Study Guide

FIRST PROFESSIONAL MBBS

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STUDY GUIDE

FIRST PROFESSIONAL MBBS

Pak Red Crescent Medical & Dental College

48-KM Multan Road, Lahore-Pakistan.

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STUDY GUIDE

ANATOMY

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Introduction	Human anatomy is a field of science that studies the human body structures at three levels, macroanatomy, microanatomy, and developmental anatomy. Anatomy is an important lesson for medical students worldwide and they must learn anatomy including gross anatomy, histology, and embryology; these are the major part of the basic sciences of medicine. Many of the clinical specialists consider having enough knowledge of anatomy a prerequisite for performing safe and competent interventions in medicine. Learning anatomy practically and with clinical approach is necessary for medical students to decrease the medical errors. Knowing the importance and clinical uses of anatomy, on the other hand, could help students improve their skills.
Target Students	1st year MBBS
Course to be studied in first year MBBS	Gross Anatomy: Upper limb, Lower limb and Thorax General Histology General Anatomy General Embryology
Course Title	**General Anatomy Upper limb**
Duration	8 weeks
Learning outcomes	• Predict loss of movement due to injury to various parts of the upper limb based on their knowledge of its normal structure, function and biochemical mechanisms. • Identify common structures and features of the skeletal of upper limb on plain X rays
Learning objectives	At the end of the course student must be able to: To Explain Brief History and Different Disciplines of Anatomy, Descriptive terms, Body Organization Classify Bones : Bones I – Classification, Bones II – Classification Bones II- Classification, Bones III- Illustrate Parts of Bones &

	General Features Bones IV – Explain Blood Supply, Clinical Correlates Explain Cartilage, Muscles – I Explain Muscles – II Describe Structures related to Muscles, Tendon, Bursae, Aponeurosis, Fascia, Ligaments Illustrate Joints – I Illustrate Joints – II Illustrate Joints – III Explain Cardio Vascular System - I Explain Cardio Vascular System – II Explain Lymphatic System Describe Nervous System I – Classification & Parts Describe Nervous System II – Neuron, Typical Spinal Nerve Explain Autonomic Nervous System introduction Interpretation of Clinical Anatomy Explain Sympathetic Nervous System Explain Parasympathetic Nervous System Interpretation of Clinical Anatomy Describe Splanchnology Explain detail of Viscera Describe in detail Glands Define Skin and explain Appendages of Skin Explain Embalming Recognize Radiography Recognize CT Scan Identifying USG images Identifying MRI images Explain MCQ's Explain SEQ's Discover Museum Keeping

STUDY GUIDE

PHYSIOLOGY

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Physiology	
Introduction	Physiology is the study of the normal functioning of a living organism and its component parts, including all its chemical and physical processes. The term physiology literally means "knowledge of nature." Aristotle used the word in this broad sense to describe the functioning of all living organisms, not just of the human body. However, Hippocrates considered the father of medicine, used the word physiology to mean "the healing power of nature," and thereafter the field became closely associated with medicine. By the sixteenth century in Europe, physiology had been formalized as the study of the vital functions of the human body.Today we benefit from centuries of work by physiologists who constructed a foundation of knowledge about how the human body functions.A few decades ago we thought that we would find the key to the secret of life by sequencing the human genome.
Course to be studied in first year MBBS	1. Cell &Membrane Physiology 2. Nerve Physiology 3. Muscle Physiology 4. Blood Physiology 5. Respiratory Physiology 6. Heart Physiology 7. Circulatory Physiology 8. Skin & Temperature Regulation
Teaching strategies	• Interactive Lectures. • Tutorials. • Clinical Integration. • Seminars • Assignments • Presentations
Target students	1st year MBBS
Duration	36 weeks
Assessment	• MCQs • SEQs • Viva Voce • Assignments • Presentations • Open Book Examination • Internal evaluation carries 20% weightage in summative examination. • Continuous monitoring of attendance and academics in tutorials

Learning Resources	1. Guyton and Hall Textbook of Medical Physiology 13th Edition 2. Ganong's Review of Medical Physiology 23rd Edition 3. Berne and Levy Physiology 7th Edition 4. Fundamentals of Human Physiology by Laurali Sherwood 4th Edition 5. Essentials of Medical Physiology by Prof. Dr. Mushtaq Ahmad 6. Physiology by Linda and Costanzo

