

# STUDY GUIDE PHYSIOLOGY

# **TABLE OF CONTENTS**

	CONTENT	Page No.
1	Physiology department in a glance	3
2	Physiology department team- AFMDC	4
3	Time line for syllabus completion	5
4	Time table	6
5	Syllabus outline	7
6	Learning objectives	10
7	Practical List	21
8	Learning Methodologies	22
9	Assessment Methodologies	23
10	Method of Feedback of Curriculum and Assessment	23
11	Textbooks and references	24
12	Table of specifications	25

# PHYSIOLOGY DEPARTMENT IN A GLANCE

Our body is nothing short of an amazing m a chine. No machine ever constructed can perform even a minutest body-like function as effectively as our bodies can do.

Physiology aims to understand the fascinating mechanisms of our body. Human physiology studies how our cells, muscles and organs work together, how they interact. Physiology, sometimes referred to as "the science of life", looks at living mechanisms from molecular basis of cell function to the whole integrated behavior of the entire body.

Our shared vision is to develop high quality professionals to pursue the excellence in the field of medicine and surgery. Our mission here at the department of Physiology AFMDC is:

To provide theoretical and practical knowledge /skills through quality teaching

To provide standard education and practical skills

To impart under graduate students a quality education to cope up with the international standards

Physiology department has highly experienced, skilled and qualified faculty and laboratory staff focused on delivering quality education and skills. The Physiology is well equipped with all necessary equipment's along with latest power lab. It has the capacity of 35 students.

The department has also computer facility to maintain departmental record, prepare lecture slides and demonstrate audiovisual aids.

Teaching strategy includes interactive lecture, small group tutorial, and practical to provide flexible multi method learning opportunities.

Students are continuously assessed depending upon their performance throughout the year. Seminar and quiz are also conducted and arranged to involve the students and to increase their interest level. Teachers focus on self-expression, discovery and enthusiasm among learners.

# **Physiology Department Team- AFMDC**

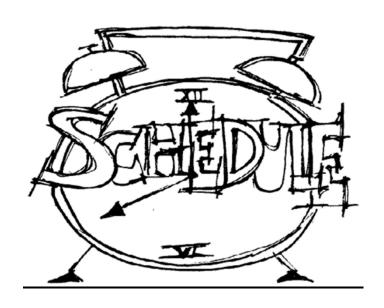
Positions	Name	Extension
Head of Department	Prof. Dr. Farah Amir Ali	181
Associate Professor	Dr. Shireen javed	
Assistant Professor	Dr. Beenish Altaf	170
Assistant Professor	Dr. Anam Rehman	
Senior	Dr. Hira	
Demonstrators		
Senior	Dr Hania Ali Chattah	
Demonstrators		
Demonstrators	DR Fairoz Ahsaan	161
	Dr. Javeria Manzoor	
	Dr. Ahmad Fayyaz	
	Dr Zunaira	
Laboratory Incharge	Mr. Shahid Hussain	
Computer operator	Mr. Kashan Ali Haider	220
Laboratory assistant	Mr. Abdul Naveed	
Laboratory attendant	Miss Fatimah Gulzar	

# TIME LINE for SYLABUS COMPLETION

# **GHANTT CHART of FIRST YEAR LECTURES**

Topic	Dec	Jan	Feb	Mai	rch	April	May	June	July	Aug	SI	EP_
Cell												
												_
Genetics												
												_
Nerve and												
muscle												
Blood			'									
11					_							
Heart												
Circulation					-							. –
Circulation					_							
Respiration												
respiration												
	Winter b	reak	Mid-se	ession	exai	m	Summ	er vacat	tions	sendup	exa	am

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TIME TABLE

<b>D</b> .	1	2	3	4	5	6
Date	08:00- 09:00	09:00- 10:00	10:00- 11:00	11:00- 12:45	12:45- 13:15	13:15- 15:00
Monday			Lec Phy	Practical		
Tuesday	Lec Phy			Practical		
Wednesday		Lec Phy		Tutorial		
Thursday	Lec Phy			Tutorial		Practical
Friday	08:00- 08:45	08:45- 09:30	09:30- 10:15	10:15- 11:30	11:30- 13:00	13:00- 15:00
Filuay			Lec Phy	Tutorial		

# **SYLLABUS OUTLINE PHYSIOLOGY**

The course outline is as follows:

### BASIC AND CELL PHYSIOLOGY

- 1. Functional organization of human body
- 2. Homeostasis
- 3. Control systems in the body
- 4. Cell membrane and its functions
- 5. Cell organelles and their functions
- 6. Genes --their control and function

### Blood

- 1. Composition and general functions of blood
- 2. Plasma proteins their production and function
- 3. Erythropoiesis and red blood cell function
- 4. Structure, function, production and different types of haemoglobin
- 5. Iron absorption storage and metabolism
- 6. Blood indices
- 7. Function, production and type of white blood cells
- 8. Function and production of platelets
- 9. Clotting mechanism of blood
- 10. Blood groups and their role in blood transfusion
- 11. Complications of blood transfusion with reference to ABO & RH incompatibility
- 12. Components of reticuloendothelial system their gross and microscopic structure including (tonsil, lymph node and spleen)
- 13. Development and function of reticuloendothelial system

### **Clinical Module**

- 1. Anemia and its different types
- 2. Blood indices in various disorders
- 3. Clotting disorders (Haemophilia etc.)
- 4. Blood grouping and cross matching
- 5. Immunity

