maxillary and mandibular prominences. Palate development requires formation of primary and secondary palate. Should be able to relate embryonic development to the normal and abnormal structures such as cleft palate, cleft lip and facial cleft.

Development of pharyngeal arches

- Derivatives of pharyngeal arches- arch cartilage, arch muscle, arch artery, arch nerve
- Derivatives of pharyngeal pouches, clefts.
- Derivatives arising from ventral wall of pharynx giving rise to tongue and thyroid gland

Course content and learning process:

Lectures (25 hours):

Gross Anatomy:

- Scalp
- Face-muscles, blood supply and nerve supply lacrimal apparatus.
- Cervical fascia, posterior triangle.
- Cranial cavity dural folds, dural venous sinuses, cavernous sinus, arachnid villi and granulations.
- Pituitary gland, blood supply, development and applied anatomy.
- Orbit, fascia bulbi, extra ocular muscles- their attachments, nerve supply and actions, arteries and nerves of the orbit, ciliary ganglion.
- Parotid gland, duct and applied anatomy.
- Anterior triangle boundaries and subdivisions with contents.
- Infratemporal fossa, mandibular nerve, otic ganglion, maxillary artery, muscles of mastication, Temporomandibular joint, maxillary nerve and pterygopalatine ganglion
- Hyoglossus muscle and its relations, Submandibular salivary gland
- Thyroid and parathyroid glands
- Great vessels of the neck, Cranial nerve 9,10,11,12) Cervical sympathetic chain
- Pharynx, soft palate, Tonsil- Sag. Sectional study
- Nasal cavity and Paranasal air sinuses
- Larynx-interior muscles, vocal cords
- Tongue- muscles and nerve supply
- External Ear, Middle ear and facial nerve
- Eyeball

Systemic histology (21/2hours)

- Thyroid and parathyroid glands.
- Pituitary glands.
- Tongue.
- Cornea and retina.

Systemic Embryology (5hours)

- Development of the face, nose, palate and its anomalies.

- Development of pharyngeal apparatus.
- Development of pituitary gland.

Practical:

At the end of the semester the students should be able to-

Scalp

- To identify the five layers, blood supply and nerve supply.

Face- muscles, blood supply and nerve supply, lacrimal apparatus

- To appreciate all the facial muscles and identify the origin, course, branches, termination of facial artery, venous drainage, nerve supply motor and sensory innervation and lymphatic drainage of face.
- To recognize the lacrimal apparatus. To locate the parts relations, nerve supply of lacrimal gland and appreciate the lacrimal canaliculi, lacrimal sac and nasolacrimal duct.

Cervical fascia, Posterior triangle

- To appreciate the general arrangement of neck structures and deep cervical fascia-layers attachments and tracings.
- To recognize the boundaries, subdivisions and contents of Posterior triangle.
- To identify the origin, insertion and action of sternocleidomastoid muscle.

Cranial cavity- dural folds, dural venous sinuses, arachnoid villi and granulations

- To appreciate the meninges, arachnoid villi and granulations
- To identify the dural folds- Falx Cerebri, falx cerebelli, Tentorium cerebelli, deaphragma sellae with their attachments.
- To recognize the dural venous sinuses its location, boundaries, extent, relations, structures passing through, tributaries and communications.

Pituitary gland, blood supply, development and applied anatomy:

- To appreciate the situation, relations, presenting parts, microanatomy, blood supply and nerve supply of the pituitary gland.

Orbit, bulbar fascia, extra ocular muscles- their attachments, nerve supply and actions, arteries and nerves of the orbit, ciliary ganglion

- To identify the boundaries and contents of orbit; superior and inferior orbital fissure; fascia bulbi; extra ocular muscles- their attachments, nerve supply, actions.
- To appreciate the nerves of the orbit: Optic nerve, Oculomotor nerve, trochlear nerve, abducent nerve, branches of ophthalmic nerve; ciliary ganglion.
- To recognize the ophthalmic artery and veins.

Parotid gland, duct and applied anatomy:

- To identify the coverings, parts and relations and structures passing through the parotid gland its nerve supply; blood supply and lymphatic drainage.

Anterior triangle and subdivisions

- To appreciate the boundaries, sub divisions, contents of Anterior triangle.

- To identify the boundaries and contents of carotid triangle.
- To recognize the carotid sheath; common carotid artery internal jugular vein and Ansa cervicalis.

Infratemporal fossa, mandibular nerve, otic ganglion, maxillary artery, muscles of mastication, Temporomandibular joint, maxillary nerve and pterygopalatine ganglion

- To identify the boundaries and contents of the Infratemporal fossa.
- To appreciate the origin, course, relations and branches of mandibular nerve, otic ganglion.
- To appreciate the origin, course relations and branches of Maxillary artery.
- To recognize the attachments and actions of muscles of mastication.
- To identify the articular surfaces, ligaments, relations, blood supply, nerve supply and movements of Temporomandibular joint.
- To appreciate the Maxillary nerve and its branches and location, relations, connections and branches of pterygopalatine ganglion.

Submandibular region, Submandibular salivary gland

- To identify the origin, insertion, relation, nerve supply of muscles of the region and recognize the neurovascular structures in the Submandibular area.
- To appreciate the situation, surface marking, parts, relations, duct and blood supply of Submandibular gland and to identify the tracings and connections of Submandibular ganglion.

Thyroid and parathyroid glands

- To appreciate the situation, extension, coverings, parts relations blood supply and innervation of thyroid gland.
- To recognize the location and relations of parathyroid gland.

Great vessels of the neck, Cranial nerve (9, 10, 11, 12), cervical sympathetic chain

- To appreciate the origin, course and branches of great vessels like Common carotid artery, External carotid artery, Subclavian artery and internal jugular vein with its tributaries.
- To identify the origin, course, distribution and applied aspects of 9, 10, 11,12th cranial nerves.
- To recognize the formation, situation, number of ganglion of the cervical part of the sympathetic chain.

Pharynx, Soft palate, Tonsil- Sag Sectional study

- To identify the location, extension, boundaries parts blood supply and innervation of the pharynx
- To appreciate the structures seen in lateral wall of Nasopharynx to recognize the auditory tube with its parts and relations
- To appreciate the Palatine tonsil in the oropharynx and to recognize the pharyngeal isthmus and Waldeyer's ring.
- To identify the boundaries of piriform fossa and its contents in the laryngopharynx.
- To recognize the attachments, actions, nerve supply: Structures passing between the pharyngeal muscles.
- To appreciate the muscular components of the soft palate, their action and nerve supply.

Nasal cavity and Paranasal air sinuses:

- To identify the composition, gross features, blood and nerve supply of the medial and lateral walls of the nasal cavity.
- To appreciate the paranasal sinuses.

Larynx – external features, interior, muscles

- To identify the salient features of the cartilages, extrinsic and intrinsic membranes & ligaments of larynx, intrinsic muscles, interior of larynx and its nerve supply.

Tongue-muscles and nerve supply:

- To appreciate the external features and parts of the tongue and to identify the papillae, muscles of tongue, nerve supply and lymphatic drainage.

External Ear, Middle ear and facial nerve

- To identify the parts of the ear, tympanic membrane, to recognize the middle ear, external and internal ear. To appreciate the course and relation, of facial nerve in relation to middle ear.

Eyeball:

- To appreciate the layers, cavities, chambers of eyeball and applied aspects.

Course content and learning process:

Practicals (62+5hours)

Systemic histology

Demonstration of histology slides

Practical (2 hours)

Demonstration of embryology models

Practical Schedule

Scalp

- Identify layers, arteries and nerves supplying the scalp.

Superficial dissection of face

- Identify muscles of face – orbicularis oris, orbicularis oculi, buccinators.

Deep dissection of face and lacrimal apparatus

- Course and branches of facial artery and branches facial nerve in face, lacrimal apparatus.

Side of the neck and posterior triangle

- Platysma, external jugular vein, area of distribution cutaneous nerves of neck, boundaries and contents of posterior triangle, sternocleidomastoid muscle and accessory nerve.

Cranial cavity, dural venous sinuses

- Bones that form the cranial cavity, cranial nerves- course and exit of each nerve from cranial cavity, three dimensional understanding of infoldings of duramater and their arrangement dural venous sinuses.

Orbit:

- Identify the nerves passing through lateral wall of cavernous sinus through superior orbital fissure to reach apex of orbit, relation of internal carotid artery to optic nerve and canal, ophthalmic artery course of optic nerve, attachments of extra ocular muscles, ganglion.

Midline structures of neck and anterior triangles:

- Identify structures related to midline of neck.
- Boundaries and contents of anterior triangle and its subdivisions like submental triangle digastrics triangle, carotid triangle & muscular triangle.

Parotid region

- Boundaries of parotid region, presenting parts, relation and structures passing through the Parotid gland, parotid duct.

Temporal and infratemporal regions:

- Boundaries and contents of infratemporal fossa attachments and action of muscles of mastication, Mandibular nerve and its branches, follow the branches of maxillary artery in this fossa, note the relationship of middle meningeal artery to auriculotemporal nerve.
- Temporomandibular joint identify capsule and articular surfaces.

Submandibular region:

- Boundaries & contents of Submandibular region. Hyoglossus muscle, lingual nerve, hypoglossal nerve.
- Parts, relations, duct of Submandibular gland, Submandibular ganglion & its connections.

Deep dissection of neck

- Relationship of thyroid gland to infrahyoid muscles, carotid sheath, larynx, trachea, and parathyroid gland. Surfaces of gland, blood supply.
- Origin course and branches of some great vessels like Common carotid artery, External carotid artery, Subclavian artery and Internal jugular vein with its tributaries.
- 9,10,11, 12th cranial nerves & their distributions, Cervical part of the sympathetic chain

Mouth and pharynx

- General introduction to mouth lips, cheek, gums and teeth pharynx – extent, subdivisions boundaries and contents of each part, pharyngeal wall attachments, innervations and action of pharyngeal muscles, Palatine tonsil, Auditory tube tracings of nerves such as glosopharyngeal, vagus, cranial accessory.

Nasal cavity, paranasal air sinuses, palate:

- Bones and cartilages forming the nasal septum and lateral wall, features of lateral wall.
- Para nasal air sinuses- relationship of sinuses with orbit, anterior cranial fossa, nasal cavity, drainage point of each par nasal sinus.
- Palate- formation, soft palate muscles.
- Maxillary nerve and pterygopalatine ganglion.

Larynx:

- Laryngeal cartilages, ligaments, muscles and interior of larynx, Vocal folds, Rima glottidis, recurrent laryngeal nerves, follow the course of superior laryngeal artery and internal laryngeal nerve to larynx.

Tongue:

- Dorsum and inferior surface of tongue, Muscles and movements of tongue, Nerves, vessels and lymphatic drainage of tongue.

Ear:

- External, middle and inner ear, walls and contents of middle ear in detail, tympanic membrane, auditory ossicles.

Eyeball:

- General structure of the eyeball and its three coats

Osteology:

- Osteology of head and neck including foetal skull surface marking and X-rays of head and **neck**.

Systemic Histology - II**(3+5hours)****Endocrine glands:**

- a) Thyroid and parathyroid glands
- b) Hypophysis cerebri/ pituitary gland
- c) Tongue
- d) Cornea and Retina

Systemic Embryology – II**(2 hours)**

1. Demonstration models of the face, nose, palate
2. Demonstration models of pharyngeal arches

Central Nervous System

(15+28hours)

At the end of this semester the students should be able to...