Course title	**Cell & Membrane Physiology**
Introduction	Cells, the smallest living entities, are the living building blocks for the immensely complicated whole body. Thus, cells are the bridge between chemicals and humans.The maintenance of constant volume and composition of the body fluidCompartments (Internal environment) is termed as homeostasis. The function of the human body represents complex processes at multiple levels. Humans inhabit many different environments and often move between environments, the body must be able to rapidly adapt to the challenges imposed by changes in ambient temperature and availability of food and water. Such adaptation requires coordination of the function of cells in different tissues and organs as well as their regulation.
Target students	1st year MBBS
Duration	02 Weeks 02 days (14 Lectures)
Learning outcomes	At the end of the course student must be able: 1. To discuss functional organization of the humanbody and control of the "internal environment" 2. To discuss cell organelles and their functions 3. To understand electrochemical gradient, and how it is used to determine whether the transport of a molecule or ion across the plasma membrane is active or passive 4. To explain genetic control of protein synthesis, cell function and cell reproduction
Learning objectives	**At the end of the course student must be able to:** Describe The Lipid Barrier of the Cell Membrane, and Cell Membrane Transport Proteins Explain Diffusion Define "Active Transport" of Substances Through Understand Basic Physics of Membrane Potentials

	Discuss Resting Membrane Potential of Nerves Discuss Nerve Action Potential Describe Propagation of the Action Potential Explain Plateau in Some Action Potentials Explain the Rhythmicity of Some Excitable Tissues— Repetitive Discharge Tell Special Characteristics of Signal Transmission in Nerve Trunks Understand Recording Membrane Potentials and Action Potentials **Cell physiology** Name the different fluid compartments in the human body. Define moles, equivalents, and osmoles Define pH and buffering. Understand electrolytes and define diffusion, osmosis, and tonicity. Understand in general terms the basic building blocks of the cell: nucleotides, amino acids, carbohydrates, and fatty acids Understand higher-order structures of the basic building blocks: DNA, RNA, proteins, and lipids. Understand the basic contributions of these building blocks to cell structure, function, and energy balance. Name the different fluid compartments in the human body. Explain Control systems of the body Describe Functional Organization of the Human Body and Control of the "Internal Environment Draw the structure of cell membrane and give the functions of each component of cell memberane Give the different types of Cell junctions Describe the organelles and their functions Explain the different type ofLocomotion of cells

	APOPTOSIS—PROGRAMMED CELL DEATH, CANCER

Course Title	**Nerve Physiology**
Introduction	The human nervous system consists of billions of nerve cells (or neurons) plus supporting (Neuroglial) cells. They are responsible for the electrical signals that communicate information about sensations, and that produce movements in response to those stimuli, along with inducing thought processes within the brain.
Target students	1st year MBBS
Duration	02 Weeks (12 Lectures)
Learning outcomes	At the end of the course student must be able: 1. To understand the parts of a neuron and their functions. 2. To discuss the various types of nerve fibers, types of glia and their functions. 3. To discuss properties of action potential 4. To explain membrane potentials and action potentials 5. To describe the changes in ionic channels that underlieelectrotonic potentials, the action potential, and repolarization. 6. To discuss patterns of propagation of nerve impulse
Learning objectives	At the end of the course student must be able to: • Name the parts of a neuron and their functions • Name the various types of glia and their functions. Describe the chemical nature of myelin, and summarize the differences in the ways in which unmyelinated and myelinated neurons conduct impulses Define orthograde and retrograde axonal transport and the molecular motors involved in each. Describe the changes in ionic channels that underlie electrotonic potentials, the action potential, and repolarization. List the various nerve fiber types found in the mammalian nervous system. Describe the function of neurotrophins

