UNIVERSITY OF HEALTH SCIENCES LAHORE

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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) 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)

Sr.No	Region/Area	Station No	No of Spots	Marks Each Stations
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

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

Course Duration

- 35 weeks per academic year
- Five hours lecture per week for 35 weeks (175 hours)
- Two hours practicals per week for 35 week (70 hours)
- Two hours tutorial/interactive group discussion classes per week (70 hours)
- Seminar / clinically-oriented presentation / case discussion one hour per week (35 hours)
- Total teaching hours for the subject of biochemistry (350 hours)

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 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-l)
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)