

PONDICHERRY UNIVERSITY COMMUNITY COLLEGE



SYLLABUS & COURSE FRAME WORK
BACHELOR OF VOCATIONAL DEGREE
in
CARDIAC LABARATORY TECHNOLOGY

WITH EFFECT FROM ACADEMIC YEAR 2019-20

**REGULATION AND CURRICULUM FOR THE
BACHELOR OF VOCATIONAL DEGREE COURSE IN
CARDIAC LAB TECHNOLOGY**

(REVISED FROM 2019-20)

1. Title of the course : B.VOC (CARDIAC LAB TECHNOLOGY)

2. Eligibility for admission:

A candidate seeking admission to the Bachelor of Vocational Degree Courses in Para medical sciences shall have passed higher secondary examination (10, +2) or equivalent with physics, chemistry and biology as principal subjects of study.

Or

Vocational higher secondary examination with Physics, Chemistry and Biology in addition to vocational subjects.

3. Sanctioned student strength: 20 Students.

4. Course significance:

Cardiac technicians also referred as Cardiac Vascular Technicians/Cardiac Care Technicians prepare patients for cardiac procedures including electro cardiogram, Stress tests etc. In addition they need to operate complicated cardiac equipment such as cardiac output monitoring units and defibrillators. Also they have to ensure that equipment's are ready to use and the cardiologists are familiar with a patient's medical history.

Plenty of career opportunities are available for trained cardiac technicians in the government and private sectors including hospitals, medical clinics, cardiologist's office and other health care environments.

5. Course objectives: The B.Voc. course on cardiac lab technology aims to develop:

- (i). **Key skills:** cardiac technicians must be very detail oriented and have strong inter personal skills to work with patients.
- (ii). **Computer skills:** ability to use computer for procuring medical data, record maintenance and inventory management.
- (iii). **Technical skills:** cardiac technicians need to operate all cardiac equipment, need to do the upkeep and maintenance of equipment, preparing patients for the procedures, briefing the cardiologist on the medical history of the patient etc.

6. Course description:

The cardiac lab technology program is structured to prepare the students to perform the duties and responsibilities of a cardiac technician. The curriculum includes two major components such as **general education and vocational education**, apart from English communication and computer skills. The vocational content has given more weightage by having more hours of teaching in theory as well as practical and also by incorporating **vocational skill training** in a clinical setting under the supervision of cardiologist, expert technicians, (skill knowledge providers) as an integral component of the curriculum. This will enable the students to gain both didactic knowledge and practical experience in cardio vascular science ECG, holter monitoring, echocardiography etc.

7. Duration of the course:

The duration of the course shall be three years with semester pattern.

8. Medium of instruction:

The medium of instruction and examination shall be in English.

9. Course implementation:

- (i). General education component of the curriculum would be imparted in Pondicherry University Community College and skill training by SKP (Skill Knowledge Providers) such as physicians, trainers, senior technicians, etc. of the hospital sectors.
- (ii). A log book would be maintained for students with SKP's and continuous assessment and end semester evaluation of skill would be done by SKP.
- (iii). Only the necessary number of core faculties would be there in the institution and the remaining would be drawn as guest faculties from skill sectors and people with experience and expertise in the specific vocational skills.
- (iv). The expenses in connection with job training (training fees) educational tour, field visits etc. if any should be borne by the candidates.

10. Attendance:

Every candidate should have attended at least 80% (compulsory) of the total number of classes conducted in an academic year from the date of commencement of the term to the last working day as notified by university, in each of the subjects prescribed for that year separately, in theory and practical. Only such candidates are eligible to appear for the university examinations.

11. Schedule of Examination:

The university shall conduct examinations semester wise as notified by the university from time to time. A candidate who satisfies the requirement of attendance, progress and conduct as stipulated by the university shall be eligible to appear for the university examination.

12. Conducting Examination:

- (i) Theory Exams: Pondicherry University for general and Vocational papers Practical Exams:
- English and computer exams: Pondicherry University
 - All other papers (general as well as vocational) periodic assessment and end semester exams): are conducted by Skill Knowledge Providers (SKP) or trainers in the clinical settings and marks shall be submitted in sealed covers (in duplicates) to Community College. This will be forwarded to Pondicherry University from Community College.

Also a certificate from the SKP / HOD / Institution shall be issued to each student at the end of each semester on the clinical training imparted in the respective institutions, giving the assessment of Skill performance of the candidate as grade(marks).

Note: Remuneration as per University norms shall be given to SKP for conducting practical exam for Vocational & general education paper.

13. Declaration of Class:

- a. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with Distinction.
- b. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 65% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in the First Class.
- c. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than 65% of grand total marks prescribed will be declared to have passed the examination in the Second Class.
- d. A candidate passing the university examination in more than one attempt shall be placed in Pass category irrespective of the percentage of marks secured by him/her in the examination.

[Please note fraction of marks should not be rounded off clauses (a),(b) and c)].

