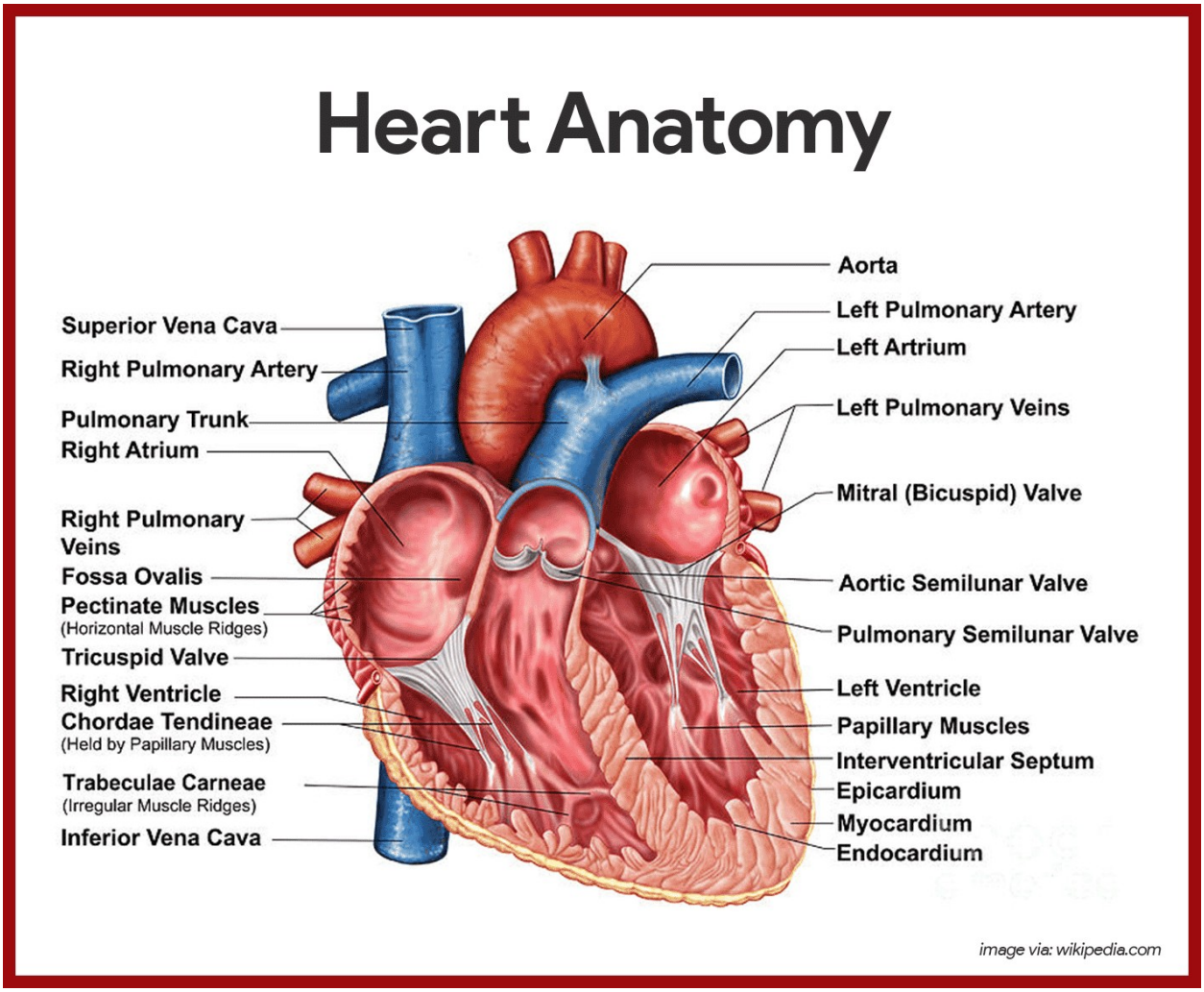
LIAQUAT NATIONAL HOSPITAL AND MEDICAL COLLEGE

Institute for Postgraduate Medical Studies & Health Science

CARDIOVASCULAR SYSTEM I MODULE

26TH AUGUST 2024 TO 28TH SEPTEMBER 2024



STUDY GUIDE FOR CARDIOVASCULAR SYSTEM MODULE-I

Module name: **Cardiovascular System-I** *Year:* ***One*** *Duration:* ***5 weeks (Aug-Sept 2024)***

