

Department of Physiology



**Study Guide For
MBBS 1st YEAR**

**Sharif Medical & Dental College,
Lahore**



PREFACE

Study Guide can make a major contribution to learning. They are sometimes likened to a tutor sitting on the student's shoulder-available 24 hours a day to advise the student what he/she should be doing at any stage in their study. Study guides are different from textbooks. They apprise the student at the beginning of an academic session about the course outline, the teaching methodology to be followed throughout the year, learning objectives of each academic activity and the assessment methodology to be followed in an academic session. At SMDC we follow the traditional annual academic schedule in which the subject of Physiology is taught in the First academic year of a medical student. Keeping in view the mission of UHS, Lahore and vision of our institute we have designed a training program which is intensive and at the same time interesting for the young minds. This guide includes details about various teaching activities which are to take place throughout the academic year along with the time allocation of each. A list of lectures to be conducted in this session with names of the instructors is attached. Broad learning outcomes of every section from the course accompanied by specific learning objective of every lecture is also included. A complete list of practical work to be carried out in the laboratory is part of this document. Details of various assessments and testing methodology are included and marks distribution for the subject in the 1st Professional examinations has been given. Names and email contacts of faculty have also been mentioned to foster better interaction between the teacher and the taught. A list of prescribed text and reference books forms part of this study guide. Since this document is the first of its kind we intend to improve upon it in light of the student-feedback every year. We shall be focusing on integrating research and education and the fusion of technology and clinical care in endeavour to produce graduates who can provide cutting edge in healthcare. We shall imbibe in our students the highest values of medical ethics to be exemplary physicians who can be a source of enlightenment for others and be leaders in their fields.

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MBBS, M.Phil

Head of Physiology Department SMDC, Lahore.

Date: 17-08-2021



Vision & Mission University of Health Sciences

Qualitative and Quantitative Revolution in Medical Education and Research through Evolution and thereby improve Health Care delivery to Populace.

UHS shall be innovative global centre of excellence in learning and research, supporting a community of scholars and professionals committed to serving society, promoting the development of students to reach their true potential in becoming competent, ethical, caring and inquiring health professionals for the benefit of the country and the wider world

Mission of SMDC

Sharif Medical & Dental College is dedicated to best serve the nation through preservation and dissemination of advanced knowledge and educating the students by latest trends in learning and research reaching levels pars excellence.

The Institution is committed to provide standardized quality medical education to its students by inculcating professional knowledge, skills and responsibilities in them with the aim of:

- Preparing them as modern physicians having initiative to act as future leaders in their respective fields and becoming lifelong learners.
- Encouraging the spirit of critical thinking through research and publication.
- Building up an understanding of the ethical values compatible with our religion, culture and social norms.
- Developing a sense of being responsible citizens of the society possessing professional competence and instilling in them the values of hard work and dedication thus preparing them to be accountable to the stakeholders and the state.

The Institution is devoted to keep abreast its faculty with the latest trends in Medical Education encompassing teaching/learning methodologies, assessment tools, research opportunities and professionalism to facilitate their professional development, competencies and commitment towards continues learning.

Our patient-centered mission is achieved by outstanding medical care & services in professional practice with due emphasis and focus on our local health needs.

Our mission further elaborate upon establishing academic and research facilities in areas of local demand under global gold standards and leading advancement in research, education & patient care.

Vision

To be recognized for the provision of a safe and functional environment conducive to collaborative teaching & learning, comfortable working atmosphere and conducting world class research through professionalism and excellence.



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PLANNED TEACHING ACTIVITIES FOR 1st YEAR MBBS DEPARTMENT OF PHYSIOLOGY

PMC has allocated 200 hours of teaching in the subject of Physiology for the 1st Year MBBS course. In order to meet this requirement following teaching modules have been planned. These modules have been carefully designed to impart core knowledge of Pharmacology in a manner that an undergraduate student can grasp the subject fully and is adequately prepared for university examinations.

Lectures:

A total of 216 lectures are planned for the entire year. The lectures will be conducted by the Professor, Associate and Assistant Professors or by Senior Demonstrator in the subject of Physiology. The lectures will be interactive and students should actively participate in them to clear their doubts. Interactive lectures using multimedia, white boards will introduce concepts, theories and application of the subject by using relevant examples. The students are required to take notes of the lectures and study the topic with the help of prescribed text books in light of the learning objectives of the topic enunciated by the teacher at the beginning of each lecture.

Class Activities (PBL):

Problems based learning classes will be conducted from time to time throughout the academic year. A clinical scenario with short history will be discussed at the end of relevant topics. Students are exposed to Group Discussion & Q/A Session with teachers in Small Group twice a month. During this time complex concepts and time practical application is further explained.

Practical classes:

Clinical important concepts are augmented by performing practicals in Physiology Lab. Like ECG recording & interpretations and blood pressure recording. One practical class has been planned per week.

Tutorials (SGD):

Important topics of modules taught in lectures & practicals are discussed again for more elaboration in Tutorial Classes. One tutorial class per week is proposed throughout the academic session. The class is divided into 04 batches. Topics for the tutorial will be notified at least one week before the class.

Two instructors, one senior and one junior, will be deputed for every batch on rotation basis. During this interactive session the students must clear their concepts regarding the topic by actively engaging with their respective teachers.

Class Presentations:

Class presentations are conducted in the Tutorials to allow the students to demonstrate the knowledge about an important topic in Physiology and improve their communication skills.