14. Course structure and scheme of Examinations:

BACHELOR OF VOCATIONAL DEGREE IN CARDIAC LABORATORY TECHNOLOGY									
		General Papers	Hours		Credits	Vocational papers	Hours		Credits
			Theory	Practical			Theory	Practical	
Diploma (1 Year)	1 st sem	English	30	20	4	Principles of Electrocardiography	40	60	7
		IT & Equipment's	30	20	4	-	-	-	-
		Anatomy & Physiology	50	20	6	-	-	-	-
		Biochemistry of the Heart	50	20	6	-	-	-	-
	2 nd sem	Cardiac Pathology	50	20	6	Advanced ECG & Exercise Physiology	40	60	7
		Microbiology	50	20	6	Hospital Service Orientation/ Infection Control	40	60	7
		-	-	-	-	Basic patient Care Techniques	40	60	7
		Total	260	120	32		160	240	28
Advanced Diploma (2 Year)	3 rd sem	Biomedical & e-Waste Management	40	20	5	Echocardiography Basic and Techniques	40	60	7
		Pharmacology in Cardiology	50	20	6	Cardiac Emergency and CPR Techniques	40	60	7
		-	-	-	-	ICCU Techniques	40	60	7
	4 th sem	Advanced Echocardiography Techniques	50	20	6	Organization and services in Cath lab	40	60	7
		Cardiac Catheterization Laboratory : Basics and Techniques	50	20	6	Cardiac Pacemakers and Defibrillators	-	180	9
		Total	190	80	23		160	420	37

B.Voc Degree (3Year)	5 th sem	Environmental Studies (EVS)	30	-	3	Interventional cardiology & cardiac Electrophysiology	40	60	7
		-	-	-	-	Internship I	-	400	20
	6 th sem	-	-	-	-	Recent Advances in Cardiac Imaging	40	60	7
		-	-	-	-	Internship II	-	460	23
		Total	30	-	3		80	980	57

	EXAMINATION SCHEME OF B.VOC DEGREE IN CARDIAC LABORATORY TECHNOLOGY									
Papers		Subjects	Theory Max	Theory Min	IA Max	IA Min	PC/PR/VV Max / Min		Total Max	Total Min
	SEMESTER- I									
General Paper-I	English		60	30	20	10	20	10	100	50
General paper-II	Computer & IT Skills		60	30	20	10	20	10	100	50
General Paper-III	Anatomy & Physiology		60	30	20	10	20	10	100	50
General Paper-IV	Biochemistry of the Heart		60	30	20	10	20	10	100	50
Vocational-I	Principles of Electrocardiography		60	30	20	10	70	35	150	75
	SEMESTER - II									
General paper-V	Cardiac Pathology		60	30	20	10	20	10	100	50
General Paper-VI	Microbiology		60	30	20	10	20	10	100	50
Vocational-II	Advanced ECG & Exercise Physiology		60	30	20	10	70	35	150	75
Vocational-III	Hospital Service Orientation/ Infection Control		60	30	20	10	70	35	150	75
Vocational-IV	Basic patient Care Techniques		60	30	20	10	70	35	150	75
	SEMESTER - III									
General Paper-VII	Biomedical & e-Waste Management		60	30	20	10	20	10	100	50
General Paper-VIII	Pharmacology in Cardiology		60	30	20	10	20	10	100	50
Vocational-V	Echocardiography Basic and Techniques		60	30	20	10	20	10	100	50
Vocational-VI	Cardiac Emergency and CPR Techniques		60	30	20	10	70	35	150	75
Vocational-VII	ICCU Techniques		60	30	20	10	70	35	150	75
	SEMESTER - IV									
General Paper-IX	Advanced Echocardiographic Techniques		60	30	20	10	20	10	100	50
Vocational-VIII	Cardiac Catheterization Laboratory : Basics and Techniques		60	30	20	10	20	10	100	50
Vocational-IX	Organization and services in Cath lab		60	30	20	10	70	35	150	75
Vocational-X	Cardiac Pacemakers and Defibrillators		-	-	20	10	130	65	150	75
	SEMESTER – V									
Compulsory Paper	Environmental Studies (EVS)		75	30	25	10	-	-	100	40
Vocational – XI	Interventional cardiology & cardiac Electrophysiology		60	30	20	10	70	35	150	75
Vocational – XII	Internship-I		-	-	20	10	330	190	350	200
	SEMESTER - VI									
Vocational – XIII	Recent Advances in Cardiac Imaging		60	30	20	10	70	35	150	75
Vocational – XIV	Internship-II		-	-	20	10	330	190	350	200

Vocational paper's practical will be evaluated by the skill provider * PC – Practical, PR- Practical Report, VV – Viva-Voce

Total Marks	Practical / Practical Report	Case study/Project	Viva-Voce
20 marks	15	-	5
70 marks	50	-	20
130 marks	80	30	20
330 marks	180	100	50