Timetable hours: **Lectures, Case-Based Learning (CBL), Self-Study, Practicals, Skills, Demonstrations**

MODULE INTEGRATED COMMITTEE

MODULE COORDINATOR:	• Professor Hafeez Ul Hassan (**Physiology**)
CO-COORDINATORS:	• Dr. Fizzah Ali (**Pharmacology**)

DEPARTMENTS & RESOURCE PERSONS FACILITATING LEARNING

BASIC HEALTH SCIENCES	CLINICAL AND ANCILLARY DEPARTMENTS
ANATOMY Professor Zia-ul-Islam	***CARDIOLOGY*** • Dr. Hafeez Ahmed
BIOCHEMISTRY Dr. Faiza Waseem	***RADIOLOGY*** Dr. Muhammad Misbah Tahir
PATHOLOGY Professor Naveen Faridi	***RESEARCH & SKILLS DEVELOPMENT CENTER*** Dr. Kahkashan Tahir
PHARMACOLOGY Professor Tabassum Zehra	
PHYSIOLOGY Professor Syed Hafeezul Hassan	

DEPARTMENT of HEALTH PROFESSIONS EDUCATION

- Professor Nighat Huda
- Professor Sobia Ali
- Dr. Yusra Nasir
- Dr. Afifa Tabassum

LNH&MC MANAGEMENT

- Professor Karimullah Makki, Principal, LNH&MC
- Dr. Shaheena Akbani, Director A.A & R.T LNH&MC

STUDY GUIDE COMPILED BY: Department of Health Professions Education

INTRODUCTION

WHAT IS A STUDY GUIDE?

It is an aid to:

Inform students how the student learning program of the module has been organized

Help students organize and manage their studies throughout the module

Guide students on assessment methods, rules, and regulations

THE STUDY GUIDE:

- Communicates information on the organization and management of the module. This will help the student to contact the right person in case of any difficulty.
- Defines the objectives which are expected to be achieved at the end of the module.
- Identifies the learning strategies such as Interactive Lectures, small group teachings, clinical skills, demonstrations, tutorials, and case-based learning that will be implemented to achieve the module objectives.
- Provides a list of learning resources such as books, computer-assisted learning programs, web-links, and journals, for students to consult to maximize their learning.
- Highlights information on continuous and module examinations' contribution to the student's overall performance.
- Includes information on the assessment methods that will be held to determine every student's achievement of objectives.
- Focuses on information about examination policy, rules, and regulations.

CURRICULUM FRAMEWORK

Students will experience an integrated curriculum similar to previous modules**.**

INTEGRATED CURRICULUM comprises system-based modules such as Foundation II, Blood II, Locomotor II, Respiratory system-II, CVS-II, and GIT Liver II, linking basic science knowledge to clinical problems. Integrated teaching means that subjects are presented as a meaningful whole. Students will be able to have a better understanding of basic sciences when they repeatedly learn about clinical examples.

LEARNING EXPERIENCES: Case-based integrated discussions, and skills acquisition in the skills lab. Computer-based assignments, and learning experiences in clinics, wards, and outreach centers.

LEARNING METHODOLOGIES

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

- Interactive Lectures
- Tutorial
- Case- Based Learning (CBL)
- Clinical Experiences
    - Clinical Rotations
- Skills session
- Self-Directed Learning
- Simulation-based learning
- Practicals

INTERACTIVE LECTURES:

In a large group, the Interactive Lectures introduce a topic or common clinical conditions and explain the underlying phenomena through questions, pictures, videos of patient interviews, exercises, etc. Students are actively involved in the learning process

TUTORIAL: This format helps students to clarify concepts, and acquire skills or desired attitudes. Sessions are structured with the help of specific exercises such as patient cases, interviews, or discussion topics. Students exchange opinions and apply knowledge gained from Interactive Lectures, tutorials, and self-study. The facilitator's role is to ask probing questions, summarize, or rephrase to help clarify concepts.

CASE-BASED LEARNING (CBL): A small group discussion format where learning is focused on a series of questions based on a clinical scenario. Students discuss and answer the questions by applying relevant knowledge gained previously in clinical and basic health sciences during the module and constructing new knowledge. The CBIL will be provided by the concerned department.

