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NOTIFICATION

The Syndicate has, in exercise of its powers under section 27 (1) of UHS Ordinance 2002, approved the Revised Syllabi, Table of Specifications and OSPE format for First Professional MBBS Part-I and Part-II Examinations, in the subjects of Anatomy including Histology, Physiology and Biochemistry, to be implemented with effect from the academic session 2013-2014 and onwards.

REGISTRAR

No. UHS/REG-13/3446 Dated: 13-12-2013

Copy forwarded for information to:

i. Principals/Heads of the Affiliated Medical Colleges for information of the Faculty and students
ii. Controller of Examinations
iii. Director (I.T.)
iv. PSO to Vice Chancellor
v. PS to Registrar

Encl. As above

REGISTRAR

SYLLABUS, ToS & OSPE

M.B.B.S.

FIRST PROFESSIONAL

PART-I

ANATOMY INCLUDING HISTOLOGY

"GROSS ANATOMY"

The study of gross anatomy must lay emphasis on applied anatomy as related to clinical medicine and surgery. For teaching, actual dissection of cadaver, dissected specimens, models, and computer aided programs shall be used. Normal images of different diagnosis techniques i.e. X-rays and CT scans, MRI and Ultra-sonography shall also be introduced.

The time for dissection of the cadaver for each region is as under:

Upper Limb	-	12 weeks
Lower Limb	-	12 weeks
Thorax	-	8 weeks

"GENERAL ANATOMY"

After the end of the course, the students are able to:

1. **Explain anatomical terms and sectional planes of the body.**
2. **Skeletal System:**
    1. Classify the skeleton system (appendicular and axial).
    2. Classify bones on the basis of shape, size, evolution, structure, development, region and miscellaneous
    3. Describe general features of bones of human body
    4. Explain the functions of bones
    5. Discuss the general concepts of ossification and growth of bones.
    6. Describe the blood supply of bones
    7. Comprehend clinical correlates of skeletal system (fractures, rickets, osteoporosis, osteomalacia, sternal puncture, avascular necrosis, radiological appearance of bone, cartilage and fractures)
3. **Joints:**
    1. Explain the basis of classification of joints.
    2. Discuss the characteristics, types and movement of synovial, cartilaginous and fibrous joints.
    3. Mention and describe the factors responsible for the stability of joints.
    4. Explain general principles of blood and nerve supply of joints.
    5. Understand, describe, and analyze different clinical scenario resulting into dislocation of joints.
4. **Muscles:**
    1. Describe different terms related to muscles.
    2. Comprehend the basis of classification of muscles.
    3. Describe general principles of blood and nerve supply of muscles.
    4. Explain sprain, spasm, trophic degeneration and regeneration changes
    5. Define and explain the mechanism of sprain and spasm.

6. Comprehend and explain the function of synovial structures related to muscles (tendon sheaths, bursae)
7. Understand and describe different form of fibrous structures occurring in skeletal muscles (aponeurosis, tendon, raphae)

5. Circulatory Systems:

1. Give the classification of circulatory systems (cardiovascular, lymphatic)

a) Cardiovascular System:

1. Understand and describe different types of cardiovascular circulation (Systemic, Pulmonary and Portal)
2. Understand and explain the classification and structures of different types of blood vessels.
3. Define, understand and classify anastomoses with examples and their clinical correlates

b) Lymphatic System:

1. Define and describe components of lymphatic system (lymph nodes and lymph vessels)
2. Comprehend the mechanism of production and circulation of lymph.
3. Describe the functions of lymphatic system and its role in spread of infection and cancer

6. Nervous System:

1. Name different components of nervous tissue (neuron, ganglion, nuclei, nerve, tracts)
2. Define and classify different types of nervous system (Somatic and Autonomic)
3. Enumerate different parts of somatic nervous system, their morphology and functions (central nervous system and peripheral nervous system).
4. Describe the formation and distribution of a typical spinal nerve.
5. Discuss the nerve plexus formation; define dermatomes and give their clinical importance.
6. Enumerate and describe different parts of autonomic nervous system and their functions (sympathetic nervous system and parasympathetic nervous system).
7. Define and comprehend reflex, reflex arc and referred pain.

7. Skin and Fascia:

1. Name different types of skin and mention its components (dermis and epidermis).
2. Enumerate its appendages and give their function (hair, nail, arrector pili muscles, sebaceous and sweat glands).
3. Comprehend and describe the structure and function of superficial and deep fasciae including retinaculae and septae.
4. Describe the skin lines and their significance.
5. Give clinical significance of discolouration of skin (jaundice, cyanosis and anemia).

8. Common Diagnostic Techniques used in the study of Human Body

1. Interpret normal radiographs of different regions of the body.
2. Identify displacement of the fracture segments of the bone.
3. Diagnose dislocation of the joints.
4. Understand and interpret ultra-sonographs of abdominal viscera.
5. Understand principle of CT scan and interpret the normal scans.
6. Comprehend MRI and interpret normal images of different diagnosis techniques i.e. X-rays and CT scans, MRI and Ultra-sonography.
7. Take the Biopsy and prepare it for examination.

"Course objectives of Upper & Lower Extremities / Limbs"

After the end of the course, the students are able to:

1. Develop an expertise in prosection and identification of structures in a cadaver
2. Develop clear concepts of the topographic anatomy of the regions.
3. Understand muscle attachments, their actions, nerve supply and effect of paralysis occurring in groups and important individual muscles
4. Develop clear concept of structure and mechanism of joints and the clinical conditions involving them.
5. Understand bones of the appendicular skeleton, their general and special features
6. Recognize and describe the bones of the foot and hand individually, in articulation and in skiagrams.
7. Develop clear concept about common fractures of the bones, displacement of their fragments and, factors causing it.
8. Understand nerve plexuses of limbs, their normal variations and different clinical conditions related to them.
9. **Understand different kinds of injuries to the important nerves of the extremities, the ways these injuries are produced, their effects and clinical tests to diagnose the conditions.**
10. Recognize important superficial veins and their clinical uses.
11. Understand the mechanism by which the blood is pumped from lower limb and anatomical factors which predispose to development of varicose veins.
12. **Understand anatomical relevance to important clinical conditions in the regions.**
13. Understand the scheme of regional lymphatic drainage and vascular supply.
14. Interpret normal skiagrams, C.T. Scans, MRI and Ultrasound.

"Course objectives of Thorax"

On completion of the Gross Anatomy of Thorax the students are able to:

1. Develop an understanding of the topographic anatomy of the region and describe it.
2. Understand and describe the anatomy of the bony thorax and costo-vertebral and other joints of thorax and the mechanism of respiration.
3. Understand and mark the important thoracic viscera and pleural reflections on the surface of the body.
4. Understand the importance of percussion nodes in eliciting the extent of resonant and non resonant viscera and their clinical importance.

5. **Give a precise account of the Anatomy of thoracic viscera, muscles, nerves, blood vessels and fasciae of the region and correlate anatomical information to common clinical conditions.**
6. Understand and describe the scheme of the regional lymphatic drainage and lymph nodes.
7. Interpret normal skiagram, CT scan, MRI and other diagnostic techniques.

"GENERAL HISTOLOGY"

After the end of the course, the students are able to:

1. Enumerate and describe structure of different components of cell.
2. Classify the basic tissues of the body.
3. Classify and describe different types of epithelia with examples.
4. Comprehend and describe surface modification of plasmalemma (intercellular junctions, microvilli, cilia, stereocilia, basal striations).
5. Define, classify and describe different types of connective tissue proper with examples.
6. Comprehend and describe the structures of connective tissue cells, fibers and ground substance.
7. Classify and describe different types of cartilages with examples.
8. Classify bones from histological point of view (spongy and compact), and describe their microscopic structure.
9. Comprehend and describe histogenesis of bone (intramembranous and intracartilagenous).
10. Classify and describe light and electron microscopic structure of muscles (smooth, cardiac and skeletal).
11. Classify and describe the structure of neuron, neuroglial cells and nerve fibre
12. Describe microscopic structure of lymphoid organs (lymph node, spleen, tonsils and thymus) and give their functions.
13. Classify and describe different sub-division of vascular system.
14. Understand and describe microscopic structure of different types of blood vessels.
15. Describe microscopic structure of skin and its appendages (hair follicle, sebaceous and sweat glands) and give their functions.
16. Understand and describe the microscopic structure of mammary gland in different functional stages.
17. Describe the microscopic structure of respiratory system (nasal cavity, epiglottis, trachea, bronchi and lungs) and give the changes in structure correlating these to their functions.
18. Define apoptosis, hypertrophy, atrophy, metaplasia, hyperplasia, anaplasia, neoplasia, necrosis.
19. Identify, draw and label light microscopic structures of above mentioned tissues.

"EMBRYOLOGY"

After the end of the course, the students are able to:

1. Comprehend and describe the process of cell division (mitosis and meiosis) and gametogenesis.
2. Understand and describe ovarian and menstrual cycle.
3. Understand and describe fertilization, cleavage, blastocyst formation and implantation of the embryo (1^{st} week of development).
4. Comprehend and describe stages of early embryonic development in second and third week of intrauterine life.
5. Understand and describe development of embryo (4^{th} - 8^{th} week of development).
6. Comprehend and describe fetal period (9^{th} week to birth).
7. Define and describe fetal structures (amnion, chorion, yolk sac, allantois and umbilical cord)
8. Comprehend and describe formation of placenta, its structure and anomalies.
9. Understand and describe the basis of multiple pregnancies.
10. Understand and describe procedures for assessment of fetal status.
11. Define and understand clinical correlates i.e. anovulatory cycles, semen analysis and abnormal sites of implantation.
12. Understand In-Vitro Fertilization (IVF), assisted in-vivo fertilization.
13. Understand and describe the rationale of choriocarcinoma, pregnancy test, sacro-coccygeal teratoma, hydatidiform mole.
14. Understand the check points of estimation of gestational age and viability of fetus.
15. Understand the basis of intrauterine growth retardation, hydramnios, twin transfusion syndrome, conjoined twins, umbilical cord length variation, and amniotic bands.
16. Define teratogenesis and name common teratogens.
17. Describe the development of Integumentry system including mammary gland and their anomalies.
18. Describe the development of limbs and vertebral column including their anomalies.
19. Understand and describe the development of muscular system and their anomalies.
20. Understand and describe the structural and numerical chromosomal anomalies i.e. Klinefelter syndrome, Turner's syndrome, Super-female, Down's syndrome, Polyploidy.

Clinical Module

1. Describe clinical effects of nerve injuries of the upper and lower limbs
2. Explain the anatomical aspects of fracture of bones of upper and lower limbs (clavicle, humerus, radius, ulna, femur, tibia, fibula, scaphoid) and ribs
3. Explain the anatomical aspects of dislocation of joints of limbs
4. Describe anatomical basis of contracture, ganglia, pulp infection, carpel tunnel syndrome
5. Explain the anatomical basis of femoral hernia, varicose veins, bursitis and lymphadenitis
6. Describe anatomical basis of spread of carcinoma breast
7. Explain clinical importance of coronary circulation with reference to angina and myocardial infarction
8. Define cardiac temponade, pericarditis and paracentesis in relation to anatomical aspects
9. Define pleural effusion pleurisy, pleural tap, pneumothorax, hydrothorax, haemothorax, pneumonia, bronchogenic carcinoma, foreign body in airways in relation to anatomical aspects

RECOMMENDED BOOKS (Latest Edition):

1. General Anatomy by Prof. Tassaduq Hussain Sheikh
2. Medical Histology by Prof. Laiq Hussain Siddiqui
3. Cunningham's Clinical Dissector
4. Di-Fiore Atlas of Histology
5. Clinically Oriented Embryology by Keith L Moore
6. Clinically Oriented Anatomy by Keith Moore.
7. Cunningham's Manual of Practical Anatomy by G.J. Romanes, 15th Ed., Vol-I, II.