- Describe the external and internal features of spinal cord, position, spinal segments, relative position of different tracts.
- Elaborate on Ascending and Descending tracts, blood supply, clinical importance.
- Describe and draw neat labelled diagram of histology of spinal cord.
- Appreciate meninges of brain, spaces in relation to them.
- Mention external and internal structure of Medulla at different levels of transverse section, cranial nerve nuclei, clinical importance.
- State external and internal structure of Pons at different levels of transverse section, cranial nerve nuclei, auditory pathway, clinical importance.
- Describe external features and location of cerebellum, subdivisions nuclei, connection, function, blood supply, clinical importance.
- Mention boundaries, features and situation of 4th ventricle, choroid plexus of 4th ventricle, clinical importance.
- Describe and draw neat labelled diagram of histology of cerebellum.
- State external and internal features of midbrain, Cranial nerve nuclei, important connections, blood supply, and the clinical importance.
- Mention external features, sulci, gyri and cortical areas of cerebrum, homunculus, insula, blood supply, discuss the clinical importance.
- Describe and draw neat labelled diagram of histology of cerebrum.
- Classify white matter of cerebrum with examples describe corpus callosum, Association fibers, Corona radiat describe internal capsule in detail with arterial supply and clinical importance.
- Enumerate part, boundaries of different parts and describe choroid plexus and choroid fissure, clinical importance of lateral ventricle.
- Describe boundaries, communications, recesses, choroid plexus and tela choroidea, clinical importance of third ventricle. CSF formation and its circulation.
- Define basal nuclei. Enumerate the components. Describe external features and parts of each components. Mention afferent and efferent connection, function and clinical importance of basal nuclei.
- Define diencephalon, Enlist major subdivisions of diencephalon, State external features and internal features, nuclei, connections functions, clinical importance of thalamus.
- Describe boundaries, subdivisions, connections, function, clinical importance of hypothalamus Sub thalamic nucleus, zone incerta, mention structure, nerve supply, functions, developments of pineal body.
- Illustrate visual pathway and effects of lesions at different levels. Outline the pathway of light and accommodation reflexes.
- Describe the internal carotid arteries, Vertebral system of arteries, Arterial circle of Willis, arterial supply of different surfaces of cerebral hemispheres, venous drainage, clinical importance.
- Mention the afferent and efferent connections of sympathetic and parasympathetic nervous system Compare between the sympathetic and parasympathetic nervous system, Define Autonomic nerve

plexus, ganglia higher control, Enteric nervous system, Enumerate the function of autonomic nervous system, Correlate the effects of autonomic nervous system on organs of the body, clinical importance.

Learning outcomes (Practical)

At the end of this portion students should be able to:

- Identify different parts of Brain, its situation, membranes and spaces in relation to them
- Demonstrate external and internal features of spinal cord and its meninges.
- Appreciate the base of the brain with interpeduncular fossa, internal carotid arteries & its branches, vertebral system & its branches, blood supply of different surfaces of cerebral hemispheres.
- Identify external and internal features of Medulla, cranial nerves emerging.
- Appreciate external and internal features of Pons. Cranial nerves emerging clinical importance.
- Identify parts of Cerebellum, its nuclei and connections
- Locate and identify the boundaries of 4th ventricle, its different areas and its choroid plexues.
- Appreciate external and internal features of midbrain Cranial nerves emerging.
- Demonstrate external features, sulci, gyri and cortical areas of cerebrum blood supply.
- Identify major example of white matter of brain, Corpus callosum, internal capsule and relationship.
- Study of median sagittal section of cerebrum, Pineal body, Boundaries, recesses and communication of IIIrd ventricle.
- Identify different parts, boundaries of lateral ventricles, internal cerebral veins and optic tracts Choroid fissure, septum pellucidum, fornix, tela choroidea, Study of Sections-Horizontal & Coronal.
- Appreciate deep dissection of cerebral hemisphere, internal capsule, basal nuclei, thalamus; its parts and relations, hypothalamus; its parts and relations, study of section-Horizontal & coronal.

Lectures (15 hours:)

- Structure of spinal cord
- Relative positions of Tracts
- Leptomeninges of brain, spaces in relation to them Parts of brain
- Medulla oblongata
- Pons and auditory pathway
- Cerebellum
- 4th Ventricle
- Midbrain
- Cerebrum: external features, cortical areas, insula, blood supply
- Histology of Cerebrum, Cerebellum, spinal cord
- White matter of Cerebrum
- Lateral ventricle, choroid plexus
- Third ventricle, choroid plexus, CSF formation and its circulation
- Basal nuclei. Horizontal section at interventricular foramen & coronal sectional study.
- Thalamus
- Hypothalamus, Subthalamus, pineal body.
- Visual pathway, light and accommodation reflex
- Blood supply of brain-Circle of willis
- Development of central nervous system and its anomalies

- Autonomic nerves system

Practicals (28 hours)

- Introduction to CNS, Membranes of brain
- Spinal cord
- Blood supply of brain
- Medulla oblongata
- Pons
- Cerebellum
- 4th ventricle
- Midbrain
- Cerebrum, sulci & gyri, cortical areas
- White matter of cerebrum
- Study of median sagittal section of cerebrum, pineal body, III ventricle
- Lateral ventricle, choroid fissure, septum pellucidum, fornix tela choroidea, internal cerebral veins and optic tracts. Study of Sections-Horizontal & Coronal.
- Deep dissection of cerebral hemisphere, internal capsule basal nuclei, study of Section- Horizontal & Coronal.
- Deep dissection of cerebral hemisphere, thalamus
- Deep dissection of cerebral hemisphere, hypothalamus.

Abdomen

4 weeks (24+52 hours)

Learning outcomes

The students should be able to...

- State the extent, surface land marks and regions of the abdomen.
- Enlist the constituents of the anterior and posterior abdominal walls and applied aspects.
- Describe the anatomy of the abdominal cavity, the peritoneum, its reflections the spaces their applied anatomy.
- Describe the location, dimensions, external and internal features, relations, blood lymphatic drainage, nerve supply and applied anatomy of the various abdominal organs.
- Enlist the major blood vessels and describe their origin, course, termination, relation branches/tributaries and area of supply/drainage.
- Mention the histological features of the various abdominal organs.
- State the developments of the various organs of the abdomen.

Course content and learning process:

Lectures 13+4+7=24 hours)

- Anterior abdominal wall- general arrangement of muscles, rectus sheath, incisions.
- Inguinal canal-hernia.
- Testis, spermatic cord, descent of testis, male and female external genital organs.
- Peritoneum, omentum, mesentery, greater and lesser sac with cross sectional Anatomy.
- Stomach-parts, blood supply, lymphatic drainage and coeliac trunk.
- Superior and inferior mesenteric vessels, small and large intestines.
- Duodenum.
- Caecum and appendix.
- Pancreas, portal vein and portocaval anastomosis.
- Liver.
- Gall bladder, spleen and extrabiliary apparatus.
- Kidney, suprarenal and posterior abdominal wall.
- The diaphragm.
- Development of GIT including liver, spleen , Gall bladder and pancreas (3)
- Development of urinary system (1)
- Histology- Oesophagus and stomach.
- Histology- Duodenum, Jejunum, ileum.
- Histology- Large intestine and appendix.
- Histology – Liver, gall bladder and pancreas.
- Histology- kidney, suprarenal gland, ureter, testis (total histology)

Learning outcomes:

The students should be able to..

- To identify the extent, surface land marks and regions of the abdomen.
- To recognize the constituents of the anterior and posterior abdominal wall.
- To appreciate the anatomy of the abdominal cavity, peritoneum, its reflections and various spaces in the abdomen.
- To identify the location, dimensions, external and internal features, relations, blood supply, lymphatic drainage and nerve supply of various organs of the abdomen.
- To recognize the major blood vessels and appreciate their origin, course, termination, relations branches/tributaries and area of supply/drainage.
- To identify the histological features of the various abdominal organs and draw a neat labelled diagram.
- To identify the bone and appreciate its parts, features and attachments.
- To recognize the radiographs, both plain and contrast pertaining to the abdomen and identify the structures present in it.
- To demonstrate the surface marking of the various organs and structures of the abdominal cavity and planes of the abdomen.

Practicals (34+14+2+2=52)

- Anterior abdominal wall, Inguinal canal, External genital organs.
- Abdominal cavity and peritoneum, Stomach, celiac trunk, mesentry, small and large intestine.
- Duodenum, Spleen, Liver, Pancreas and portal vein.
- Kidney, Suprarenal gland, posterior abdominal wall.
- Histology- Oesophagus and stomach.
- Histology- Duodenum, Jejunum, ileum.
- Histology- large intestine and appendix.
- Histology- Liver, Gall bladder and pancreas.
- Histology- kidney, suprarenal gland, ureter, Testis.
- Osteology – Lumbar vertebrae.
- X-rays and surface marking.
- Demonstration of embryology models.

Pelvis

3 week (15+25 hours)

Learning outcomes:

The students should be able to...

- Appreciate the peritoneal investment on pelvic viscera and their clinical implications.
- Describe the location, dimensions, external and internal features, relations, supports, blood supply, lymphatic drainage, nerve supply and applied anatomy of the various pelvic organs.
- Outline the boundaries and contents of the ischiorectal fossa and its clinical relevance.
- Mention the boundaries and contents of the perineal pouches and to list the actions of perineal muscles.
- State the parts of the pelvic diaphragm its attachments and its role in supporting the pelvic viscera.
- To know the location, branches and distribution of major pelvic vessels and nerves and their clinical implications.
- Describe and draw neat labelled diagram of the microscopic structure of urinary bladder, ovary, uterine tube, uterus, placenta, epididymis and vas deference.
- Illustrate the embryological events involved in testis and ovary and to explain their major anomalies.
- Illustrate the development of various pelvic organs and the anomalies associated with it.

Course content and learning process:

Lecture (8+3+4=15)

- Perineum: subdivision, ischiorectal fossa, perineal pouches and their clinical implications.
- Urinary bladder, ureter & seminal vesicle.
- Prostate, male urethra and vas deferens.
- Uterine tube and ovary.
- Uterus-parts supports, blood, nerve & lymphatic drainage with their clinical implications.
- Rectum and Anal canal.
- Pelvic diaphragm.
- Vessels and nerves of pelvis.
- Development of Male and female genital system with major anomalies.
- Histology- urinary bladder, epididymis.
- Histology- Vas deferens, prostate.
- Histology- Ovary, fallopian tube.
- Histology- Uterus, placenta.

Learning outcomes:

The students should be able to...

- Identify the peritoneal investment on pelvic viscera and their clinical implications.
- Demonstrate the location, dimensions, external and internal features, relations, supports, blood supply, lymphatic drainage, nerve supply of the various pelvic organs.
- Appreciate the boundaries and contents of the ischiorectal fossa and perineal pouches and enlist the actions of perineal muscles.
- Locate the parts of the pelvic diaphragm its attachments and its role in supporting the pelvic viscera.
- Demonstrate the location, branches and distribution of major pelvic vessels and nerves and their clinical implications.

- Identify and draw neat labelled diagram of the microscopic structure of urinary bladder, ovary, uterine tube, uterus, placenta, epididymis and vas deference.
- Demonstrate the embryological models depicting embryological events involved in testis, ovary and various pelvic organs explain their major anomalies.
- Identify gender of bony pelvis with the emphasis on major sex differences.
- Appreciate radiographs, both plain and contrast pertaining to the pelvis.

Practicals (14+8+2+1=25 hours)

- Perineum
- Urinary bladder, Ureter, Seminal vesicle and deferens, prostate and male urethra, uterine tube and ovary.
- Uterus, Rectum, Anal canal.
- Pelvic diaphragm, Vessels and nerves of pelvis.
- Histology- urinary bladder, epididymis.
- Histology- Vas deferens, Prostate.
- Histology- Ovary, fallopian tube.
- Histology- uterus, placenta.
- Osteology- Sacrum and coccyx.
- Osteology- Articulated pelvis and pelvimetry.
- X-rays.
- Demonstration of embryology models.

