MBBS Syllabus

for International Students

1st and 2nd semester

By:

Kermanshah University of MedicalSciences

2024

1st Semester:

No.	Course	Credit		Total Credit
		Theo.	Prac.	
1	Introduction to the Anatomical sciences	2.2	0.2	2.5
2	Cell Physiology	0.8	-	0.8
3	Anatomy of the Respiratory system	0.5	0.2	0.7
4	psychology of Health	2	-	2
5	Cardiovascular system Anatomy	1	0.5	1.5
6	Cellular and Molecular Biochemistry	1.9	-	1.9
7	Physiology of Heart	0.45	0.05	0.5
8	Physiology of the Respiratory system	0.6	-	0.6
9	Physiology of the circulatory system	1.1	-	1.1
10	Gastrointestinal System Physiology	0.6	-	0.6
11	Blood physiology	0.3	-	0.3
Total Credit: 12.5				

2nd Semester:

No.	Course	Credit		Total Credit
		Theo.	Prac.	
1	Medical physic	2	-	2
2	Medical Terminology	3	-	3
3	Anatomy of the Gastrointestinal System	1.5	-	1.5
4	Discipline Biochemistry	1.3	-	1.3
5	Islamic thought	2	-	2
6	Cellular and Molecular Biology	3	-	3
Total Credit: 12.8				

Course title	Introduction to the Anatomical sciences
Number of Credits	2.5
Hours of Instruction	38(Theo.)+8(Prac.)
Course content	• The introduction of anatomy • Anatomical Position • Anatomical Planes (Sagittal, Coronal, Transverse) • Terms of Direction • Terms of Direction (Trunk, Limb) • Orientation and Directional Terms • Types of Actions • Movements of joints • skeletal system • bone functions • Bone shapes (Long, Flat, Short< Irregular, Sesamoid Bones) BONES (Axial skeleton, Appendicular skeleton) • Head & Face skeleton (Calvaria, Face) • Face skeleton (Maxilla, Zygomatic, Nasal, Lacrimal, Palatin, Inf. Nasal, concha, Mandible, Vomer) • Calvaria Bones (occipital, frontal, sphenoid, ethmoid, temporal, parietal) Suture (Coronal, Sagittal, Lambdoid) • Fontanelle (Anterior, Posterior) • Maxillary bones (Mandible, Palatine bones, Nasal bones, Vomer Facial bones, Inferior nasal conchae, Zygomatic bones, Lacrimal bones, Hyoid) • Vertebral Column • Vertebrae (Regions - Cervical (7 vertebrae) - Thoracic (12 vertebrae) - Lumbar (5 • vertebrae) - Sacral bone (1) - Coccygeal bone (1)) • General features of vertebrae • Intervertebral Disks • Thoracic or Rib Cage (True ribs, False ribs, Floating ribs) Sternum • Characteristics of "typical" ribs • Characteristics of "Atypical" ribs • The Bones of Limbs • Appendicular Skeleton (Girdles, Upper limbs, Lower limbs) Scapula • Clavicle • Arm (Humerus) • Forearm (Radius, Ulna) • Skeleton of the Hand (Carpus, Metacarpus, Phalanges) • Composition of Lower Limbs (Pelvic girdle, Bones of free lower limb) • Pelvis • Hip Bone (hip: Right and Left - Ilium - Ischium - Pubis, Acetabulum, Obturator foramen, Sacrum)

	• Thigh (Femur, Patella or kneecap) • Leg (Tibia, Fibula) • Foot (Tarsals (7) - Calcaneus, talus - Navicular, cuboid - cuneiforms, Metatarsals (5), Phalanges) • Anatomy of the Nervous System Anatomy of the Visual System • Anatomy of the Auditory System • Central Nervous System & Peripheral Nervous System • Spinal Cord • Spinal Membranes and Nerve Roots • Spinal Cord Organization (Gray matter, White matter) • Spinal Nerve Origin • Brain (Hindbrain, Midbrain, Forebrain) Brain Stem • Medulla oblongata • Fourth Ventricle & Cerebellum • Pons • The Diencephalon (and Brainstem) Thalamus &Hypothalamus • Cerebrum (Two hemispheres; Fissure, Gyms) • The Cerebral Cortex (frontal Lobes, Parietal Lobes, Occipital Lobes, Temporal Lobes) Corpous callosum • Basal Nuclei (Ganglia) • Meninges & Superficial Cerebral Veins Cerebrospinal Fluid • Ventricles of the Brain (Lateral Ventricle, Interventricular Foramen - connects Lateral and 3' ventricle, 3rd ventricle, Cerebral aqueduct - connects 3rd & 4th ventricles, 4th ventricle, Central canal of spinal cord) • Somatic System • Spinal Nerves • Spinal Nerve (Dorsal Ramus, Ventral Ramus) • Nerve Plexuses (Cervical plexus, Brachial plexus, Lumbar plexus, Sacral plexus) • Inferior view of the brain • The Olfactory Nerve (I) • The optic nerve (II) • The oculomotor nerve (III) • The trochlear nerve (IV) • The abducens nerve (VI) • The Trigeminal Nerve (V) • The Facial Nerve (VII) • The Vestibulocochlear Nerve (VIII) • The Glossopharyngeal Nerve (IX) • The Vagus Nerve (X) • The accessory nerve (XI) • The hypoglossal nerve (XII) • Sympathetic & Parasympathetic system • The Reproductive System

	• Male Reproductive system (Testis (Tunica, Vaginalis, Albuginea, Vascolusa), Spermatic cord, Epididymis, Vas Deferens, Scrotum, Seminal vesicle, Prostate gland, Cowper gland, Penis) • Penile Erection • Ducts of Male Reproductive System • Female Reproductive system (Internal part: Uterus, Ovary, Oviduct, Vagina. External part, Mons pubis, Labia major, Labia minor, Clitoris, Vaginal orifice = hymen) • Pituitary Hormones Regulate Follicular Development of Ovaries • The urinary system • Organization of the Urinary System (Right & Left kidneys, Right & Left ureters, Urinary bladder, Urethra) • The Position of the Kidneys • Localization of the kidneys • Relationship (Posterior, Anterior of Right, Anterior of Left) • Hilum • Protection of the Kidneys (3 layers of connective tissue: Renal capsule, Adipose capsule, Renal fascia, para renal fat pad) • Internal Anatomy of Kidney • Internal Structure of the Kidney . • Lobe of Kidney • Microscopic structure of the Kidney and Urine Production • Blood Supply Diagram (Arterial Supply, Venous Drainage, Nerve supply, Lymphatic Drainage) • Ureters • narrow regions in Ureter: renal pelvis, in pelvic (common iliac vessel), in bladder Urinary Bladder • The structure of bladder • Nerve of bladder (T11-T12, L1-L2 Sympathetic ganglion, S2-S3-S4 Parasympathetic ganglion) • Urine Volume • Urethra • Female Urethra • Arterial Supply • Venous Drainage