Class Assignments:

Some of the important topics which are core curriculum of the subject are given to the students to prepare their assignments. Grading of these assignments give good feedback to the teachers and prepare the students for university exams.



TRAINING PROGRAM FOR LECTURES
DEPARTMENT OF PHYSIOLOGY
1ST YEAR MBBS CLASS

Human Physiology is the scientific study of different functions of Human body. Human body is incredible in the sense that it is made up of multiple cells that come together to form tissues, organs and various systems. Physiology includes two approaches to explain any event that is normally occurring within the human body; one emphasizes upon the purpose and the other the underlying mechanism. All of the human body systems serve a useful purpose and Physiology helps in determining what mechanistic process will work and be useful under a particular circumstance. So, Physiology explains how the Human body works with all systems working in harmony to maintain a balanced environment in the body during different circumstances.

1. Cell & General Physiology:

S.No	Title of Lectures	Name of Instructor
1	Introduction to Human Physiology	Dr. Sana Javaid
2	Homeostasis	Dr. Sana Javaid
3	Functional Organization Of Cell	Dr. Sana Javaid
4	Genetics and Cell Reproduction	Dr. Sana Javaid

2. Membrane Transport Physiology:

S.No	Title of Lectures	Name of Instructor
1	Structure of Cell Membrane	Dr. Sana Qanber
2	Diffusion	Dr. Sana Qanber
3	Active Transport	Dr. Sana Qanber

3. Nerve & Muscle Physiology:

(i) Nerve Physiology:

S.NO	Title of Lectures	Name of Instructor
1	Neurons & Neuroglia	Dr. Sana Qanber
2	Membrane Potentials & Action Potential	Dr. Sana Qanber
3	Nerve Degeneration & Regeneration	Dr. Sana Qanber
4	Synapses	Dr. Sana Qanber



(ii) Muscle Physiology:

S.NO	Title of Lectures	Name of Instructor
1	Muscle Physiology	Dr. Sana Qanber
2	Functional Organization of Skeletal Muscles	Dr. Sana Qanber
3	Skeletal Muscle Contraction	Dr. Sana Qanber
4	Properties of Skeletal Muscles	Dr. Sana Qanber
5	Neuromuscular Junctions Transmission in Skeletal Muscle	Dr. Sana Qanber
6	Excitation Contraction Coupling in Skeletal Muscles	Dr. Sana Qanber
7	Smooth Muscle & its Types	Dr. Sana Qanber
8	Smooth Muscle Contraction:	Dr. Sana Qanber
9	Properties of Smooth Muscle	Dr. Sana Qanber
10	Action Potential and Neuromuscular Junction in Smooth Muscle	Dr. Sana Qanber
11	Muscle Physiology	Dr. Sana Qanber
12	Functional Organization of Skeletal Muscles	Dr. Sana Qanber

4. Blood Physiology:

S.NO	Title of Lectures	Name of Instructor
1	Red Blood Cells, Anemia and Polycythemia	Prof. Dr. Ghazal Mansoor
2	Plasma Proteins	Prof. Dr. Ghazal Mansoor
3	RBC structure & functions, measurement, metabolism & enzymes	Prof. Dr. Ghazal Mansoor
4	Erythropoiesis	Prof. Dr. Ghazal Mansoor
5	Iron Metabolism	Prof. Dr. Ghazal Mansoor
6	Hb synthesis & types, Hemoglobin paths	Prof. Dr. Ghazal Mansoor
7	Classification of Anemias & different types of Anemia	Prof. Dr. Ghazal Mansoor
8	Types of polycythemia & its effects on body	Prof. Dr. Ghazal Mansoor
9	WBC Classification, structure & functions, Inflammations & lines of Defences	Prof. Dr. Ghazal Mansoor
10	Immunity, Classification Development and Inner Immunity	Prof. Dr. Ghazal Mansoor
11	Cellular Immunity	Prof. Dr. Ghazal Mansoor
12	Humoral Immunity.	Prof. Dr. Ghazal Mansoor
13	ABO Blood Grouping, Rh Blood Grouping, Erythroblastosis, Fetalis, Cross Matching and Blood Transfusion, Hazards of mismatched transfusion	Prof. Dr. Ghazal Mansoor
14	Tissue and Organ Transplant	Prof. Dr. Ghazal Mansoor
15	Details Events of Hemostasis & Blood	Prof. Dr. Ghazal Mansoor



	Coagulation and Blood Coagulation Tests, PT, APTT, INR	
16	Fibrinolytic System, Anticoagulation of Blood in Human Body	Prof. Dr. Ghazal Mansoor
17	Coagulant & Anticoagulant Thromboembolism, DVT	Prof. Dr. Ghazal Mansoor

5. Skin Body Temperature Regulation:

S.NO	Title of Lectures	Name of Instructor
1	Normal Body Temperature, Control of Body Temperature	Dr. Hira Ijaz
2	Sweating and its Regulation	Dr. Hira Ijaz
3	Role of Hypothalamus, Set Point of Temperature Control	Dr. Hira Ijaz
4	Abnormalities of Temperature Regulation:	Dr. Hira Ijaz
5	Structure of Skin & Cutaneous Circulation, Tripe Response	Dr. Hira Ijaz