### **Nerve and Muscle**

- 1. Structure and function of neuron
- 2. Physiological properties of nerve fibers
- 3. Physiology of action potential
- 4. Conduction of nerve impulse
- 5. Nerve degeneration and regeneration
- 6. Synapses
- 7. Physiological structure of muscle
- 8. Skeletal muscle contraction
- 9. Skeletal, smooth and cardiac muscle contraction
- 10. Neuromuscular junction and transmission
- 11. Excitation contraction coupling
- 12. Structure and function of motor unit

### **Clinical Module**

- 1. Perform nerve conduction studies and explain their clinical importance
- 2. Myopathies and neuropathies

3. Peripheral nerve injuries

# Cardiovascular System

- 1. Heart and circulation
- 2. Function of cardiac muscle
- 3. Cardiac pacemaker and cardiac muscle contraction
- 4. Cardiac cycle
- 5. ECG, its recording and interpretation
- 6. Common arrhythmias and its mechanism of development
- 7. Types of blood vessels and their function
- 8. Hemodynamics of blood flow (local control systemic circulation its regulation and control)
- 9. Peripheral resistance its regulation and effect on circulation
- 10. Arterial pulse
- 11. Blood pressure and its regulation
- 12. Cardiac output and its control
- 13. Heart sounds and murmurs
- 14. Importance, circulation, and control of venous returnon
- 15. Coronary circulation
- 16. Splanchnic, pulmonary and cerebral circulation
- 17. Triple response and cutaneous circulation
- 18. Foetal circulation and circulatory changes at birth

### **Clinical Module**

- 1. Clinical significance of cardiac cycle, correlation of ECG and heart sounds to cardiac cycle
- 2. Clinical significance of cardiac cycle, interpretation of ischemia and arrhythmias
- 3. Effects of hypertension
- 4. Clinical significance of heart sounds
- 5. Effects of ischemia
- 6. Shock

# **Respiratory System**

- 1. Function of respiratory tract
- 2. Respiratory and non-respiratory function of the lungs
- 3. Mechanics of breathing
- 4. Production & function of surfactant and compliance of lungs
- 5. Protective reflexes
- 6. Lung volumes and capacities including dead space
- 7. Diffusion of gases across the alveolar membrane
- 8. Relationship between ventilation and perfusion
- 9. Mechanism of transport of oxygen and carbon dioxide in blood
- 10. Nervous and chemical regulation of respiration
- 11. Abnormal breathing
- 12. Hypoxia, its causes and effects
- 13. Cyanosis, its causes and effects

### **Clinical Module**

- 1. Clinical importance of lung function tests
- 2. Causes of abnormal ventilation and perfusion
- 3. Effects on pneumothoax, pleural effusion, and pneumonia

- 4. Respiratory failure
- 5. Artificial respiration and uses & effects of O2 therapy
- 6. Clinical significance of hypoxia, cyanosis, and dyspnoea

# **Skin and Body Temperature Regulation**

# PHYSIOLOGY PRACTICALS

# Haematology

- 1. Use of the microscope
- 2. Determination of haemoglobin
- 3. Determination of erythrocyte sedimentation rate
- 4. Determining packed cell volume
- 5. Measuring bleeding and clotting time
- 6. RBC count
- 7. Red cell indices
- 8. WBC count
- 9. Leucocyte count
- 10. Prothrombin and thrombin time

# **Respiratory System**

1. Pulmonary volume, their capacities and clinical interpretation

# **Cardiovascular System**

- 1. Cardiopulmonary resuscitation (to be coordinated with the department of medicine)
- 2. Examination of arterial pulse
- 3. ECG recording and interpretation
- 4. Arterial blood pressure
- 5. Effects of exercise and posture on blood pressure
- 6. Apex beat and normal heart sounds

# LEARNING OBJECTIVES OF PHYSIOLOGY

# FIRST YEAR M.B.B.S

TOPIC	SUBTOPICS	LEARNING OBJECTIVES
Introduction to	Functional	Define human physiology
Physiology: The Cell and General Physiology	Organization of the Human Body	Explain the role of extracellular fluid as internal environment.
	and Control of the"Internal	Differentiate between extracellular and intracellular fluid .
	Environment	Associate the general concept of homeostasis along with role of body systems in maintaining it.
		Discuss feedback mechanism with its components.
		Explain negative feedback mechanism along with its examples.
		Discuss positive feedback mechanism with its examples.
		Define feed forward mechanism and adaptive control mechanism
		<ul> <li>Contrast the following units used to describe concentration: mM, mEq/l, mg/dl, mg%.</li> </ul>
		• List the typical value and normal range for plasma Na+, K+, H+ (pH), HCO3 -, Cl-, Ca2+, and glucose, and the typical intracellular
		pH and concentrations of Na+ , K+ , Cl- , Ca2+, and HCO3
		Differentiate between the terms osmole, osmolarity, osmolality and tonicity.
		List the typical value and normal range for plasma osmolality.
	The Cell and Its	Discuss general organization of cell
	Functions	<ul> <li>Describe the structure and function of cell membrane along with its cross section diagram</li> </ul>
		Enlist cell organelles with its function.
		<ul> <li>Compare smooth endoplasmic reticulum and rough endoplasmic reticulum.</li> </ul>
		Differentiate between Lysosomes and Peroxisomes
		Relate lysosomal storage disease with its function
		<ul> <li>Discover the role of cytoskeleton in maintaing the structure of cell and in movement</li> </ul>
		Discuss the concept of molecular motors
		Enlist different types of intercellular connections
		<ul> <li>Explain the role of the "tight" junctions in leaky and tight epithelia.</li> </ul>
	Genetic Control	Describe the structure and function of DNA
	of Protein	Define genetic code and gene with its different components
	Synthesis, Cell	<ul> <li>Describe structure of RNA and its types</li> </ul>
	Function, and Cell	Interpret the role of different types of RNA in transcription.
	Reproduction	<ul> <li>Explain the process of transcription &amp; post transcriptional modification</li> </ul>
		<ul> <li>Discuss the process of translation &amp; post translational modification</li> </ul>
		Summerize the regulation of gene expression
		Discuss the life cycle of cell
		Describe the process of cell mitosis
		Explain the role of telomeres in cell reproduction