REFERENCE BOOKS

1. **Clinical Anatomy** by Snell.
2. **Grant's** Dissector of Anatomy.
3. Wheater's Functional Histology
4. **Basic histology** by Junqueira and Carniero
5. **Grant's** Atlas of Anatomy
6. **Langman's embryology**

MBBS 1st PROFESSIONAL (PART-I)

TABLE OF SPECIFICATIONS (ToS)

Anatomy including Histology

General Anatomy	Anatomical Terms and Sectional Planes of the Body	1	One In reference to Upper and Lower Limbs
	Skeletal System		
	Joints	1	
	Muscles	1	
	Circulatory System (a) Cardio Vascular & (b) Lymphatic Systems	1	
	Nervous System	1	
	Skin and Fasciae	1	
	Diagnosis Techniques		
Histology	Cell	1	1
	Epithelium	1	
	Connective Tissue (a) Bones (b) Cartilage (c) Connect Tissue Proper	2	
	Muscular Tissue	1	
	Nervous Tissue, Skin and Mammary Gland	1	
	Lymphoid organs	1	
	Vascular System	1	
	Respiratory System	1	
Embryology	Cell Divisions (mitosis and meiosis) and Gametogenesis	1	1
	Fertilization, Development 1-2 weeks	1	
	Development 3- 8 weeks	1	
	Fetal Period and Teratogenesis	1	
	Fetal membranes & Placenta	1	1
	Multiple pregnancies and diagnostic procedures	1	
	Development of muscular system, skeletal system and limbs	2	
	Development of skin, appendages and mammary glands	1	
Upper Limb	Pectoral Region, Shoulder region, Axilla	2	1
	Arm	1	
	Forearm	2	1
	Hand	2	
Lower Limb	Gluteal region	1	1
	Thigh	2	
	Leg	2	1
	Foot	2	
Thorax	Heart	1	1
	Lung	1	
	Pericardium / Pericardial Sac	1	
	Pleura, Pleural Cavity	1	
	Thoracic Wall, Joints, Bones and Diaphragm	1	
	Intercostal space and contents	1	
	Mediastinum and its contents	1	
	Total	45	9

1. 25% MCQ's and SEQ's should be clinical oriented or problem based
2. In each limb, an equal distribution should be practiced for the following tissues
   i. Skin
   ii. Muscles
   iii. Bones
   iv. Connective Tissue sheathes
   v. Joints

vi. Nerves
vii. Vessels

3. SEQs of general anatomy may be asked in reference to upper and lower limb

MBBS 1st Professional Part (I) OSPE

Gross Anatomy, Radiological Anatomy & Embryology

Gross & Radiological Anatomy and Embryology.

1. Total No. of stations 12, each station will have 02 marks and 04 spots of identification.
2. Each station shall be given 1.5 min.
3. Total marks shall be 24.

Gross Anatomy of Upper Limb, Lower Limb, Thorax, Radiological Anatomy & Embryology

Time per station: 1.5 minutes (18 minutes)

Set No	Region/Area	Station No	Total Spots	Marks Each Station
1	Upper Limb	01	04	02
	Upper Limb	02	04	02
	Upper Limb	03	04	02
2	Lower Limb	04	04	02
	Lower Limb	05	04	02
	Lower Limb	06	04	02
3	Thorax	07	04	02
	Thorax	08	04	02
4	Radiological Anatomy	09	04	02
5	Embryology	10	04	02
	Embryology	11	04	02
	Embryology	12	04	02
	Total	**12**	**48**	**24**

HISTOLOGY OSPE AND VIVA

1. There shall be 10 slides fixed on 10 microscopes.
2. They will move from one to the next slide in a predetermined direction.
3. For each station one minute shall be given, students will give point/points of identifications for each slide **(Annexure A).**

4. Total number of identifications spots — 10

   a. Each spot will be given — 01 mark (0.5 marks for identification and 2 points of identification, 0.25 marks each)

   b. Total marks allocated shall be: — 10

5. Time consumed shall be — 10 min.

Long slide (Total Marks 10):

6. Time: 15 minutes will be given for

Identification	1 mark
Drawing	1 mark
Labeling	1 mark

Interactive Examination Long Slide: 7 marks

ANATOMY STRUCTURED VIVA

The following areas shall be examined; the questions are framed with emphasis on those areas which are not easily evaluated in theory examinations. Course segments, the marks allocation and number of questions for each are given as under:

Sr. #	Course Area	Marks allocated	Minimum Number of Questions
1.	Surface marking	04	01
2.	Upper limb	10	02
3.	Lower limb	10	02
4.	Thorax	10	02
5.	Embryology	12	03
Total		**46**	**10**

Note: Materials for the examination shall be the responsibility of the Department/ College which should be put in place well before the time of the examination. Examination space and facilities shall be evaluated by the external examiner who will make sure that the movements of the candidate are well organized to maintain the transparency of the procedure.

Annexure A

Standardized Identification Points for Histology Slides for 1st Year MBBS Class

General Histology

SIMPLE EPITHELIUM

Simple squamous epithelium:

Slide view →

a) Single layer of flattened / elongated/ fusiform cells

b) Central elongated bulging nucleus

Surface view →

a) Single layer of flattened / squamous cells

b) Central round nucleus

Simple cuboidal epithelium:

a) Single layer of cuboidal / square shaped cells

b) Central round / spherical nucleus

Simple columnar epithelium:

a) Single layer of tall / cylindrical cells

b) Elongated nucleus in basal part of each cell/ oval basal nucleus

Simple columnar ciliated epithelium:

a) Single layer of tall / cylindrical cells

b) Hair like cilia (on luminal surface)

Pseudostratified columnar epithelium:

a) Single layer of short basal and tall columnar cells

b) Nuclei at different levels

Pseudostratified columnar ciliated epithelium:

a) Single layer of tall columnar ciliated cells and short round / cuboidal basal cells

b) Nuclei at different levels

STRATIFIED EPITHELIUM

Stratified squamous non keratinized epithelium:

a) Multilayered epithelium

b) Superficial layer consisting of non-keratinized squamous cells

Stratified squamous keratinized epithelium:

a) Multilayerd epithelium

b) Superficial layer of keratinized squamous cell

Stratified cuboidal:

a) Multilayered epithelium

b) Superficial / surface cuboidal cells

Stratified columnar epithelium:

a) Multilayered epithelium

b) Surface columnar cells

Transitional epithelium:

a) Multilayered epithelium

b) Surface layer consists of dome-shaped cells] Any one of b, c, d

c) Middle layer consists of pear shaped cells / polyhedral cells]

d) Basal layer consists of cuboidal / columnar cells]

CONNECTIVE TISSUE

Areolar tissue / Loose connective tissue:

a) Abundant ground substance with Connective tissue cells

b) Scattered / dispersed fibres (collagen fiber bundles / elastic fibers)

Adipose tissue (H & E):

a) Vacuolated round or oval cells

b) Peripheral nucleus

Dense regular fibrous connective tissue:

a) Regularly-arranged densely packed collagen fibre bundles

b) fibroblasts in between the fibre bundles

Dense regular elastic connective tissue:

a) Densely packed elastic fibres

b) Fibroblasts in between the fibres

Dense irregular connective tissue:

a) Densely packed scattered various types of connective tissue fibres

b) Fibroblasts nuclei in between the fibres / scanty ground substance

Mucoid connective tissue:

a) Abundant ground substance

b) Stellate fibroblasts / mesenchymal cells

Hyaline costal cartilage:

a) Homogeneous matrix with isogenous group of chondrocytes

b) Perichondrium

Hyaline articular cartilage:

a) Isogenous groups of chondrocytes in homogenous matrix

b) Perichondrium absent] Any one of b, c

c) Isogenous groups of chondrocytes in vertical columns]

Elastic cartilage:

a) Elastic fibres in the matrix

b) Perichondrium] Any one of b, c

c) Isogenous groups of chondrocytes]

Fibrocartilage:

a) Collagen fibres in the matrix

b) Chondrocytes in between fibres] Any one of b, c

c) Perichondrium absent]

Compact bone:

a) Haversian systems

b) Outer and inner circumferential, interstitial lamellae

Spongy bone:

a) Bony traneculae with osteocytes

b) Irregular marrow cavities

MUSCLES:

L.S. Skeletal muscles:

a) Elongated / cylindrical muscles fibres with cross striations

b) Multiple subsarcolemmal / peripheral nuclei

T.S. Skeletal muscles:

a) Bundles of transversely cut muscle fibres

b) Peripheral rounded nuclei

Cardiac muscles:

a) Elongated / cylindrical branching striated muscle fibres

b) Central single nucleus] Any one of b, c

c) Intercalated discs]

Smooth muscles:

a) Spindle shaped non striated muscle cells

b) Single oval central nucleus

NERVOUS TISSUE

TS peripheral Nerve:

a) Bundles of transversely cut nerve fibres (axons)

b) Epineurium / perineurium / endoneurium

Sensory ganglion:

a) Rounded pseudounipolar neurons in groups at the periphery

b) Bundles of nerve fibres in central region] Any one of b, c

c) Thick connective tissue capsule]

Autonomic ganglion:

a) Small multipolar neurons

b) Cells bodies of neurons scattered irregularly

Spinal cord:

a) Central canal

b) Inner H-shaped gray matter] Any one of b, c

c) Out white matter]

Cerebrum:

a) Outer gray matter and inner white matter
b) Pyramidal cells in gray matter

Cerebellum:

a) Outer gray matter and inner white matter
b) Purkinje cell layer

Elastic artery:

a) Predominant elastic fibres in tunica media
b) Internal elastic lamina not identifiable in tunica media

Muscular artery:

a) Predominant smooth muscle fibres in tunica media
b) Prominent internal elastic lamina

Vein:

a) Thin tunica media
b) Thick tunica adventitia containing abundant collagen fibres

RESPIRATORY SYSTEM

Epiglottis:

a) Elastic cartilage
b) Stratified squamous non keratinized epithelium / pseudostratified columnar epithelium

Trachea:

a) Pseudostratified columnar ciliated epithelium
b) C-shaped hyaline cartilage

Lung:

a) Alveoli lined by simple squamous epithelium
b) Sections of bronchi and bronchioles

LYMPHOID ORGANS:

Lymph node:

a) Cortex containing lymph nodules
b) Cords of lymphoid tissue in medulla

Palatine tonsil:

a) Non-keratinized stratified squamous epithelium
b) Tonsillar crypts] Any one of b, c
c) Lymph nodules]

Thymus:

a) Thymic (Hassall's) corpuscles in medulla
b) Cortical lobules containing densely packed lymphocytes (thymocytes)

Spleen:

a) Red pulp with splenic cords and venous sinuses
b) White pulp containing lymphatic nodules

INTEGUMENTARY SYSTEM

Thin skin:

a) Epidermis with thin layer of keratinized cells
b) Dermis containing hair follicles

Thick skin:

a) Epidermis with thick stratum cornium and prominent stratum lucidum
b) No hair follicles

SYLLABUS, ToS & OSPE

M.B.B.S.

FIRST PROFESSIONAL

PART-I

PHYSIOLOGY

PHYSIOLOGY (MBBS 1st Prof. Part-I)

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

Basic and Cell Physiology

1. *Understand functional organization of human body*
2. Describe homeostasis / control systems in the body
3. Describe *structure*, functions of cell membrane and its transport mechanisms
4. List cell organelles and describe their functions
5. Understand basic concepts about DNA and RNA

Blood

1. Describe the composition and general functions of blood
2. Enumerate plasma proteins, give their properties, their sites of production and explain their functions
3. Explain erythropoiesis and factors affecting erythropoiesis
4. Explain the functions of red blood cell
5. Understand the structure; describe functions of hemoglobin and enumerate its different types.
6. Describe the role of various elements especially iron in hemoglobin synthesis.
7. Enumerate and define various blood indices
8. Explain leucopoiesis and describe types and functions of white blood cells
9. Describe monocyte-macrophage system and functions of spleen
10. Explain various types of immunity
11. Explain thrombocytopoiesis and describe functions of platelets
12. Explain hemostasis, mechanism of blood coagulation, fibrinolysis and anticoagulants
13. Explain the blood groups and their role in blood transfusion
14. Understand fate of red blood cells and bilirubin formation

Applied Physiology

Understands:

1. Anemia, its types and the effects on human body
2. Polycythemia, its types and effects on the human body

3. Blood indices in various disorders
4. Clotting and bleeding disorders
5. Hazards of blood transfusion
6. Rh incompatibility
7. Abnormal immune responses
8. Jaundice

Nerve and Muscle

1. Understand the *structure of the neuron* and describe the properties of nerve fibres
2. Classify the nerve fibres
3. Describe the physiological basis of resting membrane potential
4. Describe the genesis of action potential and compound action potential
5. Describe the propagation of action potential
6. Outline the structural-functional relationship of skeletal muscle
7. Describe neuromuscular junction and transmission
8. Explain and compare the mechanism and characteristics of contraction of the three muscle types.
9. Differentiate between the isometric and isotonic contraction
10. Understands the difference between tetany and tetanization
11. Excitation contraction coupling
12. Understand chemical changes during muscle contraction and muscle fatigue

Applied Physiology

Understands:

1. Peripheral nerve injuries
2. Myasthenia gravis
3. Muscular dystrophy
4. Muscular hypertrophy / atrophy
5. Rigor mortis / contracture
6. Drugs / poisons affecting neuromuscular junctions

Cardiovascular System

1. Describe scheme of circulation through the heart and body
2. Describe the properties of cardiac muscle
3. Explain the generation of cardiac impulse and its conduction

4. Compare and contrast action potential of SA node and ventricular myocardium
5. Describe the various events in cardiac cycle
6. Explain the mechanism for production of heart sounds
7. Describe the lead systems for a 12 lead ECG
8. Define, draw and label normal ECG and explain the physiologic basis of waves, segments and intervals
9. List types of blood vessels and their function
10. Describe the haemodynamics of blood flow (local control systemic circulation its regulation and control)
11. Explain the microcirculation and capillary dynamics.
12. Discuss peripheral resistance its regulation and effect on circulation
13. Describe the arterial pulse
14. Define venous return and explain the factors affecting it.
15. Explain cardiac output and its control
16. Describe blood pressure and its regulation
17. Describe coronary circulation and factors affecting it
18. Describe the factors regulating cerebral and cutaneous circulations
19. Define shock and its various types with their physiological / pathophysiological basis
20. Describe the various stages of shock and their physiological compensation.