Specification table I MBBS University Examination (2016-17)

Subject: Anatomy

Specification Table:

Paper –I

Head and Neck	:	28 Marks
CNS	:	22/23 Marks
Upper Limb	:	24/23 Marks
General histology	:	10 Marks
General Embryology	:	10 Marks
Genetics	:	6 Marks
Total	:	100 Marks

Paper –II

Abdomen and Pelvis	:	23 Marks
Thorax	:	21/19 Marks
Lower Limb	:	19/21 Marks
Systemic Histology	:	11 Marks
Systemic Embryology	:	10 Marks
General Anatomy	:	6 Marks
Total	:	100 Marks

Recommended Books

Essential Books:

S.N.	Name of Book	Author	Edition	Publisher
1	Human Anatomy (Vol- 1,2,3,4)	B.D. Chaurasia	7 th Edition	CBS Publisher
2	General Anatomy	B.D. Chaurasia	5 th Edition	CBS Publisher
3	Human Genetics	S.D. Gangane	3 rd Edition	Elsevier
4	Human Embryology	Inderbir Singh	10 th Edition	Jaypee borthers
5	Cunningham's Manual of Practical Anatomy	G.J. Romanes	16 th Edition	Oxford University Press
6	Text book of Human Histology	Inderbir Singh	8 th Edition	Jaypee borthers

Reference Books:

S.N.	Name of Book	Author	Edition	Publisher
1	Langman's Medical Embryology	T.W. Sadler	13 th Edition	Lippincott, Williams & wilkins
2	Atlas of Human Anatomy	Frank H. Netter	6 th Edition	Elsevier
3	Gray's Anatomy	Susan, Drake Vogl	3 rd Edition	Churchill Living stone
4	Wheater's functional Histology A text and colour Atlas	Barbara Young, Philip wood ford	6 th Edition	Elsevier health Sciences
5	Difore's Atlas of Histology with functional correlation	Victor P. Eroschenko	12 th Edition	Lippincott Williams & wilkins
6	Text book of Human Neuro Anatomy	Inderbir Singh	9 th Edition	Jaypee borthers
7	Surface & Radiological Anatomy	Dr. A. Halim	3 rd Edition	CBS Publisher
7	Human Osteology: Clinical Orientation,	Dr. N.A. Faruqi	3 rd Edition	Academic Press

Syllabus of physiology

HUMAN PHYSIOLOGY BIO- PHYSICS

Goal:

The broad goal of the teaching of undergraduate students in physiology aims at providing the student comprehensive knowledge of the normal functions of the organ systems of the body to facilitate an understanding of the physiological basis of health and disease.

Objectives

Knowledge

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

- Explain the normal functioning of all the organ systems and their interactions for well coordinated total body function
- Assess the relative contribution of each organ system to the maintenance of the milieu interior.
- Elucidate the physiological aspects of normal growth and development.
- Describe the physiological response and adaptations to environmental stresses.
- List the physiological principles underlying pathogenesis and treatment of disease.

Skills

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

- Conduct experiments designed for study of physiological phenomena.
- Interpret experimental/ investigative data. Distinguish between normal and abnormal data derived as a result of tests which he/ she has performed and observed in the laboratory.

Integration

At the end of the integrated teaching the students should acquire an integrated knowledge of Organ structure and function and its regulatory mechanisms.

Biophysics

Goal & Objectives: The broad goal of teaching biophysics to undergraduate students is that they should understand basic physical principles involved in the functioning of body organs in normal and disease.

General Physiology

Learning outcomes: At the end of this chapter the student should be able to

- Describe a normal cell, its structures & functions of organelles (overlaps with anatomy)
- Explain the different transport mechanisms across membranes & their relevance .
- Differentiate body fluid compartments in terms of their distribution, volume & composition.
- Understand the principles of measurement of the volume of a fluid compartment and to calculate the fluid volumes from a given set of data.
- Understand the role of intercellular communication & signal transduction (will be discussed under endocrinology).
- Understand the significance of bioelectric potentials in electrophysiological studies (will be discussed under Nerve- Muscle and Cardiac Physiology).

Course content and lectures

1. Transport mechanisms across cell membranes.
2. Body fluid compartments, principle of estimation.

Practicals

Practicals 1 To study osmotic effects on red blood cells.

Practicals 2 Calculation of the body fluid volumes from a given set of data / case studies.

Blood and lymph

Learning outcomes: At the end of this chapter the student should be able to

- Describe the composition and functions of blood.
- Give the normal concentrations of different plasma proteins, explain the individual functions of them and the clinical significance.
- Explain the role of plasma albumin in capillary fluid shift and pathophysiology of edema.
- Describe the morphology, production, life span and fate of red cells. Explain the pathophysiology of types of jaundice.
- Describe the synthesis structure, types and functions of hemoglobin.
- Classify anemia and describe the causes of different types of anemia
- Describe the blood group systems: their relevance to blood transfusion, hazards of blood transfusion and erythroblastosis fetalis.
- Classify leucocytes describe their morphology and functions.
- Know the essential of immune mechanisms of the body and applied aspects.
- Describe coagulation mechanisms hemorrhagic disorders, anticoagulants and the lab tests to assess hemostasis.
- Explain the formation and functions of lymph, lymphatics.
- Describe the macrophage system and their functions.

Course content and Lectures

1. General introduction to blood functions, components, functions of individual components of blood in brief, concept of homeostasis.
2. Plasma proteins dynamics of capillary fluid Development of red cell bone marrow
3. Development of red cell bone marrow
4. Necessary factors, hypoxic regulation
5. Hemoglobin: structure and functions
6. Red cell destruction: Bilirubin Metabolism, Jaundice.
7. Anemia: Brief account of iron metabolism, iron deficiency anemia, vitamin B12 folic acid deficiency anemia
8. Concept of blood groups blood transfusion hazards.
9. Leukocyte classification, phagocytic function of leucocytes, introduction to immunity, role of lymphocytes.
10. Thrombocytes and haemostatic
11. Blood coagulation, fibrinolysis disorders, anticoagulants
12. Macrophage system, lymph, lymphatic's

Practicals

- Practical 1** Study of microscope & Neubauer's chamber
- Practical 2** Enumeration of red cells
- Practical 3** Enumeration of leucocytes
- Practical 4** Differential leucocytes
- Practical 5** absolute eosinophil count
- Practical 6** Hemoglobin estimation
- Practical 7** Rouleaux formation: Erythrocyte sedimentation rate: pcv: calculation of blood indices
- Practical 8** Blood grouping & cross matching
- Practical 9** Bleeding time & clotting time
- Practical 10** Demo experiments – platelet count : reticulocyte count: prothrombin time : osmotic fragility.

Nerve Muscle Physiology

Learning outcomes: At Learning outcomes: At the end of this chapter the student should be able to

- Understand the organization of nervous system, define the terms- neuron, peripheral and central nervous system somatic and autonomic nervous system sensory and motor nerve fibers.
- Classify neurons and describe the structure of a typical neuron.
- Explain the functions of different parts of neuron ,describe myelination and its advantage.
- Understand the concept of membrane potential and action potential and explain their ionic basis
- Explain the properties of nerve action potential classify nerve fibers describe the properties of mixed nerves.
- Out line the consequences of nerve injury degeneration & regeneration of peripheral nerve fibers.
- Classify muscle tissue and compare the structure of different types.
- Describe the ultra structure of skeletal muscle fiber, myofibril sarcomere and sarcotubular system,
- Understand the molecular mechanism of muscle contraction and describe the sliding filament mechanism.
- Explain the mechanisms of muscle contraction – types of contractions ,factors influencing force of muscle contraction , types of skeletal muscle fibers, muscle fatigue rigor mortis etc.
- Describe the structure of neuromuscular junctions explain the sequence of events during neuromuscular transmission special features neuromuscular blockers & applied aspects,
- Type of smooth muscles Properties and functions of smooth muscles.

- Name the two divisions of autonomic nervous system describe the autonomic outflow, outline the location & types of autonomic receptors ,neurotransmitters and function of ANS.

Lectures

- Lectures-1** Importance of nervous system in regulation , central and peripheral nervous system , somatic and autonomic nervous system, sensory and motor neurons,
- Lectures-2** Properties of neurons- excitability RMP, basis of RMP
- Lectures-3** Nerve action potential generation , properties
- Lectures-4** Propagation velocity of conduction in nerve fibers
- Lectures-5** Classification of nerve fibers, properties of nerve trunk, compound action potential
- Lectures-6** Nerve injury and regeneration of Nerve fibers
- Lectures-7** Muscle physiology: Types structure and organization
- Lectures-8** Contractile filaments of skeletal muscle fiber and role in contraction
- Lectures-9** Excitation- contraction coupling energy sources
- Lectures-10** Types of skeletal muscle fibers , smooth muscle types
- Lectures-11** Properties of visceral &smooth muscles
- Lectures-12** Neuromuscular transmission, special features
- Lectures-13** Neuromuscular blockers, disorders
- Lectures-14** Organization of autonomic nervous system: salient features and functions.

Practicals

- Practical-1** Amphibian experiments using isolated nerve- muscle preparation (demo/ video graphs)
- Practical-2** Amphibian experiments using isolated nerve- muscle preparation (demo/ video graphs)
- Practical-3** Amphibian experiments using isolated nerve- muscle preparation (demo/ video graphs)
- Practical-4** Amphibian experiments using isolated nerve- muscle preparation (demo/ video graphs)
- Practicals-5** Amphibian experiments using isolated nerve- muscle preparation (demo/ video graphs)
- Practicals-6** Amphibian experiments using isolated nerve- muscle preparation (demo/ video graphs)
- Practical-7** Electromyography

Gastrointestinal system

Learning outcomes: At the end of this chapter the student should be able to:

- Understand the anatomy of gastrointestinal tract with special emphasis on the histological features and nerve supply.
- Explain the regulation of GI function by enteric nervous system and hormones.
- Describe the mechanism and regulation of salivary secretion and applied aspects.
- Describe the functions of stomach, cell types of gastric mucosa: cellular mechanism and components of gastric secretion.
- Describe the phases of gastric secretion and regulation in each phase.
- Describe the concept gastric mucosal barrier and explain the pathophysiology and principals of treatment of peptic ulcer disease .
- Describe the components, functions and regulation of secretion of pancreatic secretion
- Describe the components, functions and regulation of secretion of biliary secretion.
- Outline the functions of liver and gall bladder: effects of cholecystectomy.
- Describe the structure and functions of small intestine : effects of cholecystectomy
- Describe the structure and functions of small intestine: role of brush border enzymes.
- Explain the mechanism and purpose of different types of movements seen in the small intestine and their disorders.
- Understand the process of digestion and absorption and explain the basis of malabsorption syndromes.
- Describe the structure and functions of large intestine: movements of large intestine : explain purpose of gastroileal and gastrocolic reflex.
- Describe the process of defecation: explain applied aspects such as Hirschprung's disease diarrhea and constipation.

Lectures

Lecture-1 Organization of GIT autonomous control of gastro intestinal secretion and motility by enteric nervous system : Review of properties of visceral smooth muscles .

Lectures -2 Salivary secretion and regulation

Lectures -3 Deglutation

Lectures -4 Applied aspects of salivary secretion : composition ,cellular mechanism of acid recreation

Lectures -5 Gastric secretion: composition, cellular mechanism of acid secretion.

Lectures -6 Phases of secretion, regulation of gastric secretion, neural and hormonal

Lectures -7 Peptic ulcer: gastric function tests & other applied aspects

Lectures -8 Gastric motility and its regulation , vomiting

- Lectures -9** Pancreatic secretion and its hormonal regulation.
- Lectures -10** Biliary secretion, functions of gall bladder
- Lectures -11** Intestinal secretions, digesting and absorption of food
- Lectures -12** Digestion and absorption (continued)
- Lectures -13** Large intestine
- Lectures -14** Defecation : Applied aspects
- Practicals:** Nil

Respiratory system

Learning outcomes: At Learning outcomes: At the end of this chapter the student should be able to:

- Understand the organization of respiratory system, physiologic anatomy of lung, pleura and respiratory muscles
- Explain the function of upper respiratory passages.
- Define the terms- ventilation , perfusion, dead space volume, intrapleural , intrapulmonary and transpulmonary pressures.
- Describe the mechanism of normal ventilation and the role to of respiratory muscles and pressure changes
- Describe the elastic properties of lungs : concept of surface tension and compliance : respiratory distress syndrome.
- Explain the lung volumes and capacities : principle of spirometry and measurement of lung volumes and capacities define the terms vital capacity ,FEV, and the other ventilator function tests.
- Describe the gaseous diffusion and the factors influencing it
- Describe the transport of oxygen in blood: oxygen dissociation curve and its significance.
- Describe the transport of carbon dioxide in blood: Haldane effect : CO₂ dissociation curve and the role of respiratory system in acid- base balance.
- Explain the neural regulation of respiration and role of respiratory centers.
- Explain the chemical regulation of respiration and the effects of chemical feedback.
- Explain the non- chemical influence of respiration: effect of exercise on respiration.
- Define Hypoxia : Classify hypoxia and describe the causes, features and effects of hypoxia.
- Understand physiology of high altitude and describe the changes in acclimatization to high altitude.
- Describe the physiology of deep- sea diving and decompression sickness
- Define and explain applied aspects – asphyxia , cyanosis hypercapnia.