		<ul> <li>Discuss the apoptosis with role of caspases</li> <li>Associate abonormal activation of genes with cancer</li> </ul>
Membrane ,Nerve and Muscle Physiology	Transport of Substances Through the Cell Membrane	<ul> <li>Differentiate the following terms based on the source of energy driving the process and the molecular pathway for: diffusion, facilitated diffusion,osmosis, secondary active transport, and primary active transport.</li> <li>Describe how transport rates of certain molecules and ions are accelerated by specific membrane transport proteins ("transporter" and "channel" molecules).</li> <li>Contrast the types of active &amp; passive transport with its examples in detail</li> <li>Describe how energy from ATP hydrolysis is used to transport ions such as Na+, K+, Ca2+, and H+ against their electrochemical differences (e.g., via the Na+ pump, sarcoplasmic reticulum Ca2+ pump, and gastric H+ pump).</li> <li>Explain how energy from the Na+ and K+ electrochemical gradients across the plasma membrane can be used to drive the net "uphill" (against a gradient) movement of other solutes</li> <li>Define diffusion potential and Nernst potential</li> <li>Explain how the resting membrane potential is generated</li> <li>Calculate membrane potential by using the Goldman-Hodgkin-Katz equation .</li> <li>Predict how the membrane potential would change,given an increase or decrease in the permeability of K+, Na+, or Cl</li> <li>Explain the origin of normal resting membrane potential</li> <li>Describe the role of Na+-K+ pump for maintaining concentration gradient of Na+&amp; K+ ions</li> </ul>
	Membrane Potentials and Action Potentials	<ul> <li>Define the following properties of ion channels: gating, activation, and inactivation.</li> <li>Contrast the gating of ion-selective channels by ligands and voltage.</li> <li>Illustrate how the activity of voltage-gated Na+, K+, and Ca2+ channels generates an action potential and the roles of those channels in each phase (depolarization, overshoot, repolarization, hyperpolarization) of the action potential.</li> <li>Discuss the properties of action potential</li> <li>Contrast the mechanisms by which an action potential is propagated along both nonmyelinated and myelinated axons</li> <li>Explain the All or Nothing principle</li> <li>Define and discuss refractory period with its types</li> <li>Enumerate classification of nerve fibers</li> <li>Define rheobase and chronaxie</li> <li>Differentiate between the properties of electro tonic conduction, conduction of an action potential, and salutatory conduction. Identify regions of a neuron where each type of electrical activity may be found.</li> </ul>
	Contraction of Skeletal Muscle	<ul> <li>Explain the physiological anatomy of skeletal muscle</li> <li>Describe the general mechanism of muscle contraction</li> <li>Discuss cross bridge cycle, walk along theory and sliding filament mechanism</li> </ul>

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		<ul> <li>List the process of excitation contraction coupling</li> <li>Describe the roles of the sarcolemma, transverse tubules, sarcoplasmic reticulum, thin filaments, and calcium ions in excitation contraction coupling</li> <li>Describe the roles of ATP in skeletal muscle contraction and relaxation.</li> <li>Construct a table of structural, enzymatic, and functional features of the three major categories (fast-glycolytic, fast-oxidative-glycolytic, and slow-oxidative fiber types) of skeletal muscle fiber types</li> <li>Distinguish between isotonic and isometric contraction</li> <li>Define motor unit, summation, hypertrophy, hyperplasia and atrophy</li> <li>Explain the process of tantalization and treppe</li> <li>List the energy sources of muscle contraction and rank the sources with respect to their relative speed and capacity to supply ATP for contraction</li> <li>Discuss pathophysiology of Muscular Dystrophies in relation to cytoskeleton: Becker muscular dystrophy: Becker muscular dystrophy and Duchenne muscular dystrophy</li> <li>Define rigor mortis</li> </ul>
	Excitation of Skeletal muscle: Neuromuscular Transmission and Excitation- Contraction Coupling	<ul> <li>Draw the structure of the neuromuscular junction.</li> <li>List in sequence the steps involved in neuromuscular transmission in skeletal muscle and point out the location of each step on a diagram of the neuromuscular junction.</li> <li>Distinguish between an endplate potential and an action potential in skeletal muscle.</li> <li>List the possible sites for blocking neuromuscular transmission in skeletal muscle and provide an example of an agent that could cause blockage at each site</li> <li>Compare the presentation of myasthenia gravis and Lambert-Eaton syndrome</li> </ul>
	Contraction and Excitation of Smooth Muscle	<ul> <li>Describe the distinguishing characteristics of multi-unit and unitary smooth muscles</li> <li>Compare smooth muscle contraction and skeletal muscle contraction in detail</li> <li>Discuss the role of calcium, myosin light chain kinase and myosin phosphatase in contraction of smooth muscle</li> <li>Distinguish between muscle relaxation from the contracted state</li> <li>Explain why smooth muscles can develop and maintain force with a much lower rate of ATP hydrolysis than skeletal muscle./Latch phenomenon</li> <li>Describe physiologic anatomy of neuromuscular junction in smooth muscle</li> <li>Explain the two forms of action potential in unitary smooth muscle</li> <li>Define phenomenon of stress relaxation</li> <li>Discuss the phenomenon of auto rhythmicity in some smooth muscles</li> <li>Enlist the local factors that inhibits the smooth muscle contraction</li> </ul>

