

FOUNDATION MODULE**General Learning Outcomes**

By the end of this module the students should be able to;

Knowledge

1. Familiarize with the MBBS system based curriculum
2. Recognize the role of different disciplines in studying human body and its diseases.
3. Describe the structure, function and biochemical composition of cell.
4. Describe the cell division, its types and genetic material along with its clinical correlation.
5. Describe the basic organization of human body.
6. Explain the maintenance of homeostatic mechanism.
7. Describe the various stages of pre embryonic human development and correlate them with various malformations.
8. Describe the importance of buffer and PH system.
9. Describe various cellular adaptations during cell growth, differentiation and cell injury.

Skills

1. Describe the basic laboratory techniques and use of microscope.
2. Follow the basic laboratory protocols.
3. Perform biochemical analysis of carbo hydrates.

Attitude

1. Follow the basic laboratory protocols.
2. Participate in class and practical work efficiently.
3. Maintain discipline of the college.
4. Follow the norms of the college properly.
5. Communicate effectively in a team with colleagues and teachers.
6. Demonstrate professionalism and ethical values in dealing with patients, cadavers, colleagues and teachers.
7. Communicate effectively in a team with colleagues and teachers.
8. Demonstrate the ability to reflect on the performance.

FOUNDATION MODULE THEME 1		
Orientation		
SNO	Topic	Learning Outcomes
ANATOMY		
1	Anatomy and its sub branches	Define anatomy and its branches Describe purpose of study of anatomy and its branches
PHYSIOLOGY		
2	Physiology and its sub branches	Enumerate the branches of physiology
BIOCHEMISTRY		
3	Introduction to biochemistry and its implication in medicine	Define biochemistry Discuss the role of biochemistry in medicine.
PATHOLOGY		
4	Introduction to pathology and its implication in medicine	Define pathology Enumerate the different branches of pathology in medicine. Identify different sampling and processing techniques in different branches of pathology.
PHARMACOLOGY		
5	Introduction to pharmacology and its role in modern medicine	Define pharmacology and role of pharmacology in medicine. Define the pharmacodynamics and pharmacokinetics
COMMUNITY MEDICINE		
6	Introduction to community Medicine and its implication	Describe Role of community medicine/public health in health care system.
FORENSIC MEDICINE		

7	Introduction to Forensic Medicine and Toxicology	<p>Define Forensic Medicine, forensic pathology and state Medicine.</p> <p>Identify the Branches of Forensic Medicine. Describe the History of Forensic Medicine. Discuss the scope of Forensic Medicine.</p> <p>Identify the essential facilities for medico legal investigation. Define Medical Jurisprudence (not included for assessment in foundation module first year MBBS)</p>
8	Pakistan Medical & Dental Council, Consent.	Describe the structure and functions of Pakistan Medical and Dental Council.
MEDICAL EDUCATION		
9	Curriculum structure	<p>Discuss the curriculum and modules.</p> <p>Describe the use of study guides.(not to be assessed)</p>
	Teaching learning strategies	<p>Differentiate between various teaching & learning strategies.</p> <p>Enlist various assessment tools & assessment policy. (Not to be assessed).</p>
IT Skills		
10	Importance of IT skills	Define IT and its importance
11	MS word skills PowerPoint skills Excel sheet	<p>Prepare the assignment on MS word</p> <p>Prepare the presentation on power point</p> <p>Use the excel sheet</p>
Library		
12	Literature search and library resources	Literature search skills

FOUNDATION MODULE THEME 2		
Cell		
SNO.	Topic	Learning Outcomes
ANATOMY		
13	Cell structure and its Organelles	Describe the cell as a living unit of body Describe the structure of cell and its organelles. Describe the structure of cytoplasmic organelles of the cell & correlate it with their functions.
14	Nuclear structure & components	Describe the structure of the nucleus, nucleolus & chromosome and their functions in cell integrity.
15	Cell division Mitosis	Explain the process of cell division.
16	Meiosis	Explain the process of Meiosis Describe karyotyping. Explain the non-disjunction of chromosomes. Correlate the process of non-disjunction with chromosomal abnormalities
PHYSIOLOGY		
17	Cell membrane physiology	Explain Intra cellular and extra cellular environment. Correlate cytoplasmic organelles with their functions.
18	Homeostasis	Define homeostasis. Describe the Homeostatic mechanism of major functional systems. Describe the characteristics of control systems with examples
19	Membrane potential	Define membrane potential Describe ionic conc. differences across cell membrane Explain the Nernst equation. Explain origin of normal resting membrane potential
20	Movements of cell	Explain the amoeboid movement of cells. Describe the ciliary movements

21	Depolarization & Repolarization	Explain the role of voltage gated Na ⁺ and K ⁺ channels in action potentials. • Discuss the changes in conductance of Na and K channels with changes in membrane potentials
BIOCHEMISTRY		
22	Biochemical structure of cell Bio chemical structure of Mitochondria	Explain the Bio-chemical composition of cell organelles and cytoplasm Describe the chemical structure of mitochondrial membrane. Explain the biochemical importance of mitochondrial membrane.
23	Active & passive transport mechanism	Describe Bio-chemical structure of nuclear membrane and its functions.
24	RNA & DNA	Define and explain nucleotides and nucleosides. Describe the components of nucleotides Describe the functions of Nucleotides Describe the types of nucleic acids Differentiate between RNA and DNA..
25	Genetics	Describe the process of DNA Replication Describe the process of RNA Replication Describe the process of Translation
26	Buffer	Define Buffer and its role in maintenance of body PH Define colloidal state and Henderson Hassel bal chequation. Define adsorption and how it occurs. Explain ion exchange resin Explain movement of material across cell membrane(osmosis, active transport , passive transport, diffusion)
27	Cellular membrane transport mechanism	Explain membrane transport. Discuss passive diffusion, active transport, and facilitated transport via a channel or carrier. Describe and evaluate the role of ion gradients, co

		transporters, and ATP in active transport mechanisms.
PATHOLOGY		
28		Classify the various causes of cell injury.
	Homeostasis	Describe the Homeostatic mechanism of major functional systems. Describe the characteristics of control systems with examples
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		Describe the types of nucleic acids Differentiate between RNA and DNA..
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PATHOLOGY		
28		Classify the various causes of cell injury.
	Cell injury	Describe the response of a normal cell to stimuli. Describe the mechanism of cell injury. Describe mechanisms of cellular adaptations
PHARMACOLOGY		
29	Routes of administration of drugs	Enlist the routes of administration of a drug.
30	TRANSMEMBRANE DRUGTRANSPORT	Explain how drugs are transported across cell membrane and factors affecting it
31	Receptor and cellular basis	Enlist the types of drug receptors
LAB WORK		

32	The Microscope	Identify parts of microscope. Demonstrate operation of microscope. Describe the method of focusing slide at different magnifications. Follow the specified norms of lab work.
33	Lab Equipments	Introduction to lab techniques Identify the equipments used in lab work
34	PH and buffer solutions	Define normal solution Define standard solution. Prepare of 0.9% NaCl. PH of buffers Measure the PH of given solution (practical).

**FOUNDATION MODULE THEME 3****GROWTH & DEVELOPMENT OF HUMAN BODY**

SNO	Topic	Learning Outcome
ANATOMY		
35	Introduction To Embryology	Describe the developmental periods. Discuss embryologic terminology. Explain significance of embryology.
36	Spermatogenesis	Describe the process of spermatogenesis. Enlist the differences between spermatogenesis and oogenesis. Describe the morphological changes during maturation of gametes.
37	Oogenesis	Describe oogenesis and its correlation with meiosis. Compare the male and female gametes.
38	Transport Of Gametes	Discuss the transport of gametes. Describe the transport of sperms. Describe the oocyte transport. Explain the maturation of sperms.
39	Female reproductive cycle	Describe the ovarian cycle. Discuss the process of follicular development Explain the process of ovulation. Correlate with the phases of menstrual cycle.
40	Fertilization –Events	Define fertilization. Describe the process of fertilization. Explain assisted reproductive technologies like In-vitro fertilization (IVF), assisted IVF and intra cytoplasmic sperm injection (ICSI).

41	Fertilization –Clinical Correlates Cleavage & Blastocyst Formation	<p>Discuss the clinical correlation of the fertilization. Describe the process of cleavage of zygote.</p> <p>Discuss the formation of blastocyst.</p> <p>Summarize the events of first week of development.</p>
42	Implantation & Its Abnormalities	<p>Discuss the process of implantation. Enumerate the sites of implantation.</p> <p>Discuss clinical correlations of the implantation process.</p>
43	Amniotic cavity	<p>Describe the formation of amniotic cavity Discuss the development of embryonic disc</p> <p>Discuss the development of umbilical vesicle.</p> <p>Explain the development of Chorionic sac.</p>
44	Events Of 2nd Week Of Development	<p>Summarize the events of second week of development.</p> <p>Discuss the clinical correlates of the second week of development.</p>
45	Events of 3rd Week Of Development	<p>Describe the process of gastrulation. Explain the process of Neurulation. Explain the development of smites.</p> <p>Discuss the development of intra-embryonic coelom.</p>
46	Derivatives of germ layers	<p>Describe briefly derivatives of germ layers Ectoderm</p> <p>Mesoderm</p> <p>Endoderm</p>
BIOCHEMISTRY		
47	Chemistry of Acids and Bases	<p>Define acids, bases, strong acids and weak acids.</p> <p>List different types and sources of acids and bases in our body</p> <p>Describe the mechanism of their normal balance and biochemical importance</p>

48	Importance of surface tension and viscosity in our body	Explain surface tension, viscosity, vapor pressure, normal boiling point and capillary action
49	Carbohydrates -I	Explain carbohydrate and its Bio-chemical structure. Classify carbohydrate and give their Bio-chemical importance. Relate the structure of polysaccharides with its clinical importance. List the functions of carbohydrates in cell membrane, energy provision and nutrition supply to different parts of body.
50	Carbohydrates -II	Describe the different isomers of monosaccharides.e.g. Galactose, mannose, fructose, dextrose. Describe the role of dextrose in I/V infusion. Describe the role of mannitol in cerebral edema.
51	Carbohydrates -III	Describe the structure of disaccharides and oligosaccharides.
52	Enzymes	<ul style="list-style-type: none"> • Define Enzymes • Define activationenergy • Define Gibbs Freeenergy • Explain the general structure ofenzymes • Define co-factors • Explain the function ofco-factors • Enlist different types of co-factors • Define different parts and forms of enzymes • Describe the factors involved in structure of enzymes • Describe the mechanism of Enzyme activity • Define catalysis

		<ul style="list-style-type: none"> • Explain different mechanism of catalysis • Explain the Principles for Nomenclature of enzymes • Classification of Enzymes on the basis of functions • Enlist the factors affecting the activity of enzymes • Describe roles of factors affecting enzyme activity • Define enzyme kinetics • Explain different areas of enzyme kinetics • Describe the role of Km in Enzyme kinetics • Define Isoenzymes (Isozymes) • Explain Factors affecting the properties of isozymes • Explain the role of enzymes as a diagnostic tools
COMMUNITY MEDICINE		
53	Determinants of health	Define health Enlist Determinants of Health
54	Disease causation	Describe Spectrum of Disease Explain Natural History of Disease Explain Theories of Disease Causation. <ul style="list-style-type: none"> • Differentiate between Disease Elimination and Eradication.
55	Chain of infection	Describe reservoirs of infection & chain of infection
56	Levels of prevention	Discuss /describe Levels of Prevention
LAB WORK		
57	Sterilization	Explain the process of sterilization Enumerate the different methods of sterilization Observe the process of autoclaving in the laboratory
58	Oral temperature	Demonstrate how to take oral temperature.
59	Capillary Blood Sampling	Obtain capillary blood sample for hematological investigations through prick method Identify the sites for obtaining blood sample with different methods and list the indications for their use.