Course title	Cell Physiology
Number of Credits	0.8
Hours of Instruction	14(Theo.)
Course content	• Definition of Physiology • Homeostasis • Components of a homeostatic system Negative feedback • Positive feedback • Feed forward • Components of a homeostatic system Cells: The Living Units • Cell Theory: History • Definition of Cell • Cell Diversity • Two Types of Cells (Prokaryotic, Eukaryotic) Cell Characteristics • Prokaryotic Cells • Eukaryotic Cells • Cell Parts (Cell Membrane, Cell Wall, Cytoplasm) • Cytoplasmic Organelles (Membranous; Mitochondria, peroxisomes, lysosomes, endoplasmic reticulum, and Golgi apparatus. Non-membranous; Cytoskeleton, centrioles, and ribosomes) • Nucleus is the cell's information center • Nucleus • Nucleoli • Chromatin • Nuclear Envelope • Nuclear membrane • Nucleolus • Chromosomes • Modification of proteins in the Golgi complex • What is the purpose of glycosylation? • Plasma Membrane (Cell Membrane) • Singer and Nicholson • Fluid mosaic model • Cell Membrane Phospholipids • Fatty acids are essential to membrane structure and function • Membrane asymmetry • Membranes contain integral, peripheral and lipid anchored proteins • Sterols are not found in the membranes of prokaryotic cells-and are also absent in inner membrane of mitochondria • Functions of Membrane Proteins (Transport, Enzymatic activity, Receptors for signal transduction, Intercellular adhesion (CAMs), Cell-cell recognition (Glycocalyx), Attachment to cytoskeleton and extracellular matrix (ECM)) • Membrane Junctions - Cell to cell "attachments" • Membrane Junctions - Specific Types (Tight Junction (Zonula Occludent), Desmosome -(Macula adherents), Gap Junction) • Cell Membrane Transport • Passive Transport (Diffusion; Simple Diffusion, Facilitated Diffusion, Osmosis) Filtration • Active Transport (Primary Active Transport, Secondary Active Transport) • Vesicular Transport (Exocytosis, Endocytosis) • Tonicity (Isotonic, Hypertonic, Hypotonic) • Transcytosis • Vesicular Trafficking • SGLT • Epithelial cells • 2 Pathways for Epithelial Transport; diffusion (Para cellular pathway),

	transcellular pathway • Membrane Potential • Types of plasma membrane ion channels: - Passive, or leakage, channels - always open • Chemically gated channels - open with binding of a specific neurotransmitter - Voltage-gated channels - open and close in response to membrane potential Mechanically gated channels - open and close in response to physical deformation of receptors • Operation of a Gated Channel • Operation of a Voltage-Gated Channel • Electrochemical Gradient • Resting Membrane Potential (Vr) • Membrane Potentials: Signals • Changes in Membrane Potential • Graded Potentials • Action Potentials (APs) • Action Potential: Resting State • Action Potential: Depolarization Phase • Action Potential: Repolarization Phase • Action Potential: Hyperpolarization • Action Potential: Role of the Sodium-Potassium Pump Propagation of an Action Potential (Time = Oms) Propagation of an Action Potential (Time = Ims) Propagation of an Action Potential (Time = 2ms) Threshold and Action Potentials • Coding for Stimulus Intensity • Absolute Refractory Period • Relative Refractory Period • Conduction Velocities of Axons • Saltatory Conduction • Multiple Sclerosis (MS) • Muscles and Muscle Tissue • The three types of muscle tissue (skeletal, cardiac, smooth) Muscle Similarities • Skeletal Muscle Tissue • Cardiac Muscle Tissue • Smooth Muscle Tissue • Functional Characteristics of Muscle Tissue Muscle Function • Skeletal Muscle: Nerve and Blood Supply, Attachments Microscopic Anatomy of a Skeletal Muscle Fiber Myofibrils • Sarcomeres • Myofilaments: Banding Pattern • Ultrastructure of Myofilaments: Thick Filaments Ultrastructure of Myofilaments: Thin Filaments Sarcoplasmic Reticulum (SR) • T Tubules • Triad Relationships • Sliding Filament Model of Contraction Skeletal Muscle Contraction • Nerve Stimulus of Skeletal Muscle • Neuromuscular Junction • Destruction of Acetylcholine • Action Potential • Role of Acetylcholine (Ach) • Effect of amount of Actin and myosin filament overlap on tension developed by contracting muscle • Effect of muscle length on force of contraction in .the whole intact muscle • Relation of velocity of contraction to load Skeletal Muscle (Muscle Twitch) • Motor Unit: The Nerve-Muscle Functional Unit Muscle Twitch • Graded Muscle Responses • Muscle Response to Stimulation Frequency Muscle Response to

	Stronger Stimuli Stimulus Intensity and Muscle Tension Treppe: The Staircase Effect • Muscle Tone • Contraction of Skeletal Muscle Fibers Isometric Contraction • Isotonic Contraction • Muscle Metabolism: Energy • CP-ADP Reaction • Anaerobic Glycolysis • Glycolysis and Aerobic Respiration • Energy System or Source during peak activity Muscle Fatigue • Oxygen Debt • Heat Production During Muscle Activity Force of Muscle Contraction • Stimulus Frequency and Tension • Velocity and Duration of Contraction Muscle Fiber Type: Speed of Contraction Fast fibers • Slow fibers • Smooth Muscle • Types of Smooth Muscle: Multiunit, Single Unit Peristalsis • Innervation of Smooth Muscle • Microscopic Anatomy of Smooth Muscle • Myofilaments in Smooth Muscle • Contraction of Smooth Muscle • Contraction Mechanism • Role of Calcium Ion • Features of Smooth Muscle Contraction • Response to Stretch • Comparison of smooth and skeletal muscle contraction • Energy required to sustain smooth muscle contraction • Slowness of onset of contraction and relaxation • Force of muscle contraction • Hyperplasia • Muscular Dystrophy • Latch mechanism • Mechanism of latch mechanism Regulation of contraction by calcium • Stimulus for contraction • Action potential

Course title	Anatomy of the Respiratory System
Number of Credits	0.7
Hours of Instruction	8(Theo.)+8(Prac.)
Course content	• Nasal Cavity • Pharynx & Larynx • Lung & Pleura • Histology of Respiratory System • Pulmonary Ventilation • Embryology of Respiratory System • Pulmonary Volumes and Capacities • Pulmonary circulation • Physical Principles of Gas Exchange • Transport of O2 and CO2 in Blood and Tissue Fluids • ***Regulation of Respiration***

Course title	Psychology of Health
Number of Credits	2
Hours of Instruction	34(Theo.)
Course content	• Acquaintance and empowerment of medical students with theoretical and practical concepts of health psychology • General goals of the meetings: (one goal for each meeting): • Introduction to the history of psychology • Getting to know the fields and methods of research in psychology • Getting to know the field of health psychology • Getting to know health inequalities • Familiarity with stress, health, and coping methods • Getting to know ways to deal with stress • Getting to know the classification of mental disorders • Getting to know the etiology of mental disorders • Familiarity with anxiety disorders • Familiarity with mood disorders • Familiarity with personality disorders • Familiarity with schizophrenic disorders • Familiarity with childhood neurodevelopmental disorders • Introduction to the biological treatment of psychological disorders • Getting to know Barvan therapy for psychological disorders

Course title	Cardiovascular system anatomy
Number of Credits	1.5(1 Theo. +0.5 Prac.)
Hours of Instruction	17(theo.)+16(prac.)
Course content	• Thoracic Cage • Thoracic wall • Thoracic cavity • Sternum Sterno-costal joint • Typical rib • Costo-vertebral joint • Rib 1 & Rib 12 • Cervical rib • Cervical vertebra • Thoracic vertebra • Lumbar vertebra • Anatomical structure of vertebra • Typical Vertebra • Vertebral ligaments • Intervertebral disc • Intervertebral disc herniation • Lumbar puncture . • Thoracic Muscles • Pectoralis Major Muscle • Pectoralis Minor Muscle • Serratus Anterior • Weakness of serratus Anterior • Back Muscles • Muscles of back are arranged in 4 lavers. • 1st. Layer :1- Trapezius., 2- Latissimus Dorsi. • 2nd Layer: 1- Levator Scapulae, 2- Rhomboideus minor,3- Rhomboideus major, 3' Layer: • 4- Serratus posterior superior.5- and Number of small muscles called Serratus posterior inferior, 4th Laver: Erector spinae o motivators, rotators, inter-spinalis, inter-transverses • & muscles forming the suboccipital triangle respiratory Muscles • Exterior(Posterior) Intercostal Muscle • External Intercostal muscle • Interior(Anterior) Intercostals Muscle • Transverse thoracic Muscle • Diaphragm • Left crura & the Arcuate ligaments • Bone attachments of diaphragm • Cruses & ligaments • Crura & Arcuate Ligaments of diaphragm • Openings in the Diaphragm • Nerves: Motor (Phrenic), Sensory (Phrenic & 7-12thintercostal nerves) • Blood: 7-12thintercostals Artery, Inferior Phrenic Artery, Pericardiophrenic Artery Functions of diaphragm (Inspiration, Muscle of abdominal straining, Weight lifting, Thoracoabdominal pump) • Diaphragmatic hernia • Morgagni hernia • Arteries & Vessels of Thoracic Wall • Arteries of thorax wall: • Ant. Intercostal arteries: internal thoracic artery • 2-posterior Intercostal arteries: cost cervical (subclavian) and Aorta • Ant thoracic wall • Internal Thoracic Art. Branches