Cardiovascular	Heart physiology	Resed on ion nermeability and electrical resistance describe
Cardiovascular physiology	Heart Muscle; The Heart as a Pump and Function of the Heart Valves	<ul> <li>Based on ion permeability and electrical resistance describe role of gap junctions in creating a functional syncytium.</li> <li>Discuss action potential of cardiac muscle in detail.</li> <li>Describe the specific details about the special role of Ca2+ in the control of contraction and relaxation of cardiac muscle</li> <li>Contrast the duration of the action potential and the refractory period in a cardiac muscle, a skeletal muscle, and a nerve.</li> <li>Sketch the temporal relationship between an action potential in a cardiac muscle cell and the resulting contraction of that cell</li> <li>Identify the intervals of isovolumic contraction, rapid ejection, reduced ejection, isovolumic relaxation, rapid ventricle filling, reduced ventricular filling and atrial contraction in cardiac cycle</li> <li>Draw, in correct temporal relationship, the pressure, volume, heart sound, and ECG changes in the cardiac cycle</li> <li>Contrast the relationship between pressure and flow into and out of the left and right ventricles during each phase of the cardiac cycle.</li> <li>Define the following terms:- End diastolic volume, End systolic volume, Stroke volume, Ejection fraction, preload and after load</li> <li>Calculate ejection from end diastolic volume, end systolic volume, and/or stroke volume.</li> <li>Predict the change in ejection fraction that would result from a change in a) preload, b) afterload, and c) contractility.</li> <li>Draw a ventricular pressure-volume loop and on it label the phases and events of the cardiac cycle</li> <li>Enlist difference between semilunar vs. AV valves</li> <li>Explain the functions of papillary muscles in AV valves</li> <li>Explain the role of Starling's Law of the Heart in keeping the cardiac output</li> <li>Explain the role of parasympathetic &amp; sympathetic nerves on</li> </ul>
		<ul> <li>heart pumping</li> <li>Discuss the effect of potassium and calcium ions of heart function</li> </ul>
	Rhythmical Excitation of the Heart	<ul> <li>Explain the process of self excitation of SA node.</li> <li>Compare the action potential of sinus nodal fiber and ventricular muscle fiber</li> <li>Sketch a typical action potential in a ventricular muscle and a pacemaker cell, labeling both the voltage and time axes accurately.</li> <li>Describe how ionic currents contribute to the four phases of the cardiac action potential</li> <li>Illustrate the conductive system of heart</li> <li>Explain why the AV node is the only normal electrical pathway between the atria and the ventricles.</li> <li>Explain the functional significance of the slow conduction through the AV node.</li> <li>Describe factors that influence conduction velocity through the AV node.</li> <li>Discuss the cause of delay of impulse conduction from the atria to the ventricles.</li> <li>Define ectopic pacemaker</li> </ul>

Cardiac Arrhythmias and Their Electrocardiogra phic Interpretation	The above learning objective will be discussed in tutorial along with its clinical applications Interpret the characteristics of the normal electrocardiogram. Identify the voltage and time calibration of electrocardiogram. Recognize 12 electrocardiographic leads and their placement Summerize the principles of vectorial analysis of electrocardiograms Interpret the electrical axis from standard lead ECGs Enlist the normal abnormal causes of axis deviation Recognize that cause increased and decreased voltage of electrocardiogram Define current of injury and J point. Discuss changes in ECG in coronary ischemia Enlist the ECG changes of Hyperkalemia and Hypokalemia  Define tachycardia and bradycardia along with causes. Illustrate atrio ventricular block (degree 1st , 2nd , 3rd ) Discuss the significance of "overdrive suppression" and "ectopic pacemaker," including the conditions necessary for each to occur.  Define premature contractions and its cause Describe the alteration in conduction responsible for most common arrhythmias: i.e., tachycardia, bradycardia, A-V block, Wolff-Parkinson-White (WPW) syndrome, bundle branch block, flutter, fibrillation The above learning objective will be discussed in tutorial along with its clinical applications Demonstration of cardiopulmonary resuscitation (CPR)
The Circulation Overview of the Circulation; Medical Physics of Pressure, Flow, and Resistance	Describe physical characteristics of the circulation Explain basic theories of the circulatory functions Illustrate interrelationship among pressure flow and resistance in vasculature Apply the above relationship to the arteries, arterioles, capillaries, venules, and veins. Discuss conductance of a blood is a vessel and its relation to resistance Explain how Poiseuille's Law influences resistance to flow. List the factors that shift laminar flow to turbulent flow. Discuss specific blood reservoirs
Vascular Distensibility and Functions of the Arterial and Venous Systems   Microcirculation	Contrast compliance and Distensibility.  Define the following:- Delayed compliance (stress- relation) of vessels, Mean arterial pressure ,Central venous pressure  Describe the effects of following factors on venous pressures :- right atrial pressure, intraabdominal pressure, gravitational pressure, venous valves and venous pumps  Explain normal, abnormal aortic pressure pulse contours  The above learning objective will be discussed in tutorial along with its clinical applications  Examination of pulse  Determination of JVP
and the	Explain acute control of local blood flow with following aspects  : Tissue metabolism & When oxygen availability changes
	Arrhythmias and Their Electrocardiogra phic Interpretation  The Circulation Overview of the Circulation; Medical Physics of Pressure, Flow, and Resistance  Vascular Distensibility and Functions of the Arterial and