Applied Physiology

Understands:

1. Basic concepts related to electrical axes and cardiac vectors
2. Differentiation between various ECG recordings on the basis of rate and rhythm (bradycardia, tachycardia, heart-blocks, ventricular fibrillation, atrial fibrillation, myocardial ischemia / infarction)
3. Development of Oedema
4. Effects of hypertension and cardiac failure
5. Clinical significance of heart sounds and murmurs
6. Varicose veins

Respiratory System

1. Describe the functional organization of the respiratory tract.
2. Describe respiratory and non-respiratory function of the respiratory tract
3. Explain the mechanics of breathing

4. Describe the production & function of surfactant and compliance of lungs
5. Describe the protective reflexes
6. Explain lung volumes and capacities including dead space
7. Describe pulmonary circulation and pulmonary capillary dynamics
8. Describe the composition of atmospheric, alveolar and expired air
9. Describe the diffusion of gases across the alveolar membrane
10. Explain the relationship between ventilation and perfusion
11. Describe the mechanism of transport of oxygen and carbon dioxide in blood
12. Describe the nervous and chemical regulation of respiration
13. Explain abnormal breathing
14. Define and explain hypoxia, its causes and effects
15. Define and explain cyanosis, its causes and effects

Applied Physiology

Understands:

1. Causes of abnormal ventilation and perfusion
2. Effects of bronchial asthma, pneumothoax, pleural effusion and pneumonia
3. Respiratory failure
4. Artificial respiration and uses & effects of O_2 therapy
5. Clinical significance of hypoxia, asphyxia, cyanosis, and dyspnoea
6. Respiratory distress syndrome
7. Differentiation between obstructive and restrictive lung disorders on the basis of pathophysiology and lung function test
8. Respiratory acidosis and alkalosis.

Skin and Body Temperature Regulation

1. Describe body temperature regulation
2. Describe functions of skin

Applied Physiology

Understands:

Abnormalities of temperature regulation

Human Responses in Varied Environments:

1. Describe cardiovascular, muscular and respiratory adjustments in exercise
2. Explain physiologic responses to high altitude and space
3. Explain physiologic responses to deep sea diving and hyperbaric conditions

Applied Physiology

1. Acute and chronic mountain sickness
2. Nitrogen narcosis and decompression sickness

PHYSIOLOGY PRACTICALS

Haematology

1. Use of the microscope
2. Determination of haemoglobin
3. Osmotic fragility of RBCs
4. Blood groups
5. Determination of erythrocyte sedimentation rate
6. Determination of packed cell volume
7. Determination of bleeding and clotting times
8. RBC count
9. Platelet count
10. Red cell indices
11. Total Leukocyte count
12. Differential leucocyte count

Respiratory System

1. Clinical examination of respiratory system
2. Pulmonary volumes, capacities and their clinical interpretation
3. Recording of respiratory movements using Stethograph

Cardiovascular System

1. Cardiopulmonary resuscitation (to be coordinated with the department of medicine)
2. Examination of arterial pulse
3. Examination of jugular venous pulse
4. ECG recording and interpretation of normal ECG
5. Recording of arterial blood pressure
6. Effects of exercise and posture on blood pressure
7. Apex beat and normal heart sounds
8. Triple response
9. ICU / CCU / Medical ward visit to study the cases of CCF, Murmurs, Hypertension, Myocardial infarction etc.

Skin and body temperature regulation

Recording of body temperature

Demonstration of power lab (computerized data acquisition system) related experiments

RECOMMENDED BOOKS

1. **Textbook of Physiology** by Guyton and Hall, Latest Ed.
2. **Review of Medical Physiology** by William F. Ganong, Latest Ed.

REFERENCE BOOKS

1. **Human Physiology** by Laurali Sherwood
2. **Physiology** by Berne and Levy, Latest Ed.
3. **Essentials of Medical Physiology by** Prof. Dr. Mushtaq Ahmad
4. Physiology by Linda and Constanzo

MBBS FIRST PROFESSIONAL (Part-I)

Physiology (SEQs and MCQs)

Table of Specifications (ToS)

Topic / Chapter	No. of MCQs	No. of SEQs
Basic and Cell Physiology	02	01
Blood	09	02
Nerve and Muscle	09	02
Skin and Temperature Regulation	02	0.5
Cardiovascular System	14	02
Respiratory System	07	01
Human Responses in Varied Environments	02	0.5
Total	**45**	**09**

MBBS FIRST PROFESSIONAL (Part-I)

PHYSIOLOGY

Objectively Structured Performance Evaluation (OSPE)

(Total Marks: 90)

The structure of OSPE/ Practical/ Viva should be as follows:

- **Viva Voce (35 marks)**
  - Internal ------- 15 marks
  - External ------- 20 marks

- **OSPE (25 marks)**
  - Non-observed stations — 10 of 01 marks each (2 minutes each)
  - Observed stations — 03 of 05 marks each (4 minutes each)

30% C1
40% C2 } OSPE
30% C3

- **Practical (30 marks)**
  - Practical — 20 marks
  - Procedure Writing — 05 marks
  - Yearly Workbook Assessment — 05 marks

SYLLABUS, ToS & OSPE

M.B.B.S.

FIRST PROFESSIONAL

PART-I

BIOCHEMISTRY

SYLLABUS MBBS FIRST PROF. PART-I
BIOCHEMISTRY

Teaching objectives (Biochemistry Part-I):

The general objectives and overall aims of the teaching course include:

1. To teach sufficient biochemistry to give the student a basic understanding of life processes at the molecular level.
2. To provide an understanding of the normal biochemical processes in the human body in which the function of the various organs and tissues are integrated.
3. To undertake practical classes that would familiarize the student with the various chemical methods which are used in the qualitative analysis of carbohydrates, lipids, amino acids/proteins, and biological fluids (urine, etc)
4. To familiarize the students with laboratory instruments / equipment used in biochemistry laboratory.
5. To undertake practical classes that would familiarize the student with the various chemical methods by which normal and abnormal constituents of urine are detected along with the interpretation of presence of these constituents in urine.

Learning objectives (Part-I)

At the end of the Part-I course, the student should be able to demonstrate his knowledge and understanding on the subject with following learning objectives:

1. Molecular and functional organization of a cell, and sub-cellular components.
2. In-depth knowledge of structure, function and interrelationship of biomolecules and consequences of deviation from normal.
3. Delineating, learning and understanding the chemistry of biomolecules of biologic significance. In order to accomplish this, the student will learn the basic chemical aspects of the biomolecules (carbohydrates, lipids, amino acids, polypeptides, nucleic acids).
4. Description of mechanisms involved in maintenance of body fluid & pH and the related homeostatic processes.
5. Recognizing homeostatic dynamics through the concepts of human nutrition and be familiar with the biochemical role of micro- and macro-nutrients like vitamins, minerals, and electrolytes along with their clinical implications of their dietary use.
6. Having a clear understanding of the fundamental aspects of enzymology & clinical applications along with regulation of enzyme activity.
7. Developing skills as a self-directed learner, recognize continuing educational needs; use appropriate learning resources and critically analyze relevant literature in order to have a comprehensive understanding and knowledge of biochemistry.

1- Cell Biochemistry

a) Introduction to biochemistry: An overview of biochemistry and its significance in medicine.

b) Biochemical composition and functions of cell: Organization and composition of eukaryotic and prokaryotic cells (only biochemical aspects)

c) Cell membranes (biochemical composition)

d) Membrane phenomena: Transport of substances across the cell membrane via active (primary and secondary active) transport; diffusion (simple and facilitated), and vesicle-mediated transport (phagocytosis, endocytosis, and exocytosis); Gibbs-Donnan equilibrium, osmosis and osmotic pressure

e) Membrane receptors and other biologically important regulatory and catalytic membrane-bound proteins like G-proteins, adenlylyl cyclase, phospholipase.

f) Basic methods to study cell biochemistry: Centrifugation, ultracentrifugation, radioimmunoassay, ELISA (enzyme-linked imnunosorbent assay); chromatography; electrophoresis, spectrophotometry, and pH metry.

2- Water, pH and buffers

a) Ionization of water; weak acids and bases

b) pH and pH scale: Concept of pH and related topics (determination of pH), and concept of pI (isoelectric pH)

c) pKa value, dissociation constant (Ka), and titration curve of weak acids

d) Determination of pH of buffer: Henderson-Hasselbalch equation and its applications (derivation not required).

e) Body buffer systems (bicarbonate, ammonia, phosphate, and proteins) and their mechanism of action.

3- Carbohydrates

a) Definition, biochemical functions and classification of carbohydrates.

b) Structure and function of biologically important monosaccharides and their important derivatives (sugar acids, sugar alcohols, sugar amines, and glycosides)

c) Isomerism in carbohydrates (types and description)

d) Biologically important disaccharides, their properties and their biomedical importance

e) Oligosaccharides, their combination with other macromolecules and their biomedical importance

f) Homopolysaccharides of biologic significance and their structural and functional characteristics

g) Structural and functional characteristics of heteropolysaccharides including details of glycosaminoglycans; proteoglycans, peptidoglycans; and mucopolysaccharidoses.

4- Amino acids and Proteins

a) Biomedical importance and classification (biologic functions; nutritional value; and overall shape of molecule) of proteins.

b) Structure, functions and properties of amino acids

c) Classification of standard (proteinogenic) amino acids (based upon side chain structure, polarity of side chain, nutritional, and metabolic end-products), biologically important non-standard (non-proteinogenic) amino acids and their principal functions.

d) Dissociation and titration of amino acids; determination of pI of amino acids with two and three dissociable groups; importance of amino acids in the maintenance of pH; and mechanism of buffering action of proteins.

e) Structural organization of proteins: Details of four orders of protein structure (primary, secondary, tertiary, and quaternary); denaturation of proteins; and protein misfolding (amyloidoses and prion disease)

f) Important techniques for separation of proteins (electrophoresis, isoelectric focusing, chromatography, filtration, centrifugation, and dialysis).

g) Immunoglobulins; their types; structure, and biomedical significance.

h) Plasma proteins (viz, prealbumin, albumin, haptoglobin, ceruloplasmin, alpha1-anti-trypsin; alpha 2-macroglobulin and transferrin) and their principal biologic functions along with their clinical significance. Alpha fetoprotein and clinically important acute phase proteins (alpha 1-acid glycoprotein, C-reactive protein).

i) Glycoproteins: components of glycoproteins (overview of linkages between proteins and carbohydrates, N- and O-linked oligosaccharides).

5- Nucleotides and nucleic acids

a) Chemistry of purines and pyrimidines; their types and structure

b) Structure and functions of nucleotides and nucleosides (EXCLUDING metabolism of nucleotides).

c) Natural and synthetic derivatives of purines and pyrimidines and their biomedical role.

d) Structure, functions and types of nucleic acids (EXCLUDING metabolism)

6- Lipids and fatty acids

a) Classification of lipids and their general biological functions.

b) Fatty acids: Definition; nomenclature; classification; chemical and physical properties; isomerism in fatty acids; role of saturated and unsaturated fatty acids in health and disease; role of trans fatty acids (*trans*-fats) in coronary heart disease; omega-3 and omega-6 fatty acids and the importance of their dietary use.

c) Nutritionally essential fatty acids and their functions

d) Eicosanoids and their biologic functions along with their significance in health and disease.

e) Physical and chemical properties of fats and oils (triacylglycerols); saponification, iodine number, and acid number of fats; rancidity of fats

f) Structure and biologic functions & significance of phospholipids, glycolipids, sulfolipids and gangliosides

g) Cholesterol and its related compounds such as bile acids: Structure (constituent structural components), properties and biologic role

h) Lipid peroxidation and its significance

7- Enzymes

a) Introduction, classification and nomenclature of enzymes: Definitions of enzymes and IU of enzyme activity; Enzyme Commission Classification of enzymes along with main subclasses.

b) Properties of enzymes: Chemical nature, active site, catalytic efficiency, specificity, proenzymes, and kinetic properties

c) Coenzymes and cofactors: Coenzymes derived from various vitamins along with the examples of enzymes requiring these coenzymes; and metal cofactors

d) Isozymes and their clinical significance

e) Allosteric enzymes and their biological significance

f) Factors affecting enzyme activity

g) Types of enzyme inhibitors and their biomedical importance: Effects of competitive, non-competitive and uncompetitive inhibitors on enzyme activity, effects of competitive and non-competitive inhibition on Lineweaver-Burke plot.

h) Mechanism of enzyme action and kinetics of enzyme activity (Michaelis-Menten and Lineweaver-Burke equations WITHOUT derivation)

i) Regulation of enzyme activity (covalent modification, allosteric regulation and regulation by gene induction, repression & de-repression of enzyme synthesis)

j) Therapeutic use of enzymes and diagnostic application of determination of enzyme activities of certain enzymes in plasma in hepatic, muscle, prostatic, pancreatic,bone and cardiac diseases.