CLINICAL LEARNING EXPERIENCES: In small groups, students observe patients with signs and symptoms in hospital wards, clinics, and outreach centers. This helps students relate knowledge of the module's basic and clinical sciences and prepare for future practice

CLINICAL ROTATIONS: In small groups, students rotate in different wards like Medicine, Pediatrics, Surgery, Obs & Gyne, ENT, Eye, Family Medicine clinics, outreach centers &

Community Medicine Experiences. Here students observe patients, take histories and perform supervised clinical examinations in outpatient and inpatient settings. They also get an opportunity to observe medical personnel working as a team. These rotations help students relate basic medical and clinical knowledge in diverse clinical areas.

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

SELF-DIRECTED LEARNING Students assume responsibilities for their learning through individual study, sharing and discussing with peers, and seeking information from Learning Resource Center, teachers, and resource persons within and outside the college. Students can utilize the time within the college's scheduled hours of self-study.

MODULE 5: CARDIOVASCULAR SYSTEM

INTRODUCTION

Welcome to the Cardiovascular System Module-I. In the next four weeks, you will have the opportunity to develop an understanding of the basic concepts of the cardiovascular system through an integrated course designed by basic and clinical sciences faculty.

The heart being the main organ of the cardiovascular system is responsible for distributing blood all the ver human body. A perfectly functioning cardiovascular system is so important for the human body, that if it stops for a minute, rapid death may occur. In the 3rd year in the cardiovascular system - II module students will learn in-depth about cardiovascular diseases.

In Pakistan cardiovascular diseases account for about 19% of all deaths and about 38% of deaths occurring due to non-communicable diseases. It is also one of the leading causes of illness and reduces the quality of life.

The medical curriculum is not only the study of disease outcomes but also about “prevention being better than cure” Unhealthy lifestyle choices such as a rich fat diet, being overweight, and smoking, increase the risk of cardiovascular diseases. Therefore as a medical student, it is important to understand how the risk of cardiovascular disorders can be reduced by adopting a healthy lifestyle.

We hope you enjoy the next four weeks. There will be other modules ahead, but a good grounding in the cardiovascular module will be an important stage of your journey through this system-based course. As a physician, you are expected to manage individuals, families, and communities in the prevention of illnesses including cardiac disorders

1. *World Health Organization – Non-communicable Diseases (NCD) Country Profiles, 2014*

COURSE OBJECTIVES AND STRATEGIES

At the end of the module, the students will be able to:

ANATOMY

OBJECTIVES	LEARNING STRATEGY
1. Overview of the Cardiovascular system	Interactive Lecture
• Explain the organization of the cardiovascular system	
• Enumerate the components of the cardiovascular system	
• Enumerate the vessels related to the heart	
2. Middle Mediastinum: Pericardium	Interactive Lecture/Case-Based Learning
• Describe the boundaries of the middle mediastinum	
• Discuss the contents of the middle mediastinum	
• Explain the different coverings of the heart (pericardium)	
• Discuss the location of pericardial sinuses	
• Discuss the clinical conditions associated with the pericardium	
3. External features of the Heart	Tutorial
• Describe the location, coverings, borders & surfaces of the heart	
• Discuss the external features of the heart	
• Discuss briefly the chambers and valves of the heart	
• Discuss the different circulatory circuits and their working	
4. Heart: Internal features- I & II	
• Describe the anatomical position of the heart	
• Describe the chambers and valves of the heart	
• Discuss the internal features of chambers and valves of the right & left sides of the heart.	
5. Histology of Heart	Interactive Lecture
• Discuss the basic structure of the blood circulatory system	
• Enumerate the layers of the walls of the heart	
• Describe the histological characteristics of cardiac muscle	
• Discuss the structure and significance of intercalated discs	
6. Coronary blood vessels, the blood supply of heathe rt	
• Describe coronary circulation and its importance	
• Name the different branches of coronary arteries and their area of supply	
• Describe variations of coronary arteries and right and left dominance	
• Discuss variations of coronary artery disease	
• Discuss clinical manifestations of blockage of coronary arteries	
• Discuss Myocardial Infarction and Angina Pectoris about vessel occlusion	
7. Conducting system of heart and nerve supply	
• Describe the conducting system of heart	
• Explain the different components of conducting the system	