SYLLABUS CONTENTS
CARDIAC LABORATORY TECHNOLOGY
(Bachelor of Vocational Degree Course)

I-Semester	
General Paper-I	English
General Paper-II	Computer & IT Skills
General Paper – III	Anatomy & Physiology
General Paper –IV	Biochemistry of the Heart
Vocational – I	Principle of Electrocardiography

II- Semester	
General Paper – V	Cardiac pathology
General Paper – VI	Microbiology
Vocational – II	Advanced ECG & Exercise Physiology
Vocational – III	Hospital Service Orientation/Infection Control
Vocational – IV	Basic Patient Care Techniques

III-Semester	
General Paper – VII	Biomedical & e-waste Management
General Paper – VIII	Pharmacology in Cardiology
Vocational –V	Echocardiography Basic Techniques
Vocational –VI	Cardiac Emergency and CPR Techniques
Vocational - VII	ICCU techniques

IV-Semester	
General Paper-IX	Advanced Echocardiographic Techniques
Vocational-VIII	Cardiac Catheterization Laboratory Basics and Techniques
Vocational-IX	Organization and services in Cath lab
Vocational-X	Cardiac Pacemakers and Defibrillators

V-Semester	
Compulsory Paper	Environmental Studies (EVS)
Vocational – XI	Interventional cardiology & cardiac Electrophysiology
Vocational – XII	Internship-I

VI-Semester	
Vocational – XIII	Recent Advances in Cardiac Imaging
Vocational – XIV	Internship-II

SYLLABUS

I YEAR – 1st SEMESTER

GENERAL PAPER I: ENGLISH

Theory : 30 hrs

Practical: 20hrs

Foundation course — ENGLISH

Objective and Learning Outcome: To strengthen the student's academic English writing and reading skill; To strengthen skills in oral communication and be able to address different kinds of audiences.

Unit 1

Fundamentals of Language: Grammar and Vocabulary: Articles, prepositions, modal auxiliaries, Limited to the basic use of Parts of Speech.

Unit 2

Reading Skills: a) Reading official Letters and Profiles b) Reading News Reports/Newspapers c) Reading Online Content d) Reading Comprehension, Description and Narration (Objects, Places and People) Strategies: Skimming and Scanning, e) Note-making.

Unit 3

Creative writing: Basic writing skills, developing ideas and themes, writing introduction, welcoming, thanks giving, reporting events and conclusion. Describing everyday events, recounting incidents, letter writing.

Unit 4

Effective Oral Communication [Spoken English]: 1) Introducing yourself 2) Presentation 3) Group Discussion 4) role play

Unit 5

Developing Conversational Ability:

1) Meeting People, Exchanging Greetings and Taking Leave 2) facing interview 3) Introducing People to Others 4) Answering the Telephone and Asking for Someone 5) Dealing with a Wrong Number 6) Taking and Leaving Messages 7) Making Inquiries on the Phone 8) Calling for Help in an Emergency 9) Participating in small talks- At the office, At the railway station, At the airport, At the travel agency, At the bank, At the doctor's clinic, At the hospital.

Text Books:

1. David Green, *Contemporary English Grammar Structures and Compositions*. Revised Edition, Macmillan India Ltd, 2008
2. G. Radhakrishna Pillai, K. Rajeevan and P. Bhaskaran Nair, *Written English for You*. Emerald, 2007.

GENERAL PAPER II: IT & EQUIPMENT'S

Theory: 30hrs

Practical: 20hrs

Objective and Learning Outcome: To introduce the students to the basics and practical knowledge of computer programming and MS-Office tools; To familiarize the students with the basics and practical knowledge of handling equipment's related to cardiac lab.

UNIT-I

Introduction to Computer - Function and components of a computer, Types & characteristics of computers, Input and Output devices, Auxiliary storage devices.

UNIT-II

Word processing using MS –Word; Introduction –Creating a New Document- Templates and Wizards-Controlling the Screen Display-Formatting-Searching & Replacing – Tables-Desktop Publishing with Word.

UNIT-III

Spread Sheet Management using Excel; Introduction-Basic Worksheet Mechanics – Worksheet Development-Editing & Formatting Worksheet-Printing Techniques-Sorting the Data filtering-List- Pictorial representation of Data in Excel; Creating a Chart-Customizing& Embedding a Chart-Charting Techniques

Introduction to Power Point; Usage of Design Templates- Presentation Using Wizards-Slide Transition & Animations-Inserting Clip Arts & Pictures- Background & Colour Layouts

UNIT-IV

ECG machine, 2D Echo machine, Stress test system, Cardiac monitors, Infusion pumps, Balloon pumps, Defibrillators, Automated external defibrillators (AED), Diagnostics.

UNIT-V

Cardiac ultrasound machine, vascular ultrasound machine, EKG machines, Heart-lung bypass machine, Vascular Doppler, Cardiac Cath Lab equipment – closure/ compression device/ sheath/ stent/wire.