	• Ant. Intercostal arteries (i^{th}_o^{th} spaces) • 2-Perforating • 3-Pericardiopherenic • 4-Mediastinal • 5-Su. Epigastric • . 'Nth • 6-Musculopherenic (^{7th}- .L.z spaces) • Posterior Intercostal 2^{th}: Costocervical, 9^{th} - 12^{th}: AortaArtery, 1^{th} - Anterior Intercostal veins (1th-3th (Brachiocephalic vein), 4^{th}-12^{th} (Internal Thoracic vein)) • Posterior Intercostal veins (Right:1th-12^{th} (Azygos vein), L:1th-2th (Left Brachiocephalic), Left: 3th-7^{th} (Hemiazygos Superior), L: 8^{th}-12^{th} (Hemiazygos Inferior) • Nerves of thorax wall • Superior Thoracic Aperture • Inferior Thoracic Aperture • Breast • Breast lymph drainage • Blood supply of breast • Thoracostomy: Needle & Tube • Thoracotomy • Analgesia • Intercostal nerve block • Lateral Cutaneous nerve • Roof and floor of thorax • Mediastinum • superior Mediastinum contents • Anterior mediastinum • Middle Mediastinum • Posterior Mediastinum • Heart • Heart sulcus's: • Anterior Interventricular • Posterior Interventricular • coronary • surfaces • Atriums (Right & Left Atriums) • Left atrium & ventricle Right ventricle • Heart valves • Valves of Heart in Diastole Systole • Aortic Valve • Conducting system of Heart • Electrical system of the heart • Coronary arteries • Diagonal branches Left Circumflex Artery • Left Anterior Descending Artery • Left Marginal Artery Right Marginal Artery Right Coronary Artery Heart Veins • Pericardium (pericardium, serous) • Nerve & Blood supply: (Fibrous & Parietal Layer of serous) • Nerve: Phrenic • Blood: 1-Pericardiopherenic, 2-Thoracic aorta • Pericardial recesses Oblique recess • Transverse Recess Cardiac Plexus • Superficial cardiac plexus Probe Patency& ASD • Patent interventricular septum • Ventricular Septa! Defect VSD

	• Weakened aortic valve • Valvular incompetence & Valvular stenosis • Mitral Regurgitation Cardiac arrest • Pacemaker • Heart transplantation Cardiovascular System Development • Congenital heart dieses (CHD) • Early embryo development • Gastrulation • 3rd week of development • Cardiomyocyte progenitor cells migration • Cardiomyocyte progenitor cells migration • Formation of heart tube • Folding and Fusion of the Heart Tubes • Cardiomyocyte progenitor cells • Secondary heart field • Heart development • Heart Looping Dextrocardia • Development of the Sinus Venosus • Formation of the cardiac septa • Septum formation in the common atrium • Septum Formation in the Atrioventricular Canal • Septum Formation in the Ventricles • Septum Formation in the Bulbus • Heart Defects - • Hypoplastic right heart syndrome HRHS • Hypoplastic left heart syndrome HLHS • Atrial Septal Defect ASD • Ebstein anomaly • Ventricle Septal defect VSD • Tetralogy of Fallot • Persistent (Common) truncus arteriosus • Vascular development • Aortic Arches • Patent ductus arteriosus [PDA] • Venous System Vitelline Veins Umbilical Veins Cardinal Veins Circulatory Changes at Birth • Cardiac Histology • Airway anatomy • Trachea • Posterior View of trachea • Trachea Relations • Bronchus • Lobar bronchus • Segmental bronchus • Bronchopulmonary segment • Blood supply • Surface anatomy of pleura • Plural Recess • Costo diaphragmatic recess • Costo mediastinal recesses • Blood supply of parietal pleura • Lung Borders: Ant.-post. - inf. Costal surface • Right Lung mediastinal relations • Surface Anatomy of Lung • Surface marking of lungs • Nerve supply of lung

	• Muscles of Respiration • Larynx • Trachea, Bronchi, and Lungs • Respiratory system Histology • Respiratory system • Respiratory Epithelial • Nasal Cavities • Olfactory Epithelium • Larynx • Epiglottis • Trachea • Bronchial Tree & Lung • Tertiary Bronchus • Bronchioles • Respiratory Bronchioles

Course title	Cellular-Molecular Biochemistry
Number of Credits	1.9
Hours of Instruction	32(Theo.)+15(prac.)
Course content	• Functional Groups • Subordinate Groups • The Chemistry of Acids and Bases • Some Properties of Acids • Acid Nomenclature Review • Some Properties of Bases • Some Common Bases • Definitions Acid/Bases (Arrhenius, Bronsted - Lowry, Lewis) Conjugate Pairs • Lewis Acids & Bases • Lewis Acid/Base Reaction. • Lewis Acid-Base Interactions in Biology • pH of Common Substances Calculating the pH • pOH • More About Water • [H301, [OH] and pH • Calculating [H3O+], pH, [OH-], and pOH • Strong and Weak Acids/Bases • Equilibria Involving Weak Acids and Bases • Ionization Constants for Acids/Bases • Equilibrium Constants for Weak Acids & Bases • Types of Acid/Base Reactions: Summary • pH testing • pH paper • pH meter • pH indicators • ACID-BASE REACTIONS Titrations Titration • Amino acids, peptides and proteins • General structure of u amino acids • Classification of Amino Acid Amino Acids Abbreviations Some facts about amino acids • Side chains with unique properties • Diastereomers • Disulfide bridge • Properties of Amino Acid Side Chains • Uncommon amino acids in proteins "post-translational modifications" • Nonprotein amino acids • Physical and chemical properties of amino acids • Amino acid derivatives & their Use in industry • L- and D- configurations are mirror images • Stereoisomerism in u-amino acids • Fischer projection formulas Different forms of amino acids Amino acids as diprotic acids Titration of an amino acid Isoelectric pH (p1) • Titration curve for glutamate & Histidine • pl of lysine • Enzymes • Enzymes as Biological Catalysts • Naming Enzymes • Classification of Enzymes • Oxidoreductases, Transferases and Hydrolases • Lyases, Isomerases and Ligases • Active Site of an Enzyme • Enzyme Specificity