Course Title	**Muscle Physiology**

Introduction	The muscular system is the biological system of humans that produces movement. The muscular system is controlled through the nervous system, although some muscles, like cardiac muscle, can be completely autonomous. Muscle is contractile tissue and is derived from the mesodermal layer of embryonic germ cells. Its function is to produce force and cause motion, either locomotion or movement within internal organs. Much of muscle contraction occurs without conscious thought and is necessary for survival, like the contraction of the heart or peristalsis, which pushes food through the digestive system. Voluntary muscle contraction is used to move the body and can be finely controlled, such as movements of the finger or gross movements that of the biceps and triceps
Target Students	1st year MBBS
Course Title	**Muscle Physiology**
Duration	02 Weeks (12 Lectures)
Learning outcomes	At the end of the course student must be able: 1. To differentiate the major classes of muscle in the body. 2. To describe the organization of skeletal muscle, including the structural features/proteins within the skeletal muscle fiber that link the contractile elements to the extracellular matrix and bone to effect movement. 3. To illustrate the molecular and electrical makeup of muscle cell excitation–contraction coupling. 4. To explain the neuromuscular junction, and explain how action potentials in the motor neuron at the junction lead to contraction of the skeletal muscle. 5. To describe Contraction and Excitation of Smooth Muscle
Learning objectives	At the end of the course student must be able to: • Differentiate the major classes of muscle in the body. Describe the molecular and electrical makeup of muscle cell excitation–contraction coupling Define thick and thick filaments and how they slide to create contraction. Differentiate the role(s) for Ca2+ in skeletal, cardiac, and smooth muscle contraction Appreciate muscle cell diversity. Describe the main morphologic features of synapses

	Distinguish between chemical and electrical transmission at synapses. Describe fast and slow excitatory and inhibitory postsynaptic potentials, outline the ionic fluxes that underlie them, and explain how the potentials interact to generate action potentials. Describe fast and slow excitatory and inhibitory postsynaptic potentials, outline the ionic fluxes that underlie them, and explain how the potentials interact to generate action potentials. Define and give examples of direct inhibition, indirect inhibition, presynaptic inhibition, and postsynaptic inhibition. Describe the neuromuscular junction, and explain how action potentials in the motor neuron at the junction lead to contraction of the skeletal muscle Define and explain denervation hypersensitivity List neurotransmitters and the principal sites in the nervous system at which they are released. Describe the receptors for catecholamines, acetylcholine, 5-HT, amino acids, and opioids. Summarize the steps involved in the biosynthesis, release, action, and removal from the synaptic cleft of the various synaptic transmitters. Define opioid peptide, list the principal opioid peptides in the body, and name the precursor molecules from which they originate. Describe the classification of sensory receptor Name the types of sensory receptors found in the skin, and discuss their relation to touch, cold, warmth, and pain Define generator potential Explain the essential elements of sensory coding. Describe the components of a reflex arc. Describe the muscle spindles and their role in the stretch reflex.

	Describe the muscle spindles and their role in the stretch reflex. Define reciprocal innervation, inverse stretch reflex, clonus, and lengthening reaction

Course Title	Blood Physiology
Introduction	Blood is a connective tissue in fluid form. It is considered as the 'fluid of life' because it carries oxygen from lungs to all parts of the body and carbon dioxide from all parts of the body to the lungs. It is known as 'fluid of growth' because it carries nutritive substances from the digestive system and hormones from endocrine gland to all the tissues. The blood is also called the 'fluid of health' because it protects the body against the diseases and gets rid of the waste products and unwanted substances by transporting them to the excretory organs like kidneys.
Target students	**1st year MBBS**
Course title	**Blood Physiology**
Duration	06 Weeks (36 Lectures)
Learning outcomes	At the end of the course student must be able: 1. To explain the components of blood and lymph, their origins, and the role of hemoglobin in transporting oxygen in red blood cells. 2. To understand the significance of immunity, particularly with respect to defending the body against microbial invaders. 3. To relate the roles and mechanisms of innate, acquired, humoral, and cellular immunity. 4. To understand the basis of inflammatory responses and wound healing. 5. To discuss the molecular basis of blood groups and the reasons for transfusion reactions. 6. To explain the process of hemostasis that restricts blood loss when vessels are damaged, and the adverse consequences of intravascular thrombosis.
Learning objectives	**At the end of the course student must be able to:** • Discuss Blood composition,plasma and plasma proteins • Describes the blood cells, their formation and functions in order to investigation of anaemias, infections and leukaemias • Compare between plasma protein fractions, their origin and functions so as to understand disturbances of their production • Classify blood groups so as to identify the blood groups of patients and donors for the purpose of safe blood transfusion • Explain the mechanisms of haemostasis and blood coagulation so as to be

	aware by diseases arising from excessive bleeding or intravascular clotting. • Understand the significance of immunity, particularly with respect to defending the body against microbial invaders Delineate the roles and mechanisms of innate, acquired, humoral, and cellular immunity.and Understand the basis of inflammatory responses and wound healing.

