MODULE

CARDIO-PULMONARY MODULE

1st Year BDS

Table of Contents

Vision & Mission

Khyber Medical University (KMU) Vision:

Khyber Medical University will be the global leader in health sciences academics and research for efficient and compassionate health care.

Khyber Medical University (KMU) Mission:

Khyber Medical University aims to promote professional competence through learning and innovation for providing comprehensive quality health care to the nation.

Institute of Health Professions Education & Research (IHPER) Mission:

To produce leaders, innovators and researchers in health professions education who can apply global knowledge to resolve local issues.

Teaching Hours Allocation

S. No	Subject	Hours
1.	Anatomy	15hrs
2.	Physiology	33hrs
3.	Biochemistry	8hrs
4.	Oral Biology & Tooth Morphology	4 hrs
5.	Pharmacology	3hrs
6.	General Pathology	3hrs
7.	Medicine	1hr
Total		**67 hrs**

Themes

S. No	Theme	Duration in Weeks (hrs)
1.	Chest pain	17hrs
2.	Breathlessness and Ankle swelling	25hrs
3.	Blood Pressure and Palpitations	9hrs
4.	Cough and Hemoptysis	16hrs
Total		**2 Weeks (67hrs)**

Learning Objectives

By the end of this Module, 1st year BDS students will be able to:

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

Theme 1: Chest Pain			
Subject	**Topic**	**Hours**	**Learning Objectives**
Embryology	Fetal Circulation	1hr	1. Describe the physiological changes in circulation after birth.
Anatomy	Pericardium Surface anatomy Coronary circulation	1hr	2. Define pericardium. 3. Describe different reflections of pericardium. 4. Describe the gross structure of the heart. 5. Enlist the Coronary arteries and its branches.
Physiology	Cardiac Muscles Properties	1hr	6. Explain the physiologic anatomy and properties of the cardiac muscle. 7. Describe gap-junctions and the significance of functional syncytium.
	Excitation and contraction of cardiac muscles	2hrs	8. Describe excitation-contraction process in cardiac muscles and outline its differentiation from skeletal muscles. 9. Describe chronotropic, Inotropic and dromotropic effects. 10. Explain phases of action potential in cardiac muscle, plateau formation and its significance 11. Describe the significance of prolonged action potential in cardiac muscle. 12. Define automaticity and rhythmicity of heart's specialized conduction system 13. Define pacemaker of the heart and explain why SA node is the normal pacemaker of the heart. 14. Describe the conduction through AV node and ventricular purkinji system 15. Discuss sympathetic and parasympathetic effects on hearth rhythmicity and conductivity
	Normal ECG	1hr	16. Discuss the characteristics of normal ECG. 17. Describe different waves of ECG and its significance.
	Arrthythmias	1hr	18. Describe the types of arrhythmias: tachycardia and bradycardia 19. Describe the types of heart block along with their ECG characteristics 20. Describe the types and causes of premature contractions

			21. Describe the atrial fibrillation and atrial flutter along with their ECG characteristics
Biochemistry	Enzymes	4hrs	22. Define Enzymes. 23. Define activation energy. 24. Define Gibbs Free energy. 25. Explain the general structure of enzymes.
			26. Define co-factors. 27. Explain the function of co-factors. 28. Enlist different types of co-factors. 29. Define different parts and forms of enzymes. 30. Describe the factors involved in structure of enzymes. 31. Describe the mechanism of Enzyme activity. 32. Define catalysis. 33. Explain different mechanism of catalysis. 34. Explain the Principals for Nomenclature of enzymes. 35. Classify Enzymes on the basis of functions. 36. Enlist the factors affecting the activity of enzymes. 37. Describe roles of factors affecting enzyme activity. 38. Define enzyme kinetics. 39. Explain different areas of enzyme kinetics. 40. Describe the role of Km in Enzyme kinetics. 41. Define Isoenzymes (Isozymes). 42. Explain Factors affecting the properties of isozymes. 43. Explain the role of enzymes as a diagnostic tool.
	Cardiac enzymes	1hr	44. Enlist the enzymes that increase in myocardial infarction. 45. Describe lipid profile and its clinical significance. 46. Lipid peroxidation. 47. Describe the dietary sources of sodium, potassium, calcium and magnesium. 48. Describe the role of Na, K, Ca, and Mg in cardiac muscle contractility