System: Capillary Fluid Exchange, Interstitial Fluid, and Lymph Flow	<ul> <li>(vasodilator theory &amp; oxygen lack theory)</li> <li>Differentiate reaction &amp; active hyperemia</li> <li>Discuss Auto regulation of blood flow (metabolic &amp; myogenic mechanism)</li> <li>Identify the role of PO2, PCO2, pH, adenosine, and K+ in the metabolic control of blood flow to specific tissues</li> <li>Explain the role of nitric oxide for dilating upstream arteries</li> <li>Describe role of oxygen and vascular endothelial growth factors in long term blood flow regulation</li> </ul>
Control of Arterial Pressure	<ul> <li>Discuss autonomic nervous system &amp; its effect on circulatory system</li> <li>Contrast the sympathetic and parasympathetic nervous system control of heart rate, contractility, total peripheral resistance, and venous capacitance</li> <li>Predict the cardiovascular consequence of altering sympathetic nerve activity and parasympathetic nerve activity.</li> <li>Discuss the effect of sympathetic innervation on blood vessels of skeletal muscle</li> <li>Describe the parts of vasomotor center and their role in regulation of blood pressure.</li> <li>Define the following: I. Vasomotor tone II. Vasovagal syncope</li> <li>Enumerate the reflexes involved in rapid(short term) control of arterial pressure</li> <li>List the anatomical components of the baroreceptor reflex and discuss its receptors in detail.</li> <li>Explain the sequence of events in the baroreceptors reflex that occur after an acute increase or decrease in arterial blood pressure with following aspects: a)Receptor response b) Afferent nerve activity c) CNS integration d)Efferent nerve activity to heart and vessels e) Response</li> <li>Outline the cardiovascular reflexes initiated by decreases in blood O2 and increases in blood CO2.</li> <li>Describe role of chemoreceptors in regulation of arterial pressure</li> <li>Describe the Cushing Reflex and the CNS ischemic response</li> <li>Explain role of kidney in long term regulation of blood pressure.</li> <li>Discuss intermediate regulation of blood pressure</li> <li>Contrast the relative contribution of neural and renal mechanisms in blood pressure and blood volume regulation</li> <li>Describe the release, cardiovascular target organs and mechanisms of cardiovascular effects for angiotensin, atrial natriuretic factor, bradykinin, and nitric oxide.</li> <li>Determination of blood pressure at rest, effects with change in posture and exercise</li> </ul>
Cardiac Output, Venous Return, and Their Regulation	<ul> <li>Define cardiac output and cardiac index</li> <li>Identify the factors that cause a hyper effective and hypo effective heart</li> <li>Summarize the pathophysiology of high and low cardiac output</li> <li>Draw a graph showing relationship of cardiac output with right atrial pressure</li> <li>Draw a graph showing relationship of venous return with right atrial pressure</li> </ul>

		<ul> <li>Explain the effect of mean circulatory and mean systemic filling pressure on venous return</li> <li>Interpret the effect of venous return on venous return curve</li> <li>Discuss the principles underlying cardiac output measurements using the oxygen Fick principle and indicator dye dilution</li> <li>Summarize the blood flow regulation in skeletal muscle at rest and during exercise</li> </ul>
	Ischemic heart diseases and heart failure	<ul> <li>Discuss ischemic heart disease with reference to myocardial infarction &amp; angina pectoris</li> <li>Explain role of collateral circulation in the heart</li> <li>Enlist causes of death after acute coronary occlusion</li> <li>Explain coronary steal syndrome</li> <li>Explain dynamic of compensated &amp; uncompensated heart failure</li> <li>Enumerate the consequences of right and left heart failure</li> <li>Discuss the cardiac reserve</li> </ul>
	Heart sound and congenital heart defects	<ul> <li>Describe the timing and causes of the four heart sounds.</li> <li>Describe the expected auscultation sounds that define mitral stenosis, mitral insufficiency, aortic stenosis, and aortic insufficiency.</li> <li>Explain how these pathologic changes would affect cardiac mechanics and blood pressure.</li> <li>Discuss the abnormal circulatory dynamics in congenital heart defects (patent Ductus arteriosus and tetralogy of Fallot)</li> <li>Clinical examination of chest and heart sounds</li> </ul>
	Circulatory shock and its treatment	<ul> <li>Relate the three stages of shock (non-progressive progressive and irreversible shock)</li> <li>Describe the direct cardiovascular consequences of the loss of 30% of the circulating blood volume on cardiac output, central venous pressure, and arterial pressure. Describe the compensatory mechanisms activated by these changes.</li> <li>Explain three positive feedback mechanisms activated during severe hemorrhage that may lead to circulatory collapse and death</li> <li>Contrast the change in plasma electrolytes, hematocrit, proteins, and colloid osmotic pressure following resuscitation from hemorrhage using a) water, b) 0.9% NaCl, c) plasma, and d) whole blood.</li> <li>Discuss the physiology of treatment in shock</li> </ul>
Blood Cells, Immunity, and Blood Clotting	Red Blood Cells, Anemia, and Polycythemia	<ul> <li>Describe the components of blood (cells, ions, proteins, platelets) giving their normal values.</li> <li>Discuss erythropoiesis</li> <li>Identify the source, stimulus for formation, and function of the hormone erythropoietin.</li> <li>Describe the functional consequence of the lack of a nucleus, ribosomes, and mitochondria for a) protein synthesis and b) energy production within the red blood cell.</li> <li>Discuss hemoglobin with respect to: Steps of synthesis, Reactions and Types (A, A1, F, S)</li> <li>Define the following: Oxyhemoglobin ,Methemoglobin,Carboxy Hemoglobin and Car amino Hemoglobin</li> </ul>