60	Detection of Polysaccharides in a given Solution	Define Polysaccharides. Discuss structures and types of Polysaccharides Perform Iodine test
61	Detection of Monosaccharide's	Define Monosaccharide's Discuss structure and types Perform Barfoed's Test
62	Detecting of Reducing and non-reducing Sugars	Define reducing sugars, types. Discuss structure and types of reducing sugars Perform Benedicts test
63	Detection of Polysaccharides in a given Solution	Define Polysaccharides. Discuss structures and types of Polysaccharides Perform Iodine test

FOUNDATION MODULE THEME 4		
Human body Tissues, bones & joints		
SNO	Topic	Learning Outcome
ANATOMY		
64	Organization of human body	Describe the levels of organization of human body
65	Anatomical terms	Describe the anatomical terms for planes, position and movements
66	Classification of Bones	Describe the structure and function of bone Classify bones on the basis of length and shape. Identify the markings on bone
67	Cartilage	Describe the anatomical types of cartilages
68	Introduction to Joints	Classify joints on the basis of structure. Describe the mechanism of movements of joint
69	Muscles	Describe various muscle types along with structure.
70	Skin / Integumentary system Skin	Discuss the anatomical structures of Skin / Integumentary system (dermis & epidermis) Skin creases, Nails, Hairs, Glands (Sebaceous & sweat)
71	Lymphatic system	Describe the organization and functions of lymphatic system (Lymphatic system composition (lymph vessels, lymphatic tissue), Movement of lymph)

72	Nervous system Divisions	Describe the organization of nervous system (central & peripheral and somatic & autonomic), Cranial & spinal nerves, Dermatomes & Myotome Formation of a spinal nerve, Plexus Define the formation of spinal nerve and concept/idea of dermatome and myotome
73	Autonomic Nervous system Sympathetic & parasympathetic nervous system	Define the organization of autonomic nervous system Differentiate between Sympathetic & parasympathetic nervous system
74	Membranes Mucous membranes Serous membranes	Describe the structure of membranes of human body
	Fascia, ligaments and raphe	Describe the anatomy and significance of fascia, ligaments and raphe. (request of adding this Lo in final document from AIMI faculty, January 2019)
	Radiological anatomy	Identify various anatomical landmarks on radiography. Describe commonly used radiographs. Describe various view used for obtaining radiographs.(request of adding this Lo in final document from AIMI faculty)
HISTOLOGY		
75	Basic Body tissue	Define tissue and describe the basic tissues in human body
76	Epithelial tissues	Classify epithelium and describe their general features Discuss the specialized functions of different types of epithelial cells Describe the structure of main types of cell junctions

77	Glandular Epithelium	Enlist glandular epithelia Classify them on the basis of morphology, nature of secretion and mode of secretion Differentiate between exocrine & endocrine glands on the basis of structure and function.
78	Epithelial Cell Surface Specialization	Describe the surface specialization of epithelia Correlate their structure, with their location and function
79	Structure & Function Of Basement Membrane	Describe the structure of basement membrane & correlate it with its function.
80	Connective tissue	Define connective tissue. Classify connective tissues. Explain the different types of Connective tissues
PATHOLOGY		
81	Necrosis	Discuss the Process of necrosis Explain the process of apoptosis Differentiate between apoptosis and necrosis
82	Inflammation	Describe events of acute inflammation Describe chronic inflammation
FORENSIC MEDICINE		
83	Death	Define death. Describe stages of death. Describe medico legal importance of stages of death.
LAB WORK		
84	Tissue Preparation	Describe the process of tissue preparation for histological examination Perform H & E staining of tissue slides under supervision in the laboratory
85	Anatomical terms	Demonstrate anatomical terms for planes, position and movements.
		Demonstrate standard anatomical position and its application.
86	H& E staining	Perform H & E staining of tissue slides under supervision in the laboratory
87	Simple Epithelia	Identify and describe simple epithelia under M/S.

88	Stratified Epithelia	Identify and describe stratified epithelia under M/S.
89	Glands	Identify different types of glands under M/S.



Blood Module

General Learning Outcomes

By the end of this module the students should be able to;

Cognitive domain

1. Identify & describe the various cellular and non-cellular components of blood in relation to its Anatomy, Physiology & Biochemistry
2. Describe structure, synthesis and degradation of Hemoglobin
3. Describe the regulatory mechanisms of normal hemostasis and coagulation
4. Describe the conditions associated with dysfunction of cellular and non-cellular components of blood
5. Describe the basic characteristics of immune system.
6. Discuss the structure, functions and biochemical aspects of the Lympho-reticular system.
7. Explain the principles and clinical significance of ABO/RH blood grouping system
8. Explain the pathophysiology of various bleeding disorders
9. Identify the role of pharmacology in anemia and bleeding disorders.

Psychomotor domain

10. Carry out practical work as instructed in an organized and safe manner
11. Make and record observations accurately.
12. Identify slide of Lymph node, thymus, tonsils and spleen under microscope
13. Identify slide of Gut associated lymphoid tissue
14. Determine percentage of formed blood elements.
15. Identify RBC and should be able to do its counting on counting chamber and to know normal values. And also classify Anemia morphologically.

16. Determine the Hemoglobin with the apparatus and have knowledge of normal and abnormal value.
17. Identify WBC morphology and its different types, should be able to count them on counting chamber and to know the normal values. Diagnostic importance of each WBC.
18. Identify Platelets and should be able to do its counting on counting chamber and to know normal values. Its diagnostic importance in relation to bleeding disorders
19. Perform bleeding time and clotting time and to know normal values and its diagnostic importance in relation to bleeding disorders.
20. Perform Blood groups typing and Rh factor.
21. Perform ESR and to know its normal value and prognostic importance.
22. Detect blood, bile pigments & bile salts in the given sample of urine

Attitude and behavior:

23. Demonstrate ability to give and receive feedback, respect for self and peers.
24. Demonstrate empathy and care to patients.
25. Develop respect for the individuality and values of others - (including having respect for oneself) patients, colleagues and other health professionals
26. Organize& distribute tasks
27. Exchange opinion & knowledge
28. Develop communication skills and etiquette with sense of responsibility.
29. To equip themselves for teamwork
30. Regularly attend the classes
31. Demonstrate good laboratory practices

BLOOD MODULE THEME 1		
Pallor and Swelling		
SNO	Topic	Learning Outcomes
ANATOMY		
1	Introduction to hematopoietic system	<p>Describe various components of hematopoietic system including their locations and their functions</p> <p>Describe surface anatomy and applied anatomy of main organs of hematopoietic system</p> <p>Define and classify lymphoid organs and lymphoid tissues</p>
PHYSIOLOGY		
2	Introduction to Blood	<p>Describe the composition and functions of blood Define Hematocrit</p> <p>Enlist the components of plasma</p> <p>Explain the difference between Serum and plasma</p>
3	Red Blood Cells	<p>Describe the structure, function, life span and normal count of Red Blood Cells.</p> <p>Define Haemopoiesis</p> <p>Classify haematopoietic stem cells</p> <p>Summarize the erythropoiesis sites during pre-natal and post-natal periods.</p>

4	Red Blood Cells Genesis Erythropoiesis	<p>Illustrate the stages of RBC development from pluripotent hematopoietic stem cells to a mature RBC.</p> <p>Describe the erythropoiesis and factors regulating erythropoiesis</p> <p>Describe the role of Vitamin B12 and Folic acid in RBC maturation.</p> <p>Describe the effects of deficiency of Vitamin B12 and Folic acid on RBC maturation.</p>
5	Erythropoietin	<p>Describe source, control / regulation and functions of Erythropoietin</p> <p>Explain the role of Erythropoietin in RBC production.</p>
		Describe the effects of high altitude and exercise on RBC production.
6	Anemia	<p>Define and describe the different types of anemia Define hemolysis</p> <p>Describe the various red cell indices</p> <p>Interpret the diagnosis of anemia by using red cell indices</p> <p>Describe the effects of anemia on functions of circulatory system / human body</p>
7	Polycythemia	<p>Define and classify polycythemia</p> <p>Differentiate between primary and secondary Polycythemia</p>
BIOCHEMISTRY		
8	Introduction of Porphyrins	<p>Define Porphyrins</p> <p>Describe Chemistry of Porphyrins</p> <p>Enlist the types, metabolic causes and clinical presentation of different types of Porphyrias.</p>
9	Iron metabolism	Describe the iron metabolism

10	Introduction to heme synthesis and degradation	<p>Define heme and Describe its structure and functions Describe the biochemical features of the hemoglobin molecules</p> <p>Describe Heme Synthesis on cellular and molecular level Describe Heme Degradation</p> <p>Describe the Regulation of Heme Synthesis.</p> <p>Describe the concept of Oxygen binding with hemoglobin</p>
11	Hemoglobinopathies	<p>Define Hemoglobinopathies and enlist the variants of hemoglobin</p> <p>Describe causes of Hemoglobinopathies</p> <p>Describe two major categories of hemoglobinopathies</p> <p>Describe the amino acid substitution in sickle cell disease. Define and Classify thalassemias.</p> <ol style="list-style-type: none"> 1. Explain the genetic defects in α and βthalassemias. 2. Enlist the clinical features of α and βthalassemias
12	Proteins	<p>Define proteins,</p> <p>Describe the Biomedical importance of Proteins</p> <p>Classify proteins based on Physiochemical properties, Functions, Nutrition</p> <p>Explain Structure of proteins</p> <p>Describe the significance of Proteins</p>
13	Amino Acids	<p>Define Amino acids,</p> <p>Describe their structure, properties & functions</p>
		<p>Classify Amino Acid</p> <p>Describe nutritional significance of amino acids</p> <p>Describe Dissociation, titration and importance of amino acid in pH maintenance</p>
14	Proteins	<p>Explain Separation of proteins e.g. salting out, ELISA, Electrophoresis, Chromatography, Centrifugation</p>
15	Proteins	<p>Explain Separation of proteins e.g. Chromatography, Centrifugation</p>
16	Plasma Proteins	<ol style="list-style-type: none"> 3. Classify and describe the physical, chemical and electro-phoretic properties of plasma

		<p>proteins.</p> <ol style="list-style-type: none"> 4. Illustrate the production of plasma proteins and the factors affecting plasma protein synthesis. 5. Describe clinical significance of Plasma proteins 6. Explain Globulin proteins and Albumin with their functions 7. Explain gamma Globulin proteins and Albumin with their functions
PATHOLOGY		
17	Anemia's of diminished erythropoiesis	<p>define anemia</p> <p>List the factors for regulation of erythropoiesis</p> <p>Enlist the types of anemia</p>
18	• Hemolytic anemia's	<p>Define hemolytic anemia.</p> <p>Enlist types of hemolytic anemia.</p>
PHARMACOLOGY		
19	Drug treatment of anemia's	<p>Enlist the drugs used in the treatment of iron deficiency & Megaloblastic anemia</p> <p>Describe the pharmacological basis/ role of iron in iron deficiency anemia</p> <p>Describe the pharmacological basis/ role of vit B12 and folic acid in megaloblastic anemia</p> <p>Describe the role of Erythropoietin in the treatment of Anemia</p>
COMMUNITY MEDICINE		
20	Epidemiology of blood borne diseases	<p>Describe Epidemiology of Iron Deficiency Anemia</p> <p>Describe prevention of different types of anemia's in community</p>
LAB WORK		
ANATOMY PRACTICAL (HISTOLOGY)		
21	Histology	<p>Identify and describe the microscopic anatomy of lymph node, thymus, bone marrow and spleen under microscope Compare the histological features of lymph node, thymus and spleen</p>

		Identify and describe various blood cells under microscope.
PHYSIOLOGY PRACTICAL		
22	Hemoglobin determination	Assist in phlebotomy while practicing aseptic procedure. Determine the hemoglobin (Hb) concentration in the given sample Estimation of hemoglobin by Sahli's method Determination of packed cell volume
23	RBC count	Determine the red blood cell (RBC) count in the given sample and calculate RBC indices
BIOCHEMISTRY PRACTICAL		
24	Estimation of plasma proteins in serum	Estimate plasma proteins in serum.
25	Preparation of protein free filtrate	Prepare protein free filtrate

BLOOD MODULE THEME 2		
Fever (infection and immunology)		
SNO.	Topic	Learning Outcomes
ANATOMY		
26	Gross anatomy of hematopoietic system	<p>Locate, identify and describe the main gross external features of spleen, lymph node, thymus and tonsils</p> <p>Describe neurovascular supply of the mentioned structures</p> <p>Outline the surface anatomy of main lymph nodes, spleen, thymus and tonsils</p> <p>Enlist the causes of splenic injuries</p>
27	Histology of lymphoid tissues	<p>Describe the overview of lymphatic tissue including MALT</p> <p>Identify and describe the histological features and functions of Lymph node</p> <p>Identify and describe the histological features and functions of Thymus</p> <p>Identify the locations of tonsils and describe the histological features and functions of Tonsils</p> <p>Describe the histological features and functions of spleen.</p>
28	Embryology/ Developmental Anatomy of lymphoid tissue	Describe the development of lymphoid organs including lymph nodes, tonsils, thymus and spleen
PHYSIOLOGY		

29	White Blood Cells	<p>Classify white blood cells</p> <p>Describe the structure, function, life span and normal count of White Blood Cells</p> <p>Describe the stages of differentiation of white blood cells (leukopoiesis)</p> <p>Describe the characteristics of WBCs (phagocytosis / chemotaxis, diapedesis)</p>
30	Reticulo-endothelial (Monocyte-Macrophage) system	<p>Describe the components of reticulo-endothelial system (monocyte-macrophage system)</p> <p>Describe the role of monocyte macrophage system in immunity</p>
		<p>Explain the role of neutrophils, macrophages, basophils, eosinophil's and monocytes in providing immunity against infections (immune system)</p>
31	Inflammation	<p>Define inflammation</p> <p>Describe characteristics of inflammation (hallmark of inflammation) Describe the causes, sequence of events and cardinal signs of inflammation</p>
32	Abnormal leukocyte counts/ Leukemia	<p>Define Leukopenia and Leukocytosis and Lukemia</p>
33	Introduction to immunity	<p>Define and classify immunity Define antigen</p> <p>Define pathogen</p> <p>Enlist the tissues that contribute to immunity and explain their function</p>