• Discuss the blood supply of conducting system of the heart	
• Discuss the innervation of the heart and the clinical relevance of cardiac pain	
8. Surface markings of heart, valves, and great vessels	Interactive Lecture/ Tutorial
• Describe the position of the heart	
• Identify the surface anatomy of the heart on a mannequin or normal subject	
• Identify the surface marking of the borders, great vessels, and valves of the heart	
• Identify the surface markings of the areas of auscultation.	
9. Development of Heart	Interactive Lecture
• Discuss the development of heart tube	
• Describe the development of atria and interatrial septum, AV valves and aortic and pulmonary valves, ventricles and interventricular septum	
• Describe the partitioning of the outflow tract and the role of neural crest cells during it	
10. Congenital Anomalies of the Heart (Excluding vessels)	
• Describe congenital heart defects	
• Discuss clinical features of heart defects	
11. Development of arterial system & anomalies	
• Discuss the relationship between pharyngeal arches and aortic arches	
• Explain the fate and formation of aortic arches	
• Describe the formation of the brachiocephalic trunk, common carotid, and left subclavian arteries	
• Describe the anomalies of the arterial system	
12. Development of veins and their anomalies	
• Describe the major veins of the heart, coronary sinus, anterior cardiac veins, venae cordis minimal	
• Explain the development and fate of umbilical, vitelline, and cardinal veins	
• Describe the anomalies of the venous system	
13. Fetal Circulation	
• Describe the components of fetal circulation	
• Describe the location of foramen ovale	
• Describe the ductus arteriosus	
• Explain the path of fetal circulation	
• Explain the changes in circulation after birth	
• Discuss the problems with the persistence of fetal components of circulation after birth (patent ductus arteriosus and patent foramen ovale)	
14. Anatomic Radiology	Tutorial
• Identify parts of the heart and major vessels on normal chest X-ray	
15. Histology of the heart	Practical
• Describe the characteristic histological features of cardiac muscle and layers of heart walls under the light microscope	
16. Histology of vessels	
• Describe the characteristic histological features of blood vessels under the light microscope	

BIOCHEMISTRY

OBJECTIVES	LEARNING STRATEGY
LIPID METABOLISM	Interactive Lecture
1. Fatty Acid & Triacylglycerol Metabolism	
• Describe briefly the digestion and absorption of lipids	
• Discuss the biochemical significance of Fatty Acids	
• Discuss the synthesis of fatty acids	
• Discuss the regulation of fatty acid synthesis	
• Describe energy requirement during fatty acid synthesis	
• Describe the synthesis of Triacylglycerol	
2. Beta oxidation	
• Discuss the beta-oxidation of fatty acids	
• Discuss the regulation of beta-oxidation	
• Describe energy generation during beta-oxidation	
• Name the steps of unsaturated fatty acid oxidation	
• Compare fatty acid synthesis with fatty acid oxidation	
3. Cholesterol Metabolism	Interactive Lecture
• Describe briefly the structure and functions of cholesterol	
• Describe the mechanism of cholesterol synthesis and its degradation	
• Discuss the regulation of cholesterol metabolism	
• Explain the formation of Bile salts and vitamin D	
• Describe the clinical significance of cholesterol	
• Discuss the biochemical role of cholesterol in CVS diseases	
• Discuss the clinical significance of hyperlipidemia	
4. Transport of Lipids	
• Classify the lipoproteins	
• Discuss the metabolism, transport, and clinical significance of lipoproteins	
5. Ketone Bodies Metabolism	
• Classify the Ketone bodies	
• Describe the biochemical role of Ketone bodies, their synthesis, and utilization	
• Discuss the mechanism of ketoacidosis	
• Discuss the clinical significance of ketone bodies	
6. Oxidants & Antioxidants	Interactive Lecture
• Classify oxidants and antioxidants	
• List the sources of oxidants and antioxidants	
• Discuss their biochemical role, especially concerning CVS diseases	
7. Role of Minerals in Blood Pressure Regulation	
• Discuss hypertension and its risk factors	
• Describe the mechanism of action of sodium and potassium in blood pressure regulation	
• Explain dietary approaches to reduce hypertension	
• List other lifestyle interventions for the management of hypertension	
8. Lipid Profile	Tutorial
• Discuss the importance of lipid profile in CVS diseases	
• Correlate the laboratory investigations with relevant clinical conditions	