6. Respiration:

S.NO	Title of Lectures	Name of Instructor
1	Introduction to Respiratory System	Dr. Nazish Jamil
2	Pulmonary ventilation	Dr. Nazish Jamil
3	Mechanics of Respiration	Dr. Nazish Jamil
4	Lung volumes and capacities	Dr. Nazish Jamil
5	Pulmonary Compliance	Dr. Nazish Jamil
6	Respiratory Membrane & Diffusion of Gases	Dr. Nazish Jamil
7	Diffusion of gases & Oxygen transport	Dr. Nazish Jamil
8	Oxygen transport & Dissociation curve	Dr. Nazish Jamil
9	Carbon dioxide transport	Dr. Nazish Jamil
10	Nervous regulation of respiration	Dr. Nazish Jamil
11	Chemical regulation of respiration	Dr. Nazish Jamil
12	Pulmonary circulation and V_a/Q ratio	Dr. Nazish Jamil
13	Hypoxia	Dr. Nazish Jamil
14	Cyanosis/Asphyxia/ Hypercapnia	Dr. Nazish Jamil
15	Respiratory abnormalities	Dr. Nazish Jamil
16	Respiratory adjustment during exercise	Dr. Nazish Jamil
17	Obstructive lung Diseases/ Restrictive lung diseases	Dr. Nazish Jamil



7. Human Responses in Varied Environments:

S.NO	Title of Lectures	Name of Instructor
1	High Altitude physiology	Dr. Nazish Jamil
2	Deep sea physiology	Dr. Nazish Jamil

7. Cardiovascular System (CVS)

(i) Heart:

S.NO	Title of Lectures	Name of Instructor
1.	Physiologic anatomy of heart and cardiac action potential	Dr. Qurat-ul-Ain
2.	Conductive system	Dr. Qurat-ul-Ain
3.	Cardiac cycle	Dr. Qurat-ul-Ain
4.	ECG	Prof. Dr. Ghazal Mansoor
5.	Arrhythmias:	Prof. Dr. Ghazal Mansoor

(ii) Circulation:

S.NO	Title of Lectures	Name of Instructor
1	Hemodynamics of circulation	Dr. Rabia Sattar
2	Control of Local Blood:	Dr. Rabia Sattar
3	Capillary dynamics:	Dr. Rabia Sattar
4	Cardiac output	Dr. Rabia Sattar
5	Venous return	Dr. Rabia Sattar
6	Arterial blood pressure	Dr. Rabia Sattar
7	Cardiac failure	Dr. Rabia Sattar
8	Heart sounds	Dr. Rabia Sattar
9	Circulatory shock:	Dr. Rabia Sattar
10	Effect of exercise on CVS	Dr. Rabia Sattar



**LIST OF LECTURES IN THE SUBJECT OF PHYSIOLOGY AND
THEIR LEARNING OBJECTIVES
DEPARTMENT OF PHYSIOLOGY
1ST YEAR MBBS CLASS**

1. Cell & General Physiology:

Introduction to Human Physiology teaches about the basic knowledge of Human Physiology, its various branches and their importance along with the Cellular Organization starting from unicellular to multicellular level in eukaryotes. Homeostasis deals with the functional harmony of various Human Systems to ensure maintenance of a nearly constant internal environment within the human body. Genetics deal with the basic concepts of Transcription and Translation and Functional Organization explains various cellular organelles and their associated functions.

S.NO	TITLE OF LECTURES WITH LEARNING OBJECTIVES
1	<p>Introduction to Human Physiology: By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Enumerate various branches of Physiology. 2. Define Human Physiology and its basic concept. 3. Explain the Functional Organization of various body systems that make up a human body. 4. Relate the importance of Human Physiology in maintenance of various vital body systems.
2	<p>Homeostasis: By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Define various basic Human Systems. 2. Define External and Internal Environments. 3. Describe the Ionic Compositions of Extracellular and Intracellular Body fluids and their significance. 4. Explain how various systems are working together to maintain a balanced internal environment. <p>1. Explain various Feedback and Feed forward Mechanisms used for</p>
3	<p>Functional Organization Of Cell: By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Define Cell and its various organelles 2. Differentiate and Describe membranous and non membranous organelles 3. Explain structure and functions of various cellular organelles. 4. Describe the processes of vesicular transports, Endocytosis and Exocytosis. 5. Explain the role of cytoskeleton in locomotion of cell.
4	<p>Genetics and Cell Reproduction: By the end of the topic students will be able to:</p>

	<ol style="list-style-type: none"> 1. Explain Genetic Control of Protein Synthesis 2. Differentiate between DNA and RNA. 3. Explain the basis of Purines and Pyrimidines. 4. Describe the sites, steps and various enzymes involved in the process of Transcription and Translation. 5. Explain Regulation of Genetic Control. 6. Describe different types of RNA's and their functions. 7. Explain Mitosis and Meiosis and their significance 8. Describe the basic concepts of Cell differentiation, Cancer and Mutation. 9. Differentiate between Major Patterns of Cellular Death, Apoptosis & Necrosis.
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2. Membrane Transport Physiology:

Membrane Transport Physiology deals with various Transport mechanisms operable across Human Cell Membrane and their significance in controlling cellular structure and function:

S.NO	TITLE OF LECTURES WITH LEARNING OBJECTIVES
1	Structure of Cell Membrane: By the end of the topic students will be able to: <ol style="list-style-type: none"> 1. Describe the structure of Cell membrane in terms of permeability and non permeability of various substances across Cell membrane. 2. Define the Role of Lipids and Proteins in Cellular Transport. 3. Explain Transport of Substances through the Cell membrane.
2	Diffusion: By the end of the topic students will be able to: <ol style="list-style-type: none"> 1. Define Diffusion and describe its various types and their significance. 2. Explain the Process of Osmosis. 3. Describe the effects of solutions with different osmolarities on RBCs.
3	Active Transport: By the end of the topic students will be able to: <ol style="list-style-type: none"> 1. Describe the concept and mechanisms of Active Transport. 2. Define and explain Primary Active Transport Mechanism with examples. 3. Define and explain Secondary Active Transport Mechanism with examples.