Course Title	**Respiratory Physiology**
Introduction	Respiration involves the sum of the processes that accomplish ongoing passive movement of O2 from the atmosphere to the tissues to support cell metabolism, as well as the continual passive movement of metabolically produced CO2 from the tissues to the atmosphere. The respiratory system contributes to homeostasis by exchanging O2 and CO2 between the atmosphere and the blood. The blood transports O2 and CO2 between the respiratory system and the tissues.
Target students	**1st year MBBS**
Duration	04 Weeks (24 Lectures)
Learning outcomes	At the end of the course student must be able: 1. To relate the anatomical structure/function relationships of the upper and lower components of the respiratory system. 2. To compare and contrast the pulmonary and bronchial circulatory systems. 3. To define the different pressures in the respiratory system. 4. To relate the different volumes in the lung, and describe how they are measured. 5. To explain physical principles of gas exchange including diffusion of oxygen and carbon dioxide through the respiratory membrane 6. To discuss transport of oxygen and carbon dioxide in blood and tissue fluids 7. To explain the role of central and peripheral chemoreceptors in regulating respiration. 8. To describe ventilatory control during special circumstances (e.g., exercise and high altitude) 9. To discuss Aviation, High-Altitude and Space Physiology 10. To memorize physiology of deep-sea diving and other hyperbaric conditions
Learning objectives	**At the end of the course student must be able to:** • Locate the pre-Bötzinger complex and describe its role in producing spontaneous respiration. • Identify the location and probable functions of the dorsal and ventral

	groups of respiratory neurons, • the pneumotaxiccenter, and the apneustic center in the brain stem • List the specific respiratory functions of the vagus nerves and the respiratory receptors in the carotid • body, the aortic body, and the ventral surface of the medulla oblongata. • Describe and explain the ventilatory responses to increased CO_2 concentrations in the inspired air. • Describe and explain the ventilatory responses to decreased O_2 concentrations in the inspired air. • Describe the effects of each of the main non-chemical factors that influence respiration. • Describe the effects of exercise on ventilation and O_2 exchange in the tissues.

Course Title	**Heart Physiology**
Introduction	Cardiovascular system includes heart and blood vessels. The heart is the pump that imparts pressure to the blood to establish the pressure gradient needed for blood to flow to the tissues. Like all liquids, blood flows down a pressure gradient from an area of higher pressure to an area of lower pressure.Heart is a muscular organ that pumps blood throughoutthe circulatory system. It is situated in between two lungs in the mediastinum. It is made up of four chambers, two atria and two ventricles. The musculature of ventricles is thicker than that of atria. Force of contraction of heart depends upon the muscles.
Target students	1st year MBBS
Duration	03 Weeks (18 Lectures)
Learning outcomes	At the end of the course student must be able: 1. To describe heart as a pump 2. To discuss function of the heart valves 3. To explain Rhythmical Excitation of the Heart 4. To discuss electrical activity in ventricular muscle and SA node 5. To label Normal Electrocardiogram 6. To identify the abnormalities of ECG 7. To analyze vectorial analysis of ECG 8. To describe cardiac arrhythmias and their electrocardiographic interpretation
Learning objectives	**At the end of the course student must be able to:** Describe the structure and function of the conduction system of the heart and compare the action potentials in each part. Describe the way the electrocardiogram (ECG) is recorded, the waves of the ECG, and the relationship of the ECG to the electrical axis of the heart.

	Name the common cardiac arrhythmias and describe the processes that produce them. List the principal early and late ECG manifestations of myocardial infarction and explain the early changes in terms of the underlying ionic events that produce them Describe the ECG changes and the changes in cardiac function produced by alterations in the ionic composition of the body fluids **The Heart as a Pump** Describe how the sequential pattern of contraction and relaxation in the heart results in a normal pattern of blood flow. Understand the pressure, volume, and flow changes that occur during the cardiac cycle. Explain the basis of the arterial pulse, heart sounds, and murmurs Delineate the ways by which cardiac output can be up-regulated in the setting of specific physiologic demands for increased oxygen supply to the tissues, such as exercise. Describe how the pumping action of the heart can be compromised in the setting of specific disease states. **Blood as a Circulatory Fluid & the Dynamics of Blood & Lymph Flow** Describe the components of blood and lymph, their origins, and the role of hemoglobin in transporting oxygen in red blood cells. Understand the molecular basis of blood groups and the reasons for transfusion reactions. Delineate the process of hemostasis that restricts blood loss when vessels are damaged, and the adverse consequences of intravascular thrombosis Identify the types of blood and lymphatic vessels that make up the circulatory system and the regulation and function of their primary constituent cell types. Describe how physical principles dictate the flow of blood and lymph around the body. Understand the basis of methods used to measure blood flow and blood pressure in various vascular segments.