Practical's:

1. Various browsers, Search engines, email
2. Text document with images with multiple formatting options using a specified office package
3. Spread sheet using a specified office package
4. Presentation on a specified topic using the specified locations

Reference Books:

Latest editions of the following books:

1. An introduction to GCC by Brian J.Gough, foreword by Richard M.Stallman
2. Microsoft office 2003 by Jennifer Ackerman Kettell, Guy Hart-Davis

GENERAL PAPER-III
ANATOMY & PHYSIOLOGY

Theory: 50hrs
Practical: 20hrs

Objective and Learning Outcome: To describe the location and position of the heart within the body cavity. To describe the internal and external **anatomy** of the heart. To identify the tissue layers of the heart and to relate the **structure** of the heart to its function as a pump.

Anatomy

1. Background
2. Anatomical Positions and Orientation of the Heart within the Thorax.
3. Pericardium
4. Cardiac Skeleton.
5. Tricuspid Valve
6. Mitral Valve
7. Aortic Valve
8. Pulmonary Valve
9. Cardiac Grooves, Crux, Margins.
10. Right Ventricle
11. Left Ventricle
12. Ventricular Septum
13. Atrial Septum
14. Right Atrium.
15. Left Atrium
16. Coronary Arteries and Veins.
17. Regional Coronary Artery Supply.
18. Coronary Collaterals.
19. Great Vessels
20. Cardiac Conduction System.
21. Vascular Tree.

Physiology

1. Properties of cardiac tissue, including electro Physiology
2. Hemodynamics
3. Excitation: The Action Potential.
4. Excitation-Contraction Coupling
5. Fundamentals of Myocardial Contractility.
6. The Electrocardiogram and Electro cardiology.
7. The Cardiac Cycle.
8. Left Ventricular Function.
9. Cardiac Output and Blood Flow.
10. Blood Pressure, Resistance.
11. Coronary Circulation.
12. Autonomic Nervous System Control.

Practical's:

1. Identification of structures, chambers, valves of the heart and their function

2. Identification of blood cells and their function
3. Identification of blood vessels and their function
4. Blood Pressure measurement
5. Estimation of hemoglobin

Reference Books:

Latest editions of the following books:

1. Ross and Wilson: Anatomy and Physiology in health and illness by Waugh Grant; Churchill Livingstone -Elsevier
2. Comprehensive Text Book of Medical Physiology , G.K.PAL , Jaypee publications 2nd Edition, 2019

GENERALPAPER- IV BIOCHEMISTRY OF THE HEART

**Theory: 5ohrs
Practical: 2ohrs**

Objective and Learning Outcome: Students will explain/describe the synthesis of proteins, lipids, nucleic acids, and carbohydrates and their role in metabolic pathways with respect to heart

1. Myocardial Metabolism.
2. Lipids and the Heart.
3. Biochemical Estimations in Cardiology.
4. Biomarkers
5. Kidney and the Heart.
6. Acid-Base Balance.
7. Cardiac Enzymes.
8. Cholesterol Metabolism.
9. Fatty Acid Metabolism.
10. Rare Biochemical Associations of the Heart.

Practical's:

1. Estimation of cholesterol
2. Lipid Profile
3. Estimation of Triglyceride
4. Troponin test
5. Creatine Kinase (CK-MB)test
6. LDH test

Text Books:

Latest editions of the following books:

1. Medical Biochemistry – Ramakrishnan, Prasannan and Rajan: Orient publisher.
2. Textbook of biochemistry for medical students –Vasudevan & Sreekumari : Jaypee.
3. Textbook of medical biochemistry- Chaterjee & Shinde :Jaypee.
4. Practical Clinical Biochemistry- Varley : CBS publication

VOCATIONAL PAPER-I:
PRINCIPLES OF ELECTROCARDIOGRAPHY AND HOLTER

Theory: 40hrs
Practical: 60hrs

Objective and Learning Outcome: To enable the students to understand the operation, evaluate and interpret ECG patterns. To familiarize the students with Holter monitor system and reporting