		Describe the functions of immune system Describe the structure and function of lymphatic system
34	Immune system	Enlist the three lines of defenses and outline their properties Describe the characteristics, origin and functions of cells of immune system Describe the types of immunity Enlist the innate defenses List the substances and cells that participate in adaptive immunity Compare the characteristics innate and acquired immunity Compare the active and passive immunity mechanism
35	Immune response	Differentiate between primary and secondary immune response Describe the roles of cytokines, chemokines, and colony-stimulating factors in the immune response
36	Humoral and cell mediated immunity	Describe the role of T and B lymphocytes in immunity Describe the role of B lymphocytes in humoral immunity Describe cell mediated and humoral immunity Explain how helper T cells regulate the immune system Explain the function of cytotoxic T cells Describe the role of helper T cells Differentiate between humoral and cell mediated immunity
37	Complement system	Describe the complement system Explain how the complement system elicits the inflammatory response, lyses foreign cells, and increases phagocytosis Describe the two pathways that activate the complement system compare Classic and alternate pathways of complement

		activation
38	Immunity: extremes of ages	<p>Compare the active and passive immunity</p> <p>Explain the transfer of passive immunity from mother to fetus and from mother to infant during breast-feeding</p> <p>Describe changes in immune response that occurs with aging</p>
39	Allergy & Hypersensitivity	<p>Define allergy and allergen</p> <p>Describe the pathophysiology of allergy and hypersensitivity</p> <p>Define and classify the hypersensitivity reaction</p> <p>Compare the immediate and delayed hypersensitivity reactions List the diseases associated with hypersensitivity reactions</p>
Biochemistry		
40	Immunoglobulin's / Antibodies	<p>Define Immunoglobulin's</p> <p>DESCRIBE Types of Immunoglobulin's</p> <p>Describe Structure of Immunoglobulin's</p> <p>Describe the mechanism of action of antibodies</p> <p>Explain biochemical role of each immunoglobulin in immunity</p>
COMMUNITY MEDICINE		
41	Vaccinology	<p>146. Define vaccine and immunization</p> <p>147. Explain the expanded program of immunization (EPI) in Pakistan</p>
LAB WORK		
PHYSIOLOGY PRACTICAL		
42	TLC determination	Determine the total leukocyte count (TLC) in the given sample
43	DLC determination	Determine the differential leukocyte count (DLC) in the given sample

BLOOD MODULE THEME 3		
Excessive Bleeding		
PHYSIOLOGY		
SNO	Topic	Learning Outcome
44	Introduction to hemostasis	<p>Describe the structure, function, life span and normal count of Platelets.</p> <p>Define hemostasis</p> <p>Describe the role of platelets in hemostasis</p> <p>Outline the sequence of processes involved in hemostasis.</p>
45	Blood Coagulation	<p>Enlist the clotting factors</p> <p>Explain the role of calcium in coagulation</p> <p>Explain how clotting is prevented in the normal vascular system Outline the sequence of processes during blood coagulation Describe with the help of a flow diagram (or draw) intrinsic pathway of coagulation cascade</p> <p>Describe with the help of a flow diagram (or draw) extrinsic pathway of coagulation cascade</p> <p>Explain how the mechanism of clot dissolution.</p>
46	Bleeding disorders	<p>describe the role of Vit K in clotting Describe the following bleeding disorders</p> <ul style="list-style-type: none"> • Vitamin K deficiency • Thrombocytopenia • Hemophilia <p>Define Von Willebrand disease</p>

47	Thrombotic disorders	<p>Describe the effects of low platelet count on Hemostasis</p> <p>Define thrombus/thrombi</p> <p>Define emboli/embolus</p> <p>Enlist the causes of thromboembolic conditions</p> <p>Describe Femoral venous thrombosis and pulmonary embolism</p>
Pharmacology		
48	Coagulation modifying drug	<p>Identify the site of action of following drugs in coagulation cascade</p> <ul style="list-style-type: none"> • Aspirin, Heparin, • Tranexamic acid, Vitamin K
LAB WORK		
49	Clotting time determination	Determine the clotting time
50	Bleeding time determination	Determine the bleeding time
51	Prothrombin time determination	Determine the Prothrombin time (PT) in the given sample

BLOOD MODULE THEME 4		
Transfusion Reactions		
SN0	Topic	Learning Outcome
PHYSIOLOGY		
52	Blood Grouping	<p>Describe different types of blood groups</p> <p>Describe the genotype-phenotype relationships in blood groups. Interpret the plausible blood groups (A-B-O) in children of parents with known blood groups.</p> <p>Describe the role of agglutinogens and agglutinins in blood grouping</p> <p>Describe the antigens and antibodies of the O-A-B blood types/ Interpret the types of agglutinins present in individuals with a specific blood group</p> <p>Describe the process of agglutination</p>
54	transfusion reactions	<p>Describe the antigens and antibodies of the Rh system</p> <p>Describe the principles of blood typing</p> <p>Explain universal donor and universal recipient blood groups Enlist the manifestations of transfusion reaction</p>
55	Erythroblastosisfetalis	<p>Define Rhesus incompatibility Describe erythroblastosis fetalis</p> <p>Describe the transfusion reactions resulting from mismatched O- A-B and Rh blood types</p>
56	Major histocompatibility complex	<p>Define autoimmunity</p> <p>Explain how immune reaction to self-antigens is avoided</p> <p>Define and classify Major Histocompatibility complex (MHC) Characterize the significance and function of major histocompatibility complex molecules</p>

Forensic Medicine		
56	Medico-legal importance of blood groups	Describe the Medico-legal importance of blood groups in forensic work that is (a) Personal Identity b) inheritance claims (c) DNA profiling (d) Disputed paternity and maternity
COMMUNITY MEDICINE		
57	epidemiology of blood borne diseases	Identify important blood borne pathogens and how they are spread
		Discuss the epidemiology of blood borne disease transmission and the potential for HIV, HBV and HCV transmission. Identify routes of transmission of blood borne pathogens Discuss the best practices to perform safe blood transfusion. Identify potential exposure risks List important safeguards against blood borne pathogen disease
LAB WORK (Physiology Practical)		
58	Blood grouping	Determine the O-A-B and Rh blood group in the given sample
59	Blood smear preparation	Prepare blood smear by thumb prick method.
60	Blood Bank	Observe the process of blood donation, blood product separation, screening and storage and observe the process of blood transfusion.

MUSCULOSKELETAL SYSTEM

General Learning Outcomes

By the end of this module the students should be able to;

Knowledge

1. Develop an understanding of the fundamental components of the musculoskeletal system.
2. Explain the structure & function of the musculoskeletal (MSK) components of limbs and back.
3. Describe how injury and disease alter the MSK structure & function.
4. Integrate concepts relating to various metabolic processes, their disorders and relevant lab investigations in the study of human MSK system.
5. Describe the role of the limbs (upper/lower) in musculoskeletal support, stability and movements.
6. Describe the development of the limbs & correlate it with organization and gross congenital anomalies of the limbs.
7. Identify the anatomical features of bones, muscles & neurovascular components of the limbs and correlate them with their functions, injuries and clinical problems.
8. Describe the types, formation, stability, function & clinical significance of joints of the upper and lower limb.
9. Describe the basic histology of muscle fibers including its molecular structure (Sarcomere).
10. Explain the mechanism of excitation and contraction of skeletal and smooth muscles.
11. Describe the basis for the use of therapeutic agents to modulate neuromuscular transmission.
12. Describe the general principles of MSK pain management.

13. Describe ergonomics and its principles. Prevention of different MSK disorders.
14. Interpret the mechanism of post-mortem rigidity. (spiral II)
15. Give an overview of pathology of bones, muscles and joints.
16. Explain the role of different minerals, hormones and specific metabolic products related to the musculoskeletal system and correlate them with their relevant clinical metabolic disorders.
17. Interpret the relevant laboratory investigations for diagnosis of common musculoskeletal disorders. (Spiral two)
18. To develop the critical thinking and analysis in the context of various case scenarios pertaining to locomotors system.

Skills

By the end of this module, it is a core objective that students should have acquired the following skills:

1. Demonstrate the anatomical structures of the limbs in a dissected cadaver/Model/prosecuted specimen & X-ray.
2. Demonstrate the provision of first aid measures in case of a limb fracture.
3. Communicate effectively in a team with colleagues and teachers.

Attitude

While not necessarily taught explicitly, students are expected to develop following attitudes throughout the course:

1. Demonstrate respect and care for the cadaver and prosecuted parts.
2. Demonstrate humbleness and use socially acceptable language during academic and social interactions with colleagues and teachers.
3. Make ethically competent decisions when confronted with an ethical, social or moral problem related to MSKS in professional or personal life.

4. Discuss ethical issues social and preventive aspect of health care in the context of MSK system.
5. To create awareness about the ethical, social and preventive aspect of health care in the context of locomotor system.



MUSCULOSKELETAL SYSTEM THEME 1		
Shoulder Pain		
SNO.	Topic	Learning Outcomes
ANATOMY		
1	Introduction	<p>Define osseous tissue</p> <p>Classify the skeletal system (axial and appendicular)</p> <p>Name and locate different bones of axial and appendicular skeleton</p> <p>Classify bones</p> <p>Describe general features of bones Describe Nerve/blood supply of bone Describe bone marrow and its types Describe ossification and its types Describe surface markings of bones</p> <p>Define fracture, osteoporosis, rickets, osteomalacia</p> <p>Introduction to muscular system</p> <p>Classify the muscles according to the directions of fibers</p> <p>Classify the skeletal muscles according to their action.</p> <p>Types of skeletal muscle fibers(Type1 ,2,3) Describe the nomenclature of skeletal muscles</p> <p>Describe the principle of innervations and nerve supply of muscles Define paralysis, hyperplasia, hypertrophy, myasthenia gravis</p>
2	Introduction to locomotion and upper limb	<p>Identify the extent of the upper limb. Identify various regions of upper limb.</p> <p>Describe the division of the regions into compartments. State the contents of compartments of arm, forearm & hand</p> <p>Describe the joints of upper limb.</p>

		Describe the clinical anatomy of upper limb
3	Osteology of clavicle	<p>Recognize the bone Identify the site of bone</p> <p>State the bony land marks of clavicle: like borders, surfaces & land mark used for bone determination</p> <p>Describe & demonstrate the attachments of muscles. Describe the common fractures of the bone.</p> <p>Identify and describe the salient features of the bones scapula and clavicle</p> <p>Describe the surface anatomy clavicle Describe the radiological anatomy clavicle Describe the applied anatomy clavicle</p>
4	Osteology of scapula	<p>Recognize the bone. Identify the site of bone.</p> <p>State the bony landmarks of scapula: like borders, surfaces & land mark used for bone determination.</p> <p>Demonstrate the attachment of muscles on scapula</p> <p>Describe the common fractures of the bone.</p> <p>Identify and describe the salient features of the bones scapula.</p> <p>Identify the attachments to scapula</p> <p>Describe the surface anatomy scapula Describe the radiological anatomy scapula. Describe the applied anatomy scapula.</p>
5	Osteology of humerus	<p>Recognize the bone. Identify the site of bone.</p> <p>State the bony landmarks of humerus: like borders, surfaces & land mark used for bone determination.</p> <p>Demonstrate the attachment of muscles & ligaments. Describe the common fractures of the bone.</p> <p>Identify and describe the salient features of the humerus</p> <p>Identify the attachments to humerus</p>

		<p>Describe the surface anatomy humerus Describe the radiological anatomy humerus</p> <p>Describe the applied anatomy humerus</p>
6	Muscles of the pectoral girdle	<p>Recognize the role of muscles of pectoral region in stabilizing the pectoral girdle.</p> <p>List the muscle of pectoral girdle.</p> <p>Describe & Demonstrate the attachments of muscle of pectoral girdle, nerve supply and actions.</p> <p>Describe the structural organization of the clavi-pectoral fascia. Identify the triangle of auscultation.</p> <p>Describe the nerves and blood vessels of this region</p>
7	Muscles of the shoulder region	<p>Recognize the extent of shoulder region. Describe the muscle of shoulder region. List the muscles of shoulder region.</p> <p>State the detailed structures of each muscle with respect to Origin, Insertion, Nerve supply and Action of muscles with any characteristic features.</p>
8	The shoulder joint & its movements	<p>Classify the type of shoulder joint. Describe the structure of shoulder joint.</p> <p>Name the muscles acting on the joint/rotator cuff muscles. Explain the range of mobility.</p> <p>Describe the movements of shoulder joint.</p> <p>Explain the clinical anatomy of the joint</p>

9	Brachial plexus	<p>Mention the formation of brachial plexus (roots, trunk, division, and cords).</p> <p>Describe the relation of brachial plexus also in connection to clavicle (Supra, retro, infra clavicular parts).</p> <p>State the branches arising the different cords. Draw the brachial plexus.</p> <p>Describe the clinical correlates of the brachial plexus.</p> <ul style="list-style-type: none"> • Erbduchane palsy • Klumpke palsy • Saturday night palsy
10	Nerves of upper limb	<p>Describe the course and branches of nerves of upper limbs.</p> <ul style="list-style-type: none"> • Axillary nerve • Musculocutaneous nerve • Radial Nerve • Ulnar Nerve • Median Nerve <p>Explain the injuries associated with these nerves.</p> <p>Identify the causes and motor and sensory loss associated with nerve injuries of upper limb.</p> <p>Apply knowledge of gross anatomy to identify the deformities associated with these nerves.</p>
	Axilla	<p>Describe the position, shape of axilla. Describe the boundaries and content of axilla</p> <p>Describe the boundaries and muscle forming the boundaries of axilla.</p> <p>Describe the formation, course and relations of axillary vessels.</p> <p>Describe arrangement and groups axillary lymph nod</p>

11	Arm	<p>Describe the compartments of arm and how they are formed. Identify and explain the muscles and their actions found in the arm. Describe the nerve supply of arm.</p> <p>Describe the course of the nerves Identify the branches of the nerves Relate & integrate with the clinical correlations</p> <p>Describe cutaneous supply of arm.</p>
12	Brachial vessels	<p>Describe the extension, relation and branches of the Brachial artery. Describe the course of the Basilic and cephalic veins</p> <p>Describe and explain the formation and purpose of the scapular anastomosis.</p>
13	Elbow joint	<p>Identify the type of the joint.</p> <p>State and Identify the muscles acting on the elbow joint. Describe the neurovascular supply of the joint.</p> <p>Describe the carrying angle and applied aspect of the joint. Describe the anastomosis and collateral circulation.</p> <p>Describe formation of anastomosis around elbow joint</p>
14	Osteology of ulna	<p>Recognize the bone. Determine the side of bone. Identify the features of bone.</p> <p>Identify the muscles attached to bone. Describe the common fractures of the bone.</p> <p>Describe and Identify the salient features of the ulna Identify the attachments to ulna</p> <p>Describe the surface anatomy ulna and the radiological anatomy ulna</p> <p>Describe the applied anatomy ulna</p>