	Understand the basis of disease states where components of the blood and vasculature are abnormal, dysregulated, or both. **Cardiovascular Regulatory Mechanisms** Outline the neural mechanisms that control arterial blood pressure and heart rate, including the receptors, afferent and efferent pathways, central integrating pathways, and effector mechanisms involved. Describe the direct effects of CO2 and hypoxia on the vasomotor areas in the medulla oblongata. Describe how the process of autoregulation contributes to control of vascular caliber Identify the paracrine factors and hormones that regulate vascular tone, their sources, and their mechanisms of action **Circulation Through Special Regions** Define the special features of the circulation in the brain, coronary vessels, skin, and fetus, and how these are regulated. Describe how cerebrospinal fluid (CSF) is formed and reabsorbed, and its role in protecting the brain from injury Understand how the blood–brain barrier impedes the entry of specific substances into the brain. Delineate how the oxygen needs of the contracting myocardium are met by the coronary arteries and the consequences of their occlusion. List the vascular reactions of the skin and the reflexes that mediate them. Understand how the fetus is supplied with oxygen and nutrients in utero, and the circulatory events required for a transition to independent life after birth.

Course Title	**PULMONARY PHYSIOLOGY**
Introduction	The circulatory system contributes to homeostasis by serving as the body's transport system. The blood vessels transport and distribute blood pumped through them by the heart to meet the body's needs for O2 and nutrient delivery, waste removal and hormonal signaling. The highly elastic arteries transport blood from the heart to the organs and serve as a pressure reservoir to continue driving blood forward when the heart is relaxing and filling. The mean arterial blood pressure is closely regulated

	toensure adequate blood delivery to the organs. The amount ofblood that flows through a given organ depends on the caliber (internal diameter) of the highly muscular arterioles that supply the organ. Arteriolar caliber is subject to control so that flow to particular organs can be variably adjusted to best serve the body's needs at the moment. The thin-walled capillaries are the actual site of exchange between blood and surrounding tissue cells. The highly distensible veins return blood from the organs to the heart and serve as a blood reservoir.
Target students	1st year MBBS
Duration	04 Weeks (24 Lectures)
Learning outcomes	At the end of the course student must be able: 1. To describe vascular distensibility and functions of the arterial and venous systems 2. To relate microcirculation and lymphatic system: capillary fluid exchange, interstitial fluid, and lymph flow 3. To discuss local and humoral control of blood flow by the tissues 4. To explain nervous regulation of the circulation and rapid control of arterial pressure 5. To discuss role of the kidney in long-term regulation of arterial pressure and in hypertension 6. To describe cardiac output, venous return, and their regulation 7. To explain muscle blood flow and cardiac output during exercise; the coronary circulation and ischemic heart disease 8. To understand Cardiac Failure 9. To memorize Heart valves and heart sounds 10. To explain Dynamics of valvular and congenital heart defects 11. To discuss circulatory shock and physiology of its treatment
Learning objectives	**At the end of the course student must be able to:** • Describe the manner in which O2 flows "downhill" from the lungs to the tissues and CO2 flows "UPhill" from the tissues to the lungs. • Describe the reactions of O2 with hemoglobin and the oxygen–hemoglobin dissociation curve. • List the important factors affecting the affinity of hemoglobin for O2 and the physiologic significance of each. • List the reactions that increase the amount of CO2 in the blood, and draw the CO2 dissociation curve forarterial and venous blood. • List the principal buffers in blood and, using the Henderson–Hasselbalch equation, describe what is unique about the bicarbonate buffer system • Define alkalosis and acidosis and outline respiratory and renal compensatory mechanisms in response to alkalosis and acidosis