Lectures

- Lecture-1** Organization of respiratory system respiratory passages and function,
- Lecture-2** ventilation: Relationship between lungs and pleura, concept of interpleural pressure , mechanism of quiet inspiration and expiration, muscles of respiration and their actions
- Lecture-3** Ventilation (Continued)
- Lecture-4** Lung volumes, capacities and measurement , Pulmonary and alveolar ventilation, dead space pulmonary circulation- salient features
- Lecture-5** Lung compliance, elastic behavior of lungs, role of surfactant
- Lecture-6** Gaseous exchange : factors determining, flick's law ,diffusion capacity.
- Lecture-7** Transport of oxygen and delivery to tissues,ODC
- Lecture-8** Oxygen transport (continued)
- Lecture-9** Transport of carbon dioxide, Haldane effect
- Lecture-10** Neural regulation of respiration
- Lecture-11** Chemical regulation of respiration- Chemical feedback non chemical influences
- Lecture-12** Hypoxia – types cause, features
- Lecture-13** Hypoxia of high altitude, acclimatization changes: decompression sickness
- Lecture-14** Applied aspects : respiratory adjustments in exercise

Renal physiology including skin & Thermoregulation

Learning outcomes: At Learning outcomes: At the end of this chapter the student should be able to:

- Describe the structure of nephron, histological features, juxtaglomerular apparatus and salient features renal circulation.
- Review the rennin- angiotensin mechanism and its clinical relevance.
- Give an overview of renal tubular function and urine formation.
- Explain the structure of glomerulus, special features of filtration barrier and the dynamics of glomerular filtration with special emphasis on the role of starling forces,
- Define GFR, explain the factors affecting GFR and regulation and determination of GFR.
- Understand the concept of renal clearance and its application.
- Describe the functions of proximal convoluted tubeless with special emphasis on counter – current mechanism.
- Describe the function of distal convoluted tubules with special emphasis on hormonal regulation of water and sodium reabsorption.
- Explain renal handling of water and the role of kidneys water balance.
- Explain the role of kidneys in sodium and potassium balance.

- Explain secretion of hydrogen ions by renal tubules: tubular buffers; role of kidneys in acid base balance & its disturbances.
- Understand the consequences and indices of renal insufficiency and the principle of dialysis.
- Describe the nerve supply of urinary bladder, cystometrogram, maturation reflex and applied aspects.
- Describe the functions of skin and its role in thermoregulation.
- Explain the thermoregulatory mechanisms and the role of hypothalamus.
- Understand the pathogenesis of fevers.

Lectures

- Lecture-1** Functions of kidney major processes taking place in kidney , parts of nephron,
- Lecture-2** Glomerular filtration- Glomerular capillaries afferent and efferent arterioles
- Lecture-3** Renal blood- flow special features and autogulation.
- Lecture-4** Filtration barrier- its special features, forces involved in filtration, net filtration pressure filtration fraction
- Lecture-5** Glomerular filtration Rate (GFR) factors regulating : auto regulation of GFR.
- Lecture-6** tubular functions : reabsorption of substance in pct: glucose , sodium, water
- Lecture-7** Clearance concepts determination of GFR, RBF
- Lecture-8** Modification of filtrates along loop of heble and distal nephron: Reabsorption of solutes and water at different sites, changes in tonicity of tubular fluid hormones at different sites.
- Lecture-9** Handling of water by kidneys and regulation of plasma osmolarity : concentrating diluting ability of kidney role of ADH, Counter current mechanism and its importance, establishment and maintenance of medullary osmotic gradient.
- Lecture-10** Acid base balance by kidney H* secretion and acidification of urine HCO₃ reabsorption and generation, role of tubular buffers and
- Lecture-11** Maturation : Filling of bladder and cystometrogram .
- Lecture-12** Reflex emptying of bladder and voluntary control.
- Lecture-13** Initiation continuation and cessation of act of maturation
- Lecture-14** Skin and body temperature regulation Need for regulation, core and shell temperature : heat gain by body, heat loss mechanisms role of skin – cutaneous circulation and sweat glands and their regulation, Thermostat – heat regulating central mechanisms , thermoregulatory reflexes fever hyper and hypothermia.

Cardiovascular physiology

Learning outcomes: At learning outcomes: At the end of this chapter the student should be able to:

- Understand the organization of cardiovascular system: importance of cardiac pump and the types of blood vessels and their function. Relationship between pressure flow and resistance in circulation.
- List the properties of cardiac muscle and describe each property in detail: describe Starling's law of heart.
- Describe the electrophysiology of heart muscle using appropriate graphs.
- Describe the nerve supply of heart and their effects.
- Define cardiac output: describe the hemodynamic events during different phases of cardiac cycle.
- Explain the pressure – volume changes and valvular changes during the cardiac cycle.
- Explain the principle, recording waves, intervals and clinical
- Describe the factors determining and regulation of mean arterial blood pressure by short- term and long – term mechanisms.
- Understand the pathophysiology of hypertension and cardiac failure
- Outline the salient features of special regional circulations such as coronary circulation, cerebral circulation, coeliac circulation, pulmonary, splanchnic and fetal circulations: explain applied aspects such as coronary heart disease, stroke etc.
- Define circulatory shock: describe the types of shock, pathogenesis and features of hypovolemic shock, reversible and irreversible shock, and principles of treatment.
- Describe the changes in cardiovascular system in exercise.

Lectures

Lecture-1 Organization of cardiovascular system: systemic and pulmonary circulation, pressure, flow, resistance in circulation, types of blood vessels and functions.

Lecture-2 Properties of cardiac muscle: review of histological features and significance, automatic rhythm, its basis, pacemaker potential.

Lecture-3 sequential conduction of cardiac action potential, role of specialized conducting system.

Lecture-4 Action Potential of working Cardiac muscle cells and its ionic basis, refractory period.

Lecture-5 length-tension relationship in cardiac muscle, Frank-Starling law, factors influencing the force of cardiac muscle contraction.

Lecture-6 Heart as a pump – cardiac cycle, hemodynamic events, pressure and volume changes.

Lecture-7 Cardiac cycle (continued)

Lecture-8 Principle of electrocardiography, leads, waves and uses,

Lecture-9 ECG (continued)

- Lecture-10** Innervations of heart and blood vessels , neural control of heart & blood vessels.
- Lecture-11** cardiac out put – Principle and methods of measurement,
- Lecture-12** Cardiac output – principle and methods of measurement.
- Lecture-13** Regulation of cardiac output
- Lecture-14** Biophysical aspects of circulation, poiseuille's principle, velocity of blood flow laminar and turbulent flow.
- Lecture-15** Arterial blood pressure – variations determinants.
- Lecture-16** Short- term regulation of MAP – bar receptor mechanism.
- Lecture-17** Short- term regulation of MAP- chemoreceptor mechanism
- Lecture-18** Long- term regulation of Fmap chemoreceptor mechanism : CNS ischemic response
- Lecture-19** Venous circulation, venous pressure , capillary circulation, local regulation of blood flow to tissues, autoregulation of blood flow.
- Lecture-20** Special circulations- Cerebral circulation , coronary heart disease.
- Lecture-21** Special circulations- cerebral circulation, pulmonary and systemic, splanchnic and foetal circulation salient features.
- Lecture-22** Cardiovascular adjustments during exercise.
- Lecture-23** Pathophysiology of shock
- Lecture-24** cardiac failure: hypertension.

Practicals

- Practical-1** Amphibian experiments heart experiments (demo / video graphs)
- Practical-2** Amphibian experiments heart experiments (demo / video graphs)
- Practical-3** Amphibian experiments heart experiments (demo / video graphs)
- Practical-4** Amphibian experiments heart experiments (demo / video graphs)
- Practicals-5** Experiments using isolated perfused amphibian heart (demo / video / graphs)
- Practicals-6** Clinical examination of pulse
- Practicals-7** recording of blood pressure
- Practicals-8** Effects of posture & exercise on Bp
- Practicals-9** Clinical examination of cardiovascular system
- Practicals-10** Discussion of case histories.

Endocrinology

Learning outcomes: At learning outcomes: At the end of this chapter the student should be able to:

- Classify different classes of hormones, and describe the mechanisms of action of each.
- Explain the different mechanisms of regulation of secretion of hormones and the role of hypothalamus.
- Explain the actions, and regulation of secretion of hormones of posterior pituitary along with applied aspects such as diabetes insipidus
- Explain the actions and regulation of secretion of hormones of anterior pituitary along with applied aspects such as diabetes insipidus.
- Explain the synthesis transport actions and regulation secretion of hormones of adrenal cortex along with applied aspects such as Cushing's syndrome Addison's disease Conn's syndrome.
- Explain the synthesis transport actions and regulation of secretion of hormones of adrenal medulla along with applied aspects such as pheochromocytoma.
- Explain the synthesis transport actions , and regulation of secretion of hormones of endocrine pancreas medulla along with cause , features metabolic derangements , complications and principles of treatment of diabetes mellitus and describe features of hypoglycemia.
- Summarize the role of hormones in regulation of plasma glucose level.
- Describe bone physiology; functions of plasma calcium and effects of hypocalcaemia .
- Explain the source, actions and regulation of secretion of hormones regulating plasma calcium and applied aspects such as hyperparathyroidism, hypoparathyroidism , rickets and osteomalacia.
- Describe role of other endocrine organs such as juxtaglomerular apparatus and pineal gland : role of other hormones such as angiotensin II and ANP.

Lectures

- | | |
|------------------|---|
| Lecture-1 | Introduction: Mechanism of hormonal action: various mechanisms of regulation of hormonal secretion. |
| Lecture-2 | Role of hypothalamus and anterior pituitary hormones introduction. |
| Lecture-3 | Actions and regulation of secretion of growth hormone .factors influencing growth applied aspects. |
| Lecture-4 | Anterior pituitary (continued) |
| Lecture-5 | Actions and regulation of secretion of ADH and oxytocin. |
| Lecture-6 | Histology of thyroid gland: steps of synthesis of thyroid hormones – drugs affecting synthesis. |
| Lecture-7 | Transport and actions of thyroid hormones. |

- Lecture-8** Regulation of secretion of thyroid hormones, thyroid function, thyroid function tests. Goiter Hypothyroidism, hyperthyroidism.
- Lecture-9** Importance of calcium, phosphate : actions of parathormone.
- Lecture-10** Actions of 1,25 DHCC and , Regulation of plasma calcium level, tetany.
- Lecture-11** Actions of adrenaline and nor adrenaline , regulation of secretion.
- Lecture-12** Adrenal cortex: Regulation of secretion of cortical .Applied aspects.
- Lecture-13** Actions of cortisol: Regulation of secretion of cortisol. Applied aspects.
- Lecture-14** Endocrine pancreases: synthesis secretion and actions of insulin: actions of glucagon and regulation of secretion: Glucose homeostasis and diabetes mellitus.
- Lecture-15** Endocrine pancreas (continued).
- Lecture-16** Endocrine pancreas (continued) :minor endocrine glands.

Practicals

- Practical 1** Discussion of case histories

Reproductive physiology

Learning outcomes: At learning outcomes: At the end of this chapter the student should be able to:

- Describe normal sexual differentiating and development and the abnormalities.
- Explain the stages and regulation of spermatogenesis
- Describe the actions of testosterone and regulation of testicular function: explain applied. Aspects such as cryptorchidism, hypogonadism and male infertility.
- Explain the phases and regulation of menstrual cycle, its abnormalities.
- Understand the role of ovarian hormones in reproductive functions changes of female.
- Describe the physiology of pregnancy- diagnosis, changes in body and parturition
- Describe the physiology of mammary growth and lactation.
- List the contraceptive methods in male and female : explain their basis and utility.