15	Superficial veins, lymphatic's and lymph nodes of upper limb	<p>Describe the normal anatomy of veins of upper limb. Differentiate between superficial and deep veins.</p> <p>Describe the features of individual superficial veins of upper limb. Correlate the applied anatomy with the gross anatomy of superficial Veins of upper limb.</p> <p>Describe the structure of a lymph node. Identify the groups of lymph nodes.</p> <p>Describe groups and area of drainage of each group of lymph nodes. Describe the commencement, course and termination of superficial lymphatic vessels.</p> <p>Describe the clinical conditions related to lymphatic channels of upper</p>
16	Cubital fossa	<p>Describe the boundaries, the contents and the relationship among structures of Cubital fossa.</p> <p>Demonstrate the surface anatomy of the Cubital fossa. Explain the clinical importance of the Cubital fossa.</p>
17	Anterior compartment of forearm	<p>List the muscles of forearm.</p> <p>State the nerve supply of these muscles.</p> <p>Explain actions of the muscles of anterior compartment of forearm. Describe attachment and functions of flexor retinaculum Identify/Describe muscles of the anterior compartment of the arm (origin, insertion, nerve supply, blood supply, and action)</p>
18	Posterior compartment of forearm	<p>Explain the organization of muscles of posterior compartment of forearm</p> <p>Identify/Describe muscles of the posterior compartment of the arm (origin, insertion, nerve supply, blood supply, and action)</p> <p>State the nerve supply of these muscles.</p>

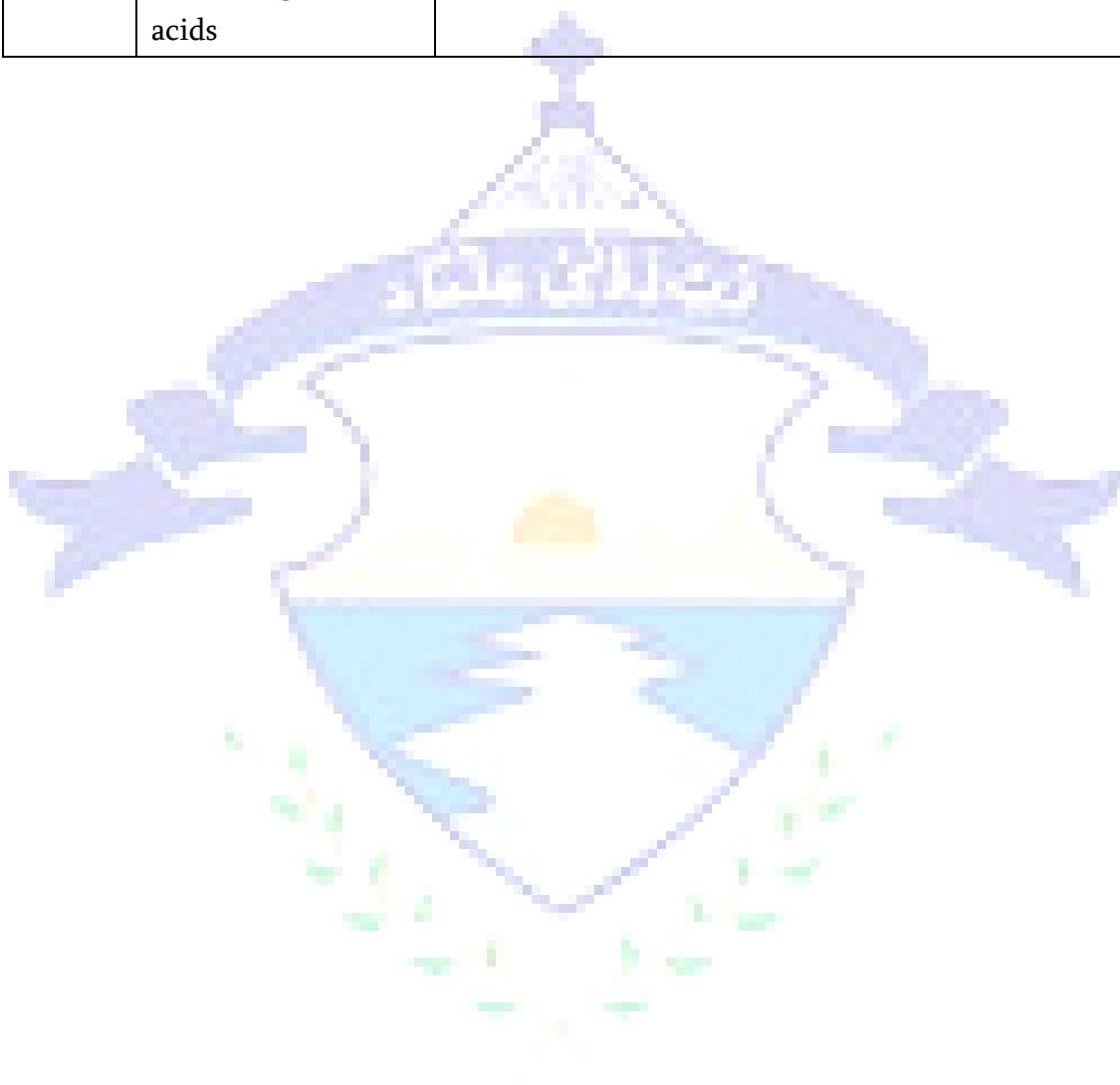
		<p>Explain the actions of the muscles of posterior compartment of forearm.</p> <p>Describe the structural organization of the Extensor Retinaculum</p>
19	Blood vessels & nerves of the forearm	<p>Describe the different vessels & nerves in forearm.</p> <p>Describe the location, destination, course & relations of radial and ulnar arteries & their branches in forearm.</p> <p>Describe the deep veins of forearm and their tributaries.</p> <p>Describe the location, destination, course & relations of ulnar, radial and median nerves & their branch.</p>
20	Radio-ulnar joint	<p>Recognize the details of Radio-ulnar joint.</p> <p>Describe and explain the movements occurring on Radio-ulnar joint. Name the muscles acting in pronation and supination.</p> <p>Describe the nerve supply and blood supply of Radio-ulnar joint.</p> <p>Describe clinical problems related to Radio-ulnar joints.</p>
21	Surface anatomy of upper limb	Demonstrate the surface markings for various arteries of upper limb
Embryology		
22	Somitogenesis	<p>Define the process of gastrulation.</p> <p>Describe the development of mesoderm. Describe the process of somitogenesis. Describe the formation of cartilage</p>

23	Development of bone ,cartilage and joints	Describe histogenesis of Bone Describe the Intramembranous Ossification Describe the Endochondral Ossification Describe the Ossification of limb bones Describe the development of joints Describe the development of cartilage Describe developmental events of fibrous joints Describe developmental events of cartilaginous joint Describe developmental events of synovial joints Describe important congenital correlates
24	Development of upper limb	Describe the early stages of upper limb development Describe the development of upper limb buds Describe the final stages of upper limb development Describe and explain the anomalies of the upper limb
25	Development of muscles	Describe the development of skeletal muscle. Describe the development of Myotomes and derivatives of epaxial divisions of myotomes and derivatives of hypaxial divisions of myotomes
HISTOLOGY		
26	Bone histology	Define and identify compact and spongy bone Describe and identify bone matrix (organic and inorganic component) Describe and identify cells of boney tissue i.e. (osteoprogenitor, osteoblasts, osteoclast, and osteocytes) Describe and identify periosteum and endosteum Describe and identify the microscopic structure of bone i.e. (primary bone, secondary bone and haversian system)

		<p>Describe Functions of various bone cells</p> <p>Describe important Functions and its role in calcium metabolism</p>
27	Classification & histology of cartilage	<p>Describe the General properties of cartilage Describe the Different types of cartilage Describe the Hyaline, Elastic and Fibrocartilage Explain the growth of cartilage</p>
28	Histology of cartilage	<p>Identify types of cartilages on microscopy, including distinctive features of each.</p> <p>Describe the structural basis.</p> <p>Classify and distinguish three types of cartilages Describe the microscopic structure of hyaline cartilage Describe the microscopic structure of Elastic cartilage Describe the microscopic structure of fibrous cartilage</p> <p>Describe important functional correlates of three types of cartilages</p>
29	Classification & histology of bone	<p>Recognize bone and its functions and ncomposition.</p> <p>Differentiate between woven bone and lamellar bone.</p> <p>Differentiate between compact bone and spongy bone.</p> <p>Describe the applied aspect of bone</p>
30	Histology of bone	<p>Identify three types of bone on microscopy, including distinctive features of each.</p> <p>Describe the structural basis of classification.</p>
31	Histology of muscles	<p>Identify three types of muscles on microscopy, including distinctive features of each muscle fiber.</p> <p>Describe the structural basis of muscle striations.</p> <p>Recognize the structural elements that produces muscle contraction and brings the movement of a body part.</p> <p>Recognize the function and organization of the connective</p>

		<p>tissue in muscle.</p> <p>Classify and distinguish three types of muscles Describe the microscopic structure of skeletal muscle</p> <p>Describe important functional correlates of skeletal, smooth Describe the microscopic structure of smooth muscle</p>
		<p>Identify/Describe the microscopic structure of cardiac muscle fiber Describe important functional correlates of cardiac muscle fiber</p>
Physiology		
32	Skeletal vs smooth muscle	Differentiate between skeletal muscle and smooth muscle.
33	Mechanism of muscle contraction	Describe the general mechanism of muscle contraction. Describe the molecular mechanism of muscle contraction
34	Energetics of muscle contraction	Describe the energetics of muscle contraction.
35	Terms related to MSK	<p>Describe the following terms related to MSK</p> <ul style="list-style-type: none"> • Excitable tissue • Stimulus • Threshold • Depolarization • Hyperpolarization • Presynaptic potential • Post synaptic potential • Goldman Equation • Nernst Equation
Biochemistry		
36	Connective tissues	Explain in detail the biochemistry of connective tissues.
37	Glycosaminoglycan	Discuss the role of glycosaminoglycan (GAG) in the formation of the connective tissues, cartilage, skin, blood vessels and tendons

38	Collagen	Describe the chemical structures of cellular matrix of collagen and elastin
Biochemistry Practical		
39	Detection of Sulphur containing amino acids	Define Sulphur containing amino acids their structure and types Lead Sulphate test



MUSCULOSKELETAL SYSTEM THEME 2**Weak grip and painful hand**

SNO.	Topic	Learning Outcomes
ANATOMY		
1	Osteology of radius & hand	<p>Recognize the bones of forearm & hand Determine side of bones.</p> <p>Identify the features of bones.</p> <p>Identify the muscles attached to bones. Describe the ossification of bones Explain the clinical significance of bones.</p> <p>Describe the common fractures of the bone.</p> <p>Describe and Identify the salient features of the radius</p> <p>Identify the attachments to radius</p> <p>Describe the surface anatomy radius and the radiological anatomy radius</p> <p>Describe the applied anatomy radius</p> <p>Describe and Identify the salient features bones of hand</p> <p>Identify the attachments to bones of hand</p> <p>Describe the surface anatomy main bones of hand and the radiological anatomy of main bones</p> <p>Describe the applied anatomy main bones of hand including carpal tunnel and fractures</p>

2	Muscles of hand	<p>Recall the structure and functions of palmar aponeurosis.</p> <p>Describe the attachments, nerve supply & actions of muscles of hand.</p> <p>Describe the thenar Muscles.</p> <p>Correlate the movements of thumb with hand anatomy.</p> <p>Identify the anatomical snuffbox.</p> <p>Relate applied with gross anatomy of few structures of hand</p> <p>Enumerate, describe and identify the small muscles of the hand</p> <p>Describe Surface anatomy of important muscles of hand</p> <p>Identify structures on transverse MRI hand taken at various levels</p> <p>Describe relevant clinical anatomy of important muscles</p> <p>Identify/Describe joints of the hand and fingers (intercarpal joints, carpometacarpal and intermetacarpal joints, carpometacarpal joint of the thumb, and metacarpophalangeal joints)</p>
		<p>Describe surface , radiological and clinical anatomy of important joints</p>
3	Vessels & nerves of the hand	<p>Identify different vessels in hand.</p> <p>Describe the location, destination course relations of radial and ulnar arteries in hand.</p> <p>State the branches of radial and ulnar arteries in hand.</p> <p>Describe the formation of superficial and deep palmar arch, veins of hand and their tributaries.</p> <p>Describe the nervous supply of the hand.</p>

4	Wrist joint	<p>Recognize the details of wrist joints.</p> <p>Describe and explain the movements occurring on wrist joints.</p> <p>Name the muscles acting in pronation and supination.</p> <p>Describe the nerve supply and blood supply of wrist joints.</p> <p>Describe wrist joint, nerve supply and blood supply.</p> <p>Describe clinical problems related to Wrist joints.</p>
5	Spaces of the palm	<p>Identify the different spaces of the hand on both palmar and dorsal aspects.</p> <p>Describe the clinical importance of these spaces</p>
Physiology		
10	Describe the important terms	<p>Describe the following</p> <ul style="list-style-type: none"> • Motor unit • Summation • Tetanization • Staircase effect • Skeletal muscle tone • Muscle fatigue • Agonist • Antagonists • Coactivation of agonist and antagonist
11	Excitation contraction coupling in skeletal muscles	<p>Discuss the process of excitation contraction coupling in skeletal muscles.</p> <p>Explain Transverse tubule-sarcoplasmic reticulum system</p> <p>Describe Release of Calcium ions by sarcoplasmic reticulum</p> <p>Explain Role of Calcium pump</p> <p>Describe Excitatory pulse of Ca^{+}</p>
12	Muscle action potential	Describe the muscle action potential.