	• Define and calculate Respiratory exchange ratio • Define partial pressure and calculate the partial pressure of each of the important gases in the atmosphere at sea level. • List the passages through which air passes from the exterior to the alveoli, and describe the cells that line each of them. • List the major muscles involved in respiration, and state the role of each. • Define the basic measures of lung volume and capacities and give approximate values for each in a normal adult. • Define compliance, and give examples of diseases in which it is abnormal. • Describe the chemical composition and function of surfactant • List the factors that determine alveolar ventilation. Difference between alveolar and pulmonary ventilation • Draw the ventilation /perfusion diagram give the concentration of O2 and CO2 in different conditions • Define diffusion capacity,facrors affecting and compare the diffusion of O2 with that of CO2 in the lungs. • Compare the pulmonary and systemic circulations, listing the main differences between them. • Define pulmonary edem. explain its mechanism

Course Title	**Skin &Temperature Physiology**
Introduction	Humans, usually in environments cooler than their bodies, must constantly generate heat to maintain their body temperatures. Also, they must have mechanisms to cool thebody if it gains too much heat from heat-generating skeletal muscle activity or from a hot external environment. Body temperature must be regulated because the rate of cellular chemical reactions depends on temperature and because overheating damages cell proteins. The hypothalamus is the major integrating center for maintaining both energy balance and body temperature
Target Students	1st year MBBS
Duration	04 days (04 Lectures)
Learning outcomes	At the end of the course student must be able to: 1. To discuss the mechanisms by which heat is produced in and lost from the body. 2. To enlist the temperature-regulating mechanisms, and describe the way in which they are integrated under hypothalamic control to maintain normal body temperature. 3. To discuss the pathophysiology of fever.

Learning objectives	**At the end of the course student must be able to:** • Define body temperature and normal average and range of body temperature • Describe the mechanism of heat production and heat loss • Describe how the body responds to changes in set-point (e.g.a fever). • Describe the process by which sweat is produced (including the role of the **sympathetic cholinergic fibers**);Describe thermoregulation in terms of a control system, including identification of the 1. Controlled variable 2 Set point

Learning Resources **Physiology**	**1. Guyton and Hall Textbook of Medical Physiology 13th Edition** **2. Ganong's Review of Medical Physiology 23rd Edition** **3. Berne and Levy Physiology 7th Edition** **4. Fundamentals of Human Physiology by Lauralee Sherwood 4th Edition** **5. Essentials of Medical Physiology by Prof. Dr. Mushtaq Ahmad** **6. Physiology by Linda and Costanzo**
Assessment	• MCQs • SEQs • Viva Voce • Assignments • Presentations • Open Book Examination • Internal evaluation carries 20% weightage in summative examination. • Continuous monitoring of attendance and academics in tutorials

Course Title	**Aviation, High Altitude, Space Physiology and Deep sea diving**
Introduction	The aim of the course is to develop basic understanding of the functions of the body and their applications in management of patients and to develop skills in assessing the physiological functions of systems of the body and basic clinical examination. Careful observation is the back bone of scientific method and so one of the aims of conducting experiments is to acquire an aptitude for careful observation.
Target students	**1st year MBBS**
Learning outcomes	1. Learn and acquire skills to understand basis of physiology 2. Acquire an aptitude for careful observation. 3. Gain skills in recording an experiments, tabulating and condensing data. 4. Learn to draw valid conclusions from available data. 5. Apply Physiological learning to health and community problems.
Learning objectives	Describe the Effects of low oxygen pressure On the body

	Enlist the type of hypoxia and explain each of them Explain acute and chronic mountain sickness Enlist the EFFECTS OF ACCELERATORY FORCES ON THE BODY IN AVIATION AND SPACE PHYSIOLOGY Explain the Physiology of Deep-Sea Diving and Other Hyperbaric Conditions