3. Physiology of Excitable Tissues:

Nerve & Muscle are the two major excitable tissues. Physiology of Excitable tissues explains why Nerve and Muscle are called Excitable tissues and how do they respond to a characteristic stimulus by generating nerve action potential and muscle contraction.

i. Nerve Physiology:

S.NO	TITLE OF LECTURES WITH LEARNING OBJECTIVES
1	<p>Neurons & Neuroglia:</p> <p>By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Define Neuron and explain its function. 2. Classify Neurons on the basis of structure and function. 3. Define Nerve fibers/Axons and explain their types on the basis of structure, function and velocity of conduction. 4. Explain Neuroglia, its types and functions.
2	<p>Membrane Potentials & Action Potential:</p> <p>By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Define Nernst Potential and explain significance of Nernst equation. 2. Define Goldman Hodgkin Katz equation. 3. Describe Resting Membrane Potential and various factors contributing in its establishment. 4. Explain the phenomenon of Action Potential along a Nerve fiber. 5. Draw and Label an Action Potential along an unmyelinated axon. 6. Describe the re-establishment of ionic gradients post action potential and All & None Law. 7. Define After potentials. 8. Describe the phenomenon of Plateau and its importance. 9. Explain Self excitation in excitable tissues and phenomenon of Repetitive discharges. 10. Define Acute Local Potentials. 11. Differentiate between Action Potential and Graded Potential. 12. Describe the phenomenon of Saltatory conduction and its importance in a myelinated axon. 13. Explain Compound Action Potentials. 14. Describe Strength Duration Curve, its components, and significance. 15. Define and explain Physiological Properties of Nerve Fibers.
3	<p>Nerve Degeneration & Regeneration:</p> <p>By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Define Nerve Degeneration & Regeneration 2. Explain the types of degeneration 3. Describe the criteria for regeneration
4	<p>Synapses:</p> <p>By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Define a Synapse and explain its types. 2. Describe the steps of transmission along a Chemical Synapse. 3. Define anterograde and retrograde axonal transport.

ii. Muscle Physiology

1.	<p>Muscle Physiology:</p> <p>By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Define a Muscle. 2. Explain Physiological properties of a Muscle. 3. Compare and Contrast 3 different types of Muscle tissues, Skeletal, Smooth, and Cardiac.
2	<p>Functional Organization of Skeletal Muscles:</p> <p>By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Describe the Functional Organization of Skeletal Muscle. 2. Define a Sarcomere and identify its various components. 3. Draw and label a Sarcomere. 4. Explain changes in a relaxed and contracted Sarcomere. 5. Define Sarcoplasm and its composition.
3	<p>Skeletal Muscle Contraction:</p> <p>By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Explain the structure of myofilaments, Actin and Myosin. 2. Describe the Walk along Theory of Skeletal Muscle Contraction. 3. Illustrate the Sliding Filament Model of Skeletal Muscle. 4. Enumerate the essential pre requisites for Skeletal Muscle Contraction. 5. Describe the process of Rigor Mortis and its Forensic Significance post mortem. 6. Differentiate between Active and Passive Muscle tension. 7. Differentiate between Preload and After load. 8. Illustrate a Simple Muscle Twitch. 9. Describe the differences between Fast and Slow Muscle Fibers. 10. Compare and contrast Isometric and Isotonic Muscle contractions with examples.
4	<p>Properties of Skeletal Muscles:</p> <p>By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Define Motor unit, Summation, and phenomenon of Tetanization. 2. Explain Staircase Phenomenon (Treppe). 3. Describe Muscle Fatigue. 4. Define Hypertrophy, Hyperplasia, and Atrophy.
5	<p>Neuromuscular Junctions Transmission in Skeletal Muscle:</p> <p>By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Define a Neuromuscular Junction (NMJ) and explain the steps of transmission along a Neuromuscular Junction. 2. Explain the effects of drugs on NMJ. 3. Describe the autoimmune muscle disease, Myasthenia Gravis.
6	<p>Excitation Contraction Coupling in Skeletal Muscles:</p> <p>By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Explain the phenomenon of Excitation Contraction Coupling in



	<p>skeletal muscle.</p> <p>2. Define Calcium Pulse.</p>
7	<p>Smooth Muscle & its Types:</p> <p>By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Define structure of Smooth Muscle. 2. Know the major differences between Skeletal and Smooth Muscle Contraction. 3. Identify two types of Smooth Muscles. 4. Compare and contrast Multiunit and Unitary smooth muscles. 5. Identify the structural differences in smooth muscles from skeletal muscles.
8	<p>Smooth Muscle Contraction:</p> <p>By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Explain the role of Calmodulin in smooth muscle contraction. 2. Explain Excitation contraction coupling in Smooth Muscle.
9	<p>Properties of Smooth Muscle:</p> <p>By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Describe Latch phenomenon. 2. Explain Stretch and Reverse Stretch relaxation.
10	<p>Action Potential and Neuromuscular Junction in Smooth Muscle:</p> <p>By the end of the topic students will be able to:</p> <ol style="list-style-type: none"> 1. Define various types of Action Potentials in Smooth Muscle. 2. Explain NMJ and different neurotransmitters involved in smooth muscle.