Lectures

- Lecture-1** Introduction to reproductive system. Sex determination and sexual differentiation.

- Lecture-2** Male reproductive system- spermatogenesis', different stages. Factors influencing spermatogenesis normal sperm count, semen composition.
- Lecture-3** Endocrine functions of testes: testicular hormones and actions
- Lecture-4** Control of testicular functions Applied aspects
- Lecture-5** female reproductive system. Oogenesis. Menstrual cycle – ovarian changes
- Lecture-6** Menstrual cycle : endometrial changes and other changes: regulation
- Lecture-7** Endocrine functions of ovary: hormones actions control of ovarian function.
- Lecture-8** Principle of diagnostic test for early pregnancy maternal changes in pregnancy
- Lecture-9** Mechanism of delivery lactation.
- Lecture-10** Methods of contraception.

Practicals

- Practical-1** Discussion of case histories

Central Nervous System

Learning outcomes: At learning outcomes: At the end of this chapter the student should be able to:

- Describe the types, morphology of synapses and the sequence of events in an excitatory synapse.
- Describe presynaptic inhibition and postsynaptic inhibition using examples.
- Describe the properties of neuron pool.
- Classify sensory receptors and explain the excitable properties of receptors.
- Explain the coding of sensory information with respect to stimulus modality intensity and location: describe the role of lateral inhibition in sensory system.
- Classify sensory pathways Compare them and draw and describe the anterolateral and dorsal column pathways from origin to termination.
- Explain the location, special features , functions and effects of lesion to sensory cortex
- Explain the organization of motor system : understand the concept of upper motor neuron lower motor neuron and final common pathway compare the effects of UMN and LMN lesions.
- Give an overview of the motor functions of spinal cord describe the components of stretch reflex explain the structure , innervations and functions of muscle spindles.
- Explain the role of stretch reflex in control of muscle tone : explain supraspinal control of muscle tone : describe inverse stretch reflex and functions of Golgi tendon organs.
- Explain flexion withdrawal reflex and its properties.

- Describe the components, receptors, mode of stimulation, central connections, functions, and method of testing vestibular apparatus.
- Understand and analyze the consequences of hemi section of spinal cord and describe the features of Brown – Squared syndrome.
- Describe the location and functions of motor cortex < describe the origin, course termination and functions of pyramidal tract and explain the features of hemiplegic
- Explain the immediate and delayed consequences of complete transection of spinal cord.
- Describe the functional lobes, connections functions and effects of lesions different lobes of cerebellum: explain cerebellar function tests.
- Describe the components connections and functions of basal ganglia: describe basal ganglia diseases: manifestations and treatment of Parkinson's disease.
- Describe the organization and functions of reticular formation
- Describe the EEG rhythms, clinical uses: types of sleep
- Describe the organization of nuclei, connections and function and functions of hypothalamus.
- Describe the organization & functions of limbic system
- Describe the organization of nuclei, connections and functions of thalamus : explain thalamic syndrome
- Describe the functional areas of cerebral cortex: association areas : effects of prefrontal lobotomy : physiology of language and speech and aphasia.
- Outline the neural basis of learning & memory describe conditioned reflex
- Describe the location, formation circulation, drainage and functions cerebrospinal fluid lumbar puncture : blood brain barrier
- Describe the organization and functions of autonomic nervous system.

Lectures

Lecture-1 Synaptic transmission Definition, types functional anatomy, sequence of events EPSP and IPSP and their ionic basis properties of synapses in all of neurons, Neurotransmitters and neuromodulators, Synaptic plasticity

Lecture-2 Synaptic transmission (continued)

Lecture-3 Sensory system – Sensory receptors classification, properties coding of sensory information.

Lecture-4 Sensory receptors (continued)

Lecture-5 Sensory pathways : Dorsal column – Lemniscal pathway

Lecture-6 Sensory pathways anterolateral system

Lecture-7 Sensory cortex, applied aspects – T10-T12 Syringomyelia

Lecture-8 Physiology of pain – Types, pathways

- Lecture-9** Descending analgesic system referred pain
- Lecture-10** Effects of hemisection of spinal cord (Brown – squared syndrome)
- Lecture-11** Motor system : Organization of motor control – types of movements Overview of spinal brain stem and cortical motor mechanisms.
- Lecture-12** Stretch reflex- structure and function of muscle spindles.
- Lecture-13** Stretch reflex – structure and function of muscle spindles,
- Lecture-14** Supraspinal control of muscle tone , decerebrate rigidity inverse stretch reflex.
- Lecture-15** poly synaptic reflexes : neural circuit properties and significance of flexion withdrawal reflex crossed – extensor reflex
- Lecture-16** Descending motor pathways : Medial and lateral system – corticospinal tract
- Lecture-17** Motor cortex, Upper motor neuron lesion , hemiplegia function of rubrospinal tract.
- Lecture-18** Effects of complete transverse section of spinal cord
- Lecture-19** Cerebellum – Functional divisions, neural connection and functions of cerebellum.
- Lecture-20** Cerebellum (continued)
- Lecture-21** Effects of cerebellar lesion
- Lecture-22** Basal ganglia connection and functions.
- Lecture-23** Basal ganglia (continued) parkinsonism chorea athetosis hemiballismus.
- Lecture-24** Vestibular apparatus
- Lecture-25** Reticular formation of brain
- Lecture-26** Physiology of EEG and sleep
- Lecture-27** Thalamic nuclei and functions , thalamic syndrome : Hypothalamus
- Lecture-28** Hypothalamus (continued)
- Lecture-29** Limbic system – components function, papez circuit kluver – bucy syndrome
- Lecture-30** Functional areas of cerebral hemisphere functions of prefrontal lobe , language areas of the brain aphasia

Practicals

- Practical-1** Clinical examination of sensory system

- Practical-2** Clinical examination of reflexes
- Practical-3** Clinical examination of motor system
- Practical-4** Clinical examination of cranial nerves
- Practical-5** Discussion of case histories (sensory system)
- Practical-6** Discussion of case histories (motor system)
- Practical-7** Video demonstration

Special Senses

Learning outcomes: At learning outcomes: At the end of this chapter the student should be able to:

- Understand the role of special sensory organs, their role in appreciation of environment around us.
- Describe the structure of eye, optical apparatus functions of different components.
- Describe the location, formation, circulation, drainage and functions of aqueous humor and understand the causes and pathogenesis of glaucoma.
- Review the physical of optics and correlate to the mechanism of image formation in human eye. Explain the accommodation of eye and presbyopia.
- Describe image formation in refractive errors and the correction of errors.
- Explain the structure and functions of retinal functions of photoreceptors.
- Describe photochemistry of vision and photo transduction.
- Draw and explain, visual pathway describe the location and role of visual cortex : explain basis of macular sparing draw neural circuitry for papillary reflexes
- Explain visual function such as visual acuity, color vision and dark adaptation.
- Define field of vision, explain visual field defects in lesions of visual pathway.
- Describe the functional anatomy of external ear, middle ear and inner ear.
- Explain the function of middle ear and describe impedance matching.
- Summarize the mechanism of hearing and explain basis of sound pitch discrimination and intensity determination.
- Draw and explain auditory pathway: outline the location and role of auditory cortex.
- Explain types of deafness: hearing tests and audiogram
- Describe the location of taste receptors draw taste pathway and explain physiology and applied aspects of taste sensation.
- Describe the location of olfactory receptors draw olfactory pathway and explain the physiology and applied aspects of olfaction.

Lectures

- Lecture-1** EYE: Functional anatomy of the eye : outline of functions of cornea sclera iris, lens, retinal and intraocular muscles
- Lecture-2** Aqueous humor – formation circulation , function glaucoma.
- Lecture-3** Optics of vision concept of reduced ey, accommodation :Refractive errors.
- Lecture-4** Optics of vision (continued)
- Lecture-5** retinal functions – structure of retina – Photochemistry transduction.
- Lecture-6** Retinal functions (Continued)
- Lecture-7** visual acuity dark and light adaptation colour vision
- Lecture-8** Visula pathway and effects of it's lesion at various levels, visual reflexes.
- Lecture-9** EAR: Functional anatomy of the ear. Elementary acoustics, role of external **ear**
- Lecture-10** Functions of middle ear.
- Lecture-11** Organ of corti , auditory receptors auditory transduction
- Lecture-12** Pitch and intensity discrimination : auditory pathway tests for hearing audiometry.
- Lecture-13** **Taste and smell , receptors pathways signification & abnormalities,**

Practicals

- Practical-1** Test for vision
- Practical-2** Tests of hearing
- Practical-3** tests for olfaction & taste
- Practical-4** Perimetry

First MBBS University Examination in physiology

Paper II (Written + MCQ)*

TOPIC	Approx Mark
Central Nervous System	36
Special Senses	14
Reproductive System	14
Endocrinology	20
Muscle Nerve Physiology	16
Total	100

Paper I (Written + MCQ)*

TOPIC	Approx Mark
Cardiovascular System	28
Respiration	18
General Physiology and Blood	18
Renal physiology (including thermoregulation)	18
Gastro Intestinal System	18
Total	100

***Each paper consists of 20 multiple choice question (1 mark each) : 2 essay questions (10 marks each) and 15 short answer type questions (4 mark each)**

VIVA VOCE : 20 Marks

Practical Examination : 40 Marks

1. Spotters
2. Hematology
3. Clinical

Recommended Books

Author	Title	Edn.	Publisher
G.K Pal	Comprehensive text book of medical physiology	Ist	Jaypee
A.K. Jain	Text book of physiology	6 th	APC
Guyton and Hall	Text Book of Medical Physiology	12 th	Elsevir
	REFERENCE BOOKS		
Keele Neil Joels	Samson Wright's Applied Physiology	13 th	Oxford University Press
John B. West	Best and Taylor's Physiological basis of Medical practice	12 th	B.I. Waverly Pvt Ltd. Delhi
Berne Levy , at al	Physiology	6 th	Mosby
RL Bijlani	Understanding Medical Physiology	4 th	Jaypee Medical Publishers
S. Manjunatha			
Lauralee Sherwood	Human Physiology- from cell to systems	5 th	Thomson books / cole
Sabyasachi Sircar	Principles of Medical Physiology	1 st	Thieme
L Prakasham Reddy	Fundamental of Medical physiology	5 th	Paras Medical

Syllabus of Biochemistry

Biochemistry

Biochemistry including medical and molecular biology

Goal

The broad goal of the teaching of undergraduate students in biochemistry is to make them understand the scientific basis of the life processes at the molecular level and to orient them towards the application of the knowledge acquired in solving clinical problems.

Objectives

a) KNOWLEDGE

At the end of the course, the students should be able to:

- Describe the molecular and functional organization of a cell and list its sub cellular components.
- Delineate structure, function and inter – relationships of bio- molecules and consequences of deviation from normal.
- Summarize the fundamental aspects of enzymology and clinical application wherein regulation of enzymatic activity is altered, and clinical application where in regulation of enzymatic activity is altered;
- Describe digestion and assimilation of nutrients and consequences of malnutrition.
- Integrate the various aspects of metabolism and their regulatory pathways.
- Explain the biochemical basis of inherited disorders with their associated sequelae;
- Describe mechanisms involved in maintenance of body fluid and pH homeostasis.
- Outline the biochemical basis of environmental health hazards, biochemical basis of cancer and carcinogenesis.
- Familiarize with the principles of various conventional and specialized laboratory investigations and instrumentation analysis and interpretation of a given data;
- The ability to suggest experiments to support theoretical concepts and clinical diagnosis.

b) SKILLS:

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

- Make use of conventional techniques/ instruments to perform biochemical analysis relevant to clinical screening and diagnosis.
- Analyze and interpret investigative data:
- De

c) INTEGRATION

- The knowledge acquired in biochemistry should help the students to integrate molecular events with structure and function of the human body in health and disease

First MBBS Biochemistry Theory and practical Syllabus and Examination Details

A) Learning Objectives

Name of the chapter**I. Introduction**

Learning outcomes: At the end of this chapter the students should be able to:

- Appreciate the scope of biochemistry with a comprehensive understanding of the cellular, metabolic, genetic, and homeostatic mechanisms of the human body.
- Understand the latest techniques used in both basic and applied areas of biochemistry and interpret the result.
- Describe the various macromolecular components of the cell and their functions.
- To know about the chemical composition of the cell membrane.
- To know the functions of the cell membrane
- To understand the mechanism of transport across the membranes with suitable examples.
- To know the various transport systems.