STUDY GUIDE

BIOCHEMISTRY

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Title	**Biochemistry Study Guide**
Introduction	Biochemistry is an emerging science, related to the chemical processes taking place in human body. Biochemistry helps to understand the complexity of life. It enables us to know how the cells, tissues and organs work in coordination, and keeps our body work normally. It is the recent field of science with lot of research advancements. It helps us to know the molecular events occurring in our body, so that we can understand better the causes of the abnormal processes resulting in the disease. Also we can find the cure of various diseases by knowing them at molecular level.
Target students	1st year MBBS
Course to be studied in first year MBBS	• Cell and Physicochemical aspects • Chemistry of Carbohydrates, • Chemistry of Proteins, • Chemistry of Lipids, • Chemistry of Nucleotides • Extracellular matrix • Heme chemistry and metabolism • Enzymology • Vitamins • Minerals and • Nutrition
Course title	**BIOCHEMICAL ASPECTS OF CELL**
Duration	8 lectures
Learning outcomes	1. To study the molecular and functional organization of cell and its subcellular organelles. 2. To study the membrane and its phenomena 3. To understand the transport mechanisms across the cell 4. To describe the methods to study cell biochemistry

Course title	**ACID BASE BALANCE AND BODY FLUIDS**

Learning objectives	At the end of the course student must be able to: 1 Understand biochemical composition and functions of cell and cell membranes Define chemistry of signals and receptors, signal transduction Compare different types of membrane transports Learn methods to study cell biochemistry

Duration	07 lectures
Learning outcomes	1. To understand the concept of pH, pKa and buffers 2. To describe the body buffer systems 3. To know the basis of acidosis and alkalosis
Learning objectives	At the end of the course student must be able to: 1. Apprehend ionization of water, weak acids and bases, pH and pH scale 2. Identify body buffers, their mechanism of action, acid base regulation 3. Learn to calculate Henderson-Hesselbach equation, biochemical actions for control of water and electrolyte balance 4. Compare different types of 5. particles and solutions and Gibbs Donnanequilibrium
Course title	**BIOCHEMISTRY OF CARBOHYDRATES**
Duration	10 lectures
Learning outcomes	1. To define carbohydrates, to know their general properties, isomerism, and biomedical importance. 2. List the monosaccharides of biological importance and learn their properties. 3. List the oligosaccharides and disaccharides of biological importance and learn their properties. 4. Study the chemistry and properties of various polysaccharides. 5. Study the chemistry and functions of proteoglycans.
Learning objectives	At the end of the course student must be able to: 1. Define carbohydrates, their biochemical function and classification 2. Learn monosaccharide nomenclature, isomerism, chemical properties 3. Compare structure and function of different monosaccharide, oligosaccharides and polysaccharides. 4. Explain biochemical 5. roles of Heteropoly saccharides and homopoly saccharides
Course title	**BIOCHEMISTRY OF AMINO ACIDS AND PROTEINS**
Duration	14 lectures

Learning outcomes	1. To know what are proteins and their biomedical importance. 2. To learn what are amino acids, their classification structure, functions, and properties. 3. To learn the classification and properties of proteins. 4. Learn the structural organization of protein. 5. To understand protein folding and misfoldingalongwithmisfolding diseases 6. To study plasma proteins and immunoglobulins.
Learning objectives	At the end of the course student must be able to: 1. Define proteins and their biochemical roles 2. Classify amino acids, structure and function of immunoglobulin and plasma proteins 3. Learn protein separation techniques 4. Determine hemoglobin structure, hemoglobinopathies, collagenopathies
Course title	**BIOCHEMISTRY OF NECLEIC ACIDS AND NUCLEOTIDES**
Duration	7 lectures
Learning outcomes	To study the structure, functions and diseases associated with **a)** Collagen **b)** Elastin **c)** Fibrillin-1 as a protein of microfibrills **d)** Glycosaminoglycans (GAGs) **e)** Proteoglycans **f)** Glycoproteins
Learning objectives	At the end of the course student must be able to: **1.** Define nucleotides, their biochemical role, structure and function **2.** Map out synthesis and clinical roles of purines and pyrimidines **3.** Relate structure and functions of nucleic acids (DNA & RNA)
Course title	**BIOCHEMISTRY OF LIPIDS**
Duration	14 lectures
Learning outcomes	1. To classify of lipids and their general biological functions 2. To understand 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 in coronary heart disease, omega-3 and omega-6 fatty acids and the importance of their dietary use. 3. To define nutritionally essential fatty acids and their functions 4. To describe eicosanoids and their biological functions along with their significance in health and disease 5. To understand physical and chemical properties of fats and oils (triacyglycerols), saponification, iodine number and acid number of fats, rancidity of fats 6. To study structure and biologic functions and significance of phospholipids, glycolipids, sulfolipids, and gangliosides 7. To know lipid peroxidation and its significance
Learning objectives	At the end of the course student must be able to: 1. Define lipids and their classification, biochemical action, structure and function 2. Elaborate biochemical roles of steroids, eicosanoids, lipoproteins and lipid per oxidation
Course title	**Heme Chemistry and Metabolism**
Duration	11 lectures
Learning outcomes	**1.** To understand chemistry and biosynthesis of heme and other porphyrins including disorders of heme biosynthesis (Porphyrias). **2.** To study 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}. **3.** To understand oxygen binding capacity of hemoglobin, factors affecting and regulating the oxygen-binding capacity of hemoglobin. Methemoglobin (metHb) and methemoglobinemia. **4.** To study bilirubin metabolism **5.** To describe hyperbilirubinemias **6.** To understand hemoglobinopathies
Learning objectives	At the end of the course student must be able to: 1. Define enzymes, isoenzymes, their properties and regulation of activity, coenzymes and cofactors 2. Classify enzymes, enzyme inhibitors, define their therapeutic uses and application in clinical diagnosis 3 Comprehend enzyme deficiency diseases