4. Blood Physiology:

This course deals with the details reading blood cells & immunity. This serves to make the base for study of Blood Physiology & retonate use of knowledge in clinical practice. At the end of the course the student must be able to discuss the functions of blood, classify Anemias.

S.NO	TITLE OF LECTURES WITH LEARNING OBJECTIVES
1	<p>Red Blood Cells, Anemia and Polycythemia:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Define Blood 2. Describe its composition 3. Discuss the functions of blood
2	<p>Plasma Proteins:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Know the relevant functions of each plasma proteins 2. Enlist the factor that changes the dead space. 3. Discuss the significance of plasma proteins
3	RBC structure & functions, measurement, metabolism & enzymes:

	<p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Describe the structure & functions of RBC's 2. Know the metabolic cycle in RBC's
4	<p>Erythropoiesis:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Define erythropoiesis 2. Enumerate & explain the steps of erythropoiesis 3. Discuss the factors affecting erythropoiesis 4. Explain the role of erythropoietin
5	<p>Iron Metabolism:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Explain the distribution of iron stores in the body 2. Give the daily requirement of iron for humans 3. Discuss the iron metabolism & importance in the body
6	<p>Hb synthesis & types, Hemoglobin paths:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Define Hb. 2. Enumerate its types 3. Explain the structure & function of Hb. 4. Enlist the different types & abnormalities of Hb & discuss the effects 5. Fate of Hb
7	<p>Classification of Anemias & different types of Anemia:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Define Anemia 2. Classify anemia mycological basis. 3. Classify anemia on the basis of etiology
8	<p>Types of polycythemia & its effects on body:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Define polycythemia 2. Discuss its types with pathophysiology 3. Explain the effects of polycythemia on the body
9	<p>WBC Classification, structure & functions, Inflammations & lines of Defences:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Give classification of leukocytes with reference to structure & function of each type of WBC 2. Discuss inflammation & types and effects 3. Explain various lines of defences of our blood
10	<p>Immunity, Classification Development and Inner Immunity:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Define Immunity 2. Give its types 3. Explain the development of immune system

	4. Name various cells of blood taking part in immunity
11	<p>Cellular Immunity:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Name the cells involved in immunity 2. Explain the origin and functions of these cells
12	<p>Humoral Immunity:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 8. Define the humoral immunity 9. Classify antibodies 10. Explain the mechanism of generation of antibodies.
13	<p>ABO Blood Grouping, Rh Blood Grouping, Erythroblastosis, Fetalis, Cross Matching and Blood Transfusion, Hazards of mismatched transfusion:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Explain ABO blood groups 2. Discuss the basis of classification 3. Define Landsteiner's Law 4. Discuss Rh blood groups & development of E.F. 5. Define cross matching 6. Give the possible hazards of blood transfusion 7. Discuss the complication & management.
14	<p>Tissue and Organ Transplant:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Explain what is tissue transplant 2. Describe the types & principle
15	<p>Details Events of Hemostasis & Blood Coagulation and Blood Coagulation Tests, PT, APTT, INR:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Define the process of coagulation 2. Draw the cascade of each mechanism involved 3. Differentiate between internal & external mechanism 4. Define Prothrombin time APTT, INR & give their clinical importance 5. Give normal values of PT, APTT, INR
16	<p>Fibrinolytic System, Anticoagulation of Blood in Human Body:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Explain the fibrinolytic system 2. Discuss the functions of different components of fibrinolytic system
17	<p>Coagulant, Anticoagulant and Thromboemolism, DVT:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Define & classify Anticoagulant 2. Discuss the mechanism of action of anticoagulant 3. Define Thromboemolism/ DVT 4. Give the causes of T. En



5. Skin Body Temperature Regulation:

This course deals with the details reading Skin Body Temperature

S.NO	TITLE OF LECTURES WITH LEARNING OBJECTIVES
1	Normal Body Temperature, Control of Body Temperature: By the end of the lecture the student will be able to <ol style="list-style-type: none"> 1. Define core temperature & give its value 2. Discuss the mechanism of heat generation 3. Discuss the mechanism of heat loss in the body
2	Sweating and its Regulation: By the end of the lecture the student will be able to <ol style="list-style-type: none"> 1. Describe the physiological anatomy of sweat gland 2. Explain the mechanism of formation of sweat
3	Role of Hypothalamus, Set Point of Temperature Control: By the end of the topic students will be able to: <ol style="list-style-type: none"> 1. Discuss the regulation of body temperature 2. Define set point for temperature control 3. Explain how it is regulated in normal and abnormal conditions
4	Abnormalities of Temperature Regulation: By the end of the lecture the student will be able to <ol style="list-style-type: none"> 1. Discuss different abnormalities of Temperature Regulation 2. Discuss their mechanism in details
5	Structure of Skin & Cutaneous Circulation, Tripe Response: By the end of the lecture the student will be able to <ol style="list-style-type: none"> 1. Describe the structural anatomy of skin 2. Name different layers of skin 3. Functions of skin

