**Cardiovascular System (CVS) Module**

**First Professional Year MBBS**

**5 Weeks**

KMU - Central Curriculum Committee

**LIST OF TEAM MEMBERS**

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| Prof. Dr. Fouzia Gul  Dean HPER | Khyber Medical University |
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**Themes of CVS module**

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| 1. **Chest pain-**   **(1 week)** | 1. **Breathlessness and ankle swelling-**   **(2 weeks)** | 1. **Blood Pressure-**   **(1 week)** |
| 1. **Palpitations**   **(1 week)** |

**General Learning outcomes**

At the end of this module, the 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

**Specific learning objectives (theme based)**

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| **1- Chest Pain** | | | |
| **Subject** | **Topic** | **S. No** | **Learning objectives** |
| Anatomy | Surface anatomy | 1 | Describe the surface marking of the heart |
|  |  | 2 | Describe the surface marking of the heart valves |
|  |  | 3 | Illustrate the surface marking of the aorta on models / x-rays |
|  |  | 4 | Describe the surface marking of the superior vena cava |
|  |  | 5 | Describe the surface marking of the inferior vena cava |
|  |  | 6 | Describe the gross structure of the heart |
|  | Coronary circulation | 7 | Describe the coronary arteries |
|  |  | 8 | Enlist the branches of each main artery |
|  |  | 9 | Describe the anastomosis of coronaries |
|  |  | 10 | Identify the area of the heart supplied by a coronary artery and its branches |
|  |  | 11 | Describe the venous drainage of the heart |
|  |  | 12 | Describe the lymphatic drainage of the heart |
|  | Pericardium | 12 | Define pericardium |
|  |  | 14 | Describe different reflections of pericardium |
|  |  | 15 | Identify entry & exit of vessels of heart via pericardium |
|  |  | 16 | Define the following clinical condition; pericarditis pericardial effusion  cardiac Tamponade |
| Histology | Histology of heart muscles | 17 | Explain the characteristics of cardiac muscle cell |
|  |  | 18 | Explain the Structure of Intercalated disc |
|  |  | 19 | Define the junctional specializations making up the intercalated disk |
|  |  | 20 | Describe identification of different microscopic views of Cardiac muscle and its ultra-structures |
|  |  | 21 | Differentiate histologically between cardiac and skeletal muscle and smooth muscles |
|  |  | 22 | Enumerate histological layers of heart wall |
| Physiology | Cardiac muscles | 23 | Explain the physiologic anatomy of the cardiac muscle |
|  |  | 24 | Describe the properties of the cardiac muscle |
|  | Coronary circulation | 25 | Describe the physiologic basis coronary circulation |
|  |  | 26 | Describe the steps of coronary thrombosis |
|  |  | 27 | Describe the etiology of coronary thrombosis |
| Biochemistry | Cardiac enzymes | 28 | Identify the enzymes that increase in myocardial infarction |
|  | Lipids and cholesterol | 29 | Describe the Chemical Structure and function of cholesterol |
|  |  | 30 | Describe the fate of cholesterol in the body |
|  |  | 31 | Define and Classify lipids |
|  |  | 33 | Describe the functions of lipids in the body |
|  |  | 34 | Classify lipoproteins and their functions |
|  |  | 42 | Describe Cardiac enzymes and their pattern of elevation in ischemic heart diseases |
|  |  | 47 | Describe the role of Na, K, Ca and Mg in cardiac muscles contractility and their biochemical abnormalities |
|  |  | 48 | Describe the cardiac manifestations of vitamin B1 deficiency |
| Pharmacology |  | 49 | Enlist the groups of drugs used in the treatment of CAD (angina and MI) |
|  |  | 50 | Enlist the groups of lipids lowering drugs |
| Pathology |  | 51 | Describe the risk factors, and lab. Diagnosis of CAD |
|  |  | 52 | Define and Enlist the stages of atherosclerosis |
| Forensic medicine |  | 53 | Describe the medicolegal aspects of sudden death due to cardiovascular diseases |
| Community Medicine | Prevention of CVD | 54 | Describe primordial, primary, secondary and tertiary prevention of CV diseases in community |
| **2- Breathlessness and ankle swelling** | | | |
| Embryology | Fetal circulation | 55 | Describe the physiological changes in circulation after birth |
|  | Cardiac developmental anomalies | 56 | Enlist the developmental anomalies of heart |
|  |  | 57 | Describe the congenital anomalies of the heart.  ASD  VSD  PDA  Tetralogy of Fallot  transposition of the great vessels  Hemangiomas and  Telangiectasia |
| Physiology | Cardiac cycle | 58 | Describe the Cardiac cycle |
|  |  | 59 | Describe the concept of systole and diastole, |
|  |  | 60 | Describe the role of atria and ventricles as pumps, |
|  |  | 61 | Describe the functions of heart valves, |
|  |  | 62 | Correlate the cardiac cycle events with ECG |
|  |  | 63 | Describe the mechanism of production of normal and abnormal heart sounds |
|  |  | 64 | Relate heart sounds with cardiac cycle, |
|  |  | 65 | Describe the metabolism and oxygen utilization of cardiac muscle |
|  |  | 66 | Describe the regulation of cardiac cycle |
|  | Cardiac output | 67 | Describe pressure volume loop (end-systolic volume / end-diastolic volume / ejection fraction / systolic volume / systolic work output) |
|  |  | 68 | Explain the Frank-Starling mechanism of the heart for the control of cardiac output by venous return |
|  |  | 69 | Describe the methods for measuring of cardiac output |
|  |  | 70 | Describe normal cardiac output and venous return during rest and during activity |
|  |  | 71 | Enlist the causes of abnormally high and abnormally low cardiac output |
|  |  | 72 | Explain the mechanisms of normal cardiac contractility and the role of calcium ion/ ATPase pumps |
|  |  | 73 | Explain cardiac output (regulation/measurement) and peripheral resistance and its regulation |