8- Porphyrins and hemoproteins

a) Chemistry and biosynthesis of heme and other porphyrins including disorders of heme bionsynthesis (porphyrias)

b) Important hemoproteins found in body along with their principal biologic functions; structure and function of hemoglobin and myoglobin, and types of hemoglobin. Hemoglobin A_{1c}

c) Oxygen binding capacity of hemoglobin, factors affecting and regulating the oxygen-binding capacity of hemoglobin. Methaemoglobin (metHb) and methaemoglobinemia.

d) Bilirubin Metabolism: Degradation of heme, synthesis, hepatic uptake, conjugation, and excretion of bilirubin and fate of bilirubin in intestine.

e) Hyperbilirubinemias: Causes of hyperbilirubinemias along with the acquired and congenital disorders leading to hyperbilirubinemias; jaundice and kernicterus.

f) Hemoglobinopathies: Sickle cell anemia (biochemical cause and its clinical manifestations), haemoglobin C disease, haemoglobin SC disease and thalassemias.

9- Vitamins and Minerals

a) General features of vitamins as essential nutrients

b) Classification of vitamins according to their physico-chemical nature and biochemical functions

c) Important dietary sources and recommended dietary allowances of vitamins.

d) Intestinal absorption, transport and storage of vitamins.

e) Mechanism of action of vitamins and their biochemical functions in body.

f) Disorders associated with vitamin deficiency and hypervitaminoses.

g) Minerals (sodium, potassium, chloride, calcium, phosphorus, magnesium, and sulfur) and trace elements (iron, zinc, selenium, iodine, copper, chromium, manganese, cadmium and fluoride) in human nutrition and their sources, absorption, transport, storage, and biochemical functions along with their recommended dietary allowances (RDA).

10- Nutrition

a) Energy metabolism: Caloric value of food, Specific dynamic action (SDA) of food, respiratory quotient, metabolic rate (determination and factors affecting metabolic rate), basal metabolic rate (BMR) (measurement, calculation, and factors affecting BMR)

b) Balanced diet

c) Proteins in nutrition: Obligatory nitrogen loss, nitrogen balance, nutritionally essential amino acids and their role in body growth and nitrogen equilibrium, determination of comparative nutritional efficiency and quality of dietary protein, recommended dietary allowance of protein, protein energy malnutrition (kwashiorkor and marasmus).

d) Fats and lipids in nutrition: Fats as a source of energy, role of saturated and unsaturated fats in health and disease, effect of dietary intake of transfats on health, and nutritionally essential fatty acids.

e) Carbohydrates in human nutrition: Protein sparing effect of carbohydrates, dietary carbohydrates and blood glucose along with the details of glycemic index, dietary fibers (types and biomedical importance).

f) Calculation of caloric requirement of a person and nutritional requirements in pregnancy, lactation, infancy, and old age.

g) Obesity and food additives (artificial sweeteners and flavor enhancers)

11- The Extracellular Matrix

a) Collagen: Types and structure of collagen; biosynthesis & degradation of collagen; collagenopathies (Ehlers-Danlos syndrome (EDS) and Osteogenesis imperfecta (OI))

b) Elastin: Structural characteristics of elastins; role of alpha1-antitrypsin in elastin degradation; major biochemical differences between collagen and elastin; genetic disorders associated with elastin like Williams-Beuren syndrome, supravalvular aortic stenosis, pulmonary emphysema, and aging of the skin.

c) Fibrillin-1 as a protein of microfibrills; Marfan syndrome; fibronectin and its role in cell adhesion and migration; laminin as a protein component of renal glomerular and other basal laminas.

d) Glycosaminoglycans (GAGs): Structure, classification, functions and distribution of GAGs; diseases associated with enzyme deficiencies of degradation of GAGs (mucopolysaccharidoses – Hunter syndrome & Hurler syndrome)

e) Structure and functions of proteoglycans

Laboratory Experiments

- Introduction to use of laboratory facilities / equipment including safety measures
- Preparation of solutions:
  - Preparation of solutions (molar and normal) from various kinds of laboratory chemicals (solid and liquids);
  - Preparation of various kinds of buffer solutions;
  - Basic methods of laboratory calculations;
- Introduction and conversion of conventional and SI measuring units.
- Demonstration of buffer action, and determination of pH (by using indicators and pH meter).
- Qualitative analysis of carbohydrates and proteins.
  - Tests to detect monosaccharides of biomedical significance ----- glucose, fructose and Galactose (Benedict's test, Selivanoff's test, and Osazone test)
  - Tests to detect proteins / peptides / amino acids (Heat coagulation test, sulphosalicylic acid test, Heller's Ring test and Ninhydrin test)
- Collection and storage of urine samples for laboratory analysis, and physical and chemical analysis of urine to detect normal and abnormal constituents.
- Writing a urine report and interpretation of results of urine analysis.

RECOMMENDED BOOKS

- Harper's Illustrated Biochemistry by Murrary RK, Granner DK and Rodwell VW, latest edition, McGraw Hill
- Lippincott's Illustrated Reviews: Biochemistry by Harvey R and Ferrier D, Latest edition, published by Lippincott Williams & Wilkins
- Marks' Basic Medical Biochemistry – A Clinical Approach, by Smith C, Marks AD, and Lieberman M. Latest edition, published by Lippincott Williams & Wilkins
- Practicals and Viva in Medical Biochemistry by Dandekar SP and Rane SA, latest edition, published by Elsevier.

REFERENCE BOOKS

- Textbook of Biochemistry with Clinical Correlations by Devlin TM, latest edition, published by Wiley-Liss
- Biochemistry by Berg JM, Tymoczko JL, and Stryer L, latest edition, published by W.H. Freeman and Company
- Clinical Chemistry and Metabolic Medicine by Martin A. Crook, latest edition, Edward Arnold (Publishers) Ltd
- Lehninger Principles of Biochemistry by David L Nelson and Michael M. Cox
- Tietz Textbook of Clinical Chemistry by Burtis CA and Ashwood ER published by Saunders.
- Fundamentals of Biochemistry Life at Molecular Level by Donald Voet, Judith G Voet and Charlotte W. Pratt

Table of Specifications for Biochemistry Theory Paper
MBBS First Professional Examination (Part-I)

CONTENTS	SEQs	MCQs
1. Biochemistry of the cell, cell membrane, and membrane phenomena, water, pH and buffers	0.5	3
2. Extracellular matrix	0.5	2
3. Chemistry of carbohydrates	1.0	4
4. Chemistry of lipids	1.0	5
5. Chemistry of proteins and amino acids; plasma proteins including immunoglobulins	1.0	6
6. Chemistry of nucleotides and nucleic acids	0.5	3
7. Enzymes	1.0	5
8. Vitamins	1.5	7
9. Nutrition	0.5	2
10. Minerals and trace elements	0.5	4
11. Heme metabolism, porphyrins, porphyrias, jaundice, hemoglobin & myoglobin, hemoglobinopahties	1.0	4
Total items	**09 SEQs**	**45 MCQs**
Total Marks (5 marks for each SEQ and 1 mark for each MCQ)	**45 marks**	**45 marks**

25% of MCQs and SEQs should be clinically oriented or problem-based.

10% *marks are allocated for "Internal Assessment"*

Total Marks for Theory Paper: *SEQ+ MCQ+ Internal Assessment=*
*45+ 45+ 10=**100 Marks***

Table of Specifications for Biochemistry Oral & Practical Examination
MBBS First Professional Examination (Part-I)

Oral and Practical Examination carries 100 marks

Examination Component	Marks
A- Internal Assessment	10
B- Practical Notebook/Manual (Internal Examiner)	05
C- Viva voce a. External examiner: 25 Marks b. Internal Examiner: 25 Marks	50
D- OSPE a. ***Observed stations (6 Marks):*** There are two observed stations; 3 marks for each station – time allowed is 3 minutes for each observed station) b. ***Non-observed stations (16 Marks):*** There are eight non-observed stations; 2 marks for each station – time allowed is 2 minutes for each non-observed station.	22
E- Practical a. Principle, supposed calculation, etc: 4 Marks (External Examiner) b. Performance of the experiment: 4 Marks (Internal Examiner) c. Structured table viva: 5 Marks (External Examiner)	13

Format (Practical Examination / OSPE)
MBBS First Professional Examination (Part-I)
BIOCHEMISTRY *(PART-I)*

Total Marks: 100

Total marks allocated to Oral and Practical Examination are 100

Internal Assessment: 10 Marks

General Viva (Theory Viva): 50 Marks

25 Marks are allocated to internal examiner and 25 marks to external examiner.

Practical Examination: 40 Marks

Practical examination comprises three components i.e. Yearly Workbook, OSPE and Experiment.

A- Yearly Workbook: 5 Marks (Internal Examiner)

B- OSPE: 22 Marks

OSPE comprises10 stations (two observed stations carrying 3 marks each and 8 non-observed stations 2 marks each)

Observed Stations (3 minutes for each station)

i. Tests for carbohydrates and proteins/ peptides / amino acids of clinical importance: 1 station
ii. Test for normal constituents and abnormal constituents of urine: 1 station

List of Tests for Observed Stations:

i. Benedict's Test.
ii. Selivanoffs Test.
iii. Identification of osazones of monosaccharides.
iv. Biuret Test.
v. Ninhydrin test.
vi. Heller's ring test.
vii. Sulphosalicylic acid test.
viii. Heat Coagulation Test.
ix. RothrasTest.
x. Hays Test.

Non-Observed Stations (2 minutes for each station)

i. Carbohydrate chemistry, biologic significance of carbohydrates and clinical implications of carbohydrates.
ii. Chemistry of proteins & amino acids, plasma proteins, and clinical implications of proteins.
iii. Chemistry of lipids, biologic significance of lipids, and clinical implications of lipids and lipoproteins.
iv. Interpretation of normal and abnormal constituents of urine.
v. Laboratory equipment/techniques (pH meter and laboratory glassware).
vi. Preparation of solutions.

C- Experiment: 13 marks

- Principle/supposed calculations of the experiment: 4 Marks (External Examiner)
- Performance of experiment. 4 Marks (Internal Examiner)
- Table Viva: 5 Marks (External Examiner)

SYLLABUS, ToS & OSPE

M.B.B.S.

FIRST PROFESSIONAL

PART-II

ANATOMY INCLUDING HISTOLOGY

"NEURO AND GROSS ANATOMY"

The study of gross anatomy must lay emphasis on applied anatomy as related to clinical medicine and surgery. For teaching, actual dissection of cadaver, dissected specimens, models, and computer aided programs shall be used. Normal images of different diagnosis techniques i.e. X-rays and CT scans, MRI and Ultra-sonography shall also be introduced.

The time for dissection of the cadaver for each region is as under:

1. **Neuroanatomy including Brain and Spinal cord 09 weeks**
2. **Head and Neck 13 weeks**
3. **Abdomen and Pelvis 13 weeks**

NEUROANATOMY COURSE OBJECTIVES

After the end of the course, the students are able to:

1. Define, enumerate and describe the structure and functions of receptors.
2. Define and describe motor end plates and their functions.
3. Understand and describe the meninges of brain and spinal cord.
4. Describe subdural and subarachnoid spaces including subarachnoid cisterns.
5. Understand and describe internal structure of spinal cord at different levels:
6. Understand and describe ascending and descending tracts of spinal cord, their functions and effects of their lesions.
7. Understand and describe internal structure of medulla oblongata.
8. Comprehend and describe the internal structure of pons.
9. Understand and describe internal structure of mid brain.
10. Comprehend and describe the surfaces of cerebral hemisphere, its lobes, their sulci and gyri.
11. Locate, identify and describe functions of different functional areas of the brain.
12. Locate, identify and describe different types of projection and association fibres of brain and their functions.
13. Identify, locate and describe hypothalamus, its nuclei and their connection and functions.
14. Identify, locate and describe thalamus, its nuclei and their connection and functions.
15. Identify, locate and describe metathalamus and its connections and functions.
16. Understand and describe the ventricular system of the brain.
17. Comprehend and describe production and circulation of CSF and clinical conditions associated with it.
18. Comprehend, describe and discuss blood supply of the brain and spinal cord and the effect of hemorrhagic and thrombotic lesions.
19. Describe intra cranial course of cranial nerves and their applied aspects.