Course title	**HEAMOGLOBIN METABOLISM**
Duration	13 lectures
Learning outcomes	**1.** To study introduction, classification and nomenclature of enzymes including definitions of enzymes and IU of enzyme activity; Enzyme Commission Classification of enzymes along with main subclasses. **2.** To learn properties of enzymes including chemical nature, active site, Catalytic efficiency, Specificity, Proenzymes, and Kinetic properties.Coenzymes and cofactors: Coenzymes derived from various vitamins along with the examples of enzymes requiring these coenzymes; and metal cofactors. Isozymes and their clinical significance. Allosteric enzymes and their biological significance. **3.** To study factors affecting enzyme activity. **4.** To understand types of enzyme inhibitors and their biomedical importance **5.** To describe mechanism of enzyme action and kinetics of enzyme activity **6.** To understand regulation of enzyme activity To learn therapeutic use of enzymes and diagnostic application of determination of enzyme activities of certain enzymes in plasma
Learning objectives	At the end of the course student must be able to: Define porphyrins, heam, types and functions of hemoglobin, its synthesis and structure, its breakdown, bile pigments Differentiate types of hemoglobinopathies, porphyrias and jaundice
Course title	**VITAMINS AND MINERALS**
Duration	8 lectures
Learning outcomes	1. To study chemistry of purines, pyrimidines, their types and structure 2. To understand structure and functions of nucleotides and nucleosides (excluding metabolism) 3. To study natural and synthetic derivatives of purines and pyrimidines and their biomedical role 4. To learn structure, functions and types of nucleic acids (excluding metabolism)
Learning objectives	At the end of the course student must be able to: 1. Classify vitamins, their chemical structure and functions, their daily requirements, sources and their deficiency

	related diseases 2. Identify different minerals in human nutrition, their sources, biochemical actions and recommended daily allowance
Course title	**NUTRITION**
Duration	06 lectures
Out comes	**1.** To study energy metabolism **2.** To understand Balanced diet **3.** To describe the role of proteins in nutrition **4.** To elaborate the role of fats and lipids in nutrition **5.** To describe the role of carbohydrates in human nutrition **6.** To learn calculation of caloric requirement **7.** To study obesity and food additives
Objectives	At the end of the course student must be able to: 1. Define balance diet, caloric requirements of body, nutritional requirements in pregnancy and lactation 2. Summarize protein energy malnutrition, compare marasmus, kwashiorkor and marasmic- kwashiorkor
Course title	**EXTRACELLULAR MATRIX**
Duration	15 lectures
Learning outcomes	**1.** To study general features of vitamins as essential nutrients. **2.** To study classification of vitamins according to their physicochemical nature and biochemical functions **3.** To describe important dietary sources and recommended dietary allowances of vitamins. **4.** To understand intestinal absorption, transport and storage of vitamins. **5.** To elaborate mechanism of action of vitamins and their biochemical functions in body. **6.** To learn disorders associated with vitamin deficiency and hypervitaminoses.
Learning objectives	At the end of the course student must be able to:Identify types of collagen, its structure, biosynthesis, degradation and related disordersExplain characteristics of elastin, fibrillin, GAGs, glycoprotein and their related disorders