			and their biochemical abnormalities. 49. Describe the cardiac manifestations of vitamin B1 deficiency. 50.
Pharmacology	Drugs in Cardio-vascular diseases.	1hr	51. Enlist and classify the group of drugs used in the treatment of coronary artery diseases (angina and MI). 52. Enlist the groups of lipid-lowering drugs.
Lab Work			
Anatomy	Anatomy of heart	2hrs	53. Identify the Heart and major blood vessels. 54. Identify chambers of the heart. 55. Identify internal structures of various chambers of the heart.
Physiology	ECG	2hrs	56. Understand and Apply Proper ECG Electrode Placement 57. Analyze the waveform to ensure proper identification of each segment (P wave, QRS complex, T wave). 58. Measure key intervals and segments, such as the PR interval, QT interval, and RR interval, and explain how these values can indicate normal or abnormal cardiac function. 59. Evaluate Heart Rate Using ECG 60. Identify any potential abnormalities in the rhythm (e.g., atrial fibrillation, ventricular tachycardia), morphology (e.g., ST elevation in myocardial infarction), or intervals (e.g., prolonged QT). 61. Understand the significance of these abnormalities and how they relate to clinical conditions.

Theme 2: Breathlessness and Ankle Swelling			
Anatomy	General features of thorax	1hr	62. Describe main features of thoracic wall. 63. Describe the location and shape of the sternum. 64. Describe the parts of the sternum. 65. Describe the gross features of the thoracic vertebra. Describe the general features of the ribs.
	Diaphragm and Mediastinum	1hr	66. Describe the origin and insertion of the diaphragm. 67. Describe the openings of the diaphragm. 68. Enlist the contents of the superior mediastinum. Enlist the contents of the Anterior & Posterior Mediastinum.
	Pleura	1hr	69. Describe the gross features of pleura.
Physiology	Cardiac cycle	1hr	70. Discuss the cardiac cycle and its regulation. 71. Describe the concept of systole and diastole. 72. Describe the role of atria and ventricles as pumps. 73. Explain pressure-volume diagram during cardiac cycle. 74. Correlate the cardiac cycle events with ECG with the help of diagram
	Heart Sounds	1hr	75. Describe heart sounds and its association with closure or opening of heart valves. 76. Differentiate between first and second heart sounds.

Cardiac output and Regulation of heart pumping	1hr	77. Describe the concept of preload and afterload 78. Describe Frank-starling mechanism of heart pumping regulation 79. Describe end-diastolic volume, ejection fraction, systolic volume, and stroke volume 80. Discuss regulation and control of heart pumping by sympathetic and parasympathetic nerves 81. Explain the role of potassium and calcium and temperature on heart function. 82. Describe Normal Cardiac output and venous return during rest and during activity
Blood flow	2hrs	83. Discuss vascular distensibility and vascular compliance. 84. Describe the regulation of blood flow and "Starling forces" 85. Discuss arterial pressure pulsations. 86. Discuss auto-control of local blood flow. 87. Explain the local metabolic vasodilator hypothesis. 88. Describe the physiological vasodilators and vasoconstrictors. Explain their mechanism of action. 89. Describe the role of oxygen in long term regulation of blood flow 90. Discuss humoral control of circulation and describe the role of vasoconstrictor and vasodilator agents in blood circulation
Microcirculation & Lymphatic System	2hrs	91. Enumerate the structure of microcirculation and structure of capillary wall 92. Discuss diffusion of substances through capillary membrane 93. Explain the forces that affect fluid filtration across capillaries 94. Describe the function of lymphatic system in the maintenance of interstitial fluid volume.
Mechanics of Respiration	1hr	95. Discuss mechanics of respiration. 96. Enlist the muscles involved in lung expansion and contraction. 97. Discuss the pressures that cause movement of air in and out of lungs. 98. Explain the pressure volume changes graph during normal breathing