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	Determination of hemoglobin by Sahlis Method
	<ul> <li>Discuss iron metabolism (absorption, transport storage and utilization)</li> </ul>
	Explain the function of ATPs in maintaining normal RBC's  fragility
	<ul><li>fragility</li><li>Enlist the causes of vit B12 and folic acid deficiency.</li></ul>
	<ul> <li>Define MCV, MCH and MCHC with formula</li> </ul>
	Classify anemia on the basis of etiology
	Interpret blood picture of iron deficiency anemia and
	megaloblastic anemia
	<ul> <li>Discuss polycythemia with its types</li> </ul>
	Compare secondary and physiological polycythemia
	The above learning objective will be discussed in tutorial along  with its discission and institute.
	with its clinical applications
	Study of haemocytometer     Determination of RRC count in parinhamal blood
	Determination of RBC count in peripheral blood     Determination of ESB.
	Determination of ESR     Determination of ESR
Resistance to	Determine the osmotic fragility of red blood cells     Discuss the different types of WPC's with its functions.
body infection	<ul> <li>Discuss the different types of WBC's with its functions</li> <li>List the genesis of myelocytes and lymphocytes</li> </ul>
	<ul> <li>List the genesis of myelocytes and lymphocytes</li> <li>Define the following :a)Phagocytosis b) Chemotaxis c)</li> </ul>
	Diapedesis d) Inflammation e)Pus
	<ul> <li>Compare Phagocytosis by Neutrophils and macrophages</li> </ul>
	Discuss role of Neutrophils and macrophages during
	inflammation (first, second, 3 <sup>rd</sup> & 4 <sup>th</sup> line of defense)
	Define: a)Leucopenia b) Leukemia's. c)Leukocytosis
	<ul> <li>Explain the role of monocyte- macrophage cell system (reticuloendothelial system)</li> </ul>
	<ul> <li>Explain the process of inflammation along with walling off effect</li> </ul>
	<ul> <li>Explain the process of formation of pus</li> </ul>
	<ul> <li>The above learning objective will be discussed in tutorial along with its clinical applications</li> </ul>
	Determination of TLC
	Determination of TEC     Determination of DLC
	Define immunity along with its types
	Describe the contributors of innate immunity
	<ul> <li>Define Antigen, epitope, plasma cells, memory cells, antigen presenting cells</li> </ul>
	Illustrate the role of MHC proteins, in immune system
	Explain types of Acquired immunity
	<ul> <li>Describe preprocessing of T and B lymphocytes during fetal life</li> </ul>
	<ul> <li>Classify immunoglobulin's (Antibodies) along with their</li> </ul>
	important characteristics
	<ul> <li>Describe the direct action of antibodies and by activation of complement system</li> </ul>
	<ul> <li>List types of T lymphocytes and their functions</li> </ul>
	<ul> <li>Identify role of Macrophages &amp; CD4 cells in controlling the immune system</li> </ul>
	Differentiate between active and passive immunity
	Explain four types of hypersensitivity
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	Blood types; transfusion; tissue and organ transplantation  Hemostasis and Blood Coagulation	<ul> <li>Describe function of agglutinogens and agglutinins in relation to blood groups.</li> <li>Describe antibody and antigen of ABO system</li> <li>Describe mechanisms that inherit the ABO system.</li> <li>List phenotype and genotype of possible ABO types.</li> <li>Describe antibody and antigen of Rh system.</li> <li>Describe transfusion reaction related to ABO system and Rh system.</li> <li>Explain pathophysiology of Erythroblastosis fetalis</li> <li>Define Allograft, auto graft, isograft and xenograft</li> <li>Discuss Tissue typing (HLA typing)</li> <li>Define Hemostasis along with its steps</li> <li>Discuss the functions of platelets</li> <li>Explain the mechanism of platelet plug formation</li> <li>Contrast the thrombin formation by intrinsic and extrinsic pathway of coagulation</li> </ul>
		<ul> <li>Enlist the clotting factors</li> <li>Enumerate the Vit k dependent clotting factors</li> <li>Enlist anticoagulants in vivo and vitro with its uses</li> <li>Explain why activation of the clotting cascade does not clot all the blood in the body</li> <li>The above learning objective will be discussed in tutorial along with its clinical applications</li> <li>Determination of bleeding time</li> <li>Determination of clotting time</li> <li>Determination of platelets count in peripheral blood</li> </ul>
Respiratory system	Pulmonary ventilation	<ul> <li>Discuss the mechanics of pulmonary ventilation with following aspects: Muscles of respiration &amp; intra alveolar pressure and trans pulmonary pressure</li> <li>Diagram how pleural pressure, alveolar pressure, airflow, and lung volume change during a normal quiet breathing cycle.</li> <li>Explain the factors affecting compliance of the lungs</li> <li>Identify two clinical conditions in which compliance is higher or lower than normal</li> <li>Define the following: 1) Tidal volume. 2) Inspiratory reserve volume. 3) Expiratory reserve volume 6) Residual volume. 5) Inspiratory capacity. 6) Expiratory capacity. 7) Functional residual capacity. 8) Dead space. 9) Alveolar ventilation. 10) Minute respiratory volume 11) Minute alveolar ventilation. 12) Pleural effusion.</li> <li>Draw a normal spirogram, labeling the four lung volumes and four capacities.</li> <li>Define surface tension</li> <li>Describe how surface tension applies to lung mechanics, including the effects of alveolar size and the role of surfactants.</li> <li>Define atelectasis and the role of surfactants in preventing it.</li> <li>Enlist steps of cough reflex and compare it with sneeze reflex.</li> <li>Spirometry</li> </ul>
	Pulmonary Circulation, Pulmonary Edema, Pleural	<ul> <li>Describe the physiologic anatomy of pulmonary circulatory system along with pressures and volume</li> <li>Contrast the systemic and pulmonary circulations with respect to pressures, resistance to blood flow, and response to hypoxia</li> </ul>