Course Content

Lectures Total 2 hours

Lecture-1 Scope of biochemistry, biotechnology, cell and sub-cellular particles.

Lecture-2 Cell membranes structure, function and transport.

Practical

Practical 1 Related spotters and case reports.

Name of the chapter:**II. Enzymes**

Learning outcomes: At the end of this chapter the student should be able to:

- Classify enzymes giving examples.
- Define active site and give its characteristic features.
- Explain the mechanism of action of enzymes with emphasis on induced fit model.
- Differentiate types of enzyme specificity.
- Describe the factors affecting enzyme action. Including definition and significance of K_m and V_{max} .
- Define and classify cofactors, name the coenzymes and give examples for reactions in which they participate.
- Explain competitive, non competitive and suicide inhibition with examples emphasizing the use of competitive inhibitors in medicine.
- Define pro enzymes and isoenzymes and give examples.
- List the diagnostically important enzymes with the pathological conditions in which the enzyme levels are altered. Make a list of therapeutic enzymes.
- Describe the regulation of enzyme action emphasizing allosteric regulation.
- Diagnostic significance of enzyme.

Course content***Lectures*** ***Total 9 hours***

- Lecture-1** Nature of enzymes, Co- enzymes, Cofactors, classification.
- Lecture-2** Mechanism of action, specificity of enzymes .
- Lecture-3** Enzyme kinetics; Effect of enzyme concentration and substrate concentration, on enzyme action.
- Lecture-4** **k_m** value and its significance (derivation not required), effect of temperature and pH on enzyme action.
- Lecture-5** Enzyme inhibition : competitive, suicide, non competitive , allosteric inhibition.
- Lecture-6** Regulation of enzyme action.
- Lecture-7** Isoenzymes
- Lecture-8** Clinical enzymology: diagnostic significance of enzymes and coenzymes: LDH, CPK , AST
ALT
- Lecture-9** Clinical enzymology contd: ALP, NTP, GGT, ACP, GPD, ChE, Amylase, Lipase.

Practical

- Practical- 1 Charts- Myocardial infarction (Diagnostic enzymes).
- Practical- 2 Charts- acute pancreatitis (Diagnostic enzymes)
- Practical- 3 Related spotters and case reports.

Name of the Chapter:**III. Carbohydrates**

Learning outcomes: At the end of this chapter the students should be able to:

- Classify carbohydrates, mono, di and polysaccharides, differentiate between pentoses and hexoses, sugars comprising of the disaccharides, sugar derivatives.
- Sketch representative monosaccharide (Glucose) illustrating isomerisms.
- Differentiate homo and hetero polysaccharides; list the monomers, type of linkage, branching and functions of the major polysaccharides.
- Detail the digestion and absorption of the carbohydrates with associated disorders, Explain glucose transport across membranes.
- Discuss the importance of Rapoport Leubering Shunt.
- List the substrates for gluconeogenesis, elucidate the regulatory steps. Compare and contrast glycolysis and gluconeogenesis. Outline the cori's and glucose alanine cycles.
- Describe glycogenesis, glycogenolysis and regulation. Enumerate glycogen storage disorders emphasizing biochemical defects.
- Outline the HMP shunt pathway explaining the significance.
- Significant aspects of metabolism of fructose and galactose: uronic acid pathway, polyol pathway associated inborn errors.
- Plasma glucose level and explain its hormonal immanence, discuss aetiopathogenesis biochemical basis and complications of diabetes mellitus.
- Describe and interpret glucose tolerance test, glycosylated albumin and tests for reducing substances in urine

Course content

<i>Lectures</i>	<i>Total 16 hrs</i>
Lecture-1	Classification, monosaccharides, glucose, fructose, mannose, galactose, epimers, anomers.
Lecture-2	N- acetyl and other derivatives, glycoside linkage
Lecture-3	Disaccharides lactose, maltose sucrose, polysaccharides, glycogen , starch cellulose dextran.
Lecture-4	Glycosaminoglycans, Blood group substances.
Lecture-5	Digestion and absorption of carbohydrates, disorders associated, transport of glucose across membranes
Lecture-6	Glycolysis: Reactions, rate limiting steps
Lecture-7	Regulation of glycolysis in brief, inhibition , energetics , Rapoport- Leubering shunt.
Lecture-8	Fate of pyruvate in aerobic and anaerobic conditions, production of acetyl CoA

- Lecture-9** Gluconeogenesis, reactions, key enzymes, regulation, Cori cycle.
- Lecture-10** Glycogen synthesis, glycogen degradation, regulation (in brief), inborn errors associated.
- Lecture-11** HMP shunt pathway NADPH generation, transketolase, significance tissue where reactions take place, G 6 PD deficiency (second part of pathway need not be emphasized).
- Lecture-12** Metabolism of fructose, galactose, uronic acid pathway, inborn errors associated with them.
- Lecture-13** Blood glucose level and its maintenance, mechanism of action of insulin, glucagon.
- Lecture-14** Diabetes mellitus, etiology, biochemical basis of symptoms and complications.
- Lecture-15** Glycosurias, reducing substance in urine, differential diagnosis, tests to distinguish different sugars.
- Lecture-16** Glucose tolerance test, precautions, procedure different types of graphs, interpretation , glycosylated hemoglobin, fructosamino albumin.
- Practical's** 2 hrs.X 4 = 8 hrs.
- Practical 1** Reactions to identify carbohydrates in general and specific monosaccharide/ disaccharide based on their functional group and glycoside linkage.
- Practical 2** Quantitative estimation and clinical significance of plasma glucose.
- Practical 3** Familiarize with the procedure for GRR and its interpretation.
- Practical 4** Spotters and case reports reports related to carbohydrate metabolism.

Name of the Chapter**IV. Lipids**

- Learning outcomes: At the end of this chapter the student should be able to:
- Classify lipids and fatty acids with examples: differentiate between saturated and unsaturated fatty acids: identify the significance and functions of PUFA (polyunsaturated fatty acid) or essential fatty acids. Understand the structure of triglyceride.
- Differentiate phospholipids, sphingolipids and cerebrolipids: enumerate their functions list the biochemical defects in the inborn defects associated with lipid storage.
- Explain the process of digestion and absorption of lipid, the role of bile salts in the process and the associated disorders.
- Explain β -Oxidation of fatty acid with respect to palmitic acid; discuss the energetics, regulation and the associated disorders, brief note on alpha and omega oxidation.
- Enumerate the substrates for de novo synthesis of fatty acids with illustration of fatty acid synthetase complex, reactions for synthesis of palmitic acid, list the regulators of acetyl CoA carboxylase, and hormonal control of the pathway : outline elongation and Denaturation of fatty acids
- Elucidate ring structure of cholesterol; outline the crucial steps in the biosynthesis of cholesterol and its regulation. State the biologically important products formed and their functions.
- Discuss the formation and utilization of ketone bodies and the role of insulin. Explain the causes, signs and symptoms of ketoacidosis.
- Describe the synthesis and degradation of triglycerides: describe the fluxes of triglyceride and fatty acids between organs in fed and fasted states; comprehend the role of insulin, glucagon and growth hormone in the regulating of hormone sensitive lipase: describe fatty liver the causes and lip tropic factors.
- Outline the first step of prostaglandin synthesis: enumerate clinically important prostaglandins, related compounds and their functions.

Course content***Lectures******Total 15 hours***

- | | |
|------------------|--|
| Lecture-1 | Definition, classification of lipids |
| Lecture-2 | Saturated and unsaturated fatty acids, acids, triglycerides. |
| Lecture-3 | Phospholipids, glycolipids, cerebrolipids functions and inborn errors associated with them. |
| Lecture-4 | Digestion and absorption, role of bile salts, disorders. |
| Lecture-5 | Beta oxidation of fatty acids, carnitine, regulation and disorders. |
| Lecture-7 | De novo synthesis of fatty acids |
| Lecture-8 | Cholesterol, chemistry synthesis (upto mevalonate in detail and only crucial intermediates) regulation, transport fate mechanism of action of statin drugs |
| Lecture-9 | Formation of bile salts fate of bile salts, other compounds derived from cholesterol |

- Lecture-10** Plasma lipoproteins, classification, transport disorders.
- Lecture-11** Blood levels of cholesterol, atherosclerosis, and role of PUFA in preventing atherosclerosis formation of ketone bodies.
- Lecture-12** Utilisation of ketone bodies, ketoacidosis action of insulin.
- Lecture-13** Metabolism of adipose tissue, triglycerides (synthesis and degradation), hormone sensitive lipase, action of insulin, glucagon growth hormone.
- Lecture-14** Liver- adipose tissue axis, postprandial and starvation states, fatty liver, lipotropic factors.

Practical

- Practical- 1** Charts- on Lipoprotein electrophoresis.
- Practical- 2** Charts- on Myocardial infarction
- Practical- 3** Charts on Lipid Profile
- Practical- 4** Spotters and case related to lipid metabolism.

Name of the chapter**V. Amino Acids and proteins**

Learning outcomes: At the end of this chapter the student should be able to:

- Enumerate the amino acids and classify them based on functional group (side chain), nutritional requirement and metabolic fate.
- Comprehend the ionic properties of amino acids and their role in buffering action of proteins, is electric pH and its importance.
- Describe the various levels of structural organization of proteins, forces involved in maintaining deferent levels of structures. Structure of insulin and collagen.
- Explain the structure- function relationship of collagen and hemoglobin.
- Categorize proteins with examples based on function, composition, shape and nutritional value.
- Explain the properties and importance of Denaturation and coagulation.
- Describe the principle, technique and the diagnostic applications of RIA and ELISA.
- Classify plasma proteins, describe the methods of separation, discuss the functions of albumin and know the blood levels of total protein, albumin, globulin and fibrinogen.
- Enumerate transport proteins. List acute phase proteins and their significance emphasizing the role of ceruloplasmin.
- Classify the immunoglobulin; describe the basic structure and functions. Alteration in multiple myeloma.
- Describe the digestion and absorption of proteins and associated disorders.
- Explain catabolism of proteins, detoxification of ammonia, urea cycle and it disorders.
- Elucidate the metabolism of glycine, sulphur containing amino acids and aromatic amino acids in detail, Biochemical importance of all other amino acids and their associated inborn errors.

Course content***Lectures******Total 21 hours***

- | | |
|------------------|--|
| Lecture-1 | Amino acids, structural classification. |
| Lecture-2 | Nutritional and metabolic classification. |
| Lecture-3 | Ionic properties of amino acids, iso – electric pH buffering acions of amino acids and proteins |
| Lecture-4 | Structural organization of proteins, primary structure, primary structure of insulin. |
| Lecture-5 | Secondary tertiary and quaternary structures forces involved in maintaining these structures, structure of collagen. Hemoglobin- Hb S. |
| Lecture-6 | Denaturation, Coagulation, Classification of proteins |
| Lecture-7 | Radio immune assay and ELIASA techniques. |

Lecture-8 Plasma proteins, blood levels and functions of albumin, transport proteins.

Lecture-9 Acute phase proteins, ceruloplasmin, immunoglobulins, types and functions.

Lecture-10 Multiple myeloma, Bence-Jones proteins, Digestion of proteins.

Lecture-11 Absorption of proteins disorders.

Lecture-12 Decarboxylation, transamination, deamination, transdeamination.

Lecture-13 Blood ammonia, urea cycle, blood urea

Lecture-14 Metabolism of glycine, inborn errors special products of glycine, Creatinine.

Lecture-15 Metabolism of cysteine, methionine transmethylation reaction.

Lecture-16 Glutathione, urinary sulphur, cystinuria, homocystinuria

Lecture-17 Metabolism of phenylalanine tyrosine.

Lecture-18 Phenylketonuria, alcaptonuria, albinism, adrenalin, catecholamines, VMA, thyroxine, melanin.

Lecture-19 Metabolism of tryptophan (only end products and PLP-dependent reaction) xanthurenic acid, niacin, synthesis in brief.