13	Excitation contraction coupling	Describe excitation contraction coupling of skeletal muscle.
BIOCHEMISTRY		
14	Role of calcium and phosphorus	Explain the role of calcium and phosphorous in formation of cellular matrix and bone
15	Vitamins	Vitamins and their role Define vitamins Classify vitamins Differentiate between Fats and water soluble vitamins Describe role of Vitamin A Explain the role of Vitamin D Describe the role of Vitamin E Describe the role of water soluble vitamins
16	Introduction to minerals	Define Minerals, Define major and minor minerals Describe classification of minerals
Biochemistry Practical's		
17	Detection of Cyclic amino Acids	Describe Cyclic amino Acids, their structure and types <ul style="list-style-type: none">• Xanthoproteic Test

MUSCULOSKELETAL SYSTEM THEME 3		
Pain lower limb, limping		
SNO	Topic	Learning Outcome
1	Introduction to lower limb	<p>Recognize different parts of lower limb. Describe regions of lower limb.</p> <p>List the bones of lower limb.</p> <p>Describe the vessels and nerves of lower limb.</p> <p>Identify different land marks in different regions of lower limb</p>
2	Hip bone	<p>Identify the different parts of the bone. Describe side determination.</p> <p>Describe muscle attachments. Describe ligamentous attachments.</p> <p>Describe the different bones articulating with the hip bone</p> <p>Identify the different parts of the bone.</p> <p>Describe the common fractures of the bone.</p> <p>Identify and describe the salient features of the bones of hip bone</p> <p>Identify the attachments of hip bone</p> <p>Describe the surface anatomy of hip bone Describe the radiological anatomy of hip bone Describe the applied anatomy of hip bone.</p>

3	The hip joint and movements	<p>Describe the characteristics features of synovial joint</p> <p>Describe the Articular surfaces of hip joint</p> <p>Identify the capsule of hip joint</p> <p>Describe the synovial membrane, cavity & fluid of hip joint</p> <p>Enumerate the ligaments of hip joint & describe their attachments</p> <p>Describe the movements possible at hip joint</p> <p>Describe the clinical correlates of the hip joint</p> <p>Describe surface and radiological anatomy (X-rays and MRI) and clinical of hip joints</p>
4	Gluteal region	<p>Describe the boundaries of gluteal region Describe bones and ligaments of gluteal region</p> <p>Describe the different structures entering and leaving gluteal region</p> <p>Describe muscles of the gluteal region. Describe Vessels of the gluteal region. Describe nerves of the gluteal region.</p>
		<p>Describe about certain clinical correlates regarding gluteal region</p> <p>Describe Surface anatomy of important muscles</p> <p>Identify structures on transverse MRI of gluteal region taken at various levels</p> <p>Describe clinical anatomy of important muscles</p>

5	Femur	<p>Identify different parts of the femur Determine the side of the bone</p> <p>Identify the surfaces and borders of the bone Describe the common fractures of the bone.</p> <p>Describe the attachments of the different muscles and ligaments on the bone</p> <p>Describe the arterial supply of the bone</p> <p>Relate to the general idea about fractures of femur and other clinical conditions Identify and describe the salient features of the bones of hip bone</p> <p>Describe the surface anatomy of femur Describe the radiological anatomy of femur Describe the applied anatomy of femur</p>
6	Nerves of lower limb and their injuries	<p>Identify the names of nerves and their main branches innervating lower limb</p> <p>Identify the nerves closely related to a bone or other structure of lower limb</p> <p>Recognize the main nerves commonly vulnerable to injury Identify the main area and loss of function if particular nerve is injured</p> <p>Define and understand terms neuritis, anesthesia, par aesthesia, paralysis, neuralgia, sciatica</p>
7	Superficial vessels and lymphatic's of lower limb	<p>Enumerate and describe the superficial arteries of lower limb Name and Describe superficial veins of lower limb</p> <p>List and Describe the superficial lymphatic vessels and lymph nodes of lower limb</p>

8	Deep fascia of thigh, iliotibial tract and superficial vessels	<p>Describe the arrangement of deep fascia in thigh</p> <p>Describe how the iliotibial tract participates in walking and running</p> <p>Describe the location of saphenous opening and its relations</p> <p>Describe the great saphenous vein.</p> <p>Describe clinical correlates of saphenous vein</p>
9	Muscles of the anterior fascial compartment of thigh	<p>Describe the muscles of anterior compartment of thigh.</p> <p>Describe the nerve supply of anterior Compartment.</p> <p>Describe the action of these muscles</p>
10	Nerves and vessels of anterior compartment of thigh	<p>Describe the nerve supply of the anterior compartment of thigh. Describe the blood supply and the venous drainage of anterior compartment of thigh</p> <p>Describe the action of these muscles</p>
11	The medial compartment of thigh	<p>Describe the muscles of medial compartment of the thigh.</p> <p>Describe the nerve supply of these muscles.</p> <p>Describe the actions of the muscles of medial compartment of thigh</p> <p>Describe the vessels of medial compartment of the thigh</p>
12	Posterior compartment of thigh	<p>Describe the muscles of posterior compartment of thigh</p> <p>Describe the arterial supply of posterior compartment of thigh Discuss the trochanteric and cruciate anastomosis at the back of thigh</p> <p>Describe the venous drainage of this region</p> <p>Describe the nerve supply of posterior compartment of thigh and Relate to the clinical conditions effecting the</p>

		region
13	Popliteal fossa	Describe the boundaries of popliteal fossa. Describe the contents of the popliteal fossa. Describe some clinical correlates regarding popliteal fossa
14	Femoral triangle and its contents	Describe the boundaries of femoral triangle List the contents of femoral triangle Describe the femoral sheath & canal Describe the clinical correlates of the Femoral triangle. Describe the location, boundaries and contents of adductor canal
15	Tibia bone	Describe the division of tibia bone in 3 parts Identify the surfaces and borders of tibia Describe the attachments of muscles on the tibia bone Describe the ossification of tibia and its primary and secondary ossification centers Describe the common fractures of the bone. Identify and describe the salient features of the bone of leg Identify the attachments to the bone of the leg Describe the surface anatomy of leg Describe the radiological anatomy of leg Describe the applied anatomy of leg
16	Fibula & bones of foot	Determine the side of bone.

		<p>Describe the bony features along with its different attachments on the fibula.</p> <p>Name and describe the tarsal bones and their arrangement</p> <p>Name and describe the metatarsal bones and phalangeal bones. Describe the common fractures of the bone.</p> <p>Describe the muscles of the sole of the foot (origin, insertion, nerve supply, blood supply, and action)</p> <p>Describe the muscles of the dorsum of the foot (origin, insertion, nerve supply, blood supply, and action)</p> <p>Describe Surface anatomy of important muscles</p> <p>Identify structures on transverse MRI of foot taken at various levels</p> <p>Describe clinical anatomy of important muscles</p>
17	Anterior and lateral compartment of leg	<p>Identify the boundaries of the compartments of leg</p> <p>State the muscles of anterior and lateral compartment of leg</p> <p>Describe the vessels of anterior and lateral compartment of leg</p> <p>Describe the nerves of lateral and anterior compartment of leg</p> <p>Describe action of these muscles</p>
18	Posterior compartment of leg	<p>Explain the muscles of posterior Compartment of leg.</p> <p>Describe nerve supply of these muscles. Explain the actions of the muscles of posterior compartment of leg</p>

19	Knee joint	<p>Describe the type of knee joint</p> <p>Describe the articular surfaces of knee joint Describe the articular capsule of knee joint</p> <p>Describe the synovial membrane and the synovial cavity</p> <p>Enumerate the ligaments of knee joint</p> <p>Describe the bursa around the knee joint</p> <p>Describe the blood and nerve supply of the knee joint</p> <p>Describe the mechanism of locking and unlocking of knee joint. Describe surface and radiological anatomy (X-rays and MRI) and clinical of knee joints</p>
20	Surface anatomy of lower limb	<p>Demonstrate the surface anatomy of arteries of lower limb.</p> <p>Demonstrate the surface anatomy of superficial & deep veins lower limb.</p> <p>Demonstrate the surface anatomy of nerves of lower limb</p>
Embryology		
21	Development of lower limb	<p>Describe the early stages of lower limb development</p> <p>Describe the development of lower limb buds</p> <p>Describe the final stages of lower limb development</p> <p>Describe and explain the anomalies of the lower limb</p>
Biochemistry		
22	Sodium, potassium and chlorine in biology	<p>Discuss RDA, serum Levels</p> <p>Enlist sources of Sodium, Potassium and chlorine, Describe functions</p> <p>Discuss absorption excretion,</p> <p>Describe disorders related to increase and decrease in amount of Sodium, Potassium and chlorine</p>
Biochemistry Practical's		

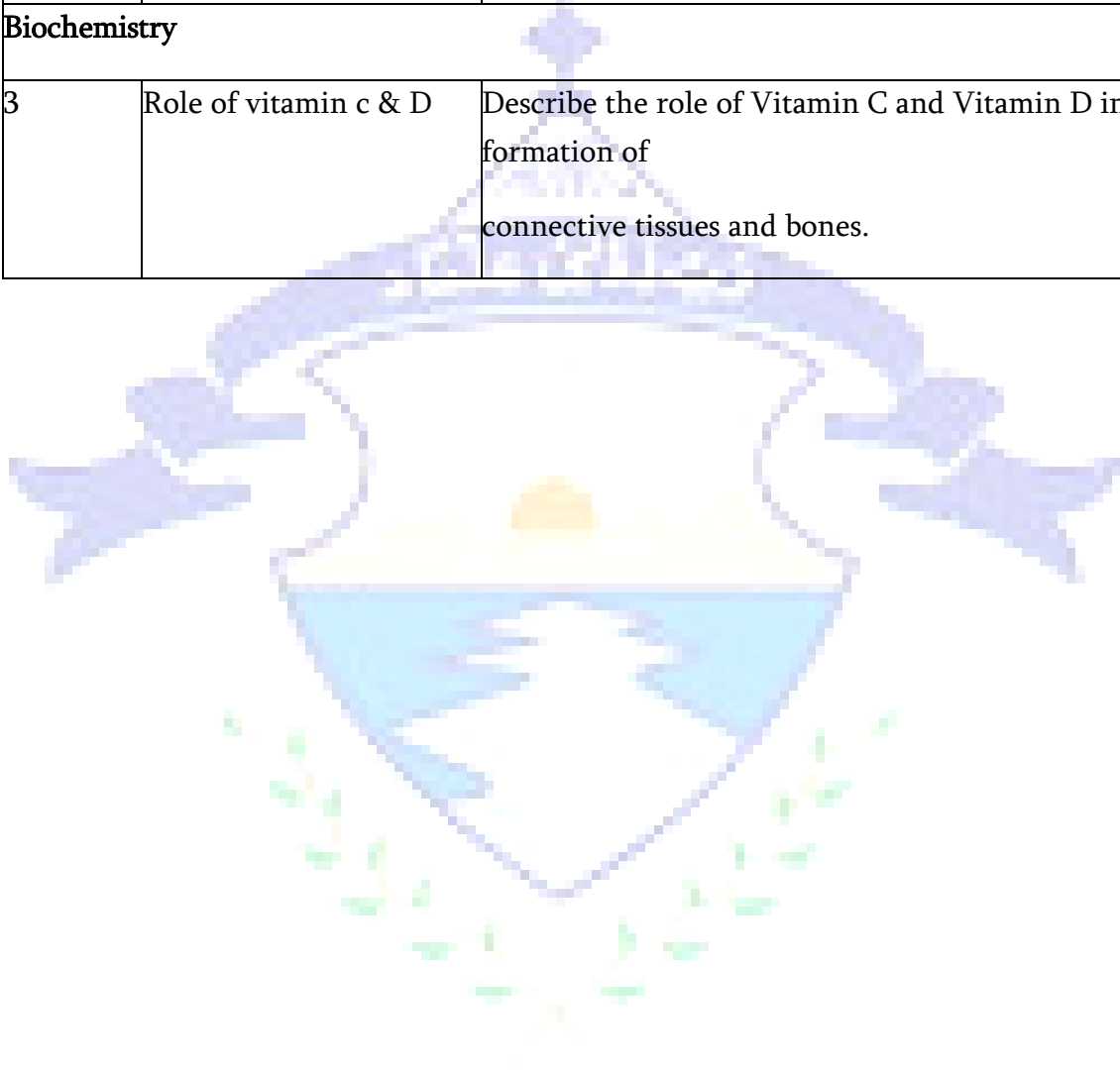
23	Salt Saturation Test	Perform Salt Saturation Test
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MUSCULOSKELETAL SYSTEM THEME 4

Bony Arches and fracture of the foot

SNO	Topic	Learning Outcome
ANATOMY		
1	Muscles and neurovascular supply of the foot	<p>Describe the dorsal muscles of foot.</p> <p>Describe the origin and insertion of planter muscles of foot.</p> <p>Describe their nerve supply and actions.</p> <p>Describe vascular and nervous supply of sole and dorsum of foot Describe their course through foot</p> <p>Describe relationships</p> <p>Identify and describe the salient features of the bone of foot</p> <p>Identify the attachments to the bone of the foot</p> <p>Describe the surface anatomy of foot Describe the radiological anatomy of foot Describe the applied anatomy of foot</p>
2	Arches of foot	<p>Describe the arches of foot</p> <p>Describe the factors responsible for their maintenance of the arches of the foot</p> <p>Recognize the injury when it occurs and be able to evaluate plantar fasciitis.</p> <p>Describe about counseling regarding the rehabilitation for</p>

		plantar fasciitis
Biochemistry		
3	Role of vitamin c & D	Describe the role of Vitamin C and Vitamin D in the formation of connective tissues and bones.