Fluid	<ul> <li>Describe the regional differences in pulmonary blood flow in an upright person.</li> </ul>
	<ul> <li>Define zones I, II, and III in the lung, with respect to pulmonary vascular pressure and alveolar pressure.</li> </ul>
	·
	Describe the starting forces and pulmonary capillary dynamics
	Explain the development of pulmonary edema by a) increased     bydrostatic procesure, b) increased parmoability, c) impaired.
	hydrostatic pressure, b) increased permeability, c) impaired lymphatic outflow or increased central venous pressure
	<ul> <li>Explain the mechanism for keeping the alveoli dry and safety of</li> </ul>
	pulmonary edema
Principles of gas	Name the factors that affect diffusive transport of a gas
exchange	between alveolar gas and pulmonary capillary blood.
	<ul> <li>Contrast the following terms: anatomic dead space, physiologic</li> </ul>
	dead space, wasted (dead space) ventilation, total minute
	ventilation and alveolar minute ventilation.
	<ul> <li>Explain ventilation perfusion ratio with following aspects: VA/Q</li> </ul>
	=0.8,>1, ∞
	<ul> <li>Explain how V/Q is affected by the vertical distribution of</li> </ul>
	ventilation and perfusion in the healthy lung
	<ul> <li>Predict how the presence of abnormally low and high V/Q</li> </ul>
	ratios in a person's lungs will affect arterial PO2 and PCO2.
	<ul> <li>Define the following terms: hypoventilation, hyperventilation,</li> </ul>
	hypercapnea, eupnea,
	<ul> <li>Describe various form transport of oxygen from lungs to the body tissues</li> </ul>
	<ul> <li>Identify the percentage of total O2 transported as each form</li> </ul>
	Analyze oxygen hemoglobin dissociation curve with right & lift
	shift (along graph)
	<ul> <li>Explain the relation of hemoglobin saturation, partial</li> </ul>
	pressure of O2 and volume of oxygen carried by Hb at
	various partial pressures
	Define P50
	Define utilization coefficient
	<ul> <li>Describe how carbon monoxide poisoning affect the shape of</li> </ul>
	the oxyhemoglobin dissociation curve
	• List the forms in which carbon dioxide is carried in the blood.
	• Identify the percentage of total CO2 transported as each form.
	Describe the importance of the chloride shift in the transport of
	CO2 by the blood.
	Define Bohr's & Haldane effect
5	Describe respiratory exchange ratio
Regulation of respiration	<ul> <li>Identify the regions in the central nervous system that play important roles in the generation and control of cyclic</li> </ul>
	breathing.  • Discuss the inspiratory ramp signal and the Hering Brouer
	<ul> <li>Discuss the inspiratory ramp signal and the Hering Breuer inflation reflex</li> </ul>
	Explain mechanism of chemical control of respiration (Central &
	peripheral )
	<ul> <li>List the anatomical locations of chemoreceptors sensitive to</li> </ul>
	changes in arterial PO2, PCO2, and pH that participate in the
	control of ventilation.
	- Idea of the color of the colo
	• Identify the relative importance of each in sensing alterations in

		<ul> <li>Define respiratory acidosis and alkalosis and give clinical examples of each.</li> </ul>	
		<ul> <li>Describe the mechanism and function of respiratory acid base compensations.</li> </ul>	
		<ul> <li>Discuss the basic mechanism of Cheyne –stokes breathing</li> <li>Discuss the sleep apnea</li> </ul>	
	Respiratory pathophysiology	<ul> <li>Explain the FEV1/FVC ratio &amp; its clinical importance</li> <li>Differentiate between the two broad categories of restrictive and obstructive lung disease, including the Spiro metric abnormalities associated with each category.</li> <li>Discuss hypoxia with its four type</li> <li>Explain the role of oxygen therapy in different types of hypoxia</li> <li>Define dyspnea and cyanosis</li> <li>Recording of chest movements by stethography</li> </ul>	
Body temperature regulation and fever		<ul> <li>Define core temperature</li> <li>Discuss how body temperature is controlled by balancing heat production and heat loss</li> <li>Explain the role of atriovenous anastomoses in heat transfer</li> <li>Enlist the various methods by which heat is lost from surface</li> <li>Identify the role of evaporation at very high air temperatures</li> <li>Describe the mechanism of sweating and its regulation by autonomic nervous system</li> <li>Interpret the role of aldosterone in acclimatization of sweating mechanism to heat</li> <li>Explain the role of hypothalamus in regulation of body temperature</li> <li>discuss the mechanism of fever with role of pyrogens and cytokines in resetting regulation center along with chills and crisis</li> <li>Define heat stroke, frost bite and artificial hypothermia</li> </ul>	