9. Cardiac Biomarkers	Tutorial
• Outline the bio-techniques for the detection of cardbiomarkerskers in a sample	
• Discuss the importance of cardiac biomarkers in the diagnosis of CVS disease	
• Correlate the laboratory investigations with relevant clinical conditions	
10. Triacylglycerol (TAGs)	Practical
• Identify the chemical tests and bio-techniques to detect Triacylglycerol	
• Outline the method for the detection of Triacylglycerol in a sample	
• Describe the estimation of TAGs in the given sample by Spectrophotometry	
• Correlate the laboratory investigations with relevant clinical conditions	
11. Total Cholesterol, HDL (High-Density Lipoprotein) & LDL (Low-Density Lipoprotein) Estimation	
• Identify the chemical tests and bio-techniques to detect total cholesterol, HDL & LDL	
• Outline the method for the detection of total cholesterol, HDL & LDL in a sample	
• Perform the estimation of total cholesterol, HDL & LDL in serum by Spectrophotometry	
• Correlate the laboratory investigations with relevant clinical conditions	

CARDIOLOGY

OBJECTIVES	LEARNING STRATEGY
1. Coronary Artery Disease	Interactive Lecture
• Describe the basics of coronary artery disease and its clinical manifestation	
2. Overview of valvular Heart Disease	
• Discuss the basics of valvular Heart Disease	
3. Basics of interventional cardiology	
• List the various cardiology intervention procedures	

PATHOLOGY

OBJECTIVES	LEARNING STRATEGY
Pathophysiology of atherosclerosis	Interactive Lecture
• Describe the pathophysiological process of atherosclerosis	

PHARMACOLOGY

OBJECTIVES	LEARNING STRATEGY
Lipid Lowering Agents	Interactive Lecture
• Discuss the basic pharmacology of lipid-lowering agents	

PHYSIOLOGY

OBJECTIVES	LEARNING STRATEGY
1. Properties of cardiovascular muscles	Interactive Lecture/ Tutorial
• Define the properties of cardiac muscles	
• Explain the phenomenon of generation of action potential in cardiac muscles and the process of excitation-contraction coupling	
2. Excitatory and conductive system of the heart	Interactive Lecture
• Describe the conducting system of the heart and the role of a pacemaker in maintaining cardiac rhythm	
• Explain the regulation of heart rhythm and conduction by the autonomic nervous system	
3. Cardiac cycle and heart sounds	Interactive Lecture/ Tutorial
• Describe events of the cardiac cycle and associated events (pressure changes and heart sound generation), and their effect other the volume of heart chambers and vessels (aorta, pulmonary artery)	
4. ECG 1: Lead System	Interactive Lecture
• Describe 12 lead ECG record	
• Define Einthoven's triangle & Einthoven's law	
5. ECG 2: Normal ECG pattern	
• Explain the normal ECG waves	
6. ECG 3: Vector Analysis	
• Analyze ECG vectors and their interpretation	
• Define right & left axis deviation	
7. Cardiac arrhythmia	
• Define arrhythmia	
• Discuss the common cardiac arrhythmias, their causes, and effects	
8. Overview of circulation (blood flow, pressure, resistance)	Interactive Lecture/ Tutorial
• Define vascular distensibility and compliance	
• Define blood flow pressure and resistance in different blood vessels	
• Explain veins and their functions	
9. Cardiac output, venous return, and its regulation	Interactive Lecture
• Define cardiac output and factors regulating cardiac output	
10. Nervous regulation of circulation and arterial pressure	
• Define arterial blood pressure state mechanism of regulation of blood pressure (short, intermediate, long term)	
11. Intermediate and long-term control of blood pressure	
• Discuss the processes and regulatory mechanisms of intermediate and long-term control of blood pressure	
12. Local control of blood flow	Interactive Lecture/ Tutorial
• Explain the process of Acute and long-term blood flow regulation	
• Discuss auto-regulation of blood flow	
• Describe humoral regulation of circulation	
13. Micro-circulation	Interactive Lecture
• Describe Starling Equilibrium for capillary exchange	
14. Lymphatic system and edema	
• List the functions of lymphatic systems	