Lung compliance and surfactant	1hr	99. Define compliance of the lung. 100. Discuss compliance curve. 101. Describe elastic forces caused by surface tension. 102. Explain the role of surfactant in the collapse of alveoli. 103. Discuss the role of surfactant in respiratory distress syndrome of newborn.
Pulmonary volumes and capacities	1hr	104. Describe types of pulmonary volumes and its significance. 105. Discuss types of pulmonary capacities. 106. Explain the graph of lung volume and capacities.
Pulmonary ventilation	1hr	107. Define alveolar ventilation. 108. Describe the formula of rate of alveolar ventilation 109. Discuss dead space and its effects on alveolar ventilation. 110. Compare anatomic and physiologic dead space. 111. Describe the basic concepts of measurement of dead space. 112. Differentiate between alveolar ventilation and minute ventilation.
Gas exchange through respiratory membrane	2hrs	113. Enlist differences between composition of alveolar and atmospheric air. 114. Discuss partial pressures of oxygen and carbon dioxide in alveoli and atmosphere. 115. Describe physiological anatomy of respiratory membrane and factors affecting gas diffusion through respiratory membrane. 116. Describe the diffusing capacity of respiratory membrane. 117. Describe the effects of ventilation/perfusion ratio of alveolar gas concentration. 118. Discuss physiological shunt and dead space. 119. Describe abnormalities of ventilation perfusion ratio.
Transport of O2 and CO2 in blood and tissue fluids	2hrs	120. Discuss the transport of oxygen from lungs to tissue cells. 121. Discuss the diffusion of carbon dioxide from tissue cells to alveoli. 122. Describe the role of Hb in oxygen transport. 123. Explain Oxy/Hb dissociation curve and Enlist the factors that shift Oxy/Hb dissociation curve to right and left.

			124. Describe the transport of oxygen in dissolved state and oxygen poisoning. 125. Discuss the mechanism of transport of carbon dioxide in blood. 126. State Bohr effect and Haldane effect.
	Regulation of Respiration	1hr	127. Enlist respiratory centers in CNS. 128. Describe the role of dorsal and ventral respiratory group of neurons. 129. Discuss the chemical control of respiration. 130. Explain the role of oxygen in respiratory control. 131. Describe the regulation of respiration during exerciseDescribe periodic breathing and basic mechanism of Cheyne-Stokes breathing. 132. Define sleep apnea. 133. Describe the mechanism of hypoxia and cyanosis
	Common Respiratory Abnormalities	1hr	134. Describe periodic breathing and basic mechanism of Cheyne-Stokes breathing. 135. Define sleep apnea. 136. Describe the mechanism of hypoxia and cyanosis.
Biochemistry	Complex lipids	2hrs	137. Define complex lipids. 138. Classify complex lipids. 139. Define and classify phospholipids. 140. Describe functions of glycolipids 141. Describe Lipoproteins, their functions, and bio-medical significance.
Lab Work			
Physiology	Spirometry	2hrs	142. Draw a normal spirogram, labeling the four lung volumes and four capacities. 143. List the volumes that comprise each of the four capacities. 144. Identify which volume and capacities cannot be measured by spirometry. 145. Define the factors that determine total lung capacity, functional residual capacity, and residual volume.

Theme 3: Blood Pressure and Palpitations			
Physiology	Short term regulation of blood pressure	1hr	146. Define blood pressure and discuss high and low blood pressures. 147. Describe Autonomic regulation of blood pressure. 148. Discuss the mechanism of baroreceptors in arterial blood pressure control. 149. Discuss the chemo receptors and CNS ischemic response.
	Long term regulation of blood pressure	1hr	150. Discuss the role of kidneys in long-term control of arterial pressure 151. Explain the renin-angiotensin system in arterial pressure control 152. Classify hypertension and describe its pathophysiology a. Primary hypertension b. Secondary hypertension
	Shock	1hr	153. Define shock and describe its physiological causes 154. Describe the stages of shock 155. Explain the types of shocks: a. Hemorrhagic shock b. Neurologic shock c. Anaphylactic shock d. Septic shock
General Pathology	Circulatory Shock	1hr	156. Define shock and explain causes and types of circulatory shock. 157. Explain the stages of circulatory shock.
Biochemistry	Derived lipids	1hr	158. Define and classify Fatty Acids. 159. Describe the functions of fatty acids. 160. Describe the structure, bio-chemical functions, and fate of cholesterol. 161. Discuss the types of lipo-proteins.
Medicine	Hypertension	1hr	162. Define hypertension. 163. Enlist the causes and types of hypertension. 164. Identify the major risk factors contributing to diseases of the CVS. 165. Discuss the preventive strategies for hypertension.