1. Introduction to ECG, ECG Apparatus, Bipolar Standard Leads, Bipolar Chest Leads, Unipolar Leads, Unipolar extremity Leads, Unipolar Precordial Leads, Monitor Leads, and Relation between Unipolar Extremity Leads & Standard Bipolar Leads.
2. Electrophysiology of the Heart: Intracellular Potentials, Electrical Potentials produced by normal cardiac muscle
3. Cardiac Electrical Activity: Anatomic Orientation of the Heart, The Cardiac cycle, Cardiac impulse formation and conduction, Recording Long and Short axis of cardiac electrical activity.
4. Recording the Electrocardiogram: Evolution of Frontal Plane Leads; Transverse plane Leads; Correct and incorrect leads placement; Display of the 12 standard ECG.
5. Interpretation of the Normal ECG: ECG features, Rate and Regularity, P-Wave morphology, PR interval, QRS morphology, ST-segment, T-wave & U wave morphology, QTC interval, Cardiac rhythm, ECG in Infants & Children, Normal Variants of the Adult ECG, Dextrocardia & Dextroversion, Technical Dextrocardia.
6. Abnormal Wave Morphology: Chamber Enlargement: Atrial enlargement, systematic approach to the evaluation of atrial enlargement, Ventricular Enlargement (RV, LV dilation, Hypertrophy) Systematic approach to the Evaluation of Ventricular enlargement.
7. Intra ventricular Conduction abnormalities: Normal conduction, Bundle Branch and Fascicular blocks, Systematic approach to the Analysis of BB and Fascicular blocks.
8. Introduction to Holter Recordings. Principles and Techniques, Indications, Equipment, Data Retrieval and Storage .Reporting

Practical's:

1. Types of ECG Equipment's: Proper handling and maintenance of Equipment's
2. Patient information and patient privacy
3. Connecting ECG electrodes, ECG recording, standardization, writing correct name and ID of the patient.
4. Performing bed side ECG
5. Maintenance of Equipment's and maintenance of their cords
6. Troubleshooting
7. Proper communication with the patients
8. Holter Recording-Practical Aspects, Equipment and Connections, Recording and Storage

TEXT BOOKS RECOMMENDED:

Latest editions of the following books:

1. Electrocardiogram- LEOSHAMROTH
2. Principles of Electrocardiogram-MARRIOTGOLDMAN

I YEAR – II SEMESTER

GENERAL PAPER V: CARDIAC PATHOLOGY

Theory: 50hrs
Practical: 20hrs

Objective and Learning Outcome: To provide the student with a systematic approach to the evaluation of patients with heart disease. To understand and classify common cardiovascular conditions and diagnostic tests.

1. Atherosclerosis, Heart attack, Ischemic stroke, Hemorrhagic stroke, Heart failure, Arrhythmia, Heart valve diseases.
2. Myocardial Ischemia: Introduction, ECG changes during myocardial ischemia, injury and infarction, Ischemia and Injury due to increased myocardial demand, Ischemia and Injury due to insufficient Blood supply.
3. Myocardial Infarction: Changes in the QRS complex, QRS complex criteria for Diagnosis of infarction, localizing Infarction, Estimating Infarct size, Changes in the ST segment and Twave.
4. Miscellaneous conditions: Cardiomyopathies, Pericardial Abnormalities, Pulmonary Abnormalities Intracranial Hemorrhage, Endocrine and Metabolic Abnormalities, Electrolyte Abnormalities, drug effects.
5. Abnormal Rhythms: Introduction to Arrhythmias, Approach to arrhythmia diagnosis, problems of Automaticity, impulse conduction (block & re-entry)
6. Brady and Tachyarrhythmia, SVT, VT, VF, wide QRS, Tachycardia.
7. Coronary artery disease; Acute myocardial infarction; segmental hypo kinesis;
8. Inferior infarct, anterior infarct, apical infarct, chronic ischemic heart disease, LVT hrombi.
9. CONGENITAL HEART DISEASE:-Diagnostic approach:
Variation in cardiac position and situs: situs solitus with evocardia, situs solitus with, situs inversus with dextrocardia, situs inversus with levocardia

GENERAL PAPER-VI

MICROBIOLOGY

Theory: 50hrs
Practical: 20hrs

Objective and Learning Outcome: To explain the theoretical basis of the tools, technologies and methods common to **microbiology** and demonstrate practical skills in the use of tools, technologies and methods common to **microbiology**,

Microbiology

1. Introduction to microbes and study of Microscope
2. Sterilization and Disinfection
3. Identification of Bacteria
4. Common Culture media in Laboratories
5. Staphylococci
6. Streptococci
7. Pneumococci
8. Neisseria
9. Mycobacterium Tuberculosis
10. Gram Positive and Gram Negative Organisms
11. Pasteurall, Yersinia and Brucella
12. Bacteriological Examinations of Body Fluid

Practical's: Microbiology

1. Methods of Sterilization
2. Collection of specimens for bacteriological examination
3. Handling and preparation of the specimens for microscopic examination
4. Common bacteriological staining techniques
5. Composition and preparation of common types of culture media.
6. Examination of specimens such as pus, body fluids, urine, stool, sputum, throat swab etc.

OCATIONAL PAPER II:
ADVANCE ECG & EXERCISE PHYSIOLOGY

Theory: 40hrs

Practical: 60hrs

Objective and Learning Outcome: To provide the students with basic and practical knowledge with reference to advance ECG and exercise physiology.