6. Respiration:

This course should aim at imparting knowledge on the Physiological aspects of Respiratory System, Deep Sea Physiology and High Altitude Physiology to understand the various parts, major functions and some common disease affecting the system. At the end of unit the student must know the functional Anatomy & Physiology of Respiratory System, understand the mechanics pulmonary ventilation, circulation, gases exchange and transport mechanism, regulatory mechanism of Respiration. Also able to discuss the Pathophysiology, prevention and treatment of related abnormalities

S.NO	TITLE OF LECTURES WITH LEARNING OBJECTIVES
1	Introduction to Respiratory System: By the end of the lecture the student will be able to <ol style="list-style-type: none"> 1. Define respiration. 2. Compare between external and internal respiration

	<p>3. Know the functional anatomy and various parts of respiratory tract.</p> <p>4. Describe respiratory and non-respiratory functions of respiratory system.</p>
2	<p>Pulmonary ventilation: By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Define and compare the anatomical dead space/ physiological dead space, 2. Enlist the factor that changes the dead space. 3. Define total minute ventilation, alveolar ventilation, hyperventilation, hypoventilation, dyspnea, eupnea and hypercapnia.
3	<p>Mechanics of Respiration: By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Know the role of inspiratory and expiratory muscles during quiet and forceful respiration 2. Understand the mechanics of respiration 3. Understand various pressures acting on lungs and chest wall 4. Understand the change in alveolar, pleural and trans pulmonary pressures during each phase of respiration
4	<p>Lung volumes and capacities: By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Know the normal lung volumes/capacities and correlate it with the volume changes in forceful respiration 2. Define the compliance of lung and elastic recoil. 3. Draw and label the compliance diagram and know the significance of hysteresis in the curve. 4. Identify the clinical conditions in which lung compliance is higher and lower than the normal.
5	<p>Pulmonary Compliance: By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Define surface tension, surfactants and atelectasis 2. Know the composition & role of surfactant in alveolar surface tension. 3. Understand the law of Laplace 4. Describe the pathophysiology of respiratory distress syndrome. 5. Explain the concept of work of breathing
6	<p>Respiratory Membrane & Diffusion of Gases: By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Enlist the layers of respiratory membrane 2. Know the concept of diffusing capacity through respiratory membrane 3. Identify the factors affecting gas diffusion through respiratory membrane
7	<p>Diffusion of gases & Oxygen transport By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Know the mechanics of oxygen diffusion from alveoli to blood

	2. Understand the mechanism of oxygen transport in the arterial blood, tissue fluid and cell
8	<p>Oxygen transport & Dissociation curve</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Discuss the role of Hb in oxygen transport 2. Draw and explain the normal oxygen-hemoglobin dissociation curve 3. Define P50. 4. Explain the factors that shift oxygen-hemoglobin dissociation curve to left and right. 5. Understand the concept of Bohr Effect.
9	<p>Carbon dioxide transport</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Know the various chemical form in which CO₂ is transported in blood 2. Explain the normal CO₂ dissociation curve 3. Understand the concept of Haldane effect and importance chloride shift
10	<p>Nervous regulation of respiration</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Identify different group of neurons composing respiratory center and their role. 2. Discuss the role of medullary and pontine center in respiration 3. Describe the role of pre-Bötzinger complex. 4. Describe the generation and control of cyclic breathing. 5. Understand the regulatory mechanism of hering-breuer inflation reflex 6. Know the role of other receptors and factor that involved in controlling the breathing mechanism 7. Explain the cough and sneeze reflex
11	<p>Chemical regulation of respiration</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Describe the central chemosensitive area & its stimulation by CO₂ and H⁺. 2. Explain the role of peripheral chemoreceptors for control of respiration 3. Determine the composite effects of PCO₂, pH, & PO₂ on alveolar ventilation
12	<p>Pulmonary circulation and Va/Q ratio</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Know the physiological anatomy of pulmonary circulation. 2. Discuss the pressure differences b/w pulmonary & systemic circulation 3. Understand the pulmonary blood flow & effect of hydrostatic pressure on it. 11. Identify the average V/Q ratio in a normal lung.

	<p>12. Discuss ventilation perfusion ratio (V_a/Q) and its clinical significance.</p> <p>13. Explain the concept of physiological shunt</p>
13	<p>Hypoxia</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Define hypoxia and explain its types with characteristic features. 2. Describe the various causes and treatment of hypoxia. 3. Know the effects of hypoxia on the body
14	<p>Cyanosis/Asphyxia/ Hypercapnia</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Define and discuss the causes of cyanosis and asphyxia 2. Explain the effects of very high blood CO₂ levels on respiratory center
15	<p>Respiratory abnormalities</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Describe the periodic breathing, basic mechanism of Cheyne Strokes breathing, Kussmaul and Biot's breathing 2. Define sleep apnea and its pathophysiology.
16	<p>Respiratory adjustment during exercise</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Know oxygen consumption and pulmonary ventilation during exercise 2. Explain the respiratory changes during exercise 3. Discuss the body's regulation of respiration during exercise 4. Describe the Oxygen Debt
17	<p>Obstructive lung Diseases/ Restrictive lung diseases</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Name the obstructive/Restrictive lung diseases 2. Discuss the causes and pathophysiology of Obstructive/ Restrictive lung Diseases 3. Draw and interpret the spirogram of Obstructive and restrictive lung Diseases 4. Define FEV₁/FEC ratio and its clinical significance. 5. Differentiate between obstructive and restrictive lung Diseases on the bases of Spirometry and FEV₁/FEC ratio. 6. Draw and interpret the spirogram of Obstructive and restrictive lung Diseases 7. Define FEV₁/FEC ratio and its clinical significance. 8. Differentiate between Obstructive and restrictive lung Diseases on the bases of Spirometry and FEV₁/FEC ratio.