- Lock-and-Key Model
- Induced Fit Model
- Enzyme Catalyzed Reactions
- Example of an Enzyme Catalyzed Reaction
- Isoenzymes
- Diagnostic Enzymes
- Temperature and Enzyme Activity
- pH and Enzyme Activity
- Optimum pH for Selected Enzymes
- Enzyme Concentration and Reaction Rate
- Substrate Concentration and Reaction Rate
- Enzyme Inhibitors
- Reversible Inhibitors (Competitive Inhibition)
- Reversible Inhibitors (Noncompetitive Inhibition)
- Examples of Isoenzymes
- The Michaelis-Menten equation
- Enzyme inhibition
- Classification of enzymes: six classes according to reaction type
- Vitamin classification (Lipid-soluble A, D, E & K) & (water-soluble vitamins 8 B Vits & Vit C) Vitamin A, Vit. A transport and metabolism, Vitamin A and vision, Vitamin A and other functions, Vitamin A - deficiency, Vitamin A - toxicity, Metabolic functions of vitamin A, Sources of vitamin A
- Vitamin D, Synthesis, Effects of vitamin D, Vitamin D - deficiency, Vitamin D and immunity, Sources of vitamin D
- Vitamin E, Vitamin E as antioxidant, Vitamin E as enzyme cofactor, Vitamin E - deficiency and toxicity, Sources of vitamin E
- Vitamin K, Vitamin K - function, Vitamin K - deficiency, Sources of vitamin K Water soluble vitamins
- Vitamin B1(thiamine), Vitamin B1 - deficiency, Source of vitamin B1
- Vitamin B2 (riboflavin), FMN a FAD function, Causes of vitamin B2 deficiency, Vitamin B2 symptoms of deficiency, Sources of vitamin B2
- Vitamin B3 - niacin, Vitamin B3 - deficiency, Sources of vitamin B3
- Vitamin B5 — pantothenic acid, Vitamin B5 — deficiency, Sources of vitamin B5
- Vitamin B6, Transamination reaction, Vitamin B6 deficiency. Vitamin B6 - natural sources Vitamin B7 - biotin, Biotin - natural source
- Vitamin B9 - folic acid, Folic acid deficiency, Sources of vitamin B9
- Vitamin $_{B12}$ – cobalamin, Vitamin C, The role of vitamin C, Deficiency of vitamin C, Vitamin C
- as antioxidant, Vitamin C as pro-oxidant
- Carbohydrates, Biomedical Importance, Carbohydrate Structure, classification, Classification of Important Monosaccharides.
- , Hexoses of Physiologic Importance, Pentoses of Physiologic Importance
- Various Forms of Isomerism in monosaccharides; Structural Isomerism, Optical Isomerism Functional group isomers (Aldose-ketose isomers), Ring isomers (Pyranose and furanose) D & L Isomers, Epimers
- Sugar derivatives, Sugar acids, Deoxy sugars, Sugar alcohols, Sugar Phosphates, Amino Sugars (Hexosamines), Disaccharides (double sugar or bivose), Formation of disaccharides, Common Disaccharides, Polysaccharides, Common Homopolysaccharides (Starch, Glycogen, Cellulose, Chitin, Inulin, Pectin), Heteropolysaccharides (heteroglycans)Glycosaminoglycans.
- Glycoproteins LIPIDS, Biomedical Importance, Structure
- Fatty Acids, Fatty Acids isomerism, Numbering, Naming of fatty acids, some naturally occurring fatty acids in animals
- Triacylglycerols (Triglycerides)
- Membrane Lipids.
- Phospholipids, Glycerophospholipids, Sphingomyelin: A Sphingo-Phospholipid, Glycci lipids or Sphingo glycolipids, Cholesterol, a steroid alcohol.

Course title	Physiology of Heart
Number of Credits	0.5
Hours of Instruction	8(Theo.)+2(Prac.)
Course content	• Physiology of cardiac muscle (physiologic anatomy, action potentials, excitation- • contraction coupling) • The Cardiac Cycle • Regulation of heart pumping • Physiology of cardiac muscle: physiologic anatomy • Types of Cardiac Muscle (Atrial, Ventricular, Specialized excitatory and conductive muscle fibers) • Cardiac Muscle Structure (Myofibrils, Triad of the reticulum, Z line, A band, I band, Sarcolemma, Transverse tubule, Sarcoplasmic reticulum, Mitochondrion, Terminal cisternae) • Action Potential • Excitation-contraction coupling • voltage-sensing dihydropyridine receptor • L-type Ca (2+) channels • Intercalated disks • Cardiac muscle as a Syncytium • gap junction • T tubule • The ventricular action potential • the fast action potential • Phases of the Action Potential in the Cardiac cells (Phases 0,1,2,3,4) • Refractory period of cardiac muscle • Refractory period and absence of tetanus • The Cardiac Cycle: Diastole and Systole • What do happen if the atria lose their ability to contract? • Isovolumetric relaxation (Ventricular diastole) • bundle of His • Wiggers diagram • Aortic pressure • Atrial pressure • Ventricular pressure and volume • Electrocardiogram (ECG or EKG) • Function of the valves: close and open passively Work output of the heart • The heart performs two types; external & internal work Graphical Analysis of ventricular pumping • Chemical energy required for cardiac contraction Regulation of cardiac contractility • Nerves of heart (Sympathetic, Parasympathetic) Innervations of the heart • Sympathetic Effect on SA node • Tachycardia & Bradycardia • Effect of Potassium and Calcium Ions on Heart Function • Ca channel blocker • Effect of Temperature on Heart Function Ventricular functions curve in human • Schematic structure of the conductive system • Sinus node • Internodal pathways • AV Node • His bundle

	• Left bundle B • Right bundle B • Purkinje fibers • AV node and delay of impulses • Different parts of AV node • Rapid transmission in the Purkinje system One-way conduction through the AV bundle • Distribution of the Purkinje fibers in the ventricles Transmission of impulse in the ventricular muscle Summary of the impulse transmission time • The sinus node as the pacemaker of the heart Abnormal pacemakers-Ectopic pacemaker • Effect of vagal stimulation to slow cardiac rhythm Mechanism of the vagal effects • Effect of sympathetic stimulation on cardiac rhythm Mechanism of the sympathetic effects

Course title	Physiology of the respiration system
Number of Credits	0.6
Hours of Instruction	8(Theo.)+2(Prac.)
Course content	• Familiarity with breathing mechanics Explain the mechanism of normal and deep inhalation and exhalation. Name the respiratory muscles. Explain intra-alveolar pressure and its origin. To explain the elastic properties of the lung and the factors affecting the specific lung compliance. Explain the side pressure and its origin. Explain surfactant and its applications. Explain the respiratory murmur. Explain when I run away Explain how to block the airways of the baby Explain lung volumes and capacities. • Getting to know breathing mechanics (continued) Write the FRC formula and calculate it. Write the minute volume formula and calculate it. Explain the types of dead space and measure it with different methods. Explain alveolar ventilation. Name the respiratory tract and explain its disorders. Explain the anatomical and physiological features of the wall of the ducts. Explain cough and sneeze reflexes and their differences. and write the basics of gas release. Write two types of pulmonary blood flow. How to explain the regional distribution of red blood flow and the effective mechanisms in it. Explain the mechanism of the effect of exercise on the regional distribution of extravascular flow. Write the publication and the rules governing it. Explain the emission of gases from the respiratory barrier. Write the partial pressure of gases in different areas of the lung. Write the composition of alveolar air and the factors affecting it. Write the diffusion capacity of the membrane and explain how to measure it. • Familiarity with pulmonary blood circulation • Familiarity with the release of gases and transfer of respiratory gases in the blood Changes in ventilation and blood flow in different areas Explain the ratio of ventilation to blood flow. Explain the shunt, calculate it and explain the effect of different factors on this phenomenon. Explain how respiratory gases are transported in the blood in

	terms of the relative pressure of the gases. Explain the effect of blood flow and tissue metabolism on partial pressure of oxygen and carbon dioxide in tissue fluid. Name the methods of oxygen transfer in the blood. Calculate the oxygen capacity, oxygen content and oxygen saturation of hemoglobin. Draw the curve of oxygen decomposition and explain the factors affecting the shift of this curve. Explain the utilization factor and write its values in different conditions. • Familiarity with the transfer of respiratory gases in the blood and the introduction of Non-order Nervous breathing Write the metabolic use of oxygen in cells and its limiting factors. Explain the method of transporting oxygen in the form of solution in plasma. Explain oxygen toxicity. Find the decomposition curve of carbon monoxide and explain it. Explain carbon monoxide poisoning and its treatment method. Explain the methods of transferring carbon dioxide in the blood. Draw the decomposition curve of carbon dioxide and explain it. Write the ratio of respiratory exchange and name the factors affecting it. Name the different nervous areas of breathing and write the function of each area. Explain the central and peripheral control of breathing. • Getting to know the nervous system of breathing Explain the phenomenon of acclimatization and its mechanism. Write the effect of changes in partial pressure of oxygen, carbon dioxide and pH on ventilation control. Explain the regulation of breathing in sports and the effective mechanisms in it. Explain periodic breathing and its mechanism. Write the effect of cerebral edema, anesthesia and sleep apnea on the respiratory system Name the pulmonary and chest receptors. Explain breathing.