1. Cardiovascular and pulmonary responses to exercise. Type of Exercise, Exercise Physiology Maximum Oxygen Uptake, Myocardial Oxygen uptake, Heart rate Response, Arterial Blood pressure response etc.
2. Relative & absolute Indication ,contraindication, Termination of Exercise, Testing Procedures: Subject preparation, Electrocardiographic Recording, Equipment and protocols, test supervision and interpretation, post exercise period
3. Fourlevelanginascaleforexercisetolerancetest.Metabolicequivalent,etc
4. Complication secondary to exercise tests.
5. Interpretation; clinical response:-symptoms, subject appearance, physical examination, exercise capacity
6. Haemo dynamic response; blood pressure, HR during exercise, Brog scale for rating perceived exertion.
7. Normal and abnormal ECG Response; P,QRS,T,U Wave changes, ST-segment depression, elevation, ST-Segment elevation in Post-MI patient conduction abnormalities.
8. Diagnostic value of the exercise test, prognostic use of the exercise test, exertional hypotension. Cardiac events in-patient with silent ischemia. Exercise parameters associated with poor prognosis and/or increased severity of CAD. Other uses of exercise test.
9. Drugs and exercise testing; Beta blockers, vasodilators, ACE-Inhibitors, calcium antagonists, digitalis, other drugs
10. Special cases of exercise testing interpretation.

LIST OF PRACTICAL EXERCISES:

1. Types of TMT equipment's: Proper handling and maintenance of equipment's
2. Getting familiarize with different TM protocols
3. Patient information and patient privacy
4. Performing TMT
5. Interpretation of ECG changes during exercise and recovery
6. Reporting and Data Storage

TEXT BOOKS RECOMMENDED:

Latest editions of the following books:

1. Elle stedt's Principles of Exercise Electrocardiogram.
2. Manual of Exercise Electrocardiogram-Edward. Hung

TEACHING LEARNING ACTIVITIES

The course content will be covered by:

1. Lectures
2. Group Discussions
3. Practical
4. Demonstrations
5. Clinical lab postings
6. Seminars
7. Assignments.

VOCATIONAL PAPER-III
HOSPITAL SERVICES ORIENTATION/INFECTION CONTROL

Theory: 40hrs
Practical: 60hrs

Objective and Learning Outcome: To equip the students with an understanding of the various service departments and their functions; To provide them with the handling of patients and infection control practices.

- Hospital Departmental Classification
- Non Clinical Departments
- Central Sterile and Supply departments
- Medical Records
- Pharmacy
- Front Office & Billing
- Laundry and Linen Services
- House Keeping Services
- Kitchen Services
- Biomedical and Engineering Services
- Clinical departments
- OPD, IPD, ICU, Emergency,
- Visit to hospital departments
- Diagnostics (cardiology Lab)
- INITIAL APPROACH TO THE PATIENT:-

Atrial situs and viscera atrial relation; Abdominal situs- viscerotrial discordance; Atrio ventricular connections; Ventricular number, size, orientation and identity.

Great vessel orientation and identity; Ventricle and great vessel relationship Presence and location of intra cardiac shunt; Location and presence of outflow obstruction.

- Introduction to Hospital Routine Procedures:
Admissions; Discharge; Patient Complaints; Availability of Materials; Methods of Infection Control (sterilization, disinfection, spill management, etc).

VOCATIONAL PAPER-IV:
BASIC PATIENT CARE TECHNIQUES

Theory: 40hrs
Practical: 60hrs

Objective and Learning Outcome: To provide the students with a thorough knowledge of the basic and routine patient care techniques; To enable them to service to the basic care procedures.

1. Patient Rights, Customer etiquette, telephone handling
2. Introduction to Sick Nursing
3. Sponging of Patients
4. Medical Terminology
5. Basic Infection Control practices
6. Cleanliness and disinfection of ward and appliances
7. Bed Making
8. Sample and medicine transport
9. Reception of Patients ,appointments
10. Medical and Nursing Ethics
11. Care of Skin
12. Care of Bed sores and their prevention
13. Attendance to Patients various needs
14. Care of Mouth
15. Care of Nails
16. Care of Bladder and Bowel
17. Shifting and transportation of Patients
18. Patient safety
19. First Aid Certificate Course Basic
20. First Aid Techniques

**BIOMEDICAL & e-WASTE MANAGEMENT – III SEMESTER
GENERAL PAPER – VII**

**Theory: 40 hrs
Practical: 20 hrs**

Objective and Learning Outcome: To understand, classify and dispose biomedical waste; To learn the regulations governing waste management and best practices.

Biomedical waste

1. Introduction
2. General Considerations
- 3. Separate waste streams**
 - 3.1. Sharp wastes
 - 3.2. Infectious non sharp wastes
 - 3.3. General waste
 - 3.4. Recyclable items
 - 3.5. Pharmaceuticals
4. Colour coding
5. BMW Management Committee
 - 5.1. Structure Composition
 - 5.2. Functions
6. Steps
 - 6.1. Segregation
 - 6.2. Collection
 - 6.3. Transportation
 - 6.4. Disposal
7. Documentation
 - 7.1. Application for authorization

GENERAL PAPER VIII
PHARMACOLOGY IN CARDIOLOGY

Theory: 50hrs
Practical: 20hrs

Objective and Learning Outcome: To utilize critical thinking skills in discussing the concept of pharmacotherapy. To understand basic concepts of pharmacology in cardiology.