7. Human Responses in Varied Environments:

S.NO	TITLE OF LECTURES WITH LEARNING OBJECTIVES
1	<p>High Altitude physiology</p> <p>By the end of the lecture the student will be able to</p>

	<ol style="list-style-type: none"> 1. Explain physiologic responses to high altitude and space. 2. Explain the effects of acute and chronic mountain sickness. 3. Describe the physiology of acclimatization
2	<p>Deep sea physiology</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Explain physiologic responses to deep sea diving and hyperbaric conditions. 2. Describe the clinical features, pathophysiology, prevention, and treatment of Nitrogen narcosis, Decompression sickness, Oxygen and carbon dioxide toxicity. 3. What is SCUBA diving? 4. Identify the uses of hyperbaric oxygen therapy.

8. Cardiovascular System:

CVS Physiology (HEART AND CIRCULATION)

The Cardiovascular System comprises the study of the blood circulation through the heart and great vessels. This module will cover a specific part of the cardiovascular system in an integrated form. The initial teaching learning activities will help you understand the normal structures of the system. This will be followed by the comprehensive introduction to the functions of the system. The methodologies used for teaching include lectures, tutorials, PBL, Practical, dissection and Lab work.

(i) Heart:

S.NO	TITLE OF LECTURES WITH LEARNING OBJECTIVES
1.	<p>Physiologic anatomy of heart and cardiac action potential</p> <p>By the end of the lecture the student will be able to:</p> <ol style="list-style-type: none"> 1. Appreciate the physiological arrangement of right and left hearts along with the parallel arrangement of systemic circulation. 2. Know the physiologic anatomy of cardiac muscles, its functional syncytium and intercalated disc and difference between cardiac, skeletal and smooth muscles. 3. Know the phases of action potential in cardiac muscle and autorhythmic cells/ conducting system of the heart along with comparison of action potential in different tissues of the heart. 4. Associate movement of ions across the cell membrane with different phases of action potential.
2.	<p>Conductive system:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Comprehend importance and relationship between refractory period and mechanical periods. 2. Know the mechanism of generation and propagation of cardiac impulse in conductive system of heart. 3. Appreciate characteristics of spread of cardiac impulse through

	conductive system, atrial and ventricular myocardium and its association with the function of heart.
3.	<p>Cardiac cycle: By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Understand various cardiac events in relation to each other 2. Understand and interpret cardiac cycle diagram 3. Comprehend preload and afterload, its influence on stroke volume 4. The Frank-Starling's mechanism and role of autonomic regulation of heart rate and pumping action.
4.	<p>ECG: By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Comprehend genesis of ECG, the way it is recorded and its relationship with the electrical axis of heart. 2. Understand significance of waves, segments and intervals of ECG recording. 3. Learn the concept of a vector and principles of the measurement of ECG vector. 4. Appreciate relationship between vector and lead, type and locations of leads and principles for vector analysis. Know general principles of analysis of ECG.
5.	<p>Arrhythmias: By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Understand the basis of common cardiac arrhythmias, process that produce them and their clinical significance. 2. Evolve the concept of sinus arrhythmia and its clinical significance. Appreciate principal changes in ECG during myocardial ischemia and infarction. 3. Comprehend changes in ECG and cardiac function during common abnormalities in ionic composition of body fluids. 4. Understand the pathophysiology of ectopic focus and its clinical significance. 5. Appreciate the events of cardiac cycle and prospective changes in ECG, heart sounds, pressures and volumes during different phases.

(ii) Circulation:

1	<p>Hemodynamics of circulation: By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Know the organization of circulatory systems i.e. Greater (Systemic) and Lesser (Pulmonary) circulations along with accessory circulatory system (Lymphatic). 2. The physiologic anatomy of different types of blood vessels and their
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	<p>importance.</p> <ol style="list-style-type: none"> 3. Know the relationship between flow, resistance and conductance. Have the concept of blood flow, its types and significance of turbulent and laminar flow, the concept of pressure gradient, resistance to blood flow and its significance. 4. Understand the Physiology of vascular compliance? Changes in compliance of blood vessels with age and comparison between the compliance of arteries versus veins. 5. Appreciate the origin of arterial pressure pulse and its propagation to the peripheral arteries. Know the factors damping the arterial pulse and abnormalities of arterial pulse. 6. Know about the jugular venous pulse, its significance and differentiation from arterial pulse.
2	<p>Control of Local Blood:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Know about acute and chronic control of local blood flow 2. Understand the theories of metabolic control of blood flow 3. Describe the active and reactive hyperemia 4. Explain the effects of blood flow control on total peripheral resistance
3	<p>Capillary dynamics:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Understand the principles of capillary dynamics, structure of Interstitium, 2. Describe the Starling's forces for fluid exchange across the capillary membrane and factors affecting thereof. Have the concept of starling's equilibrium, and how of the interstitial space is kept dry? 3. Know the mechanism of formation of interstitial fluid, its composition and factors creating starling's disequilibrium leading to the development of edema. 4. Appreciate Types of edema, its pathophysiology and safety factors preventing edema formation.
4	<p>Cardiac output</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Understand the determinants of cardiac output and factors affecting cardiac output. 2. Appreciate the mechanics of low and high cardiac outputs along with their effects on heart. 3. Comprehend the factors affecting stroke volume, heart rate and total peripheral resistance. 4. Understand Fick's principle for the measurement of cardiac output.
5	<p>Venous return:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Recognize the role of veins in blood flow, their functions and factors