Course title	Physiology of the circulatory system
Number of Credits	1.1
Hours of Instruction	19(Theo.)+4(Prac.)
Course content	• Blood Cells, Anemia, and Polycythemia • Erythrocyte Physiology • Erythrocyte generation • Vitamin B12 role in RBCs production • Hemoglobin • Iron in heme • Anemia • Polycythemia • What is blood? • Erythrocytes • Red Blood Cells (Erythrocytes) function • Erythrocytes -Structure • RBC Count • Site of erythropoiesis • Production of Red Blood Cells • Erythropoiesis • Genesis of Blood Cells • Pluripotential Hematopoietic Stem Cells • Growth inducers • Differentiation inducers • Genesis of Blood Cells • Stages of Differentiation of RBCs • *Diapedesis* of reticulocytes *in bone* marrow • Maturation of RBCs • Deficiency in B12 vitamin/folic acid • Formation of Hemoglobin • Heme and hemoglobin A structures • Oxygen ion coordinate to the iron ion in the hemoglobin • Types of adult hemoglobin • Sickle cell anemia--- HbS • Red Blood Cells-Pathological shapes • Iron Metabolism • Iron absorption • Erythrocyte Death & Disposal • Genetic methemoglobinemia (lack of NADH methemoglobin reductase) • Anemia (Deficiency of RBCs or Hb Causes of anemia) • Resistance of the Body to Infection: Leukocytes, Granulocytes, the Monocyte Macrophage System, and Inflammation • White Blood cells (Granulocytes, A granulocytes) • Leukocytes (White Blood Cells) (7000 white blood cells per microliter of blood) • Genesis of WBCs • Life Span of WBCs • Mostly Neutrophils and Macrophages Defend Against virus, bacteria, injures agents • What is Chemotaxis stimulation? What is: • Phagocytosis • Opsonization • Phagocytosis by neutrophils Macrophages & Neutrophils • Reticuloendothelial or Monocyte-Macrophage Cells System: a general

	phagocytic sys Lymphatic gland • Inflammation: Role of Neutrophils and Macrophages • Some of the many tissue products that cause these reactions • Walling-Off" (following Inflammation): Initial result of inflammation • Macrophage and Neutrophil Responses in inflammation • Feedback Control of the Macrophage/Neutrophil Responses • Pus • Eosinophils • Basophils • Leukopenia • Leukemia- uncontrolled production of wbcs • Effects on of leukemia the body *Hemostasis and blood coagulation* Physiological Hemostasis • Vascular Constriction • Platelets • Platelet Plug Formation • Platelet thrombosis forming ASPRIN • Thrombocytopenic purpura • Inactive Platelet • Activated Platelet for Hemostasis Clotting • Plasma clotting factors • 3 stages of clot formation • Clot formation defective cycle (positive feedback) • External pathway • Internal pathway • Coagulator hemostasis • Role of ca" in coagulation • External and internal pathway interaction • Prevent clotting in healthy blood (before start of clotting) • Thrombin elimination • Heparin & antithrombin 3 complex Plasmin • Anticoagulant substances • Practical: • CT • BT • Hemostasis • Hemostasis Steps • Two paths of coagulation: Internal pathway, External pathway common pathway • Blood coagulation mechanism • Bleeding time (BT) • How to work • Clotting time(CT) • How to work • White blood cell count (WBC) or leucocyte • Leucocyte types • Normal rate • Leukocytosis (Pathological, Physiological) • Leukopenia • Leukemia • white blood cell count test

	• Test steps: sampling, Dilution. Counting, Computing Neubauer Chamber • RBC (Red blood cell) COUNT • RBC synthesis (erythropoiesis) • Normal range . • Anemia • Polycythemia (pathologic, Physiologic) • Red blood cell count • Test steps: sampling, Dilution, Counting, Computing The desired area in Neobar Lam • Formula for calculating the number of RBCs counted

Course title	Gastrointestinal System Physiology
Number of Credits	0.7
Hours of Instruction	10(Theo.)+4(prac.)
Course content	• Explain the physiological dissection of the wall of the digestive system. • Describe the types of action potentials and how each one occurs in the digestive system. • Explain how the enteric nervous system controls the actions of the digestive system. • Explain the reflexes in the digestive system and their effect on its actions. • Explain the types of movements of the digestive system and how they occur • Explain the different stages of chewing and swallowing and how to adjust them completely. • Describe the movement and storage actions of the stomach, its contraction and emptying, and the factors regulating emptying • Explain the basic mechanism of stimulation and secretion of digestive tract glands. • Explain how to make, secrete, mix and regulate the secretion of saliva. • Describe the types of mucus secreting cells, their location and the importance of each. • Explain the types of gastric secretory cells, their secretions and their regulating factors • Explain pancreatic digestive enzymes and how to regulate their secretion. • Explain how bile is made and secreted and its stimulating and inhibiting factors. • Explain the sources of bicarbonate secreted into the small intestine and how it is made. • Explain the secretions of the small intestine. • Describe the secretions of the large intestine and the factors affecting it. • Describe the functions of bile in the digestion and absorption of fats • Describe the stages of digestion of carbohydrates in the mouth, stomach and intestines. • Explain the effective enzymes in the digestion of carbohydrates in each step and the importance of each. • Explain the stages of digestion of proteins and enzymes involved in it. • Name how fats are digested by different enzymes. • Explain the basic principles of absorption in the alimentary canal. • Describe the microscopic structure of the absorptive surface of the small intestine.

	• Explain how to absorb different types of carbohydrates and their transporters. • Explain the cellular mechanism of protein absorption. • Describe the different stages of absorption of fats and their entry into the blood. • Explain the complete steps of iron absorption from the digestive system. • Explain how to absorb vitamins.

Course title	**Physiology of Blood**
Number of Credits	**0.3**
Hours of Instruction	**5(Theo.)+2(Prac.)**
Course content	• Introduction safety and blood sampling • Pocked cell volume measurement • Erythrocyte sedimentation rate (ESR) measurement • Measurement of bleeding time • white blood cell count test

Course title	Medical Physics
Number of Credits	2
Hours of Instruction	30(Theo.)+8(Prac.)
Course content	• Radiation and its application in Medicine • What Is the Radiation? • Radiation (Electro-Magnetic Waves, Mechanical Waves) • Application of Electro-Magnetic (EM) radiations in medicine • Application of Mechanical radiations in medicine • Electro-Magnetic (EM) Radiations • Electromagnetic Spectrum • Electro Magnetic Radiations (Non-Ionizing, Ionizing Radiation) • Light and Optics (Light and Optics, Characteristics, Application in Medicine) • Physics: The Nature of Light (Confirmation of Wave Nature, Confirmation of Particle Nature, Dual Nature or Dual Characteristics of Light) • Electromagnetic Radiation • Particle concept of EM radiations (Energy. Wavelength as Equations) • The Ray Optics • Physical Properties of Light • Reflection of Light (Specular Reflection, Diffuse Reflection, Law of Reflection) • Refraction of Light (Law of Reflection, The Index of Refraction, Light in a Medium, Index of Refraction Extended, Snell's Law of Refraction, Possible Beam Directions, Critical Angle, Total Internal Reflection) • Applications of Light (Visible light, UV and IR) in Medicine • Fiber Optics (Endoscopic systems used Fiber Optics) • UV classification • Ultra Violet effects in Biology • Penetration of UV in human eyes • Application of UV (Photo Therapy) • Infra-Red radiations IR • IR imaging in Breast Cancers • Electrology In Medicine • High Frequency Currents • Effects of Electric Current on Human cells (Effects of Electric Current on Human cells) Electric Current used in two forms (Direct Current (DC), Alternative Currents (AC)) There are four main applications of Electric Currents in medicine • DC Currents: Galvanic treatment, Neuro-Muscular Electrical Stimulation (NMES), Micro-current Electrical Neuromuscular Stimulation (MENS) • AC Currents: High-Frequency treatment • High Frequency Current (Alternative Currents with f>0.1MHz) • Production of High Frequency Currents • Application of High Frequency Electrical Currents in Medicine (Application of Heating Effects (Diathermia), Application of Surgical Effects (Electro-Surgery)) • Diathermy (Application of High-Frequency Currents to generate heat in body tissues) Physiologic Responses to Diathermy • Thermal effects of high frequency currents • Types of Diathermy