# **LIST OF Practical**

# **Haematology**

- 1) Study of the compound microscope
- 2) Determination of hemoglobin
- 3) Determination of erythrocyte sedimentation rate (ESR)
- 4) Determination of packed cell volume (PCV) or hematocrit (HCT)
- 5) Study of haemocytometer
- 6) Determination of red blood cell count in peripheral blood
- 7) Red blood cell indices
- 8) Determination of total leucocyte count (TLC)
- 9) Determination of platelet count in peripheral blood
- 10) Differential leucocyte count (DLC)
- 11)Determination of bleeding time (BT)
- 12) Determination of clotting time (CT)
- 13) Determination of blood groups (ABO system)
- 14) Determination of rh system of blood groups
- 15) Determination of the osmotic fragility of red blood cells

# Respiratory system

- 1) Determination of respiratory volumes and capacities
- 2) Examination of chest
- 3) Graphic recording of respiration by stethography

# **Cardiovascular System**

- 1) Clinical examination of precordium & study of heart sounds
- 2) Examination of arterial pulse
- 3) Examination of jugular venous pulse
- 4) Study of cutaneous circulation
- 5) Electrocardiography (ECG OR EKG)
- 6) Demonstration of cardio pulmonary resuscitation (CPR)
- 7) Measure of blood pressure at rest
- 8) Changes in blood pressure with posture

# skin and body temperature regulation

1) Recording of body temperature

# **Learning Methodologies**

The following teaching / learning methods are used to promote better understanding:

- Interactive Lectures
- Small Group Session
- Scenario discussion
- Practical
- Skills session
- Self Study

**INTERACTIVE LECTURES**: In large group, the lecturer introduces a topic or common physiological mechanisms, clinical conditions and explains the underlying phenomena through questions, pictures of patients' interviews, exercises, etc. Students are actively involved in the learning process.

**SMALL GROUP SESSION (SGS):** This format helps students to clarify concepts acquire skills or attitudes. Sessions are structured with the help of specific exercises such as patient case, interviews or discussion topics. Students exchange opinions and apply knowledge gained from lectures, tutorials and self-study. The facilitator role is to ask probing questions, summarize, or rephrase to help clarify concepts.

**SCENARIO DISCUSSION**: A small group discussion format where learning is focused around a series of questions based on a clinical scenario. Students' discuss and answer the questions applying relevant knowledge gained in clinical and basic health sciences.

**PRACTICAL:** Basic science practical related to physiology are scheduled for student learning.

**SKILLS SESSION:** Skills relevant to respective unit are observed and practiced where applicable in skills laboratory.

**SELF STUDY**: Students' assume responsibilities of their own learning through individual study, sharing and discussing with peers, teachers and resource persons within and outside the college. Students can utilize the time within the college scheduled hours of self study in library

## **Assessment Methodologies**

- Internal Assessment Policy:
  - i) 20 marks are allocated from UHS for internal assessment.
  - ii) 80% attendance is mandatory to appear in annual prof. examination.
  - iii) **Formative assessments:** After completion of each unit, test will be held on the pattern of university examination (SEQs, MCQs and OSPE)

At the end of session 20 marks are distributed as:

- > 70% on monthly test
- ➤ 20% on Send up
- ➤ 10% weightage on attendance( Minimum 80 % attendance is required to appear in final professional exams)
- **Summative assessments:** At the end of session by students are assessed by professional examinations conducted by UHS.

### **Methods of Feedback of Curriculum and Assessment:**

- Feedback on curriculum is taken by medical education department on feedback proforma.
- Feedback assessment is taken as post –test discussion in tutorial timings.
- Key of MCQs is displayed immediately after the test to found any discrepancy in MCQs and to address queries of students.

# **RECOMMENDED TEXTBOOKS**

- > TEXT BOOK OF PHYSIOLOGY GUTYON & HALL (13<sup>TH</sup> Ed)
- ➤ GANONG'S REVIEW OF MEDICAL PHYSIOLOGY (23<sup>rd</sup> Ed)

# **REFERENCE BOOKS**

- > HUMAN PHYSIOLOGY BY LAURALI SHERWOOD LATEST Ed
- > PHYSIOLOGY BY BERNE AND LEVY, LATEST Ed
- > PHYSIOLOGY BY LINDA CONTANZO (BRS) LATEST Ed
- HUMAN PHYSIOLOGY: THE BASIS OF MEDICINE BY GILLIAN POCOCK, CHRISTOPHER D. RICHARDS, LATEST Ed.
- PHYSIOLOGICAL BASIS OF MEDICAL PRACTICE BY JOHN B. WEST AND TAYLOR, LATEST Ed.

# TABLE OF SPECIFICATIONS FOR PHYSIOLOGY

### THEORY PAPER FIRST PROFESSIONAL

CONTENTS		MCQs	SEQs
1.	Basic and cell physiology	02	01
2.	Blood	09	02
3.	Nerve and muscle	09	02
4.	Skin and temperature regulation	02	0.5
5.	Cardiovascular system	14	02
6.	Respiratory system	07	01
7.	Human Responses in Varied Environments	02	0.5
TOTAL ITEMS		45 MCQs	09 SEQs
TOTAL MARKS		45 Marks	45 Marks

10% marks are allocated for 'Internal Assessment'

**Total marks for theory paper:** SEQ+ MCQ + Internal Assessment = 45 +45+10=100 Marks

# ORAL AND PRACTICAL EXAMINATION FIRST PROFESSIONAL (PART-I)

The structure of OSPE/ Practical/Viva should be as follows.(Total Marks:90)

# Viva Voca(35 marks)

Internal-----15 marks External-----20 marks

# > <u>OSPE:</u> (25 marks)

Non-observed stations 10 of 01 marks each (2 minutes each) Observed stations 03 of 05 marks each (4 minutes each)

# Practical (30 marks)

Practical 20 marks
 Procedure Writing 05 marks
 Yearly Workbook Assessment 05 marks

# Thankyou