1. Angiotensin, Aldosterone and Renin Inhibition.
2. Positive Inotropic Drugs.
3. Antihypertensive Drugs.
4. Diuretics.
5. Drugs for Dyslipidemias.
6. Drugs for Diabetes and Cardio dysmetabolic Syndrome.
7. Drugs for Acute Coronary Syndromes.
8. Drugs for Dysrhythmias.
9. Drugs for Heart Failure.
10. Drugs for Stable Angina.
11. Drugs for Pulmonary Hypertension
12. Cardiac Drugs in Pregnancy.

Practical's:

1. Labelling of drugs
2. Calculation of drug doses and dilutions
3. Pharmacy preparation
4. Route of administration of drugs
5. Short experiments for efficacy and safety

Text Books:

Latest editions of the following books:

1. Essentials of Pharmacotherapy – Barar ; S.Chand & Co.
2. Essentials of medical Pharmacology by Tripathi: Jaypee
3. Practical manual of Pharmacology by
Badyal Dinesh: Jaypee

**VOCATIONAL PAPER V:
ECHOCARDIOGRAPHY BASIC TECHNIQUES**

**Theory: 40hrs
Practical: 60hrs**

Objective and Learning Outcome: The student will be exposed to and become familiar with the technical performance, interpretation, strengths, and limitations of 2-dimensional echocardiography and Doppler. To enable the students to correlate Echo and Doppler exam with other exam results

1. Physical principles, instrumentation, and routine examination Properties of ultrasound, the transducer, Echocardiography
2. Basic Principles of Echocardiography-equipment's and Instrumentation
3. Indications for Echo
4. Trans Thoracic Echo cardio graphic examination
5. Standard plane position-standard imaging planes;
Parasternal long axis, parasternal short axis, apical views, Subcostal views
suprasternal views
6. M mode echocardiography
7. Principles of Doppler flow images
The Doppler Effect, frequency description and analysis, Application of sampling theory to Doppler signal analysis, Limitation in the direct application of the Doppler equation to clinical velocity& Bernoulli's equation for velocities
8. Doppler instrumentation
Doppler pulse transmission, summary of factors affecting Doppler sensitivity
9. Principles of flow:
Structure of blood and its relation to ultrasonic scattering, blood flow, hydraulic energies, pulsatile flow, vessel diameter, velocity profile
10. Principles of colour flow imaging:
The colour flow mapper, interrelationship of velocity resolution, depth of field, line density and frame rate
Colour Doppler spatial, temporal and velocity resolution
11. Trans esophageal Echo-Indications, Contraindication, Indications, Equipment and Transducers, Patient Preparation, Image Recording, Views and Interpretation.

VOCATIONAL PAPER VI
CARDIAC EMERGENCIES AND CPR TECHNIQUES

Theory: 40hrs
Practical: 60hrs

Objective and Learning Outcome: To enable understanding of cardiac emergencies and CPR techniques

- 1) Cardiac Arrhythmias
- 2) Cardiovascular (Cardiogenic) Shock
 - a) etiology
 - b) practical exposure to patients
- 3) SUDDEN CARDIAC DEATH
 - a) Definition of sudden cardiac death
 - b) Causes of SCD
 - c) Mechanisms underlying SCD
 - d) Predictors of SCD
 - e) Identification of high-risk patient
 - f) Pathological correlates of SCD
 - g) Prodromal symptoms
 - h) Cardio-vascular manifestations prior to SCD
 - i) Prevention of SCD
- 4) CARDIAC ARREST
 - a) Definition
 - b) Common causes
 - c) Diagnosis and identification
 - d) Prevention
 - e) Prompt action (CPR)
- 5) First Aid in cardiac emergencies
- 6) Cardio – Pulmonary Resuscitation (CPR) and Basic Cardiac Life Support (BCLS)
 - a) Practical training in management of cardiac arrest
 - b) Role of resuscitation (CPR) in SCD and cardiac arrest
 - c) “ABC” of cardio – pulmonary resuscitation
 - d) Definition of cardiac life support (BCLS)
 - e) BCLS training for cardiac technicians and Para-medical professionals
- I. Maintenance of clear AIRWAY (A) during CPR in BCLS Head and jaw position, Heimlich procedure - swabbing out throats creations- During CPR in ACLS – use of suction devices – use of pharyngeal airway – endo-tracheal intubation – adjuncts for airway control.
 - I. BREATHING (Ventilation) during CPR in BCLS – expired air respiration – mouth to mouth breathing – mouth to mask venturi tube – use of bag-valve devices – ambu’s bag ventilation in ACLS – oxygenation – nasal cannula – plastic oxygen face mask – venturi mask – nasal prongs – oxygen reservoir mask- pocket mask-use of ventilator so respirators–adjuncts for ventilator support.