	• Electro-Magnetic Diathermy (E.M.D) -, Shortwaves Diathermy (S.W.D) --, Microwaves Diathermy (M.W.D) • Ultrasonic Diathermy (U.S.D) • Range of Frequencies used in Diathermy (SWD (Short-wave diathermy), MWD (Microwave diathermy)) • Shortwave Diathermy Unit • Dielectric Heating via capacitor field • Inductive Hating via induction fields • Application of Capacitor Type and Inductor Type Electrodes in SWD • Micro Wave Diathermy (MWD) • Electro-Surgery (Cutting, Coagulating, Desiccating, Fulgurating) • Electro-Surgery Units • Common electrode configurations for ground-return-pad devices • Electrosurgical modalities (Cutting mode, Coagulation Mode, Dual Mode Electro surgery, Desiccation (or Drying) Mode, Fulguration (or Arc) Mode) • Cauterization • Application of Ultrasound In Medical Imaging • Ultrasound Physics • Ultrasound Behaviors • Interaction Between US & Matter (Reflection, Refraction, Absorption, Scattering) Incidence beam angle • Acoustic Impedance (Z) • U/S Reflection depended on Acoustic Impedance • U/S image creation via Reflection • Some Artifacts in Ultrasound • Attenuation Of Ultrasound • T.G.C. (Time Gain Control) • How a U/S image create? • Transducer or U/S Probe • Piezoelectric Effects • Characteristics Of Ultrasound Beam • Ultra Sonic Beam created by Transducer has two parts (Fresnel Zone, Fraunhoffer Zone) Ultrasound Types (A-Mode, B-Mode, M-Mode, 3D Ultrasound, 4D Ultrasound, Doppler Ultrasound) • Application of A-mode • Obstetrics Measurements via B-Mode • M-MODE & TM-MODE • M--mode Images • 3D Ultra Sonography • 4D Ultra Sonography • Doppler Effect • Color Doppler Image • Physics of Nuclear Medicine • Applications of Nuclear Based Radiation in Medicine

	• Radionuclides used in Medicine • Reactor Radioisotopes • Cyclotron Radioisotopes • Nuclear Stability Curve • Activity • Fundamental Decay Equation • Physical Half-Life(Tp1/2) • Decay Curve • Nuclear Transformation • Most radionuclides decay in one or more of the following ways: (a) Alpha decay, (b) Beta-minus decay (Electron Emission), (c) Beta-plus decay (Positron Emission), (d) Electron capture decay, (e) Gama decay • Annihilation Effect • Isomeric Transition(IT) of Gamma Decay • Decay Schemes (Alfa Decay Scheme, Beta-minus Decay Scheme, Beta-plus Decay Scheme, Beta-plus & EC Decay Scheme, Gamma Decay, Isomeric transition Scheme) • Applications of Radionuclides in Nuclear Medicine Imaging • Generators • Radiopharmaceuticals used for Nuclear Medicine Imaging • Nuclear Medicine Imaging Systems • Scintillation Detectors • Well Counter • Imaging Systems (Linear Scanner, Gamma camera, Emission Tomography systems, Hybrid systems) • Thyroid Scan by Gama Camera • Pulmonary Scanning by Gama Camera • Bone Scan by Gama Camera • Single Photon Emission Computer Tomography SPECT • Cardiac Scanning by SPECT • PET Scan • Radiation Therapy • Cancer treatment methods (Surgery, Chemotherapy, Radiotherapy) • Purpose of Radiotherapy in Cancer Treatment • Radiation Dose Administered in Radiotherapy • Absorbed dose (D) • Radiation Absorbed Dose • Radiotherapy performed by two ways: External Radiation Therapy or Tele therapy • Internal Radiation Therapy or Brachy therapy • Co-60 Tele therapy machine • Radiotherapy with external beams by LINAC • Brachytherapy Source • Brachy therapy of Breast Cancer Brachy therapy of Prostate Cancer

	• Treatment of cancer of Tongue with Brachytherapy • Treatment of cancer of Parotid Physics of Nuclear Medicine • Applications of Nuclear Based Radiation in Medicine (Diagnostic, Treatment) • Radionuclides used in Medicine Internal Conversion • Applications of Radionuclides in Nuclear Medicine for Diagnostics: In-vivo evaluations of organs Metabolism, Imaging • Image Production • Types of Photon Interactions with matter in brief • X-ray Interactions with body Production of Scatter Radiation • Beam-Restricting Devices (Aperture Diaphragm and Cone) • Field size and scattering Grids • Image Intensification • Screens: General Principles Image intensifying Screens Intensification Factor • Image Receptors in Diagnostic Radiology • X-Ray Film • X-Ray Film Construction (Film Base Film Bas, Emulsion, Super coating) • Image production according to Gurney-Mott Hypothesis • Photographic or Optical Density Radiographic Contrast • Film Contrast Film Contras Speed • Density and Exposure • Radiobiology • Effects of ionizing radiation • The stages of action of ionizing radiation: 1-Physical stage, 2-Physico-chemical stage, 3-Chemical stage, 4-Biological stage • Radiation Effects in biological level (Deterministic Effects, Stochastic Effect) • Whole Body Irradiation Syndromes • Skin and tissue burns by Radiation • Radiation Effects on the Embryo and Fetus • Data from Rats and Mice • Radiation Effects On the Embryo and Fetus according to Russell and Russell project • The Principal Factors • Radiation induce DNA Damage • Types of Chromosomes Damage (Chromosomal Aberrations, Chroma tidal Aberration) Examples for Chromosomal Aberrations (Chromosomal Break and Deletions, Chromosomal Translocations, Centric Ring, Dicentric Chromosome) • Examples for Chroma tidal Aberrations (Anaphase Bridge) • Biological Dosimeter • Stochastic Effects • Some Hereditary Effects

Course title	Medical Terminology
Number of Credits	3
Hours of Instruction	51(Theo.)
Course content	• Introduction to medical terminology • Concepts, Suffixes, and Prefixes • of Medical Terminology • Introduction • Concepts of Medical Terminology • Word Parts • Combining Forms Word Derivations Words Ending in x Suffixes Beginning with rh • Pronunciation • Soft and Hard c and g • Silent Letters and Unusual Pronunciations Abbreviations • Phrase Abbreviations Symbols • Blood and hematology • Medical Dictionaries Suffixes • Noun Suffixes • Adjective Suffixes Forming Plurals • Some Exceptions to the Rules • Prefixes • Body Structure Endocrine System Introduction • The Cell • Tissues • Membranes • Organs and Organ Systems • Word Parts Pertaining to Cells, Tissues, and Organs the Body as a Whole • Directional Terms Body Cavities • Respiratory system Abdominal Regions Positions • Word Parts Pertaining to Body Structure • Disease and Treatment • Introduction • Types of Diseases Infectious Diseases Bacteria • Responses to Disease Inflammation • Phagocytosis • Immunity • Neoplasia • Word Parts Pertaining to Disease • Diagnosis • GIT • Imaging Techniques Treatment • Surgery • Alternative and Complementary