MUSCULOSKELETAL SYSTEM THEME 4

Bony Arches and fracture of the foot

SNO	Topic	Learning Outcome
ANATOMY		
1	Muscles and neurovascular supply of the foot	<p>Describe the dorsal muscles of foot.</p> <p>Describe the origin and insertion of planter muscles of foot.</p> <p>Describe their nerve supply and actions.</p> <p>Describe vascular and nervous supply of sole and dorsum of foot Describe their course through foot</p> <p>Describe relationships</p> <p>Identify and describe the salient features of the bone of foot</p> <p>Identify the attachments to the bone of the foot</p> <p>Describe the surface anatomy of foot Describe the radiological anatomy of foot Describe the applied anatomy of foot</p>
2	Arches of foot	<p>Describe the arches of foot</p> <p>Describe the factors responsible for their maintenance of the arches of the foot</p> <p>Recognize the injury when it occurs and be able to evaluate plantar fasciitis.</p> <p>Describe about counselling regarding the rehabilitation for plantar fasciitis</p>
Biochemistry		
3	Role of vitamin c & D	Describe the role of Vitamin C and Vitamin D in the

		formation of connective tissues and bones.
4	Iodine in Biology	Discuss RDA, serum Levels Iodine Enlist sources of Describe functions Discuss absorption excretion, Describe disorders related to increase and decrease in amount of Iodine
PATHOLOGY		
5	introduction to Bone pathology	Define and differentiate osteopenia, osteoporosis, osteomalacia Define osteomyelitis Enlist various forms of arthritis
Forensic Medicine		
6	Injury	Define injury on medico legal basis. Classify injury. Define mechanical injury Classify mechanical injury Describe mechanisms of injury. Interpret the nature (manner) of injury.
7	Wound	Define wound. Define hurt. Identify factors affecting appearance of wound

MUSCULOSKELETAL SYSTEM THEME 4

Bony Arches and fracture of the foot

SNO	Topic	Learning Outcome
ANATOMY		
1	Typical spinal nerve	<p>Define a spinal nerve.</p> <p>Recognize the spinal nerve as a part of PNS. Enumerate the spinal nerves in different regions Identify their location and site of emergence.</p> <p>Identify various components of a typical spinal nerve. Recall the fate of rami.</p> <p>Associate the rami communicans with typical spinal nerve Recall the distribution of gray rami</p>
2	Vertebral column	<p>Describe the muscles of back (origin, insertion, nerve supply, blood supply, and action) Describe Surface anatomy of important muscles</p> <p>Identify structures on CT/MRI of vertebral column taken at various levels</p> <p>Describe clinical anatomy of important muscles</p>
3	Lumbo sacral plexus, cutaneous nerves	<p>Describe the formation of lumbar Plexus.</p> <p>List the branches of lumbar plexus with their root values. Describe relation of the nerves with Psoas major muscle. List the structures supplied by lumbar plexus.</p> <p>Describe the formation of sacral plexus.</p> <p>Describe the composition and relations of sacral plexus. List the branches of this plexus</p>

Biochemistry		
4	Phosphorus and Magnesium in biology	<p>Discuss RDA, serum Levels</p> <p>Enlist sources of Phosphorus and Magnesium Describe functions</p> <p>Discuss absorption excretion,</p> <p>Describe disorders related to increase and decrease in amount of Phosphorus and Magnesium</p>
5	Sulphur in biology	<p>Discuss RDA, serum Levels Enlist sources of Sulphur</p> <p>Describe functions of Sulphur</p> <p>Discuss absorption excretion of Sulphur</p> <p>Describe disorders related to increase and decrease in amount of Sulphur</p>
6	Copper and cobalt in biology	<p>Discuss RDA, serum Levels Copper and cobalt Enlist sources of Copper and cobalt</p> <p>Describe functions Copper and cobalt</p> <p>Discuss absorption excretion, Copper and cobalt</p> <p>Describe disorders related to increase and decrease in amount of Copper and cobalt</p>
Community Medicine		
7	Back pain	<p>Explain the causes of low back pain</p> <p>Describe the prevention of low back pain</p> <p>Describe the causes & prevention of msk related to child labor</p>

MUSCULOSKELETAL SYSTEM THEME 5

Muscle weakness and fatigue

SNO	Topic	Learning Outcome
Physiology		
1	Physiologic anatomy of the skeletal muscle fiber	<p>Explain the physiologic anatomy of the skeletal muscle fiber.</p> <ul style="list-style-type: none"> • Skeletal muscle fiber • Sarcolemma • Myofibrils • I band • A band • Z disk • M line • Sarcomere • Titin microfilament molecules • Sarcoplasm • Sarcoplasmic reticulum
2	Characteristics of whole muscle contraction	<p>Identify the characteristics of whole muscle contraction.</p> <p>Compare isotonic and isometric exercises.</p> <p>Compare and contrast slow and fast muscle fibers. Describe the mechanics of skeletal muscle contraction. Describe muscle tone and muscle fatigue.</p> <p>Describe lever systems of the body and positioning of a body part.</p>

		Describe remodeling of muscle to match function.
3	Neuromuscular junction	Describe the transmission of impulses from nerve endings to skeletal muscle fibers.
		Explain the physiologic anatomy of the neuromuscular junction
4	Neuromuscular Transmission	<p>Explain the mechanism of transmission of impulses from nerve endings to muscle fibers</p> <p>Explain Formation and Secretion of acetylcholine at nerve terminals</p> <p>Describe Action of acetylcholine at postsynaptic membrane</p> <p>Describe Degradation/Destruction of released acetylcholine</p> <p>Describe End plate potential</p> <p>Describe Fatigue of junction</p>
5	Neuromuscular drugs	<p>Describe the physiologic basis of the drugs used in the neuromuscular disorders (Drugs that enhance or block the transmission at neuromuscular junction)</p> <p>Enlist the excitatory and inhibitory transmitter substances secreted at the smooth muscle neuromuscular junction</p> <p>Drugs that stimulate the muscle fiber by acetylcholine like action</p> <p>Drugs that stimulate neuromuscular junction by inactivating acetyl cholinesterase</p> <p>Drugs that block transmission at the neuromuscular junction</p> <p>Enlist the excitatory and inhibitory transmitter substances secreted at the smooth muscle neuromuscular junction</p>
6	Myasthenia gravis	Describe the pathophysiology of myasthenia gravis

7	Smooth muscle	<p>Classify smooth muscles</p> <p>Describe the physiologic anatomy of the smooth muscle neuromuscular junction</p>
8	Skeletal Muscle fiber	<p>Discuss in detail types of muscles and arrangement of skeletal muscle fibers.</p>
9	Contraction of smooth muscle	<p>Describe the contractile mechanisms in smooth muscles</p> <p>Describe excitation and contraction of smooth muscle.</p> <p>Identify the types of smooth muscles.</p> <p>Describe the chemical and physical basis for smooth muscle contraction.</p> <p>Compare smooth and skeletal muscle contraction.</p> <p>Chemical basis of smooth muscle contraction</p> <p>Physical basis of smooth muscle contraction</p>
		<p>Explain how the calcium ions regulate the contraction.</p> <p>Regulation of smooth muscle contraction by the calcium ions Enlist the excitatory and inhibitory transmitter substances secreted at the smooth muscle neuromuscular junction</p>
10	Nervous and hormonal control of smooth muscle contraction	<p>Describe the nervous and hormonal control of smooth muscle contraction</p>
11	Resting Membrane Potential	<p>Enumerate the intracellular and extracellular concentrations of sodium, potassium, chloride and calcium ions in a resting/normal cell.</p> <p>Describe the characteristics of major membrane ion channels and their role in the membrane potential</p> <p>Describe the resting membrane potential in a cell/nerve</p>

		fiber
12	Muscle Remodeling	<p>Describe</p> <ul style="list-style-type: none"> • Muscle hypertrophy • Muscle atrophy • Muscle hyperplasia • Rigor mortis • Muscle dystrophy • Recovery of muscle contraction in poliomyelitis
13	Membrane potentials and action potentials in smooth muscles	<p>Describe the membrane potentials and action potentials in smooth muscles.</p> <p>Describe Spike potentials</p> <p>Describe Action potentials with plateaus</p> <p>Describe Role of calcium channels in generating the smooth muscle action potential</p> <p>Describe Slow wave potentials</p> <p>Describe Excitation of visceral smooth muscle by muscle stretch Describe Depolarization of multi-unit smooth muscle without action potentials</p>
14	Control of smooth muscle contraction	Describe the mechanism nervous, hormonal and local control of smooth muscle contraction.
15	Smooth muscle and skeletal muscle contraction	Compare the smooth muscle contraction and skeletal muscle contraction
16	Skeletal muscle contraction	<p>Describe the three sources of energy for muscle contraction</p> <p>Compare isometric and isotonic contractions</p> <p>Compare characteristics of fast and slow muscle fibers.</p> <p>Sources of energy for muscle contraction</p>

		Compare isometric and isotonic contractions Compare characteristics of fast and slow muscle fibers
Biochemistry		
17	Hormonal regulation	Explain the hormonal regulation of calcium and phosphorous to maintain musculoskeletal system
18	Sodium, potassium and chlorine in biology	Discuss RDA, serum Levels Enlist sources of Sodium, Potassium and chlorine, Describe functions Discuss absorption excretion, Describe disorders related to increase and decrease in amount of Sodium, Potassium and chlorine
19	Calcium in Biology	Discuss RDA, serum Levels Enlist sources of Calcium Describe functions Discuss absorption excretion, Describe disorders related to increase and decrease in amount of Calcium
20	Fluoride and Lithium in biology	Discuss RDA, serum Levels Fluoride Enlist sources of Fluoride Describe functions Discuss absorption excretion, Describe disorders related to increase and decrease in amount of Fluoride Brief description on role of lithium in biology
21	Molybdenum, Selenium, Zinc, chromium, manganese, silicon, vanadium in biology	Enlist sources of Molybdenum, Selenium, Zinc, chromium, manganese, silicon, vanadium Describe functions Molybdenum, Selenium, Zinc, chromium, manganese, silicon, vanadium Discuss absorption excretion of Molybdenum, Selenium, Zinc, chromium, manganese, silicon, vanadium

		Describe disorders related to increase and decrease of the said elements
22	Toxic elements	Discuss different effects of toxic elements (Aluminum , Arsenic, Antimony, Boron, Bromine, Cadmium, Cesium, Germanium, Lead, Mercury, Silver, Strontium)
Pharmacology		
23	Drug used in MSK	Define & classify NSAIDS Classify neuromuscular blocking agents. Enlist more most comomly used analgesia aspirin , ibuprofen , diclofenac, paracetamol, COX-2 Salicox Classify corticosteroids
Community Medicine		
24	MSK diseases	Explain the risk factors for different types of msd's Describe the preventive measures for different types of risk factors formsd's
25	Epidemiology and prevention of MSD	Describe work related msd's Identify risk factors of msd at workplace. Describe prevention of exposure to risk factors related to workplace Describe the preventive strategies and safety guidelines in order to reduce the incidence of msds related to work place. Describe the burden /epidemiology of work related msd's Describe application of ergonomics in the prevention of work related msd's

Cardiovascular System

General Learning Outcomes

By the end of this module the students should be able to;

Knowledge

- 1) Describe the structure and surface markings of the heart, valves and great vessels
- 2) Describe the steps of development of the heart
- 3) Describe the steps of development of arterial, venous and lymphatic system
- 4) Describe the conduction system of the heart
- 5) Describe the anatomy of valves of the heart
- 6) Describe the microscopic structure of myocardium, and blood vessels
- 7) Describe the cardiac cycle
- 8) Discuss cardiac output, and venous return
- 9) Discuss blood pressure and its regulation
- 10) Discuss coronary circulation and diseases associated with it
- 11) Describe the mechanisms and types of circulatory shock and associated compensatory mechanisms
- 12) Describe the anatomy and common pericardial diseases
- 13) Describe the cardiac enzymes
- 14) Discuss the hyperlipidemias and the roles lipoproteins and cholesterol in the development of atherogenesis
- 15) Describe the mechanisms of impulse generation, conduction and excitation of myocardium
- 16) Discuss normal ECG and common ECG abnormalities
- 17) Enlist the drugs used in ischemic heart disease and hyperlipidemias