|  |  | 74 | Explain the factors regulating cardiac output and venous return. |
|  | Blood flow | 75 | Describe the Biophysics and Interrelationships of Pressure, Flow, and Resistance in terms of Ohm’s law and Poiseuille’s Law |
|  |  | 76 | Describe starling forces |
|  |  | 77 | Describe regulation of blood flow |
|  |  | 78 | Define basal tone. |
|  |  | 79 | List several substances potentially involved in local metabolic control of vascular tone. |
|  |  | 80 | State the local metabolic vasodilator hypothesis. |
|  |  | 81 | Describe physiological Vasodilators and Vasoconstrictors and their mechanisms |
|  |  | 82 | Describe the factors affecting the local blood flow including auto-regulation. |
|  |  | 83 | Describe the function of capillaries |
|  |  | 84 | Describe circulatory changes during exercise |
|  |  | 85 | Describe blood flow to different organs like brain, heart, liver and skin during exercise |
|  | Functions of heart valves | 86 | Describe the functions of mitral, tricuspid, aortic and pulmonic valves |
|  |  | 87 | Describe the hemodynamics and sequel related to stenosis and regurgitation of heart valves |
|  | Lymphatic system | 88 | Describe the function of lymphatic system in the maintenance of interstitial fluid volume. |
|  |  | 89 | Describe the effects of Interstitial Fluid Pressure on Lymph Flow. |
|  |  | 90 | Describe how changes in capillary hydrostatic pressure, plasma oncotic pressure, capillary permeability, and lymphatic function can lead to tissue edema |
| Medicine | Heart failure | 91 | Define Heart failure |
|  |  | 92 | Differentiate between right-sided Heart failure and left-sided heart failure |
| **3- Blood Pressure** | | | |
| Anatomy |  |  |  |
|  | Histology of blood vessels | 93 | Describe the histological composition of vessel |
|  |  | 94 | Describe the microscopic structure of artery and vein |
|  |  | 95 | Differentiate histologically between artery and vein under light microscope |
|  |  | 96 | Describe the histological composition of lymphatic channels |
| Embryology | Development of arteries and veins | 97 | Describe the development of arterial system |
|  |  | 98 | Describe the development of venous system |
|  |  | 99 | Describe the congenital abnormalities in in the vessels. - Coarctation of Aorta |
| Physiology | Blood Pressure | 100 | Define blood pressure |
|  |  | 101 | Describe the causes of High / low BP |
|  |  | 102 | Discuss the mechanisms for rapid and long term control of blood pressure (including Renin Angiotensin system) |
|  |  | 103 | Describe the effects of sympathetic and parasympathetic stimulation on the heart and circulation |
|  | Circulatory Shock | 104 | Define Circulatory Shock |
|  |  | 105 | Explain the physiologic causes of circulatory shock |
|  |  | 106 | Explain the stages of circulatory shock |
|  |  | 107 | Describe cardiogenic shock |
|  |  | 108 | Describe Hemorrhagic Shock |
|  |  | 109 | Describe of Neurogenic Shock |
|  |  | 110 | Describe Anaphylactic Shock |
|  |  | 111 | Describe Septic Shock |
|  |  | 112 | Explain the physiology of treatment in Shock |
| Pharmacology |  | 113 | Describe the mechanisms of drugs used in the treatment of Hypertension |
| Community medicine |  | 114 | Describe the preventive strategies of hypertension |
| **4- Palpitations** | | | |
| Anatomy | Conduction system of the heart | 115 | Describe the different components of conduction system   * SA Node * AV Node * Bundle of His * Purkenje Fibers * Bundle branches |
|  |  | 116 | Describe the sympathetic innervation of heart |
|  |  | 117 | Describe the parasympathetic innervation of the heart |
| Physiology | Excitation and contraction of cardiac muscles | 118 | Describe the excitation–contraction process in cardiac muscle.  Describe Chronotropic, Inotropic and Dromotropic Effects |
|  |  | 119 | Describe Chronotropic, Inotropic and Dromotropic Effects |
|  |  | 120 | Differentiate excitation–contraction process in cardiac and skeletal muscle cells |
|  |  | 121 | Describe gap junctions and the significance of functional syncytium |
|  |  | 122 | Explain phases of cardiac muscle action potential |
|  |  | 123 | Describe the characteristics of cardiac action potentials and the role of “slow calcium” channels in causing plateau and its significance |
|  |  | 124 | Describe the significance of AV nodal Delay |
|  |  | 125 | Define Pacemaker and explain why SA node is the normal pacemaker of the heart |
|  |  | 126 | Define Ectopic Pacemaker and describe its causes |
|  |  | 127 | Describe the effects of sympathetic and parasympathetic stimulation on the heart rate and conduction of cardiac action potentials |
|  |  | 128 | Define various types of refractory periods |
|  |  | 129 | Differentiate the refractory period of cardiac muscle with that of skeletal muscle |
|  |  | 130 | Describe the significance of prolonged action potential in cardiac muscle |
|  |  | 131 | Describe the physiological anatomy of the sinus node |
|  |  | 132 | Define automaticity and rhythmicity and conductivity |
|  |  | 133 | Describe the specialized excitatory and conductive pathway of the cardiac muscle tissue |
|  | ECG | 134 | Describe the characteristics of normal ECG, time duration of waves, segments and voltages |
|  |  | 135 | Explain how to record ECG |
|  |  | 136 | Describe the AV nodal, ventricular impulse conduction |
|  |  | 137 | Interpret ECG paper and its calibration |
| Community Medicine | CVD prevention | 138 | Identify the major risk factors which contribute to common diseases of the cardiovascular system |
|  |  | 139 | Enumerate modifiable and non-modifiable risk factors of CV diseases |
|  |  | 140 | Apply primordial, primary, secondary and tertiary prevention of CV diseases in community |