20. Identify, locate and describe cranial nerves nuclei and their connection and functions.
21. Understand and describe different lobes of cerebellum, its white and grey substances including the deep cerebellar nuclei.
22. Understand afferent and efferent connections of cerebellum and correlated these to its functions.
23. Understand and describe the signs and symptoms of cerebellum disease with logical explanation.
24. **Understand and describe clinical conditions related to nervous system.**
25. Comprehend and understand neuroanatomical basis of the following:
    a) Hemiplegia / hemiperesis.
    b) Upper motor and lower motor neuron lesions.
    c) Parkinsonism
    d) Syringomyelia.
    e) Hemi-section / complete section of spinal cord.
    f) Cerebellar ataxia
    g) Other clinical conditions

"HEAD AND NECK COURSE OBJECTIVES"

On completion of the course of Head and Neck, the students are able to:

1. Describe mandible and different normae of the articulated skull.
2. Identify individual bones of the skull, their parts with important features.
3. Give post-natal growth changes in skull and face.
4. Comprehend cranial fossae, identify the foramina of the skull base and the structures passing through them.
5. Understand the vertebral column as a whole including sacrum and coccyx; describe regional features of the vertebrae, intervertebral joints, the movements thereof, and **comprehend clinical problems of the region.**
6. Identify, comprehend and describe cervical vertebrae, and the joints of the region i.e. temporo-mandibular, intervertebral, and cranio-vertebral. (cricothyroid and crico-arytenoid joints).
7. Identify and describe important muscles of the region i.e. muscles of: Facial expression, Mastication, prevertebral, postvertebral, infra and suprahyoid, suboccipital, tongue and palate; (pharynx, and larynx) **comprehend their actions nerve supply, effect of injury to them and clinical tests applied for diagnosis.**
8. Name and identify muscles of the floor of the mouth, sternocleidomastoid, trapezius, levator scapulae, and describe their origin, insertion, nerve supply, actions, important relations and effects of injury to their nerves and clinical tests to diagnose the nature of injury.
9. Identify and describe important arteries of the region, their branches and distribution i.e. subclavian, common, internal and external carotid arteries.
10. Comprehend clinical importance related to the arteries of head and neck and their branches

11. Identify subclavian, internal, external, and anterior Jugular veins, give their course, relationship, tributaries and clinical importance.
12. Identify and describe cranial venous sinuses and give their clinical significance.
13. Locate, identify and enlist the regional lymph nodes and describe the scheme of lymphatic drainage of the region.
14. Understand and describe the course and distribution of the cervical spinal and cranial nerves; comprehend formation of Cervical and Brachial plexuses, describe their branches and distribution.
15. **Understand and describe clinical conditions related to the nerve plexuses and their clinical manifestations.**
16. **Comprehend, understand and clearly describe the effects of injuries to different nerves and their clinical tests.**
17. **Identify sympathetic trunk and describe the scheme of sympathetic and parasympathetic innervations of the region, including the four parasympathetic ganglia, their roots, branches and distribution along with the clinical and applied anatomy..**
18. .Identify and describe the boundaries, contents and subdivisions of the anterior and posterior triangles of the neck.
19. **Understand and describe the superficial and deep fasciae of the region and correlate different fascial planes to their clinical importance.**
20. Identify and describe the viscera of the region i.e. salivary, thyroid, parathyroid glands, trachea and esophagus, and describe their anatomy and its applied aspects correctly
21. **Identify the anatomical features of the oral cavity, tongue, cheek, lips, gums and teeth, and describe these in detail with particular emphasis on their clinical applications.**
22. **Understand and describe the anatomy of the scalp, orbital and cranial cavities, their contents including meninges with highlights on important clinical aspects.**
23. **Understand and describe the anatomy of the nasal cavity, Para nasal sinuses, eye ball and external, middle and internal ear along with the clinical aspects.**
24. **Understand and describe the anatomy of pharynx, its muscles, their nerve supply and actions; clinical and applied aspects of pharynx.**
25. **Comprehend and describe the anatomy of larynx, its joints, muscles, their nerve supply and actions; clinical conditions related to the organ.**
26. **Correlate the anatomical information of the region to their clinical applications.**
27. **Interpret normal radiographs, CT Scans, MRI, and Ultrasound images.**

Additional Clinical Correlates

Cranial nerves distributions and lesions, dislocation of temporomandibular and intervertebral joints, scalp wounds, danger area of face, Little's area, Horner's syndrome, cavernous sinus thrombosis, intracranial hemorrhages, tracheostomy, mumps, sinusitis and retropharyngeal abscess, lymph nodes and lymphatic drainage of head and neck and, different conditions associated with lymphatics. Important muscles of head and neck their functions and effect of their nerve lesions.

"COURSE OBJECTIVES OF ABDOMEN AND PELVIS"

On completion of the Gross Anatomy of Abdomen and Pelvis, the students are able to:

1. Develop a sound understanding of the topographic anatomy of the regions.
2. Mark the regions of the abdomen on the surface of the body.
3. Mark the important abdominal and pelvic viscera on the surface of the body
4. Understand the importance of percussion notes in eliciting the extent of resonant and non-resonant viscera and their clinical importance.
5. Give a description of the Anatomy of the anterolateral and posterior abdominal walls.
6. **Understand and give clear description of inguinal canal, different varieties of external hernias and their complications.**
7. **Understand the peritoneum, peritoneal cavity and possible sites of internal hernias along with their clinical features.**
8. **Comprehend, understand and describe the abdomino-pelvic fasciae and their clinical importance.**
9. **Give a precise account of the Anatomy of abdominal and pelvic viscera, muscles, nerves and blood vessels of the regions and correlate anatomical information to common clinical conditions.**
10. **Understand the clinical effects and apply clinical tests to verify injuries to different nerves of the region.**
11. Develop clear concepts of anatomy of normal male and female pelvises, and differences between them.
12. **Understand the dimensions of the normal and contracted adult female pelvis and their clinical importance in the mechanism of delivery.**
13. **Understand the anatomy of the perineal region in both male and female and comprehend the anatomical basis of clinical conditions of the area.**
14. **Understand anatomical basis of possible birth injuries to the mother in difficult labor and the clinical conditions produced thereafter.**
15. Understand the scheme of the regional lymphatic drainage and lymph nodes.
16. **Comprehend normal radiological anatomy of the region, CT Scans, MRI, Ultrasound and, other diagnostic techniques.**

Additional Clinical Correlates

Portosystemic anastomosis, spread of carcinoma stomach, duodenal and peptic ulcer, appendicitis, hemorrhoids, anal fistula, anterior abdominal wall hernias, abdominal incisions, varicocele, hydrocoele, benign prostatic hyperplasia and carcinoma of prostate and uterus prolapse

"SYSTEMIC HISTOLOGY"

At the end of the course, the students are able to:

Digestive System:

1. Name and describe the epithelium lining the oral cavity, tongue, gums, hard and soft palate, pharynx and lips and, explain the histology of tongue.
2. Understand and describe the histological structure of oesophagus, stomach, small intestine, large intestine, appendix and anal canal; explain the change in structure of their epithelium in relations to the function.
3. Comprehend and describe the histological structure and functions of salivary glands.
4. Understand and describe the histological structure and functions of Liver, Pancreas and Gall Bladder.

Urinary System:

Comprehend and describe the histological structure of kidney, ureter and urinary bladder, and their functions.

Male Reproductive System:

Comprehend and describe histological structure of testis, epididymis, vas deferens, seminal vesicle and prostate, and relate it to their functions.

Female Reproductive System:

Understand and describe histological structure of ovaries, fallopian tube, uterus and vagina, and explained their functions related to their structure.

Endocrine System:

Understand and describe the histological structure and functions of the following glands:

1. Pituitary
2. Thyroid
3. Parathyroid
4. Adrenal
5. Islets of Langerhans.

Eye and Ear:

1. Understand and describe the histological structure of eyeball with emphasis on cornea and retina, and give their functions related to their structure.
2. Comprehend and describe the Membranous Labyrinth and give the histological structure of different parts; correlate their functions to the structure.

Nervous System:

Understand and describe the histological structure of spinal cord, cerebellum and cerebrum and correlate it to the functions.

Identify, draw and label light microscopic structures of above mentioned tissues.

"EMBRYOLOGY"

At the end of the course, the students are able to:

Head and Neck:

1. Understand and describe the development and derivatives of pharyngeal apparatus (arch, cleft, pouch and membrane).
2. Comprehend and describe the development of tongue.
3. Describe the development of thyroid gland.
4. Understand and describe the development of pituitary gland.
5. Comprehend and describe the development of face and palate.
6. **Understand different congenital malformations of the region.**

Digestive System, Body Cavities and Diaphragm:

1. Understand and discuss the development of the body cavities, mesenteries and diaphragm.
2. Comprehend and describe the development of gastrointestinal tract (fore-gut, mid-gut and hind- gut).
3. Understand and describe the development of liver, pancreas and gall bladder.
4. Understand and describe the development of spleen.
5. **Understand different congenital malformations of the region.**

Respiratory System:

Comprehend and describe the development of upper and lower respiratory passages, and give their congenital anomalies.

Cardiovascular System:

1. Describe the development of heart, aortic arches, aorta, superior and inferior vena cavae and portal vein.
2. Describe the foetal circulation and changes at birth.
3. Understand and describe the congenital anomalies of cardiovascular system.

Urinary System:

1. Comprehend and describe the development of kidneys, ureters, urinary bladder and urethra, and their congenital malformations.

Reproductive System:

1. Understand and describe the development of testes, epididymis, vas deferens, seminal vesicles and prostate.
2. Comprehend and describe the development of the ovaries, uterus and vagina.
3. Describe the development of external genital organs.
4. **Comprehend and describe congenital abnormalities of the regions.**

Nervous System:

1. Name different brain vesicles, comprehend and describe their derivatives.

2. Understand and describe the development of spinal cord.
3. Comprehend and describe the derivatives of neural crest.
4. Understand and describe congenital abnormalities of the nervous system.

Ear:

1. Understand and describe the development of external, middle and internal ear.
2. Describe congenital abnormalities of the region.

Eye:

1. Comprehend and describe the development of lacrimal apparatus, eyeball and their congenital abnormalities.

RECOMMENDED BOOKS

1. **Clinically Oriented Anatomy** by Keith L Moore.
2. **Cunningham's Manual of Practical Anatomy** by G.J. Romanes, 15th Ed., Vol. II and III.
3. **The Developing Human. Clinically Oriented Embryology** by Keith L. Moore, 6th Ed.
4. **Medical Histology** by Prof. Laiq Hussain Siddiqui.
5. **Neuroanatomy** by Richard S.Snell.

REFERENCE BOOKS

1. **Gray's Anatomy** by Prof. Susan Standring 39th Ed., Elsevier.
2. **Clinical Anatomy for Medical Students** by Richard S.Snell.
3. **Clinical Anatomy** by R.J. Last, Latest Ed.
4. **Wheater's Functional Histology** by Young and Heath, Latest Ed.
5. **Langman's embryology**

MBBS 1st PROFESSIONAL (PART-II)

TABLE OF SPECIFICATIONS (ToS)

Anatomy including Histology

Histology	Digestive system	1	1
	Urinary System	1	
	Nervous System	1	
	Male Reproductive System	1	
	Female Reproductive System	1	
	Endocrine glands	1	
	Special Senses (Eye and Ear)		
Embryology	Body Cavities, mesenteries and diaphragm	1	1
	Respiratory system	1	
	Cardiovascular System	2	
	Nervous System, Eye, Ear	1	
	Urinary System	1	1
	Male reproductive system	1	
	Female reproductive system	1	
	Digestive system	1	
	Pharyngeal Apparatus and face	1	
Brain	External and internal structure of brain	2	1
	External and internal structure of spinal cord	2	
	Cranial nerves: nuclei and their intracranial course	1	
	Blood supply of brain and spinal cord	1	
	Meninges, Cisterns, Ventricles	1	
Pelvis	Pelvic Wall, Pelvic diaphragm, pelvic peritoneum	1	1
	Pelvic Viscera & Structures	1	
	Perineum, urogenital diaphragm	1	
Abdomen	Abdominal Wall	1	1
	Peritoneum	1	
	Abdominal Viscera & other structures	4	1
Head and Neck	Cranial cavity, Skull & Cervical Vertebrae & joints of Neck	2	1
	Scalp, Temple & face	1	
	Side of neck & Triangles, Back of Neck, cervical fascia	2	
	Cranial nerves and ganglia	2	
	Orbit, Eyeball, Ear	1	1
	Parotid, temporal, infratemporal, submandibular regions	2	
	Mouth, Pharynx, Tongue	2	
	Nasal Cavity and Larynx	1	

1. In each gross region of body, an equal distribution should be practiced for the following tissues:

   i. Skin
   ii. Muscles
   iii. Bones
   iv. Connective tissue sheathes
   v. Joints
   vi. Nerves
   vii. Vessels

2. 25% MCQs and SEQs should be clinical-oriented or problem based.