Cardiovascular System THEME 1

Chest Pain

Anatomy

#	Topic	Learning objectives
1	Surface anatomy	Describe the surface marking of the heart
2		Describe the surface marking of the heart valves
3		Illustrate the surface marking of the aorta on models / x-rays
4		Describe the surface marking of the superior vena cava
5		Describe the surface marking of the inferior vena cava
6		Describe the gross structure of the heart
7	Coronary circulation	Describe the coronary arteries
8		Enlist the branches of each main artery
9		Describe the anastomosis of coronaries
10		Identify the area of the heart supplied by a coronary artery and its branches
11		Describe the venous drainage of the heart
12		Describe the lymphatic drainage of the heart
12	Pericardium	Define pericardium
14		Describe different reflections of pericardium
15		Identify entry & exit of vessels of heart via pericardium

16		Define the following clinical condition; pericarditis pericardial effusion cardiac Tamponade
Histology		
17	Histology of heart muscles	Explain the characteristics of cardiac muscle cell
18		Explain the Structure of Intercalated disc
19		Define the junctional specializations making up the intercalated disk
20		Describe identification of different microscopic views of Cardiac muscle and its ultra-structures
21		Differentiate histologically between cardiac and skeletal muscle and smooth muscles
22		Enumerate histological layers of heart wall
Physiology		
23	Cardiac muscles	Explain the physiologic anatomy of the cardiac muscle
24		Describe the properties of the cardiac muscle
25	Coronary circulation	Describe the physiologic basis coronary circulation
26		Describe the steps of coronary thrombosis
27		Describe the etiology of coronary thrombosis
Biochemistry		
28	Cardiac enzymes	Identify the enzymes that increase in myocardial infarction
29	Lipids and cholesterol	Describe the Chemical Structure and function of cholesterol
30		Describe the fate of cholesterol in the body

31	Define and Classify lipids
32	Describe the metabolism of adipose tissue and role of brown adipose tissue
33	Describe the functions of lipids in the body
34	Classify lipoproteins and their functions
35	Describe the Synthesis of fatty acids, tri-acyl glycerol and phospholipids
36	Describe the process of Ketone bodies production and utilization
37	Describe the chemistry and metabolism of lipoproteins and the associated clinical disorders
38	Classify hyperlipidemias
39	Describe the metabolism of cholesterol in the body
40	Enlist the factors affecting cholesterol levels and synthesis
41	Describe hypercholesterolemia and its causes
42	Describe Cardiac enzymes and their pattern of elevation in ischemic heart diseases
43	Describe the sources and fate of acetyl-CoA in the body
44	Describe the mechanism of formation of fatty acids in the body
45	Define and classify lipid storage diseases
46	Describe Lipid profile and values
47	Describe the role of Na, K, Ca and Mg in cardiac muscles contractility and their biochemical abnormalities
48	Describe the cardiac manifestations of vitamin B1 deficiency

Pharmacology		
49		Enlist the groups of drugs used in the treatment of CAD (angina and MI)
50		Enlist the groups of lipid lowering drugs
Pathology		
51		Describe the risk factors, and lab. Diagnosis of CAD
52		Define and Enlist the stages of atherosclerosis
Forensic medicine		
53		Describe the medicolegal aspects of sudden death due to cardiovascular diseases
Community Medicine		
54	Prevention of CVD	Describe primordial, primary, secondary and tertiary prevention of CV diseases in community
Cardiovascular System THEME 2		
Breathlessness and ankle swelling		
Embryology		
55	Fetal circulation	Describe the physiological changes in circulation after birth
56	Cardiac developmental anomalies	Enlist the developmental anomalies of heart
		Describe the congenital anomalies of the heart. ASD
		VSD PDA
		Tetrology of fallot
		transposition of the great vessels
		Hemangiomas and Telegactesias

Physiology		
58	Cardiac cycle	Describe the Cardiac cycle
59		Describe the concept of systole and diastole,
60		Describe the role of atria and ventricles as pumps,
61		Describe the functions of heart valves,
62		Correlate the cardiac cycle events with ECG
63		Describe the mechanism of production of normal and abnormal heart sounds
64		Relate heart sounds with cardiac cycle,
65		Describe the metabolism and oxygen utilization of cardiac muscle
66		Describe the regulation of cardiac cycle
67	Cardiac output	Describe pressure volume loop (end-systolic volume / end-diastolic volume / ejection fraction / systolic volume / systolic work output)
68		Explain the Frank-Starling mechanism of the heart for the control of cardiac output by venous return
69		Describe the methods for measuring of cardiac output
70		Describe normal cardiac output and venous return during rest and during activity
71		Enlist the causes of abnormally high and abnormally low cardiac output
72		Explain the mechanisms of normal cardiac contractility and the role of calcium ion/ ATPase pumps
73		Explain cardiac output (regulation/measurement) and

		peripheral resistance and its regulation
74		Explain the factors regulating cardiac output and venous return.
75	Blood flow	Describe the Biophysics and Interrelationships of Pressure, Flow, and Resistance in terms of Ohm's law and Poiseuille's Law
76		Describe Starling forces
77		Describe regulation of blood flow
78		Define basal tone.
79		List several substances potentially involved in local metabolic control of vascular tone.
80		State the local metabolic vasodilator hypothesis.
81		Describe physiological Vasodilators and Vasoconstrictors and their mechanisms
82		Describe the factors affecting the local blood flow including auto-regulation.
83		Describe the function of capillaries
84		Describe circulatory changes during exercise
85		Describe blood flow to different organs like brain, heart, liver and skin during exercise
86	Functions of heart valves	Describe the functions of mitral, tricuspid, aortic and pulmonic valves
87		Describe the hemodynamics and sequel related to stenosis and regurgitation of heart valves
88	Lymphatic system	Describe the function of lymphatic system in the

		maintenance of interstitial fluid volume.
89		Describe the effects of Interstitial Fluid Pressure on Lymph Flow.
90		Describe how changes in capillary hydrostatic pressure, plasma oncotic pressure, capillary permeability, and lymphatic function can lead to tissue edema
91	Heart failure	Define Heart failure
92		Differentiate between right-sided Heart failure and left-sided heart failure
<p style="text-align: center;">Cardiovascular System THEME 3</p> <p style="text-align: center;">Blood Pressure</p>		
Anatomy		
93	Histology of blood vessels	Describe the histological composition of vessel

94		Describe the microscopic structure of artery and vein
95		Differentiate histologically between artery and vein under light microscope
96		Describe the histological composition of lymphatic channels
Embryology		
97	Development of arteries and veins	Describe the development of arterial system
98		Describe the development of venous system
99		Describe the congenital abnormalities in in the vessels. - Coarctation of Aorta
Physiology		
100	Blood Pressure	Define blood pressure
101		Describe the causes of High / low BP
102		Discuss the mechanisms for rapid and long term control of blood pressure (including Renin Angiotensin system)
103		Describe the effects of sympathetic and parasympathetic stimulation on the heart and circulation
104	Circulatory Shock	Define Circulatory Shock
105		Explain the physiologic causes of circulatory shock
106		Explain the stages of circulatory shock
107		Describe cardiogenic shock
108		Describe Hemorrhagic Shock
109		Describe of Neurogenic Shock
110		Describe Anaphylactic Shock

111		Describe Septic Shock
112		Explain the physiology of treatment in Shock
Pharmacology		
113		Describe the mechanisms of drugs used in the treatment of Hypertension
Community medicine		
114		Describe the preventive strategies of hypertension



Cardiovascular System THEME 4		
Palpitations		
Anatomy		
115	Conduction system of the heart	Describe the different components of conduction system <ul style="list-style-type: none"> • SA Node • AV Node • Bundle of His • Purkenje Fibers • Bundle branches
116		Describe the sympathetic innervation of heart
117		Describe the parasympathetic innervation of the heart
Physiology		
118	Excitation and contraction of cardiac muscles	Describe the excitation–contraction process in cardiac muscle. Describe Chronotropic, Inotropic and Dromotropic Effects
119		Describe Chronotropic, Inotropic and Dromotropic Effects
120		Differentiate excitation–contraction process in cardiac and skeletal muscle cells
121		Describe gap junctions and the significance of functional syncytium
122		Explain phases of cardiac muscle action potential
123		Describe the characteristics of cardiac action potentials and the role of “slow calcium” channels in causing plateau and its significance

124		Describe the significance of AV nodal Delay
125		Define Pacemaker and explain why SA node is the normal pacemaker of the heart
126		Define Ectopic Pacemaker and describe its causes
127		Describe the effects of sympathetic and parasympathetic stimulation on the heart rate and conduction of cardiac action potentials
128		Define various types of refractory periods
129		Differentiate the refractory period of cardiac muscle with that of skeletal muscle
130		Describe the significance of prolonged action potential in cardiac muscle
131		Describe the physiological anatomy of the sinus node
132		Define automaticity and rhythmicity and conductivity
133		Describe the specialized excitatory and conductive pathway of the cardiac muscle tissue
134	ECG	Describe the characteristics of normal ECG, time duration of waves, segments and voltages
135		Explain how to record ECG
136		Describe the AV nodal, ventricular impulse conduction
137		Interpret ECG paper and its calibration
Community Medicine		
138	CVD prevention	Identify the major risk factors which contribute to common diseases of the cardiovascular system
139		Enumerate modifiable and non-modifiable risk factors of CV

	diseases
140	Apply primordial, primary, secondary and tertiary prevention of CV diseases in community
Psychomotor domain	
Chest Pain	Identify the heart & its coverings in the model / dissected specimen
Anatomy	Identify the heart and major blood vessels in cadaver/dissected specimen
	Identify the chambers of the heart.
	Identify the internal structures of various chambers of the heart.
	Identify the Cardiac Muscle under the microscope
Chest Pain	Perform basic life support. (Important)
Physiology	
Blood Pressure	Identify salient features of a medium sized artery & vein in a cross-section under microscope.
	Identify the histological differences between medium size artery& vein under microscope.

	Describe the histological differences between large size artery& vein.
Breathlessness and ankle swelling Clinical	<p>10- Identify normal cardiac shadow, borders and cardiomegaly on chest radiographs.</p> <p>11- Identify the position of borders and valves of the heart by surface marking on model / simulator</p> <p>12- Palpate and find apex beat, and auscultatory areas in the chest of the subject provided and describe their significance.</p> <p>13- Demonstrate the use of Stethoscope for Auscultation.</p> <p>14- Differentiate between normal and displaced apex beat</p>
Physiology	<p>15- Measure the blood pressure.</p> <p>16- Measure the effect of posture and exercise on blood pressure.</p> <p>17- Examine the arterial pulses.</p> <p>18- Auscultate the heart sounds.</p>
Palpitations	19- Perform systematic analysis of ECG
Affective domain	

PRIME	<p>20- Demonstrate ability to give and receive feedback, respect for self and peers.</p> <p>21- Carry out practical work as instructed in an organized and safe manner</p> <p>22- Demonstrate empathy and care to patients.</p> <p>23- Develop respect for the individuality and values of others - (including having respect for oneself) patients, colleagues and other health professionals</p> <p>24- Organize& distribute tasks</p> <p>25- Exchange opinion & knowledge</p> <p>26- Develop communication skills and etiquette with sense of responsibility.</p> <p>27- To equip themselves for teamwork</p> <p>28- Regularly attend the classes</p> <p>29- Role play for the counseling of patients with risk factors for coronary heart diseases on modification of life style</p> <p>30- Role play for the counseling of patients with risk factors for coronary heart diseases on modification of life style</p>
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Respiratory System

General Learning Outcomes

By the end of this module the students should be able to;

- 1- Describe the anatomy and abnormalities of thoracic cage
- 2- Describe the development and gross anatomy of the diaphragm
- 3- 3- Describe the contents of mediastinum and their relations
- 4- Describe the anatomy of pleura and its reflections
- 5- Describe the gross and microscopic structure, development, nerve supply and blood supply of trachea, bronchi and lungs
- 6- Describe the epithelia and connective tissues lining the respiratory passageways.
- 7- Describe pulmonary ventilation
- 8- Discuss the mechanisms of gaseous exchange between alveoli, and blood and blood and tissues
- 9- Elaborate the transport of gases in the blood
- 10- Describe the mechanisms of regulation of respiration
- 11- 11- Define hypoxia, and cyanosis
- 12- Describe the effect of aging on respiratory system
- 13- 13- Describe glycolysis
- 14- Describe the processes of kreb`s cycle
- 15- Describe the mechanisms of biologic oxidation
- 16- Describe the mechanisms of energy production in the body
- 17- Describe the mechanisms of O₂ and CO₂ transport in the blood
- 18- Classify anti-asthmatic and anti-tuberculous drugs
- 19- Describe the types and signs of asphyxia

20- Enlist the causes and signs of pneumonias, bronchial asthma, tuberculosis, Acute Respiratory Distress Syndrome (ARDS), and pulmonary edema

21- Describe the parameters of Pulmonary Function Tests (PFTs)