• Define edema and its types	
• Describe the process of edema formation	
15. Circulatory shock	
• Explain the physiological causes of shock, its stages, and types	
16. CVS adaption during exercise	
• Describe cardiovascular adaptation to exercise	
17. Ischemic Heart Disease (IHD)	Case-Based Learning
• List the common ischemic heart diseases	
• Define common IHDs	
• Discuss the changes and effects of common IHDs	
18. Power lab: The refractory period of cardiac muscle	Practical
• Describe how to record the refractory period of cardiac muscles through the power lab	
19. ECG (its major components, Correlation of ECG and heart sounds)	
• Describe how to set up the ECG machine and arrangement of leads	
20. Normal and abnormal heart sounds	
• Describe how to differentiate between normal and abnormal heart sounds	
21. Examination of arterial pulses	
• Examine arterial pulses in normal human subject	
• Define common abnormal arterial pulsations	
22. Recording of blood pressure	
• Describe how to record blood pressure by palpatory and auscultatory methods	

RADIOLOGY

OBJECTIVES	LEARNING STRATEGY
• Interpret different parts of the cardiovascular system on radiological images.	Interactive Lecture

RESEARCH & SKILLS DEVELOPMENT CENTER

OBJECTIVES	LEARNING STRATEGY
1. Auscultation of Heart	Simulation-based learning
• Identify the point of auscultation for heart sound	
2. Normal and abnormal heart sounds	
• Identify normal and abnormal heart sounds	

LEARNING RESOURCES

SUBJECT	*RESOURCES*

ANATOMY	**A. GROSS ANATOMY** 1. K.L. Moore, Clinically Oriented Anatomy 2. Neuro Anatomy by Richard Snell **B. HISTOLOGY** 1. B. Young J. W. Health Wheather's Functional Histology **C. EMBRYOLOGY** 1. Keith L. Moore. The Developing Human 2. Langman's Medical Embryology
BIOCHEMISTRY	**A. TEXTBOOKS** 1. Harper's Illustrated Biochemistry 2. Lehninger Principle of Biochemistry 3. Biochemistry by Devlin
PHYSIOLOGY	**A. TEXTBOOKS** 1. Textbook Of Medical Physiology by Guyton And Hall 2. Ganong ' S Review of Medical Physiology 3. Human Physiology by Lauralee Sherwood 4. Berne & Levy Physiology 5. Best & Taylor Physiological Basis of Medical Practice **B. REFERENCE BOOKS** 1. Guyton & Hall Physiological Review 2. Essentials Of Medical Physiology by Jaypee 3. Textbook Of Medical Physiology by Indu Khurana 4. Short Textbook Of Physiology by Arthur 5. NMS Physiology

ASSESSMENT METHODS:

- **Best Choice Questions(BCQs)** also known as MCQs (Multiple Choice Questions)
- **Objective Structured Practical/Clinical Examination (OSPE or OSCE)**

Internal Evaluation

- Students will be assessed comprehensively through multiple methods.
- 20% marks of internal evaluation will be added to JSMU final exam. That 20% may include class tests, assignments, practicals, and the internal exam which will all have specific marks allocation.

Formative Assessment

Individual departments may hold quizzes or short answer questions to help students assess their learning. The marks obtained are not included in the internal evaluation

For JSMU Examination Policy, please consult the JSMU website!

More than 75% attendance is needed to sit for the internal and final examinations

LNMC EXAMINATION RULES & REGULATIONS

- Students must report to the examination hall/venue, 30 minutes before the exam.
- **The exam will begin sharply at the given time.**
- No student will be allowed to enter the examination hall after 15 minutes of the scheduled

examination time.

- Students must sit according to their roll numbers mentioned on the seats.
- **Cell phones are strictly not allowed in the examination hall.**
- If any student is found with a cell phone in any mode (silent, switched off, or on) he/she will not be allowed to continue their exam.
- No students will be allowed to sit in exams without University Admit Card, LNMC College ID Card, and Lab Coat.
- Students must bring the following stationary items for the exam: Pen, Pencil, Eraser, and Sharpener.
- Indiscipline in the exam hall/venue is not acceptable. Students must not possess any written material or communicate with their fellow students.

SCHEDULE:

WEEKS	1ST YEAR	MONTH
WEEK 5	CVS MODULE	26th Aug 2024

PRE PROF EXAM*

*Final dates will be announced later