MBBS 1st Professional Part (II) OSPE

Gross Anatomy, Radiological Anatomy & Embryology:

Gross Anatomy

1. Total No. of stations 12, each station will have 02 marks and 04 spots of identification.
2. Each station shall be given 1.5 min.
3. Total marks shall be 24.

Time per station: 1.5 minutes (18 minutes)

Sr. No	Region/ Area	Station No	No. of Spots	Marks/ each spot
1	Head & Neck	01	04	2
	Head & Neck	02	04	2
	Head & Neck	03	04	2
2	Abdomen	04	04	2
	Abdomen	05	04	2
	Abdomen	06	04	2
3	Pelvis	07	04	2
4	Brain	08	04	2
	Brain	09	04	2
5	Radiological Anatomy	10	04	2
6	Special Embryology	11	04	2
	Special Embryology	12	04	2
	Grand Total	**12**	**48**	**24**

Arrangement of OSPE in Histology:.

1. Histology Practical Examination shall also be used to cover nearly all areas of the subjects.
2. Histology long slide and Viva shall be arranged simultaneously on the same day.

Histology OSPE and VIVA (Total Marks 20)

There shall be 10 slides fixed on 10 microscopes.

1. They will move from one to the next slide in a predetermined direction.
2. For each station one minute shall be given, students will give point/points of identifications for each slide **(Annexure B).**

3. Total number of identifications spots 10

a. Each spot will be given 01 mark (0.5 marks for identification and 2 points of identification, 0.25 marks each)

b. Total marks allocated shall be: 10

4. Time consumed shall be 10 min.

Long Slide (Total Marks 10):

5. Time: 15 minutes will be given for

Identification 1 mark

Drawing 1 mark

Labeling 1 mark

Interactive Examination Long Slide: 7 marks

ANATOMY STRUCTURED VIVA

The following areas shall be examined; the questions are framed with emphasis on those areas which are not easily evaluated in theory examinations. Course segments, the marks allocation and number of questions for each are given as under:

Sr. #	Course Area	Marks allocated	Minimum Number of Questions
1.	Surface marking	04	01
2.	Head & Neck	10	02
3.	Brain & Spinal cord	08	02
4.	Abdomen	10	02
5.	Pelvis	04	01
6.	Special Embryology	10	02
Total		**46**	**10**

Note: Materials for the examination shall be the responsibility of the Department/ College which should be put in place well before the time of the examination. Examination space and facilities shall be evaluated by the external examiner who will make sure that the movements of the candidate are well organized to maintain the transparency of the procedure.

Annexure A

Identification Points for Histology Slides for 2nd Year MBBS Class

DISGESTIVE SYSTEM

1. **Tongue:**
   a) Lingual papillae of various types
   b) Skeletal muscle fibres
2. **Esophagus:**
   a) Stratified squamous non-keratinized epithelium
   b) Submucosal glands
3. **Stomach Fundus & Body:**
   a) Shallow gastric pits
   b) Gastric glands containing chief cells and parietal cells
4. **Stomach-Pylorus:**
   a) Deep gastric pits
   b) Pyloric glands lined mostly by mucous cells
5. **Duodenum:**
   a) Leaf shaped villi
   b) Brunner's glands (submucosal glands)
6. **Jejunum:**
   a) Tall rounded villi / finger like villi
   b) Crypts of Leiberkuhn in lamina propria] Any One of b, c
   c) Muscularis externa / inner circular outer longitudinal]
7. **Ileum:**
   a) Club-shaped villi
   b) Peyer's patches
8. **Colon:**
   a) Simple columnar epithelium with abundant goblet cells
   b) Villi are absent

9. Appendix:

a) Star-shaped lumen

b) Prominent lymph nodules in lamina propria

10. Rectum:

a) Rectal folds lined by simple columnar epithelium with abundant goblet cells

b) Muscularis mucosa & submucosa extending into the rectal folds

11. Parotid Gland:

a) All serous acini

b) Striated / intercalated / interlobular ducts

12. Sublingual Gland:

a) Predominant mucous acini and few serous acini

b) Few serous demilunes] Any One of b, c

c) Very few intercalated ducts]

13. Submandibular Gland:

a) Predominant serous acini

b) Many serous demilunes

14. Pancreas:

a) Serous acini

b) Islets of Langerhans

15. Liver:

a) Cords of hepatocytes radiating from the central vein

b) Hepatic sinusoids] Any One of b, c

c) Portal triad]

16. Gall Bladder:

a) Mucosal folds lined by simple tall columnar epithelium

b) Fibromuscular layer outer to mucosa

URINARY SYSTEM

17. Kidney:

a) Renal corpuscles

b) Sections of proximal and distal convoluted tubules

18. Ureter:

a) Transitional epithelium

b) Star shaped small lumen] any one of b, c

c) Inner longitudinal & outer circular smooth muscle layers]

19. Urinary Bladder:

a) Transitional epithelium

b) A thick smooth muscle coat

20. Testis:

a) Seminiferous tubules lined by spermatogenous cells and sertoli cells

b) Groups of Leydig cells in the intertubular connective tissue

21. Dustus Epididymis:

a) Pseudostratified columnar epithelium with stereocilia

b) Numerous cut sections of the duct

22. Ductus Deferens:

a) Pseudostratified columnar epithelium with stereocilia

b) Thick muscularis externa with 3 layers of smooth muscle fibres

23. Seminal Vesicles:

a) Pseudostratified columnar epithelium

b) Highly convoluted lumen with crypts and cavities

24. Prostate:

a) Glandular acini containing corpora amylacea

b) Fibromuscular stroma in between the acini

25. Ovary:

a) Outer surface covered by simple cuboidal epithelium

b) Ovarian follicles in various stages of development in cortex

26. Fallopian Tubes:

a) Simple columnar ciliated epithelium

b) Very prominent mucosal folds

27. Uterus: (in proliferative phase)

a) Endometrium with simple columnar epithelium

b) Simple tubular glands in lamina propria

28. Vagina:

a) Stratified squamous non-keratinized epithelium

b) No glands] any one of b, c

c) Thick muscular layer]

29. Mammary glands-inactive state:

a) Lobules and abundant inter lobular connective tissue

b) Cord like tubules lined by simple cuboidal epithelium

30. Mammary gland (lactation state):

a) Alveoli of various sizes and shapes containing secretions

b) Scanty connective tissue stroma

31. Thyroid gland:

a) Follicles lined by simple cuboidal epithelium

b) Colloid in follicles] any one of b, c

c) Parafollicular cells]

32. Parathyroid gland:

a) Anastomosing cords of chief cells

b) Oxyphil cells

33. Pituitary gland:

a) Chromophiles and chromoprobes

b) Acidophils and basophils

34. Adrenal gland:

a) Three zones of cortex (Zona glomerulosa, fasciculata and reticularis)

b) Medulla with irregular cords of chromaffin cells and sinusoids

SPECIAL SENSES

35. Eye Lid:

a) Thin skin with hair follicles

b) Tarsal plate containing tarsal glands

36. Cornea:

a) Stratified squamous non keratinized epithelium

b) Bowman's membrane, substantia propria and Descemet's membrane

37. Retina:

a) Ten layers

b) Rods & Cones present

38. Pinna:

a) Thin skin

b) Elastic cartilage

SYLLABUS, ToS & OSPE

M.B.B.S.

FIRST PROFESSIONAL

PART-II

PHYSIOLOGY

PHYSIOLOGY (MBBS 1st Prof. Part-II)

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

Body Fluids and Kidney

1. Describe the components and quantitative measurements of body fluids.
2. Discuss the different fluid compartments, tissue and lymph fluid.
3. Describe the structure of the kidney and nephron, and explain general functions of the kidney.
4. Describe the GFR and its regulation.
5. Describe the formation of urine including filtration, re-absorption and secretion.
6. Discuss plasma clearance.
7. Describe the mechanism of concentration and dilution of urine
8. Describe regulation of osmolality, water balance and acid base balance
9. Describe the role of the kidney in blood pressure regulation.
10. Describe the hormonal functions of the kidney.
11. Describe acidification of urine and its importance.
12. Describe the mechanism of micturition and its control.

Applied Physiology:

Understands:

1. Renal plasma clearance tests and their clinical significance.
2. Dehydration, rehydration, overhydration and oedema.
3. Renal failure and dialysis.
4. Metabolic acidosis and alkalosis.
5. Abnormalities of micturition.

Nervous System

1. Describe general organization of the nervous system.
2. Describe the properties of synaptic transmission.
3. Classify the neurotransmitters and explain their functions.
4. Explain neuropeptides and their functions
5. List the types and describe the properties and functions of sensory receptors.
6. Describe the pathways for transmission of somatic sensations
7. Define reflex action. Classify and describe reflexes

8. Describe the muscle spindle and Golgi tendon organ. Explain their functions.
9. Describe the physiology of pain and analgesia system.
10. Explain the functions of the cerebral cortex.
11. Differentiate between the sensory and motor cortex and their functions.
12. Describe the motor pathways including pyramidal and extrapyramidal.
13. Describe basal nuclei (basal ganglia) and their functions.
14. Describe cerebellum and its function.
15. Describe the functions of vestibular apparatus.
16. Explain the organization and functions of reticular formation.
17. Explain mechanism and regulation of the muscle tone.
18. Describe the control of posture and equilibrium.
19. Explain the physiology of sleep.
20. Describe the physiology of memory.
21. Describe the mechanism and control of speech.
22. Discuss the functions of thalamus
23. Discuss the functions of hypothalamus
24. Explain the components and functions of limbic system.
25. Describe the production, circulation, absorption and functions of CSF.
26. Describe the blood brain and blood CSF barriers and their clinical significance.
27. Describe the organization and functions of the autonomic nervous system.

Applied Physiology

Understands:

1. Significance of dermatomes.
2. Injuries of the spinal cord.
3. Hemiplegia and paraplegia.
4. Diseases related to Basal ganglia.
5. Effects of cerebellar dysfunction.
6. Hydrocephalus.
7. Alzheimer's disease.
8. Speech disorders
9. Sleep disorders.
10. Clinical abnormalities of pain.

Endocrinology

1. Classify the hormones and describe mechanism of their action
2. Name the hormones secreted by the anterior and posterior pituitary and describe their regulation and functions.
3. Describe the neuroendocrine functions of the hypothalamus
4. Describe the physiological changes of growth and aging.
5. Describe the functions and regulation of the hormones secreted by thyroid gland.
6. Describe the hormones regulating calcium homeostasis (parathormone, vitamin D and calcitonin)
7. Name the hormones secreted by the adrenal cortex and describe their functions and regulation.
8. Name the hormones secreted by the adrenal medulla and describe their functions and regulation.
9. Describe the endocrine functions of the pancreas and regulation of pancreatic hormones.
10. Describe the endocrine functions of pineal gland.

Applied Physiology

Understands:

1. Acromegaly, gigantism and dwarfism.
2. Effects of panhypopitutiarism.
3. Diabetes insipidus.
4. Thyrotoxicosis, myxoedema and cretinism
5. Pheochromocytoma.
6. Cushing's disease / syndrome.
7. Addison's disease.
8. Hypocalcemia and hypercalcemia.
9. Adrenogenital syndrome.
10. Conn's syndrome.
11. Diabetes mellitus and hypoglycaemia.

Gastrointestinal Tract

1. Describe the general functions of gastrointestinal tract.
2. Describe the enteric nervous system, control of gastrointestinal motility and secretion
3. Describe mastication, swallowing and their control

4. Describe the motility of the stomach, small intestine, large intestine and regulation.
5. Describe the functions of GIT hormones
6. Describe gallbladder motility and its regulation
7. Explain mechanism of vomiting and its control pathway
8. Explain defecation and its control pathway

Applied Physiology

Understands:

1. Dysphagia
2. Achalasia cardia
3. Diarrhea and constipation
4. Megacolon

Reproduction

1. Describe the functions of the male reproductive system.
2. Describe the mechanism of erection and ejaculation.
3. Describe the production and function of testosterone.
4. Describe the physiological changes during male puberty.
5. Describe the function of the female reproductive system.
6. Explain the production and function of oestrogen and progesterone.
7. Describe the functions of hypothalamo-hypophysio-gonadal axis.
8. Describe the ovarian and endometrial cycle.
9. Describe the physiological changes during female puberty and menopause.
10. Discuss pregnancy and explain the physiological changes taking place in the mother.
11. Describe the functions of placenta.
12. Discuss the hormones regulating parturition, lactation and development of breast.