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| **Psychomotor domain** | | |
| Chest Pain | Anatomy | 1. Identify the heart & its coverings in the model / dissected specimen 2. Identify the heart and major blood vessels in cadaver/dissected specimen 3. Identify the chambers of the heart. 4. Identify the internal structures of various chambers of the heart. 5. Identify the Cardiac Muscle under the microscope |
| Physiology | 1. Perform basic life support. |
| Blood Pressure |  | 1. Identify salient features of a medium sized artery & vein in a cross-section under microscope. 2. Identify the histological differences between medium size artery & vein under microscope. 3. Describe the histological differences between large size artery & vein. |
| Breathlessness and ankle swelling | Clinical | 1. Identify normal cardiac shadow, borders and cardiomegaly on chest radiographs. 2. Identify the position of borders and valves of the heart by surface marking on model / simulator 3. Palpate and find apex beat, and auscultatory areas in the chest of the subject provided and describe their significance. 4. Demonstrate the use of Stethoscope for Auscultation. 5. Differentiate between normal and displaced apex beat |
|  | Physiology | 1. Measure the blood pressure. 2. Measure the effect of posture and exercise on blood pressure. 3. Examine the arterial pulses. 4. Auscultate the heart sounds. |
| Palpitations |  | 1. Perform systematic analysis of ECG |
| **Affective domain** | | |
| PRIME |  | 1. Demonstrate ability to give and receive feedback, respect for self and peers. 2. Carry out practical work as instructed in an organized and safe manner 3. Demonstrate empathy and care to patients. 4. Develop respect for the individuality and values of others - (including having respect for oneself) patients, colleagues and other health professionals 5. Organize& distribute tasks 6. Exchange opinion & knowledge 7. Develop communication skills and etiquette with sense of responsibility. 8. To equip themselves for teamwork 9. Regularly attend the classes 10. Role play for the counseling of patients with risk factors for coronary heart diseases on modification of life style 11. Role play for the counseling of patients with risk factors for coronary heart diseases on modification of life style |