	<p>regulating venous return and significance of venous reservoirs.</p> <ol style="list-style-type: none"> 2. Appreciate the equality of cardiac output and venous return. 3. Understand factors affecting venous return
6	<p>Arterial blood pressure:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Comprehend the determinants of arterial pressure, factors affecting and mechanisms regulating blood pressure on short and long term basis. 2. Understand mean arterial pressure and its significance. 3. The individual and integrative role of baroreceptors, chemoreceptor, volume receptors, arterial natriuretic factors and Renin-angiotensin – aldosterone system in regulation of arterial pressure. 4. Understand the characteristics of regional circulations (skeletal muscles, pulmonary, coronary & cerebral) and factors regulating
7	<p>Cardiac failure:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Define cardiac failure, its pathophysiology and clinical manifestations 2. Know the different types and treatment of cardiac failure
8	<p>Heart sounds:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Describe origin of heart sounds 2. Know about murmurs 3. Know about clinical importance of various heart sounds
9	<p>Circulatory shock:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Define shock, its types, stages of development and differences between compensated and uncompensated shock. 2. Understand the pathophysiology of compensated and uncompensated shock. 3. Comprehend the short term and long term compensatory mechanisms in circulatory shock. 4. Know the pathophysiology of irreversible shock. 5. Comprehend the general principles for the treatment of shock.
10	<p>Effect of exercise on CVS:</p> <p>By the end of the lecture the student will be able to</p> <ol style="list-style-type: none"> 1. Know the types and severity of exercise in different sports. 2. Have the concept of general adaptive changes in muscles in response to increased and decreased physical activity. 3. Know about the fuels available in body during rest and exercise. 4. Comprehend cardiovascular and pulmonary changes (including oxygen consumption) during different grades of exercise.



PHYSIOLOGY PRACTICALS:

Haematology

1. Study and use of the microscope.
2. Describe the various parts & functioning of Haemocytometer (Neubar's chamber).
3. Calculate the red blood cell (RBC) count.
4. Determination of total leukocyte count (TLC).
5. Prepare and examine the blood smear and determine differential leucocyte count.
6. Calculate the Platelet count.
7. Determine the Osmotic fragility of RBC's.
8. Estimate the hemoglobin levels by Sahli's method.
9. Determine the erythrocyte sedimentation rate (ESR).
10. Determine the packed cell volume (PCV).
11. Calculate and Interpret the Red cell indices.
12. Determine the bleeding and clotting time.
13. Determine the Blood groups.

Respiratory System

1. Clinical examination of respiratory system.
2. Determination of various lung volumes, capacities and their clinical interpretation by Spirometry.
3. Record the respiratory movements by using Stethograph.

Cardiovascular System

1. Examination of arterial pulse.
2. Examination of jugular venous pulse.
3. ECG recording and interpretation of normal ECG.
4. Recording of arterial blood pressure.
5. Effects of exercise and posture on blood pressures.
6. Clinical examinations of precordium/ auscultation of apex beat and normal heart sounds.
7. Cardiopulmonary resuscitation.

Skin and body temperature regulation

1. Record the human body temperature using a clinical thermometer.



ASSESSMENT PLAN
DEPARTMENT OF PHYSIOLOGY
SHARIF MEDICAL & DENTAL COLLEGE LAHORE

Following modes of assessment are planned for 1st Year MBBS class in the subject of Physiology. This plan has been designed keeping in view the university curriculum and hopefully will facilitate the students in preparing for 1st Professional Examinations in the subject.

UNITS Tests:

Two tests will be conducted from each unit. The test will comprise of MCQs and SEQs on the pattern of university examinations. A preparatory time of at least one week shall be given prior to these tests.

VIVA VOCE:

Viva for every unit will be conducted after the completion of each topic.

OSPE Tests:

In order to prepare the students for practical examinations at least two OSPE tests will be conducted on the pattern of university examinations.

SEND-UPS:

This will be conducted at the completion of course exactly following the format of UHS Professional Exams. This will comprise of MCQ's, SEQ's and viva segments and a sizeable portion of the total course will be included in each of them.

Internal Assessment:

Internal assessment will be calculated out of 20 on the basis of all these tests that will be conducted throughout the year.



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PRESCRIBED TEXT & REFERENCES BOOKS

Recommended Books:

- Textbook of Physiology by Guyton and Hall, Latest Ed,
- Review of Medical Physiology by William F. Ganong, Latest Ed, published by McGraw –Hill education.

Reference Books:

- Human Physiology by Laurali Sherwood, Latest Ed, published by Yolando Cossio.
- Physiology by Berne and Levy, latest edition.
- Essentials of Medical Physiology by Prof. Mushtaq Ahmad.
- Physiology by Linda and Costanzo, Latest Ed, published by Elsevier Health Sciences.
- Essential of Medical Physiology (Jaypee), Latest Ed, published by Brothers Medical Publishers.