Lecture-20 Serotonin, melatonin, indoxyl, Hartnup's disease

Lecture-21 Glutamic acid, glutamine, aspartic acid, asparagine, branched chain amino acid (metabolism-first and second steps and end products only), maple syrup urine disease, polyamines (synthesis and functions).

Practical (2 hours x4=8 hours)

Practical- 1 Colour reactions to identify proteins in general and specific amino acids based on their functional group.

Practical- 2 Separation of amino acids using paper chromatography and be acquainted with its uses in metabolic screening of aminoacidurias.

Practical- 3 Precipitation reactions of proteins

Practical- 4 Familiarize with the technique of electrophoresis and interpret normal and abnormal electrophoretograms including multiple myeloma

Practical- 5 Related spotters and case reports.

Note: i) Normal and abnormal constituents of urine.

ii) Quantitative estimation and clinical significance of total protein albumin urea and Creatinine in serum, to be dealt under clinical function tests (Chapter IX)

Name of the chapter:

VI. TCA Cycle, integration of metabolism , in born errors of metabolism (IEM) electron transport chain (ETC)

Learning outcomes: At the end of this chapter students should be able to

- Elucidate the TCA CYCLE, accentuating its overall function in metabolism, the amphibolic and anaplerotic role.
- Describe metabolic pathways that operate under well fed conditions fasting and prolonged starvation, major organs that are involved in the integration of these pathways influence of the hormones.
- Describe and classify high energy compounds with examples.
- Comprehend redox potential, exergonic and endergonic reactions,
- Draw the path of electrons from reduced electron carriers to oxygen in the electron transport chain as well as the major complexes and mobile carriers in the pathway, Enumerate the inhibitors of the ETC.
- Explain how the electron transports and ATP synthesis is coupled, Enumerate uncouples.
- Describe the role oxidative phosphorylation in metabolism and fuel utilization.
- Outline the steps for screening various inborn errors of metabolism and interpret the results.

Course content

Lectures Total 8 hours

Lecture-1 Citric acid cycle, reactions, regulation , inhibitors

Lecture-2 Energetics amphibolic and anaplerotic role

Lecture-3 Integration of carbohydrate, lipid and protein metabolisms, and lipids cannot be converted to carbohydrates

Lecture-4 Fed state and starvation

Lecture-5 Redox potential exergonic and endergonic reactins, high energy compounds.

Lecture-7 Oxidative phosphorylation, uncouplers.

Lecture-8 IEM screening and evaluation.

Practical

Practical 1 Chart on IEM

Name of the chapter

VII. Molecular Biology, molecular Genetics, Biotechnology

Learning outcomes: At the end of this chapter the students should be able to:

- Know the structure and sources of atoms in the purine and pyrimidine rings.
- Understand the functions of biologically important bases, nucleosides and nucleotides.
- Be able to outline the denovw synthesis for purines and the salvage pathways with emphasis on first two and last two steps.
- Describe briefly pyrimidine synthesis
- Understand the degradation of purines and know the clinical applications of the disorders associated with hyperuricemia.
- Apply the significance of purines , pyrimidines and nucleotide analogs to clinical situations.
- Know briefly about Gout, Lesch Nyhan syndrome and Orotic aciduria.
- Describe in detail, the structure and diagrammatic representation of eukaryotic DNA.
- Define the signification ao Denaturation of DNA an Tm.
- Enumerate the differences between DNA and RNA
- Enumerate the inhibitors of DNA replication.
- Describe transcription process in prokaryotes and how it differs from eukaryotes.
- Understand the concept of Reverse Transcriptase
- Describe the characteristics of Genetic code.
- Explain the Wobble hypothesis
- Describe the process of translation and how it deffers from eukaryotes, inhibitors of translatin.
- Briefly explain chaperones , protein folding and associated diseases post translational modifications .
- Know the regulation of gene expression repression , derepression induction and have brief idea of lac operon.
- Outline the principles of gene cloning with applications of restriction endonucleases , vectors,
- Explain the applications of recombinante DNA genomic and cDNA library gene therapy.

- Describe the principles and applications of techniques like pcr and western, southern and northern blotting, RFLP, VNTRs DNA chips and microarray DNA hybridization techniques, monoclonal antibodies and anti – sense therapy.
- Explain DNA damage and repair oncogenes and tumor suppressor genes, genes, genetic origins of cancer and clinical applications of tumor markers,
- Explain chemical and viral mutagens types and consequences of mutations with examples.
- Provide an introduction to the applications of human genome project, proteomics and metabolomics.

Course content

Lectures ***Total 21 hours***

Lecture-1&2 Structure of purines and pyrimidines nucleosides and nucleotides, functions nucleotides.

Lecture-3 Sources of carbons and nitrogens for purine synthesis (only first two steps of synthesis and formation of GMP, AMP from IMP), Functions of PRPP, degradation of purines.

Lecture-4 Gout and hyper – uricemias , synthesis of pyrimidines orotic aciduria (degradation of pyrimidines not required) , salvage pathway Lesch – Nyhan syndrome

Lecture-5 Structure of DNA different types of DNA, Mitochondrial DNA, base pairing rule, chargaff's rule.

Lecture-6 Structure and functions of different types of RNA, ribosomes differences between DNA and RNA

Lecture-7 Characteristics of genetic code.

Lecture-8 DNA replication, DNA polymerase, regulation, antimetabolites and anticancer agents. DNA

Lecture-9 Transcription , RNA polymerase, post- transcriptional modifications, inhibitors .

Lecture-10 Reverse transcriptase, introns and exons, ribozymes.

Lecture-11 Translation, post- translational modidifications inhibitors of protein biosynthesis.

Lecture-12 Repression derepression , induction

Lecture-13 Mutations (insertion, deletion, frame shift), consequences of mutations.

Lecture-14 Cell cycle, mutagens, chemical carcinogens, viral carcinogenesis.

Lecture-15 Oncogenes, tumour markers AIDS.

Lecture-16, 17&18 Recombinant DNA technology, restriction endonucleases, genetherapy .

Lecture-19 DNA hybridization techniques, southern blot northern blot, western blot, polymerase chain reaction.

Lecture-20 Restriction fragment length polymorphism DNA finger printing techniques.

Lecture-21 Hybridoma technology and monoclonal antibodies, anti-sense therapy. FISH

Lecture-22 Human genome project, micro array technique.

Lecture-23 Introduction to proteomics and metabolomics

Practicals

Practical-1 Related spotters and case reports.

Name of chapter

VIII. Hemoglobin Metabolism

Learning outcomes: At the end of this chapter the student should be able to:

- Identify compounds containing heme, chemistry of porphyrins (ring structure).
- Heme synthesis- site subcellular site reactions, regulation effect of lead poisoning porphyrias enzyme defects and important clinical symptoms, manifestations and investigations- evaluation of altered biochemical findings in urine, blood.
- Formation and fate of bilirubin- sources of heme, degradation (formation of bilirubin) site reactions fate of bilirubin – transport uptake, conjugation secretion, formation and fate of urobilinogen.
- Serum bilirubin- types, normal values, properties jaundice- definitions classification, causes variations of different biochemical parameters in plasma urine and feces in different types differential diagnosis of jaundice, Biochemical findings in hepatitis. Prothrombin time and jaundice.
- Defects in Gilbert's syndrome, Crigler Najjar syndrome type I and type II Dubin Johnson syndrome and Rotor Syndrome.
- Physiological jaundice in neonates, kernicterus and treatment.
- Abnormal hemoglobins, hemoglobinopathies – HbS – occurrence, molecular basis homozygous and heterozygous HbS, abnormalities associated, mechanism of sickling in sickle cell anemia diagnosis of sickle cell anemia and sickle cell trait – Hb electrophoresis- normal and HbS, sickling test A-thalassemsias, B-thalassemsias

Course content

Lectures **Total 8 hours**

Lecture-1 Biosynthesis of heme and regulation

Lecture-2 Porphyrias examples of heme proteins

Lecture-3 Degradation of hemoglobin and metabolism of heme pigments

Lecture-4 Jaundice- classification

Lecture-5 .Clinical chemistry investigations in blood urine

Lecture-7 thasassemias, HB electrophoresis

Practicals

Practical 1 Related spotters and case reports

Name of the chapter

IX. Clinical function tests

Learning outcomes: At the end of this chapter the student should be able to:

- Describe the synthetic, detoxification and excretory functions of liver.
- Explain and interpret the various tests available to evaluate liver function.
- Explain the normal constituents of urine and how it changes in various diseases.
- Explain the abnormal constituents of urine their clinical importance.
- Explain the various glomerular and tubular function tests and their applications.
- Explain and interpret various clearance tests.
- Explain how to measure specific gravity of urine and its implications.
- Explain micro albuminuria and its clinical importance.
- Understand the general presenting features and laboratory screening of inborn metabolic disorders.
- List few types of mitochondrial disorders with presenting features.

Course content

Lectures

Total 04 hours

Lecture-1 Liver function tests: albumin, van den Bergh test, ALP AST, ALT, other tests.

Lecture-2 Kidney function tests: glomerular function Creatinine clearance test.

Lecture-3 Tubular functions tests (dilution and concentration tests)
microalbuminuria.

Lecture-4 IEM screening and evaluation, introduction to mitochondrial disease.

Practicals

Practical- 1 Analysis of normal urine.

Practical- 2 Analysis of abnormal urine.

Practical- 3 Determination of total serum protein and A.G. ratio.

Practical- 4 Determination of serum / urine Creatinine, calculation of Creatinine clearance.

Practical- 5 Determination of blood urea by diacetyl monoxime method/ urease method.

Practical- 6 Liver function test- charts.

Practical- 7 renal function tests- Charts

Practical- 4 Related spotters and case reports

Name of the Chapter:**X. ACID BASE BALANCE, DETOXIFICATION**

Learning outcomes: At the end of this chapter the student should be able to:

- Understand the various buffer systems of our body.
- Understand the application of Henderson – Hasselbalch equation.
- Explain the role of the body buffers, respiratory system and kidney in acid base regulation.
- Understand the disorders of acid base status their assessment and interpretation.
- Know the normal values of arterial blood gas analysis and electrolytes.
- Define xenobiotics.
- Understand the various types of phase I and Phase II reactions available in our body for detoxification of xenobiotics.
- Give specific examples for detoxification by any given mechanism.

Course content

<i>Lectures</i>	<i>Total 08 hours</i>
Lecture-1	Buffer Systems
Lecture-2	Henderson – hasselbalch equation (without derivation), buffer capacity.
Lecture-3	Acids and bases of the body, mechanism of pH regulation.
Lecture-4	Body buffers, respiratory and renal mechanisms
Lecture-5	Acidosis, alkalosis assessment of acid base status.
Lecture-6	Normal values of electrolytes, blood gas analysis.
Lecture-7&8	Detoxification mechanisms.

Practicals

Practical 1 Related spotters and case report.

XI. A. Vitamins

Learning outcomes: At the end of this chapter the student should be able to:

- Define and classify vitamins.
- Know the general characteristics of fat soluble and water soluble vitamins.
- Know the chemical nature, coenzyme forms, biochemical functions, sources requirement, deficiency diseases, antagonists and toxicity of vitamin A vitamin D, Vitamin E and Vitamin K
- Know the different chemical forms of vitamin A.
- Know the absorption, transport and storage of Vitamin A.
- Explain wald's visual cycle.