Pharmacology	Anti-hypertensive drugs Drugs used to treat Arrhythmias	1hr	166. Classify antihypertensive drugs. 167. Describe the mechanism of action of drugs used to manage hypertension. 168. Enlist Antiarrhythmic drugs on the basis of their Effect on Action Potential
Lab Work			
Physiology	Blood pressure measurement	2hrs	169. Apply appropriate techniques to measure blood pressure. 170. Interpret and record blood pressure values.

Theme 4: Cough and Hemoptysis			
Anatomy	Introduction	1hr	171. Describe the major components of the (upper and lower) respiratory system.
	Trachea and bronchi	1hr	172. Describe the general and anatomical features of trachea and bronchi.
	Lungs	1hr	173. Describe the anatomical features of lungs.
Histology	Histological features of trachea	1hr	174. Describe the histological features of trachea and its layers.
Physiology	Functions of respiratory passageways	1hr	175. Describe the respiratory and non-respiratory functions of the respiratory passageways. 176. Discuss autonomic control of bronchial musculature. 177. Explain the role of mucous lining. 178. Discuss cough and sneeze reflex.
Pathology	Pneumonias Pulmonary Tuberculosis Pulmonary Edema Bronchial Asthma	2hrs	179. Define pneumonia and enlist the causative pathogens of pneumonia. 180. Define primary and secondary Tuberculosis and state its etiology. 181. Define pulmonary edema and classify it according to underlying causes. 182. Enlist the etiological factors and clinical features of asthma.

Pharmacology	Anti-Asthmatic drugs Anti-Tuberculous drugs	1hr	183. Classify Anti-asthmatic drugs. 184. Classify Anti-tuberculous drugs.
Lab Work			
Histology	Microscopic features of trachea, bronchi, and lung alveoli.	2hrs	185. Identify the various microscopic features of trachea.
		2hrs	186. Identify the various microscopic features bronchi, and lung alveoli.
Oral Biology & Tooth Morphology	Mandibular 2nd and 3rd Molars	4 hrs	4. Identify on tooth models/specimens or images crown outline, buccal, lingual, mesial, distal surfaces, occlusal table, and its components. 5. Draw and label different aspects of mandibular molars (buccal, lingual, mesial, distal, and occlusal aspect). 1. Differentiate between mandibular 1st and 2nd Molar.

Learning Resources

S#	Subjects	Resources
1.	Anatomy	**A. GROSS ANATOMY** 1. SNELL Last's Anatomy **B. EMBRYOLOGY** 1. Langman's Medical Embryology **C. HISTOLOGY** 1. Medical Histology By Laiq Hussain **Reference Books** 1. Netter Atlas of Human Anatomy 2. Gray's Anatomy
2	Biochemistry	**Text Books** 1. Lippincott illustrated reviews 8th 2. Harper's illustrated Biochemistry 30th 3. U. Satyanarayan and U. Chakarpani 4th **Reference Books** 1. Lippincott illustrated reviews 2. MLA. Harvey, Richard A., PhD. Lippincott's illustrated reviews: Biochemistry 3. U. Satyanarayana Biochemistry 4. U. satyanarayan and U. Chakarpani 4th edition 5. Harper's illustrated Biochemistry 6. Rodwell VW, Bender DA ,Botham KM., Kennelly PJ, Weil P. Eds. Victor W. Rodwell et al. 7. Fundamentals of Biochemistry 8. Donald V., Judith G. Voet, Charlotte W. John wiley and sons, New york 9. Netter's essential Biochemisty 10. Lippincott illustrated reviews 11. MLA. Harvey, Richard A., PhD. Lippincott's illustrated reviews: Biochemistry

3	Physiology	**Textbooks** Physiology Text Books: 1. Guyton and Hall Textbook of Medical Physiology, 13th Edition by John E. Hall. 2. Human Physiology: From Cells to Systems, 8th Edition by Lauralee Sherwood
4	Oral Biology	**Textbook** 1. Ten Cate's Oral Histology 2. Orban's Oral Histology and Embryology **3.** Concise Dental Anatomy and Morphology by James L. Fuller **Reference Books** 2. Oral Anatomy, Histology and Embryology by B.K.B Berkovitz