Applied Physiology

Understands:

1. Male infertility.
2. Female infertility.
3. Postmenopausal syndrome / Andropause.

4. Contraception.
5. Basis for pregnancy tests.
6. Hypogonadism / hypergonadism.
7. Cryptorchoidism.

Special Sense

1. Describe the optics of the eye, mechanism of accommodation, light reflex.
2. Explain visual acuity, depth perception, neural functions of the retina.
3. Describe the errors of refraction and their corrections.
4. Describe the secretion, circulation, drainage and functions of aqueous humor.
5. Describe the movements of eyeballs.
6. Describe the visual transduction, color vision, visual cortex and visual pathway.
7. Describe the mechanisms for the light and dark adaptation.
8. Describe the functions of external ear.
9. Enumerate the contents of middle ear cavity and functions of the middle ear
10. Describe the structure and functions of internal ear.
11. Explain the determination of the sound frequency, loudness, direction of sound, auditory pathway and auditory cortex.
12. Describe the signal transduction for hearing.
13. Describe the signal transduction for taste and smell.
14. Describe the pathways for the sense of taste and smell.

Applied Physiology

Understands:

1. Types of deafness.
2. Errors of refraction.
3. Lesions of the visual pathway.
4. Night blindness.
5. Colour blindness.
6. Squint.
7. Argyll Robertson pupil.
8. Horner's syndrome.
9. Abnormalities of sense of smell and taste.
10. Glaucoma.

PHYSIOLOGY PRACTICAL

Nervous System

1. Examination of superficial reflexes.
2. Examination of deep reflexes.
3. Examination of motor system.
4. Cerebellar function tests.
5. Examination of sensory system.
6. Examination of 12 cranial nerves (3-4 settings).

Special Senses

1. Plotting of the field of vision (perimetry and confrontational methods).
2. Testing the visual acuity for near and distant vision.
3. Elicitation of light reflex (direct and consensual) and accommodation reflex.
4. Ophthalmoscopy.
5. Testing the colour vision.
6. Testing for hearing.
7. Testing taste and smell.

Pregnancy Tests

RECOMMENDED BOOKS

1. **Textbook of Physiology** by Guyton and Hall, Latest Ed.
2. **Review of Medical Physiology** by William F. Ganong, Latest Ed.

REFERENCE BOOKS

1. **Human Physiology** by Laurali Sherwood
2. **Physiology** by Berne and Levy, Latest Ed.
3. **Essentials of Medical Physiology by** Prof. Dr. Mushtaq Ahmad
4. Physiology by Linda and Constanzo

MBBS FIRST PROFESSIONAL (Part-II)

Physiology (SEQs and MCQs)

Table of Specifications (ToS)

Topic / Chapter	No. of MCQs	No. of SEQs
Kidney and body fluids	08	02
Nervous system	12	02
Special senses	06	01
Endocrines	08	02
Reproduction	06	01
GIT	05	01
Total	**45**	**09**

MBBS FIRST PROFESSIONAL (Part-II)

PHYSIOLOGY

Objectively Structured Performance Evaluation (OSPE)

(Total Marks: 90)

The structure of OSPE/ Practical/ Viva should be as follows:

- **Viva Voce (35 marks)**
  - Internal ------- 15 marks
  - External ------- 20 marks

- **OSPE (25 marks)**
  - Non-observed stations — 10 of 01 marks each (2 minutes each)
  - Observed stations — 03 of 05 marks each (4 minutes each)

30% C1
40% C2 } OSPE
30% C3

- **Practical (30 marks)**
  - Practical — 20 marks
  - Procedure Writing — 05 marks
  - Yearly Workbook Assessment — 05 marks

SYLLABUS, ToS & OSPE

M.B.B.S.

FIRST PROFESSIONAL

PART-II

BIOCHEMISTRY

SYLLABUS MBBS 1st PROF. PART-II
BIOCHEMISTRY

Teaching objectives (Biochemistry Part-II):

The general objectives and overall aim of the teaching course include:

1. To teach sufficient biochemistry to give the student a basic understanding of life processes at the molecular level.
2. To provide an understanding of the normal biochemical processes in the human body in which the function of the various organs and tissues are integrated.
3. To comprehend the principles of metabolic integration that would contribute to the students' understanding of the biochemical basis of various disease processes.
4. To familiarize the students with laboratory instruments / equipment used in biochemistry laboratory.
5. To undertake practical classes that would familiarize the student with the various chemical methods which are used in the diagnosis of disease.
6. To familiarize the students with modern biochemical techniques and their uses in the diagnosis of diseases especially genetic diseases.

Learning objectives (Part-II)

At the end of the Part-II course, the student should be able to demonstrate his knowledge and understanding on the subject with following learning objectives

1. To be familiar with the homeostatic mechanisms through the concepts of inter-regulation of carbohydrates, lipids and protein metabolism and its relation to hormone actions in the human body.
2. Once these basic concepts are understood, it will be straightforward to understand how alterations in the basic processes can lead to a disease state.
3. To have understanding and knowledge about many pathological situations where these can be related to biochemical defects, and to have some experience of biochemical techniques in order to understand the practical/clinical problems in biochemistry.
4. To develop skills as a self-directed learner, recognize continuing educational needs; use appropriate learning resources and critically analyze relevant literature in order to have a comprehensive understanding and knowledge of biochemistry.
5. To learn and understand the basic biochemical processes taking place in the body, since these underline an understanding of normal and abnormal human metabolism. In order to accomplish this, the student should learn how large molecules are synthesized and used (DNA, RNA, and proteins), and how energy is generated, stored, and retrieved (metabolism).

6. To describe digestion assimilation of nutrients & consequences of malnutrition. Integrate the various aspects of metabolism & their regulatory pathways.
7. To explain biochemical basis of inherited disorders with their associated sequelae.
8. To outline the molecular mechanisms of gene expression, the principles of genetic engineering & their applications in medicine.
9. To outline the biochemical basis of cancer & carcinogenesis.
10. To make use of conventional techniques/instruments to perform biochemical analysis relevant to clinical screening & diagnosis. Familiarize with principles of various conventional & specialized lab investigations & instrumentation analysis & interpretation of a given data.
11. Applying basic knowledge of protein synthesis, post translational modification and targeting to its cellular destination.
12. 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

1- Bioenergetics and Biologic Oxidation

a) Endergonic and exergonic reactions, free energy, free energy change, ATP and other compounds as carriers of energy

b) Electron transport chain: Components and organization of electron transport chain (ETC)

c) Reactions of electron transport chain, redox potential, methods of electron transfer among the components of electron transport chain, and energy release during electron transport

d) Oxidative phosphorylation: ATP synthesis in ETC, inhibitors and uncouplers of oxidative phosphorylation, and chemiosmotic hypothesis of oxidative phosphorylation.

2- Metabolism of Carbohydrates

a) Glycolysis

- Reactions of aerobic and anaerobic glycolysis occurring in RBCs and other tissues
- Biomedical significance and energy yield of aerobic and anaerobic glycosis and its significance, and substrate-level phosphorylation
- Regulation of glycolytic pathway
- Metabolic fates of pyruvate
- Lactic acidosis; genetic deficiency of pyruvate kinase and pyruvate dehydrogenase

b) Tricarboxylic acid (TCA) cycle

- Reactions of TCA cycle and their regulation along with energy yield.

- Importance of TCA cycle and its amphibolic role

c) Gluconeogenesis

- Reactions of gluconeogenesis using pyruvate and glycerol as precursors, and regulation of gluconeogenesis.
- Important gluconeogenic precursors: Entrance of amino acids, intermediates of TCA cycle, glycerol, and other compounds as gluconeogenic precursors.
- Biomedical significance of gluconeogenesis: Role of gluconeogenesis in plasma glucose level regulation, and the Cori cycle, and glucose-alanine cycle.

d) Glycogen metabolism

- Synthesis and importance of UDP glucose
- Reactions of glycogenesis and glycogenolysis
- Regulation of glycogenic synthase and glycogen phosphorylase
- Importance of allosteric regulation of glycogen phosphorylase 'a' (a plasma glucose sensor) by plasma glucose
- Disorders of glycogen metabolism (glycogen storage diseases)

e) The hexose monophosphate pathway and other pathways of hexose metabolism

- Hexose monophosphate (HMP) pathway: Reactions of oxidative and non-oxidative phases of HMP pathway, importance of HMP pathway along with uses of NADPH, and glucose 6-phosphate dehydrogenase deficiency.
- Reactions of uronic acid pathway along with its biologic importance.
- Metabolism of fructose: Metabolic fate of fructose in human body, sorbitol metabolism along with effect of hyperglycemia on sorbitol metabolism, essential fructosuria and hereditary fructose intolerance.
- Metabolism of galactose: Metabolic fate of galactose in body and synthesis of lactose; and disorders of galactose metabolism (galactokinase deficiency and classic galactosemia).
- Metabolism of ethanol

f) Regulation of blood glucose level

- Regulation of plasma glucose hormonally (insulin, glucagon, growth hormone, epinephrine, and cortisol) and non-hormonally, and the role of various metabolic pathways in blood glucose level regulation
- Hypoglycemia and hyperglycemia: An overview of hypoglycemia and hyperglycemia, their important causes, and clinical manifestations.
- Diabetes mellitus: Types of diabetes mellitus along with its clinical manifestations, metabolic changes in type 1 and type 2 diabetes mellitus, and diagnosis of diabetes mellitus.

3- Metabolism of lipids

a) de novo synthesis of fatty acids: Production of cytosolic acetyl CoA, fatty acid synthase multienzyme complex, reactions of cytosolic fatty acid synthesis, elongation of fatty acid chain, synthesis of polyunsaturated fatty acid, and regulation of fatty acid synthesis.

b) Synthesis and storage of triacylglycerols in body.

c) Mobilization of stored triacylglycerols along with its regulation

d) Oxidation of fatty acids: Activation of fatty acid, translocation of fatty acyl CoA into mitochondrial matrix, reactions of β-oxidation of saturated and unsaturated fatty acids, energy yield of β-oxidation, fate of acetyl CoA, and other types of fatty acid oxidation (alpha-oxidation, omega-oxidation, and oxidation of odd-carbon fatty acids).

e) Synthesis and utilization of ketone bodies: Reactions of hepatic ketogenesis, and utilization of ketone bodies by extrahepatic tissues.

f) Ketoacidosis and regulation of ketogenesis.

g) Synthesis of eicosanoids, their regulation and functions along with their biomedical importance.

h) Metabolism of phospholipids and sphingolipids: Synthesis of phospholipids (phosphatidylcholine and phosphatidylethanolamine), synthesis of glycerol ether phospholipids (cardiolipin and platelet activating factor), degradation of phospholipids, deficiency of lung surfactant, metabolism of glycolipids, biosynthesis of ceramide, sphingomyelin, and gangliosides, and degradation of sphingolipids along with sphingolipidoses.

i) Cholesterol metabolism: Reactions and regulation of cholesterol biosynthesis, and fate and functions of cholesterol in body.

j) Biosynthesis and fate of bile acids and their significance in health and disease.

k) Plasma lipoproteins: Synthesis, transport, and fate of chylomicrons, VLDL, IDL, LDL, and HDL; disorders associated with impairment of lipoprotein metabolism, and atherogenic effect of oxidized LDL.

l) Biochemical defects leading to fatty liver

4- Metabolism of Proteins and Amino Acids

a) An overview of protein turnover in human body; nitrogen balance (positive and negative).

b) Inter-organ amino acid exchange in normal post-absorptive state

c) Degradation of amino acids; removal of nitrogen from amino acids by transamination and deamination; sources of ammonia in body; transport of ammonia, ammonia toxicity; fate of ammonia in body, reactions and regulation of the urea cycle along with metabolic disorders of the urea cycle.

d) An overview of amphibolic intermediates formed from the carbon skeleton of amino acids.

e) Concept of glucogenic and ketogenic amino acids; an outline of the metabolism of individual amino acids like glycine, cysteine, arginine, proline, phenylalanine, tyrosine, histidine, tryptophan, methionine amino acids; causes and salient features of important metabolic defects in amino acid metabolism like phenylketonuria, maple syrup urine disease (MSUD), histidinemia, alkaptonuria, cystathioninuria, homocystinuria, hyperprolinemia, cystinuria, cystinosis, tyrosinemias, and albinism.

f) Metabolism of epinephrine and norepinephrine, creatine, creatinine, histamine, gamma-aminobutyrate, serotonin, melatonin, and melanin

5- Integration and Regulation of Metabolic Pathways

a) Fed-fast cycle and starvation.

b) Basic concepts of intermediary metabolism, introduction of anabolic and catabolic pathways.

c) An overview of regulation and integration of various metabolic pathways (role of liver, heart, brain, skeletal muscle and adipose tissue).