Respiratory System THEME 1

Chest wall injuries

#	Topic	Learning objectives
Anatomy		
1	Gross anatomy of thorax	Describe main features of thoracic wall
2		Describe the location and shape of the sternum
3		Describe the parts of the sternum
4		Describe the articulations and muscle attachments
5		Describe the gross features of the thoracic vertebrae <ul style="list-style-type: none"> a. Vertebral body b. Intervertebral disc c. Laminae d. Pedicles e. Intervertebral foramina f. Processes g. Ligaments
6		Differentiate between typical and atypical ribs.
7		Describe different joints of thorax
8		Discuss Intercostal muscles
9		Discuss the contents of intercostal spaces
10		Describe the origin of intercostal arteries
11		Describe the origin, course and distribution of intercostal

		nerves
12		Discuss branches and course of internal thoracic artery
13	Abnormalities of thoracic wall	Describe thoracic wall abnormalities and its clinical correlation
14	Diaphragm	Describe the origin and insertion of the diaphragm
15		Describe the openings of the diaphragm
16		Describe the nerve supply of diaphragm and its clinical significance
17	Mediastinum	Describe the contents of the superior mediastinum
18		Describe the contents of the Anterior & Posterior Mediastinum
19		Describe the relations of different contents in mediastinum
20		Identify various anatomical landmarks on chest X-Rays, CT and MRI
Embryology		
21	Development of Diaphragm	Describe development of diaphragm
22		Describe diaphragmatic hernias and clinical significance
23	Development of Ribs	Describe the development of ribs from costal elements of primitive vertebrae
Physiology		
24	Mechanics of Respiration	Describe the mechanics of respiration
25		Describe the pressures that cause the movements of the air in and out of the lungs
26	Lung compliance	Define compliance of the lung and elastic recoil
27		Identify two common clinical conditions in which lung

		compliance is higher or lower than normal.
28	Lung volumes and capacities	Describe changes in the lung volume, alveolar pressure, pleural pressure, and trans-pulmonary pressure during normal breathing
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38		Describe Broncho-pulmonary segments and their clinical importance
39		Describe innervations, blood supply and lymphatic drainage of the lungs.
Embryology		
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Histology		
46	Respiratory epithelium and connective tissues	Classify the types of epithelia lining the various parts of respiratory system
47		Differentiate between the histological differences among various parts of respiratory system
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49		Discuss the microscopic picture of respiratory bronchiole, alveolar ducts, alveolar sacs and alveoli.
50		Describe the different types of cells found in alveoli
Physiology		
51	Functions of respiratory	Describe the respiratory and non-respiratory functions of the

	passageways	respiratory passageways
52		Identify the mechanism by which particles are cleared from the airways.
Pharmacology		
53	Anti-Asthmatic drugs	Enlist Anti-asthmatic drugs
54	Anti-Tuberculous drugs	Classify Anti-tuberculous drugs
Pathology		
55	Pneumonias	Define pneumonia and enlist the causative pathogens of pneumonia
56	Pulmonary Tuberculosis	Define primary and secondary Tuberculosis and state its etiology
57	Bronchial Asthma	Describe the etiology, pathogenesis and clinical features of asthma
58	Pulmonary Edema	Define pulmonary edema and classify it according to underlying causes
Community Medicine		
59	Prevention of Respiratory disorders	Discuss preventive strategies of different problems related to respiratory system
60		Discuss the relationship of smoking with lung Diseases
61		Describe preventive strategies for smoking
Respiratory System THEME 3		
Breathlessness		
Anatomy		
62	Mechanics of respiration	Describe briefly mechanics of respiration

63	Pleura	Describe the gross features of pleura
64		Describe the pleural cavity and the pleural reflections
65		Describe the surface anatomy related to pleural reflections
Embryology		
66		Describe the development of pleural cavity
Histology		
67		Discuss surfactant, alveolar septum, alveolar pores and alveolar macrophages
Physiology		
68	Pulmonary ventilation	Define respiration
69		Compare between the internal and external respiration
70		Enlist the steps of external respiration accomplished by the respiratory system and those carried out by the circulatory system
71		State the functions of Type I alveolar cells, Type II alveolar cells, and alveolar macrophages
72		Describe the forces that keep the alveoli open and those that promote alveolar collapse.
73		Define the following terms: anatomic dead space, physiologic dead space, wasted (dead space) ventilation, total minute ventilation and alveolar minute ventilation.
74		Compare anatomic and physiologic dead space
75		Describe the basic concept of measurement of dead space
76		Enlist the factors that changes the dead space

77		Define the following terms: hypoventilation, hyperventilation, hypercapnea, eupnea, hypopnea, and hyperpnea.
78		Define surface tension, surfactants, atelectasis
79		Describe the role of surfactants on the lung compliance.
80		Describe the composition of the pulmonary surfactants and its role
81		Describe the pathophysiology of respiratory distress syndrome of the newborn
82		Discuss the work of breathing
83	Pulmonary circulation	Explain the physiologic anatomy of the pulmonary circulatory system
84		Describe the pressures in the pulmonary circulatory system
85		Describe blood volume of the lungs
86		Describe blood flow through the lungs and its distribution
87		Compare the systemic and pulmonary circulations with respect to pressures, resistance to blood flow, and response to hypoxia.
88		Describe the regional differences in pulmonary blood flow in an erect position.
89		Describe the consequence of hypoxic pulmonary vasoconstriction on the distribution of pulmonary blood flow.
90		Describe the pulmonary capillary dynamics
91		Describe the development of pulmonary edema
92	Gas exchange	List the normal airway, alveolar, arterial, and mixed venous PO ₂ and PCO ₂ values.

93		List the normal arterial and mixed venous values for O ₂ saturation, [HCO ₃ ⁻]
94		List the factors that affect diffusive transport of a gas between alveolar gas and pulmonary capillary blood.
95		Describe respiratory unit
96		Describe the physiologic anatomy of the respiratory membrane and its significance
97		Describe the factors that affect the rate of gaseous diffusion through the respiratory membrane
98		Describe the diffusing capacity of respiratory membrane for O ₂ and CO ₂ at rest and exercise.
99		Describe the effect of ventilation/perfusion (V/Q) ratio on alveolar gas concentrations.
100		Identify the average V/Q ratio in a normal lung.
101		Explain the concept of physiologic shunt and physiologic dead space
102		Describe the abnormalities of ventilation perfusion ratio in normal lung and chronic obstructive lung disease.
103		Enlist common causes of hypoxemia
104	Transport of O ₂ and CO ₂ in the blood	Define oxygen partial pressure (tension), oxygen content, and percent hemoglobin saturation as they pertain to blood.
105		Describe Oxyhemoglobin dissociation curve (hemoglobin oxygen equilibrium curve) showing the relationships between oxygen partial pressure, hemoglobin saturation, and blood oxygen content.
106		Describe the relative amounts of O ₂ carried bound to hemoglobin with that carried in the dissolved form.

107		State Henry's Law (the relationship between PO ₂ and dissolved plasma O ₂ content)
108		Describe how the shape of the oxyhemoglobin dissociation curve influences the uptake and delivery of oxygen.
109		Define P ₅₀ .
110		Describe how the oxyhemoglobin dissociation curve is affected by changes in blood temperature, pH, PCO ₂ , and 2,3-DPG.
111		Describe how anemia and carbon monoxide poisoning affect the shape of the oxyhemoglobin dissociation curve, PaO ₂ , and SaO ₂ .
112		List the forms in which carbon dioxide is carried in the blood.
113		Describe the percentage of total CO ₂ transported as each form.
114		Describe the chloride shift and its importance in the transport of CO ₂ by the blood.
115		Describe the enzyme that is essential to normal carbon dioxide transport by the blood and its location.
116		Describe the carbon dioxide dissociation curves for oxy- and deoxyhemoglobin.
117		Describe the interplay between CO ₂ and O ₂ binding on hemoglobin that causes the Haldane effect.
118	Regulation of Respiration	Describe the regions in the central nervous system that play important roles in the generation and control of cyclic breathing.
119		Give three examples of reflexes involving pulmonary receptors that influence breathing frequency and tidal volume. Describe the receptors and neural pathways involved.

120		List the anatomical locations of chemoreceptors sensitive to changes in arterial PO ₂ , PCO ₂ , and pH that participate in the control of ventilation. Identify the relative importance of each in sensing alterations in blood gases.
121		Describe how changes in arterial PO ₂ and PCO ₂ alter alveolar ventilation, including the synergistic effects when PO ₂ and PCO ₂ both change.
122		Describe the significance of the feedforward control of ventilation (central command) during exercise, and the effects of exercise on arterial and mixed venous PCO ₂ , PO ₂ , and pH.
123		Describe voluntary control of respiration
124		Describe the effect of irritant receptors, J-receptors, brain edema and anesthesia on breathing.
125	Common Respiratory abnormalities	Describe periodic breathing and basic mechanism of Cheyne-Stokes breathing
126		Define sleep apnea
127		Describe the pathophysiology of Obstructive sleep apnea and central sleep apnea.
128		Describe the pathophysiology of specific pulmonary abnormalities:
129		Describe hypoxia
130		Describe cyanosis
131		Describe the effect of aging on lung volumes, lung and chest wall compliance, blood gases, and respiratory control.
Biochemistry		
132	Glycolysis	Explain Aerobic and Anaerobic Respiration

133		Define Glycolysis
134		Enlist different enzymes used in Glycolysis
135		Enlist the intermediate compounds of glycolysis
136		Enlist the reversible and irreversible reactions in glycolysis
137		Explain production of Energy
138		Explain Regulation of rate limiting enzymes Hexokinase and glucokinase Phosphofructokinase Pyruvate kinase
139		Explain aerobic regeneration of NAD^+ and Disposal of Pyruvate
140		Describe conversion of carbohydrates into fatty acids and cholesterol
141		Explain conversion of Pyruvate into oxaloacetate for citric acid cycle
142		Describe role of Glycolysis in genetic diseases and cancer.
143	Kreb's cycle	Define Kreb cycle
144		Enlist different enzymes used in Kreb's cycle
145		Enlist the intermediate compounds of Kreb's cycle
146		Describe Sequence of reactions Kreb's cycle
147		Explain substrate level phosphorylation
148		Explain production of Energy in Kreb's cycle
149		Explain the regulation of Kreb's cycle
150		Describe briefly the major pathways converging into Kreb's cycle

151	Biologic oxidation	Define biological oxidation
152		Define redox reactions
153		Describe the structure of Mitochondria
154		Enlist the Functions of Mitochondria
155		Describe Oxidoreductases
156		Describe sources of NADH and FADH ₂
157		Describe Glycerol 3-phosphate Shuttle
158		Describe Malate Shuttle
159		Enumerate different parts enzymes and co-enzymes that carry out biological oxidation
160		Enlist components of each enzyme involved in Biological Oxidation
161		Describe transfer of electron through each complexes
162		Describe the free radicals involved in BO
163	Formation of ATP	Explain Chemiosmosis theory.
164		Describe structure of ATP
165		Describe the mechanism of ATP production by ATP Synthase
166		Describe transfer of protons from Inter mitochondrial membrane to Mitochondrial matrix through ATP Synthase
167		Explain P/O ratio
168		Explain coupling
169		Describe uncoupling along with examples
170		Enumerate the Electron transport chain inhibitors

171		Define respiration and Explain steps of respiration.
172		Define partial pressure and explain its role in the transport of gases according to Dalton's law.
173		Explain various modes of oxygen transport and clinical importance of oxygen.
174		Describe the formation of oxyhemoglobin.
175		Explain Respiratory exchange ratio.
176	O ₂ and CO ₂ transport	Explain oxygen-dissociation curves with various factors affecting oxygen delivery.
177		Describe Bohr effect and its importance.
178		Describe the modes of carbon dioxide transport
179		Explain various modes of oxygen transport
180		Describe in detail all the events occurring at lung site and tissue site including Haldene effect.
181		Explain the chloride shift and its importance.
182		Explain the factors affecting the transport of carbon dioxide transport.
183		Describe the role of Nitrogen in plasma.
184		Explain how free radicals are produced and why oxygen is more prone to produce superoxide radical?
185		Discus various toxic effects of free radicals.
186		Classify antioxidants. How they are produced and discuss its role in combating free radicals.
187		Describe the respiratory control of acid base balance.

188		Role of dipalmitoyl phosphotidyl inositol in infant respiratory syndrome.
Forensic Medicines		
189	Asphyxia	Define Asphyxia
190		Describe different types of Asphyxia
191		Identify classical signs of asphyxia
Medicine		
192	Introduction to Respiratory symptomatology	Enumerate the various symptoms of respiratory disorders
193	PFT`s	Interpret the Pulmonary Function Tests
194	ARDS	Discuss acute lung injury and its correlation Acute Respiratory Distress Syndrome
195		Describe the causes of Acute Respiratory Distress Syndrome
196		Discuss the morphology of Acute Respiratory Distress Syndrome
Psychomotor and Affective domain		
1	Breathlessness Physiology	Draw a normal spirogram, labeling the four lung volumes and four capacities.
2		List the volumes that comprise each of the four capacities.
3		Identify which volume and capacities cannot be measured by spirometry.
4		Define the factors that determine total lung capacity, functional residual capacity, and residual volume.

5		Describe the mechanisms responsible for the changes in those volumes that occur in patients with emphysema and pulmonary fibrosis.
6		Differentiate between the two broad categories of restrictive and obstructive lung disease, including the spirometric abnormalities associated with each category.
7		Examine the chest of the subject
8		Calculate the respiratory rate of the subject
9		Determine the peak expiratory flow (PEF) by peak flow meter
10		Describe the use of inhaler
11		Demonstrate the use of inhaler to the subject
	Cough and Hemoptysis Histology	Identify the various microscopic tissue types in the Respiratory system <ul style="list-style-type: none"> • Epithelium of the respiratory system • Trachea • Bronchi • Bronchioles • Alveoli
20		Identify various anatomical landmarks on chest X-Rays, CT and MRI
Embryology		
21	Development of Diaphragm	Describe development of diaphragm
22		Describe diaphragmatic hernias and clinical significance
23	Development of Ribs	Describe the development of ribs from costal elements of primitive vertebrae

Physiology		
24	Mechanics of Respiration	Describe the mechanics of respiration
25		Describe the pressures that cause the movements of the air in and out of the lungs
26	Lung compliance	Define compliance of the lung and elastic recoil
27		Identify two common clinical conditions in which lung compliance is higher or lower than normal.
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