	• Medicine • Cancer • Liver, gall bladder and pancreas • Word Parts Pertaining to Diagnosis and Treatment Drugs • Adverse Drug Effects Drug Names • Drug Information Herbal Medicines Drug Administration • Word Parts Pertaining to Drugs • Genital organs • PART II Body Systems • Integumentary System • Introduction • Anatomy of the Skin Associated Skin Structures • Roots Pertaining to the Integumentary System Clinical Aspects of the Skin • Wounds • Dermatitis • Psoriasis • Autoimmune Disorders • Skin Cancer • Skeletal System Introduction • Divisions of the Skeleton • Bone Formation Structure of a Long Bone • Joints • Muscular System Musculoskeletal system: • Introduction • Types of Muscles • Skeletal Muscles • Muscle Structure • Muscle Action • Naming of Muscles • Roots Pertaining to Muscles • Clinical Aspects of the Muscular System Muscular Dystrophy • Multiple-System Disorders Involving Muscles Stress Injuries • 7 Nervous System and Mental Health Introduction • Organization of the Nervous System • The Neuron • Nerves • The Brain • Protecting the Brain • The Spinal Cord • The Spinal Nerves • Reflexes • The Autonomic Nervous System • Word Parts Pertaining to the Nervous System Clinical Aspects of

	the Nervous System Vascular Disorders • Head Injury • Confusion and Coma • Infection • Neoplasms • Degenerative Diseases • Epilepsy • Sleep Disturbances • Others • Behavioral Disorders • Anxiety Disorders • Mood Disorders • Psychosis • The heart and great vessels • Attention Deficit Hyperactivity Disorder Autism Spectrum Disorder • Drugs Used in Treatment • 8 Special Senses: Ear and Eye Introduction • The Senses • Organs of special sense • The Ear • Clinical Aspects of Hearing • Hearing Loss • Otitis • Otosclerosis • Meniere Disease • Acoustic Neuroma • The Eye and Vision • Word Parts Pertaining to the Eye and Vision • Clinical Aspects of Vision • Roots Pertaining to the Skeletal System • Clinical Aspects of the Skeleton • Infection • Nervous system • Fractures • Metabolic Bone Diseases • Neoplasms • Organs of special sense Joint Disorders • Disorders of the Spine Errors of Refraction Infection • Disorders of the Retina Cataract • Glaucoma • Circulatory system • kidney and urinary tract • Review

Course title	Anatomy of the Gastrointestinal System
Number of Credits	1.5(theo.)+
Hours of Instruction	26(Theo.)
Course content	• Anatomy of Oral Cavity, Pharynx, & Esophagus • Histology of Oral Cavity • Histology of Salivary Glands & General Structure of • Digestive Tract • Abdominal Wall Regions & Inguinal Canal • Peritoneal Cavity & Abdominal Viscera • Abdominal Digestive Tract • Digestive Tract in Pelvis • Microanatomy of Digestive Tract • Histology of Accessory Glands of Digestive System • Vessels & Nerves of Digestive System • Embryology of Foregut • Embryology of Midgut & Hindgut • General Principles of GI System • Gastric Secretion, Salivary and Esophagus Secretions • Pancreatic, Small and Large Secretions • Bile Secretion, Gall Bladder, and Liver Functions • GI Motility, Digestion, and Absorption

Course title	Discipline Biochemistry
Number of Credits	1.3
Hours of Instruction	(Theo.)
Course content	• Getting to know the glycolysis pathway and its regulation, explaining gluconeogenesis and how it is regulated • Getting to know how carbohydrates are digested • Explanation of glycolysis pathway and its enzymes Explaining the importance of the glycolysis pathway and its end products Explain how the glycolysis pathway is regulated Clinical significance of glycolysis Explaining the metabolism of other monosaccharides (fructose and galactose) and clinical disorders related to them Introducing and explaining the importance of the gluconeogenesis pathway, its enzymes and reactions Explanation of how the gluconeogenesis pathway is regulated, the simultaneous regulation of this pathway with the glycolysis cycle in starvation and satiety • Explaining and introducing the citric acid cycle and the pentose phosphate pathway Complete explanation of pyruvate dehydrogenase enzyme reaction, coenzymes, reaction mechanism, reaction effectors and its inhibition Introducing the Krebs cycle and its role

	Explaining the importance of Krebs in energy production, step by step explanation of reactions, enzymes and substrates and cycle inhibitors Calculation of energy balance in glycolysis and Krebs and explanation of other roles of Krebs cycle. Explanation of the pentose phosphate pathway, its enzymes and reactions Explaining the importance of the pentose phosphate pathway in the production of NADPH and ribose-5 phosphate and clinical disorders related to this pathway • Explanation and familiarization with glycogen metabolism and glucuronic pathway Explanation of glycogenolysis and related enzymes Description of glycogens and enzymes related to it Explanation of the control mechanism of these two pathways and the role of hormones in regulating the pathways Introduction of glycogen storage diseases Introduction of glucuronic pathway and its importance • Explanation of oxidation of fatty acids and their types, metabolism of ketone bodies Explain how lipids are digested and absorbed Basic explanation of fatty acid oxidation and its necessary prerequisites Explain how free fatty acid enters mitochondria Step-by-step explanation of reactions, enzymes, substrates and pathway products Explaining the method of fatty acid oxidation in peroxisomes and its tips Explanation of alpha and omega oxidation, their cellular location and their difference with beta oxidation and genetic defects related to them Expression of the general path of ketogenesis and its importance Explain how tissues interact in ketogenesis Step-by-step explanation of reactions, enzymes, substrates and pathway products and how to regulate them Biosynthesis of fatty acids, metabolism of unsaturated fatty acids and eicosanoids, metabolism of phospholipids and sphingolipids. Step-by-step explanation of fatty acid biosynthesis reactions, fatty acid synthase complex, substrates and products, effects Effectors and how to set the path Explaining how to control the acetyl CoA carboxylase enzyme Explanation of the energy-providing reactions of the fatty acid biosynthesis pathway Explaining the elongation of fatty acid in the endoplasmic reticulum and expressing the controlling effects of nutrition and physiology on the pathway Introduction of the general metabolism pathway of acylglycerols and sphingolipids Explaining the effects of phospholipids lysing enzymes and their physiological roles Description of the primary biosynthesis pathway of sphingolipids and ceramide

	Explanation of diseases related to disturbances in the metabolism of acylglycerols and enzyme defects in the path of sphingolipid biosynthesis. • Biosynthesis of cholesterol, lipoproteins and how lipids are transported Explain the importance of cholesterol and its roles in the cell Step-by-step explanation of reactions, substrates and products, enzymes and coenzymes of the pathway Explaining how to regulate the activity of HMG CoA reductase enzyme as the most important enzyme controlling cholesterol biosynthesis General description of the biosynthesis of bile salts Introduction of lipoproteins, their types and roles Explaining the metabolism of lipoproteins in the body and target tissues and how to form intermediate and final compounds and enzymes key in these reactions • Catabolism of amino acids Explain how proteins are digested Familiarity with the intestinal absorption of amino acids and genetic disorders in the intestinal absorption of amino acids Introduction and explanation of biochemical pathways involved in the synthesis of non-essential amino acids Introduction of glucogenic and ketogenic amino acids Explanation of the catabolic pathways of the carbon skeleton of amino acids Conversion of amino acids into specific products and inborn errors of amino acid metabolism Introduction and explanation of genetic defects related to amino acid metabolism Explaining the importance of amino acids containing sulfur and their role in various diseases Glycine, β-Alanine, Methionine, Ornithine & Arginine, Explanation of conversion of specific amino acids of products into Histidine and Tryptophan, Tyrosine, Glutamate • Definition of urea cycle, its regulation and clinical importance of urea cycle Explanation of the glucose-alanine cycle and how ammonia is transferred in the blood circulation Explanation of the decarboxylation and decarboxylation reactions of amino acids and cofactors related to them Explaining the urea cycle and its important enzymes Explanation and introduction of metabolic disorders related to urea cycle Explaining the importance of aminotransferase enzymes in medical diagnoses • Metabolism of purine and pyrimidine bases Explanation of re-synthesis and recycling reactions of nucleotide biosynthesis Explanation of synthesis precursors of de novo purine biosynthesis and important enzymes in these pathways. Regulation and coordination of resynthesis and recycling pathways in the biosynthesis of purine nucleotides