- Know the deficiency of Vitamin A- ocular and non – ocular disorders.
- Explain the synthesis of calcitriol, its regulation.
- Know the mechanism of action of calcitriol.
- Understand the deficiency symptoms of vitamin D- Rickets and osteomalacia
- Understand and know about free radicals, lipid per oxidation and antioxidants and action of vitamin E.
- Understand the significance of vitamin K administration to newborns vitamin K antagonists as anticoagulants, relation between vitamin K and prothrombin time.
- Know the chemical nature coenzyme forms, biochemical functions sources, requirement deficiency diseases and antagonists of thiamine riboflavin, niacin , pantothenic acid, pyridoxine biotin, folic acid vitamin B and vitamin C.
- Know the biochemical basis of disorders – beriberi, wernicke- knorsakoff syndrome pellagra, scurvy megaloblastic anemia.
- Explain the synthesis and activation of folic acids.
- Explain the folic acid involvement I one carbon metabolism.
- Know the inhibitors of folate synthesis and their implication in cancer therapy – folate antagonists.
- Describe the folate trap
- Know the absorption transport and storage of vitamin B₁₂

Course content

<i>Lectures</i>	<i>Total 10 hours</i>
Lecture-1	Vitamin A
Lecture-2	Vitamin D
Lecture-3	Vitamin E, free radicals, antioxidants lipid peroxidation.
Lecture-4	Vitamin K
Lecture-5	Thiamine and Riboflavin
Lecture-6	Pyridoxine and pantothenic acid
Lecture-7	niacin and biotin
Lecture-8	Folic acid, one carbon metabolism antifolate agents
Lecture-9	Vitamin B ₁₂
Lecture-10	Vitamin C

Practicals

Practical 1 Related spotters and case reports

Name of the chapter:

XI B. Mineral : Bulk and Trace Minerals

Learning outcomes: At the end of this chapter the student should be able to:

- Explain the various sources of bulk and trace minerals.
- Mention their dietary requirements.
- Understand their absorption and transport in the body,
- Describe their fate, metabolism and excretion
- Explain their functions.
- Give their deficiency manifestations
- Explain normal values of sodium, potassium, chloride and the associated disorders.

Course content

Lectures *Total 6 hours*

Lecture-1 Calcium (regulation of normal levels in blood , effect of vitamin B, parathyroid, calcitonin), phosphorus magnesium.

Lecture-2 Iron, copper

Lecture-3 Iodine, thyroid hormones, thyroid function tests, hyper and hypothyroidism

Lecture-4 Normal values of sodium, potassium and chloride.

Lecture-5 Zinc, manganese, selenium fluoride

Lecture-6 Chromium lithium, nickel, cobalt molybdenum (clinical significance only).

Practical

Practical- 1 Related spotters and case reports

Practical- 2 Thyroid function tests

XI. C Nutrition and diet

Learning outcomes: At the end of this chapter the student should be able to:

- Know the concept of balanced diet- definition, significance, calorific value of principal nutrients, percentage contribution of each principle nutrient, caloric requirement of adult males and females (sedentary moderate and heavy workers), pregnant and lactating women.
- Factors to be considered while calculating the energy requirement – age sex physical activity, BMR, SDA- energy calculation in short,
- Definition, normal values, factors affecting BMR.
- Thermogenic Affect/ SDA of food- definition values for major macronutrients.
- Recommended daily allowance (RDA) – definition, standard values for some important major nutrients.

- Daily requirements of carbohydrates, fats proteins essential fatty acids dietary fiber vitamins, mineral- a concept of proximate principle of diet and their relative proportions, food groups importance of each in balanced diet.
- Glycemic index
- Essential fatty acids- definition functions and deficiency saturated and unsaturated fatty acids, Trans fatty acids- definition sources and examples of each.
- Essential amino acids – definition function limiting amino acids- definition and examples, protein quality – definition and examples of positive and negative nitrogen balance, protein sparing effect mutal supplementation of protein.
- Malnutrition- protein calorie malnutrition- kwashiorkor and marasmus- definition, similarities. Differences, biochemical basis for the occurrence of anemia, fatty liver and edema in kwashiorkor.
- Obesity – important biochemical aspects in brief, life style modifications, eating disorders.
- Toxic substances in food, total parenteral nutrition nutritional anemias- causes deficiency symptoms and biochemical evaluation.

Course content

Lectures Total 8 hours

Lecture-1 Calorific value of food, respiratory quotient, basal metabolic rate, clinical significance specific dynamic action

Lecture-2 Energy allowance based on age sex and activity, energy calculation in short (calculation based on BMR, SDA ,physical activity)

Lecture-3 **Nitrogen balance essential amino acids , protein quality biological value.**

Lecture-4 Combination of cereals and pulses, protein requirements, limiting amino acids. Dietary requirements of carbohydrates, lipids, essential fatty acids, dietary fibre.

Lecture-5 Balanced diet, proximate principles of diet and their relative proportions, vitamins and minerals- recommended daily allowance food groups.

Lecture-6 Protein calorie malnutrition- kwashiorkor, marasmus. Obesity in brief

Lecture-7 Toxic substances in food (natural and food additives), total parenteral nutrition.

Lecture-8 Eating disorders, Overview of anemias (nutritional anemias)

Name of the chapter:

XII. Biophysics- Radioisotopes

Learning outcomes: At the end of this chapter the student should be able to:

- Know about different ionizing radiations
- Define the isotope and its half life
- Know the different units of radioactivity
- Know the applications of radioisotopes in biochemistry (Research)
- Explain the uses of isotopes in diagnosis and treatment
- Know about the radiation hazards.

Course content

Lectures Total 1 hour

Lecture-1 Isotopes

(B) Internal Assessment:

Two Internal Assessment Examinations and a Pre University Exam is conducted in theory and practical separately .

Theory	Marks	3 hrs. Paper
	80 (Theory)+ 20 (MCQ)*=100 (Total)	20 MCQ For 20 mins+ Essay paper for 2 hrs. 40 mins
Viva Voce	20	Total marks:120

***No negative marking for MCQs**

Practical	Marks
Quantitative experiment	09
Quantitative experiment	06
Spotters / OSPE	15
Case discussion	05
Marks for records	05
Total	40

Note: Submission of completed record book is the eligibility to attend all the examinations conducted by the department.

(C) University Examination

Maximum marks in biochemistry (Theory + Practical) =140+60 =200

Theory: Paper I and II

Theory	Marks	
Paper- I	80 (Theory)+ 20 (MCQ)=100 (Total) To be scaled down to 50	3 hrs. Paper: 20 MCQ For 20 mins+ Essay paper for 2 hrs. 40 mins
Paper -2	80 (Theory)+ 20 (MCQ)=100 (Total) To be scaled down to 50	3 hrs. Paper: 20 MCQ For 20 mins+ Essay paper for 2 hrs. 40 mins
Viva Voce	20	
Internal Assessment	20	
Total	140	

***No negative marking for MCQs**

Minimum pass criteria: (Both should be fulfilled) 40/100 for theory and 70/140 as aggregate pass

Practical	Marks
Quantitative experiment	12
Quantitative experiment	08
Spotters / OSPE	15
Case discussion	05
Total	40

Total: 40+20 (Internal assessment) = 60. Minimum pass requirement is 16/40 and 30/60 as aggregate.

Note: Submission of completed and certified record book is the eligibility to attend the university practical examination.

(D) Calculation of Internal Assessment

For candidates with attendance of 75% or above in theory and practical's separately, the averages of best two examination marks are considered and finally calculated to 20 marks.

For candidates with attendance of below 75% in theory and practical's separately. The averages of all three examination marks are considered and finally calculated to 20 marks.

(E) Minimum requirement of internal assessment as eligibility criteria to appear for university examination.

35% internal assessment marks in theory and practical's separately i.e. 7/20 for theory and practical separately.

(F) Minimum requirement of attendance as eligibility to appear for university examination.

75% attendance in theory and practical's separately

(G) Specification table for FIRST MBBS University examination in Biochemistry (Approximate percentage of marks allotted)

Paper I (Written + MCQ)

Carbohydrates	Chemistry digestion, Absorption Metabolism	24 Marks (include minimum 5 MCQ's)
Lipids	Chemistry digestion, Absorption Metabolism	24 Marks (include minimum 5 MCQ's)
Amino acids and proteins	Chemistry digestion Absorption Metabolism	29 Marks (include minimum 5 MCQ's)
Enzymes		13 Marks (include minimum 2 MCQ's)
Biological Oxidation Radio isotopes Integration of metabolism IEM screening		10 Marks (include minimum 3 MCQ's)
Total		100 marks

Paper II (Written+ MCQs)

Purine, Pyrimidine chemistry and metabolism Molecular biology, Molecular genetics, Biotechnolgy Cell membrane + Transport across membrances	36 Marks (include minimum 8 MCQ's)
Heme metabolism LET, Detoxification RFT	19 Marks (include minimum 3 MCQ's)
Acid Base Balance	9 Marks (include minimum 2 MCQ's)
Vitamins (Fat soluble + water soluble)	19 Marks (include minimum 4 MCQ's)
Minerals	8 Marks (include minimum 2 MCQ's)
Nutrition	9 Marks (include minimum 2 MCQ's)
Total	100 rks

(H) Pattern for Internal and University Examination theory question paper in Biochemistry.

SI.	Nature of Questions	Duration of paper 3hours (max. Marks-100)		
1	Essay	2	10	20
2	Short Answer	15	4	60
3	MCQ	20	1	20
			TOTAL	100

Recommended Books

S.N.	Name of Book	Author	Edition	Publisher
	Essential Books:			
1	Biochemistry	U. Satyanarayana	4 th	Uppala author publisher Interlinks
2	Text Book of Bichemistry for Medical students	D.M. Vasudevan	8 th	Jaypee
	Reference Books:			
1	Harper's review of Biochemistry	Harper's	30 th	Lange
2.	Lippincott's Illustrated reviews Biochemistry	Richard Harvey	6 th	William & Wilkins

Community Medicine

5.1 Goal

The broad goal of Community Medicine in the undergraduate curriculum is to train the students to function as first level physicians in the community in accordance with the institutional goals.

5.2 Objectives

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

1. Describe the health care delivery system including rehabilitation of the disabled in the country.
2. List epidemiological methods and describe their application to communicable and non-communicable diseases in the community or hospital situation.
3. Understand the epidemiology of the Communicable and Non-communicable disease and the concept of control of these diseases at individual, family and community level.
4. List out the common causes of maternal and child mortality and morbidity in our country, understand measures to reduce it and describe the National Health Programmes related to maternal and child health.
5. Apply bio- statistical methods and techniques.
6. Outline the demographic pattern of the country and appreciate the roles of the individual, family, community and socio-cultural milieu in health and disease.
7. Describe the health information systems.
8. Enunciate the principles and components of primary health care and national health policies to achieve the goal of "Health for all".
9. Identify the environmental and occupational hazards and their control.
10. Describe the importance of water and sanitation in human health.
11. To understand the principles of health economics, health administration, health education in relation to community.

5.3 Skills

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

1. Use epidemiology as a scientific tool to make rational decisions relevant to community and individual patient intervention.
2. Collect, analyze, interpret and present simple community and hospital based data.
3. Diagnose and manage common health problems and emergencies at the individual, family and community levels keeping in mind the existing health care resources and in context of the prevailing socio-cultural beliefs.

4. Diagnose and manage maternal and child health problems and advise a couple and the community on the family welfare planning methods available in the context of the national priorities.
5. Diagnosis and manage common nutritional problems at the individual and community level.
6. Plan, implement and evaluate a health educational programme with skill with help of simple audio-visual aids.
7. Interact with other members of the health care team and participate in the organization of health care services and implementation of national health programmes.

5.4 Integration

The undergraduate training in Community Medicine would give an insight to integrated approach to management of certain diseases and community health problems.

5.5 Lectures: 10 hours

Introduction to Behavioural Sciences and Medical Sociology

- Concepts in Medical Sociology and role of behavioural sciences in Health Sociology, social organizations, social classification.
- Family, role of family in health and disease, and family health care
- Cultural factors in health and disease

5.6 Field Visits: 12 hours

Visit to the health establishments in the community to give an idea about primary, secondary, tertiary levels of health care and the range of services provided through these establishments in terms of health promotion, disease prevention, and rehabilitation besides treatment of sickness.

Further, introduce them to the concept of delivery of health services through outreach programmes, domiciliary care etc., and sensitise them to the national health problems and national health programmes implemented through the primary health centres.

5.7 Student Seminars: 15 hours

The following are suggested topics

1. Population explosion and its consequences
2. Vegetarianism Vs Non-vegetarianism

3. Smoking or health the choice is yours
4. HIV infection and AIDS
5. Health hazards of pollution and its control

5.8 Humanities: 20 hours

1. Village India
2. Indian cultural heritage
3. Ancient Indian system of medicine
4. Environment and sustainable development.