6- Metabolism of Nucleotides

a) *de novo* Synthesis of purines and pyrimidines; the salvage pathways of nucleotide synthesis; degradation of purine and pyrimidine nucleotides

b) Disorders associated with purine nucleotide metabolism like adenosine deaminase deficiency, purine nucleoside phosphorylase deficiency, and hyperuricemia

c) Natural and synthetic derivatives of purines and pyrimidines and their role in health and disease.

7- Biochemical Genetics (Informational Flow in the Cell)

a) The structural basis of cellular information

b) Organization of DNA: chromosomes, Karyotyping.

c) Replication of DNA: Reactions of DNA replication in eukaryotes and prokaryotes; types of damage to DNA and DNA repair; mutations

d) Transcription (DNA-dependent RNA synthesis): Steps in the transcription of eukaryotic and prokaryotic genes; post-transcriptional modifications (processing) of RNA; reverse transcription in retroviruses and its relation to cancers and AIDS.

e) Translation (protein synthesis): The genetic code; components required for protein synthesis, composition of eukaryotic and prokaryotic ribosomes; steps of protein synthesis; post-translational modifications of polypeptide chains; protein targeting.

f) Regulation of gene expression in prokaryotes and eukaryotes

g) Molecular biology techniques: Basic information and biomedical importance of molecular biology techniques; DNA extraction; recombinant DNA technology; DNA cloning; polymerase chain reaction (PCR); hybridization; blotting techniques.

h) Oncogenes and their role in carcinogenesis; mechanisms of activation of proto-oncogenes; mechanism of action of oncogenes; tumour supressor genes and oncogenic viruses.

i) Genetic basis of disease

j) Important tumor markers and their clinical significance (Carcinoembryonic Antigen, Alpha fetoprotein, human chorionic gonadotropin, calcitonin and prostatic acid phosphatase).

8- Biochemistry of Endocrine System

a) An overview of endocrine system; classification of hormones based on their mechanism of action and chemical nature; mechanisms of action of each class of hormone; general characteristics of various types of hormone receptors; types and actions of various kinds of G-proteins in mediating the actions of hormones; signal transduction pathways of various hormones; types and role of various kinds of second messengers

b) Pituitary and hypothalamic hormones: Structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all hypothalamic and pituitary hormones; disorders associated with hyper- and hypo-activities of these hormones such as growth hormone deficiency (dwarfism), gigantism, acromegaly, Cushing's syndrome, Addison's disease, Diabetes insipidus, and the inappropriate secretion of ADH (SIADH).

c) Thyroid Hormones: Structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all thyroid hormones; disorders associated with hyper- and hypo-activities of these hormones like goiter, hypothyroidism, hyperthyroidism, Graves' disease.

d) Calcium Regulating Hormones: Structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of parathyroid hormone; disorders associated with hyper- and hypo-activities of these hormones like; role of parathyroid hormone, calcitriol, and calcitonin in calcium homeostasis; hypoparathyroidism, hyperparathyroidism (primary, secondary, and tertiary), pseudohypoparathyroidism, rickets, and osteomalacia).

e) Adrenal Cortical Hormones: Structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all adrenal cortical hormones; disorders associated with hyper- and hypo-activities of these hormones like Cushing's disease / syndrome, secondary adrenal deficiency, Addison's disease, primary aldosteronism and secondary aldosteronism.

f) Adrenal Medullary Hormones: Structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all adrenal medullary hormones; and associated disorders like pheochromocytoma

g) Male and Female Gonadal Hormones: Structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all male and female

gonadal hormones; disorders associated with hyper- and hypo-activities of these hormones like; hypergonadism and hypogonadism in males and females.

h) Hormones of Pancreas: Structure, biosynthesis, secretion, transport, regulation, catabolism, and biologic actions of all pancreatic hormones (insulin, glucagon, somatostatin and pancreatic polypeptide); disorders associated with hyper- and hypo-activities of these hormones like; pathophysiology of insulin deficiency and diabetes mellitus

9- Biochemistry of Digestive Tract

a) Introduction, chemical composition, and secretion and regulation of various digestive juices of GIT such as saliva, gastric juice & HCl, pancreatic juice, bile, and succus entericus

b) Hydrolysis (digestion) of carbohydrates, lipids, proteins, and nucleic acids in gastrointestinal tract

c) Absorption of carbohydrates, lipids and amino acids.

d) Disease states associated with GIT disorders like achlorhydria, peptic ulcers, lactose intolerance, cholelithiasis and pernicious anemia, cystic fibrosis and celiac disease.

e) Site of synthesis and major actions of gastrointestinal hormones like gastrin, cholecystokinin (CCK), secretin, gastric inhibitory peptide (GIP), vasoactive intestinal polypeptide (VIP), motilin, enkephalins, substance P, neurotensin, and enteroglucagon.

10- Metabolism of Xenobiotics

a) Definition and classes of important xenobiotics of medical relevance, their phases of metabolism and clinical significance (Cytochrome P450: Cytochrome P450 hydroxylase cycle in microsomes; role of cytochrome P450 in phase I metabolism of xenobiotics; induction of cytochrome P450)

b) Phase II metabolism of xenobiotics; types of phase II reactions;

c) Responses to xenobiotics including pharmacologic, toxic, immunologic and carcinogenic effects

11- **Water & electrolyte balance; acid-base regulation**

a) Biochemical mechanisms to regulate water and electrolyte balance in body: Fluid compartments of the body; gain and loss of body water; regulation of body water balance, effect of pure water deprivation, water excess or water intoxication; and electrolytes of body fluids (sodium, potassium, magnesium and chloride).

b) Body buffer systems, role of lung and kidney in maintenance of acid-base balance.

c) Acid-base disturbance in the body like respiratory and metabolic acidosis (lactic acidosis and ketoacidosis); respiratory and metabolic alkalosis; concept of anion gap, base excess and base deficit.

d) Clinical interpretation of laboratory report of arterial blood gases.

Laboratory Experiments

- The introduction of techniques and instrumentation of clinical biochemistry like centrifugation, spectrophotometry (visible, UV, infra red and atomic absorption), pH metry, chromatography, electrophoresis, enzyme-linked immunosorbent assay (ELISA), micropipetting, flame photometry and ion selective electrode (ISE) technique
- Collection, preservation, and storage of blood sample
- Estimation of various substances in blood and other biological fulids, like glucose, creatinine, urea, protein, albumin, uric acid, and calcium, total cholesterol; HDL cholesterol, and triacylglycerols; demonstration of creatinine clearance; and oral glucose tolerance test (OGTT)
- Determination of plasma enzyme activities of alanine aminotransferase (ALT), aspartate aminotransferase (AST), amylase, creatine phosphokinase (CK), alkaline phosophatase (ALP), and lactate dehydryogenase (LDH)
- Clinical interpretation of common laboratory values of the compounds and enzymes as listed above
- Determination of amino acids in urine by paper chromatography (demonstration)

RECOMMENDED BOOKS

- Harper's Illustrated Biochemistry by Murrary RK, Granner DK and Rodwell VW, latest edition, McGraw Hill
- Lippincott's Illustrated Reviews: Biochemistry by Harvey R and Ferrier D, Latest edition, published by Lippincott Williams & Wilkins
- Marks' Basic Medical Biochemistry – A Clinical Approach, by Smith C, Marks AD, and Lieberman M. Latest edition, published by Lippincott Williams & Wilkins
- Practicals and Viva in Medical Biochemistry by Dandekar SP and Rane SA, latest edition, published by Elsevier.

REFERENCE BOOKS

- Textbook of Biochemistry with Clinical Correlations by Devlin TM, latest edition, published by Wiley-Liss
- Biochemistry by Berg JM, Tymoczko JL, and Stryer L, latest edition, published by W.H. Freeman and Company
- Lehninger Principles of Biochemistry by David L Nelson and Michael M. Cox
- Tietz Textbook of Clinical Chemistry by Burtis CA and Ashwood ER published by Saunders.
- Fundamentals of Biochemistry Life at Molecular Level by Donald Voet, Judith G Voet and Charlotte W. Pratt
- Biochemistry by Berg JM, Tymoczko JL, and Stryer L, latest edition, published by W.H. Freeman and Company
- Tietz Textbook of Clinical Chemistry by Burtis CA and Ashwood ER published by Saunders.
- Clinical Chemistry and Metabolic Medicine by Martin A. Crook, latest edition, Edward Arnold (Publishers) Ltd
- Practicals and Viva in Medical Biochemistry by Dandekar SP and Rane SA, latest edition, published by Elsevier.

Table of Specifications for Biochemistry Theory Paper
MBBS First Professional Examination (Part-II)

CONTENTS		SEQs	MCQs
1.	Bioenergetics and biologic oxidation	0.5	2
2.	Carbohydrate Metabolism	1.5	6
3.	Lipid metabolism	1.5	6
4.	Metabolism of proteins and amino acids	1.5	6
5.	Metabolism of purines, pyrimidiens, and nucleotides	0.5	2
6.	Replication of DNA, mutations, and DNA repair	0.5	3
7.	Transcription, RNA processing and proteins synthesis Regulation of gene expression, genetic diseases, and basic techniques used in molecular genetics	0.5	3 3
8.	Endocrinology	1.0	6
9.	Biochemistry of digestive juices of GIT, digestion and absorption in GIT	0.5	3
10.	Oncogenesis and metabolism of xenobiotics	0.5	3
11.	Water & electrolyte balance; acid-base regulation	0.5	2
Total items		**9 SEQs**	**45 MCQs**
Total Marks (5 marks for each SEQ and 1 mark for each MCQ)		**45 marks**	**45 marks**

25% of MCQs and SEQs should be clinically oriented or problem-based.

10% *marks are allocated for "Internal Assessment"*

Total Marks for Theory Paper: *SEQ+ MCQ+ Internal Assessment=*
*45+ 45+ 10=**100 Marks***

Table of Specifications for Biochemistry Oral & Practical Examination
MBBS First Professional Examination (Part-II)

Oral and Practical Examination carries 100 marks

Examination Component	Marks
A- Internal Assessment	10
B- Practical Notebook/Manual (Internal Examiner)	05
C- Viva voce a. External examiner: 25 Marks b. Internal Examiner: 25 Marks	50
D- OSPE a. ***Observed stations (6 Marks):*** There are two observed stations; 3 marks for each station – time allowed is 3 minutes for each observed station) b. ***Non-observed stations (16 Marks):*** There are eight non-observed stations; 2 marks for each station – time allowed is 2 minutes for each non-observed station.	22
E- Practical a. Principle, supposed calculation, etc: 4 Marks (External Examiner) b. Performance of the experiment: 4 Marks (Internal Examiner) c. Structured table viva: 5 Marks (External Examiner)	13

Format (Practical Examination / OSPE)
MBBS First Professional Examination (Part-ll)
BIOCHEMISTRY (PART-II)

Total Marks: 100
Total marks allocated to Oral and Practical Examination are 100

Internal Assessment: 10 Marks

General Viva (Theory Viva): 50 Marks
25 Marks are allocated to internal examiner and 25 marks to external examiner.

Practical Examination: 40 Marks

Practical examination comprises three components i.e. Yearly Workbook, OSPE and experiment

A- **Yearly Workbook:** 5 Marks (Internal Examiner)

B- **OSPE:** 22 marks
OSPE comprises 10 stations (two observed stations carrying 3 marks each and 8 non-observed stations 2 marks each).

List of Tests for Observed Stations (3 minutes at each station)

i. Spectrophotometer.
ii. Centrifuge Machine.
iii. Pipettes.
iv. Blood samples.

Non-Observed Stations (2 minutes for each station)

i. Tests to determine the concentration of total cholesterol, HDL cholesterol, and triacyglycerols, in plasma.
ii. Tests to determine the concentration of total proteins, and glucose in plasma and CSF, and albumin in plasma.
iii. Determination of plasma uric acid and calcium.
iv. Determination of creatinine and urea in plasma, and creatinine clearance.
v. Determination of activities of ALT and alkaline phosphatase in plasma.
Estimation of plasma bilirubin.
vi. Determination of activities of creatine kinase, LDH, and AST

C- **Experiment**: 13 marks
- Principle/supposed calculations of the experiment:: 4 Marks (External Examiner)
- Performance of experiment : 4 Marks (Internal Examiner)
- Table viva : 5 Marks (External Examiner)