	Explaining the clinical importance of purine biosynthesis pathways Explaining the clinical importance of pharmacological inhibition of purine nucleotide biosynthesis Explanation of the synthesis precursors of pyrimidine de novo biosynthesis and important enzymes in these pathways. Regulation and coordination of resynthesis and recycling pathways in the biosynthesis of pyrimidine nucleotides Explaining the clinical importance of pyrimidine biosynthesis pathways Explanation of the importance of folic acid in the biosynthesis of pyrimidine nucleotides Explanation of catabolism of purine nucleotides, production of uric acid and important enzymes in catabolism Purine nucleotides Explanation of the reasons for increasing uric acid Explanation of the catabolism of pyrimidine nucleotides • Getting to know metabolic pathways in liver tissue, fat tissue, muscle tissue and nerve tissue Familiarity with metabolic pathways in liver tissue Getting to know metabolic pathways in fat tissue • Familiarity with metabolic pathways in muscle tissue (skeletal muscle and cardiac muscle) Understanding the role of the neuroendocrine system in coordinating metabolism and understanding metabolism in the brain Familiarity with the metabolic pathways in the fasting state, after long-term starvation and after eating and the role of hormones in regulating the metabolism of fuel materials. Getting to know the changes in the metabolism of fuel materials in the fasting state Getting to know the changes in fuel metabolism after long-term starvation Getting to know the changes in the metabolism of fuel after eating Knowing the role and mechanism of insulin, glucagon, epinephrine and cortisol hormone changes in different nutritional conditions of the body (in fasting state, after long-term hunger and after eating) • Familiarity with the laws of thermodynamics, free energy changes, reduction potential, electron transfer chain, chemical theory of osmosis and electron transfer chain inhibitors. Familiarity with the first and second laws of thermodynamics, free energy changes, types of oxidation-reduction reactions and reduction potential Familiarity with the oxidative-phosphorylation mechanism, mitochondrial membranes and respiratory chain components Recognition of 4 electron-transporting protein complexes of the respiratory chain and the role of flavoproteins, iron-proteins Sulfur and coenzyme Q Understanding the coupling of electron transfer from the components of the respiratory chain to the proton pump to the interstitial space, familiarity with the ATP synthase complex and the role of the proton motor in ATP synthesis through this complex in the process

	Oxidative Phosphorylation (Theory of Chemical Osmosis) Understanding the role of phosphorylation separators from oxidation and the role of toxins and respiratory chain inhibitors • Explaining the clinical importance of enzymes, effective factors in their measurement, introducing and explaining the clinical importance of aminotransferases and lactate dehydrogenase. Giving an introduction of the importance and introducing and reviewing the general concepts of enzymes, their properties and characteristics and enzyme reactions Description of different applications of enzyme reaction in disease diagnosis and laboratory diagnosis methods based on the use of Enzyme Explaining the importance of enzyme reaction specificity and types of reactions based on the relative specificity of enzymes Description of the role and importance of isozymes and their clinical applications Explanation of various factors affecting enzyme activity and enzyme activity assays Introduction of different enzymes based on functional and non-functional in blood flow Introducing specific diagnostic enzymes and some information about their activity in target tissues Introduction and explanation of aminotransferases in the diagnosis of various liver diseases and their applications in determining the differential diagnosis. Course of disorders and prognosis of hepatic and non-hepatic disorders Introduction and explanation of lactate dehydrogenase and its isoenzymes in the diagnosis of various liver and heart diseases and their applications in Determination of differential diagnosis, course of disorders and prognosis of various disorders • Introducing enzyme biomarkers in the diagnosis of heart attack, explaining the importance of alkaline phosphatase, creatine kinase, aldolase, and gamma glutamyl transferase. Introduction and explanation of the history and importance of enzyme biomarkers in heart attack diagnosis Introduction and explanation of acid phosphatase in the diagnosis of various diseases Introduction and explanation of alkaline phosphatase and its isoenzymes in the diagnosis of various diseases Introduction and explanation of creatine phosphokinase and its isoenzymes in the diagnosis of various diseases Introduction and explanation of aldolase and its isoenzymes in the diagnosis of various diseases Introduction and explanation of gamma-glutamyl transferase in the diagnosis of various diseases and differentiation of liver disorders Explaining the effects of some pharmaceutical inhibitors on the inhibition of target enzymes • Description of other uses of enzymes

Course title	Islamic thought 1
Number of Credits	2
Hours of Instruction	34(Theo.)
Course content	• The general plan of the education subjects mentioned in Lesson of Islamic thought 1 • getting to know the main concerns of students, their revision and classification • What is a human being? • What is faith and its relationship with knowledge? Choice, reason and action • rational arguments to prove the existence of God • Examining different points of view regarding, Knowing the attributes of God • different categories regarding • Attributes of God • familiarization with levels of divine knowledge and examination Some doubts raised in this regard. • Familiarity with the meaning and examples of divine power and Examining some doubts in this field. • of the midterm exam • familiarization with the definitions raised in this regard The concept of justice and its types • examination of the doubt of evil and its types and challenge-Advances in the correct understanding of the concept God's justice and benevolence • familiarization with some benefits and wisdom Evil prescribed by God. • rational proof of monotheism and its stages and plan Some doubts in this field, such as appeal, Blessings and intercession • explaining the importance of dealing with the issue of life After death and examination of some proofs Rational and narrative in proving resurrection, review Some doubts in this regard.

Course title	Cellular and molecular biology
Number of Credits	3
Hours of Instruction	51(Theo.)
Course content	• Cell structure and function • What is biology? • Biology • A view of life • Characteristics of life (Evolution, information transfer, energy transfer) • Types of cells (Prokaryote and Eukaryote) • Cytoplasm, Cell membrane, Nucleus, Endoplasmic Reticulum, Ribosomes, Mitochondria, Golgi, Lysosome, Peroxisome, Cytoskeleton • Active and passive transport • Cell membrane and its composition • Transport across membranes (Passive transport and Active transport) • Active transport (Simple diffusion, Osmosis, Facilitated diffusion (Channel proteins, Carrier proteins)) • Active transport (Primary and secondary active transport) • Primary active transport (Sodium Potassium pump, Calcium pump, Hydrogen Potassium pump, Hydrogen/Proton pump) • Secondary active transport (Co-transport Symport and Antiport) • Vesicle transport (Endocytosis (Phagocytosis, Pinocytosis, Receptor-mediated endocytosis), Exocytosis) • Nucleic Acids (DNA and RNA) • Processes in the transfer of genetic information (Replication, Transcription, Translation) Nucleotides and their components (Nitrogen heterocyclic base, Pentose sugar, Phosphate residue) • Nucleotides in DNA and RNA • Nucleosides in DNA and RNA • Nomenclature • Functions of Nucleotides and Nucleic acids • Base Pairing in DNA; The Watson-Crick Model • Primary structure • Properties of a DNA double helix • RNA types & functions • DNA & RNA • DNA Replication (3 proposed models of replication) • Three stages of DNA Replication (Initiation, Elongation, Termination) • Requirements of DNA replication (Template, Substrate, Enzymes & Primer) • How does DNA replication begin? • Errors in DNA replication can lead to mutation

	• Error prevention by DNA polymerase • Prokaryotic & Eukaryotic Replication • DNA Transcription • RNA polymerase in prokaryotes • Transcription (Initiation, Elongation, Termination) • Promoter (in both Prokaryotes & Eukaryotes) • Post transcription modifications (5`capping, polyadenylation, & intron splicing, • alternative splicing) • Translation (tRNA Secondary structure) • Translation (tRNA charging, Initiation, Elongation, Termination) • Water, Water Balance, Osmolarity • Why is water important in our body? Hydrogen bonding in water, Water is a weak acid, strong and weak acids, pH, Regulation of Plasma pH-Acidosis, Bicarbonate Buffer System in the Regulation of Plasma pH. • How the kidney regulates blood pH. • Types of Microscope • Light microscope parts, magnifications and its work • Samples processing and preparations • Type of slice cutting • Types of dyes • Type of fixations solutions • Preparing of oral swab slide and examination under microscope • Examination Cell membrane and effect of preparations on it • Nucleus and cell organelle Prokaryotic & Eukaryotic Adipose Tissue study sample Blood cells • Basophils, Lymphocytes, Monocytes, • Bone tissues & its cells Epithelial tissues& its cells Muscles tissues & its cells • Nervous tissue & its cells