II. Circulatory support during CPR

- I. in BCLS – external chest compression – procedure with practical demonstration
- II. in ACLS – adjuncts for circulatory support – manual chest compressor – automatic chest compressor – definitive therapy – defibrillation–use of drugs–use of IABP and Cardiac assist devices.

Outcome of resuscitation – prognosis related to time of initiating CPR- of Brain death- termination of CPR attempts – post arrest care – after care following Successful CPR.

VOCATIONAL PAPER VII

ICCU TECHNIQUES

Theory: 40hrs

Practical: 60hrs

Objective and Learning Outcome: To familiarize the students with principles and procedures in ICCU; To provide a practical knowledge in handling ICCU patients and equipment's.

1. Introduction to Cardiac Intensive Care- Principles, Common Disorders
2. Approach to a patient with Cardiac Emergency, Commonly Used Cardiac drugs, dosage and side effects
3. Management of Common cardiac Emergencies-Acute Myocardial Infarction, Acute Left ventricular failure, Pulmonary edema ,Pulse less Ventricular tachycardia, Ventricular fibrillation, cardiac Tamponade
4. Principles and Techniques of Bedside Cardiac Procedures-Trans venous Pacing, Central Venous lines, Pericardio cent sis, IABP
5. Cardiopulmonary Resuscitation:-
Advanced Cardiac Life Support- Principles and Techniques

II YEAR - IV SEMESTER

Theory: 5ohrs
Practical:2ohrs

GENERAL PAPER -IX

ADVANCED ECHOCARDIOGRAPHIC TECHNIQUES

Objective and Learning Outcome: To learn the functions and operations of advanced echo cardiograph; To interpret the reports.

1. Left ventricular inflow tract:
Mitral valve: normal valve, anatomy, normal leaflet motion-
Abnormal mitral valve Echo: Rheumatic mitral stenosis; severity estimation,
Mitral insufficiency:- diagnosis, severity assessment
Mitral valve prolapse - Flail mitral leaflet
Mitral valve vegetation
2. Left Atrium: Left atrial function, dimension atrial dilatation and compression,
LA tumours, LA thrombus.
3. Left ventricular out flow tract:
Aortic valve; normal anatomy, trans valvar flow patterns
Abnormal aortic valve echo, congenital aortic valve abnormalities, bicuspid
aortic valve
Aortic leaflet thickening without stenosis
Valvular aortic stenosis, severity estimation of AS,
Aortic Insufficiency:-Ascending aorta, arch, Co-arctation of Aorta, Aortic
aneurysms,
The sub valvular LV-Outflow tract:-subaortic stenosis,
4. Left ventricle;-
Examining planes, parasternal long axis, SAX, Apical view, subcostal view, LV
volume-Simpson method, normal and abnormal values, LV mass, LVH, stroke
volume EF, FS, valvular disease and LV, LV in hypertension, Hypokinesia,
akinesia, dyskinesia, pseudo/true aneurysm.
5. Left ventricle; Coronary artery disease;
Acute myocardial infarction; segmental hypokinesia; Inferior infarct, anterior
infarct, apical infarct, chronic ischemic heart disease, LV Thrombi.
6. Stress Echocardiography;
Assessment of global ventricular function, types of response, bulls eye
method of analysis, complications of pharmacological stress- Echo
7. Echocardiographic assessment of cardiomyopathies:-
Hypertrophic cardiomyopathy, Dilated Cardiomyopathy, Restrictive
Cardiomyopathy

GENERAL PAPER -X

CARDIAC CATHETERIZATION LABORATORY BASICS & TECHNIQUES

Theory: 5ohrs

Practical: 2ohrs

Objective and Learning Outcome:

To learn cardiac catheterization procedures and techniques. To interpret reports and learn the interventions.

1. Cardiovascular laboratory technology during cardiac interventions,:
2. Techniques and Principles in Hardware Choices I Coronary Interventions
3. Balloon Preparation and sizing for Valvuloplasty
4. Quantitative Coronary Angiography for guiding angioplasty and Stenting
5. Angiographic measurement of defect sizes
6. Connection of Angiographic contrast injectors and performance of cavity angiography
7. Process the cine films
8. Identification of intra cardiac signals
9. Setting up of Intra cardiac multichannel recordings for Electrophysiology studies
10. To assist in detecting abnormal intra cardiac signals
11. Emergency care of Cardiac patients
12. Cardiac Resuscitation
13. Proper concentration on sterility
14. Maintaining a proper hospital record of the procedures

LIST OF PRACTICAL EXERCISES:

1. Cardiovascular laboratory technology during cardiac interventions,:
2. Techniques and Principles in Hardware Choices I Coronary Interventions
3. Balloon Preparation and sizing for Valvuloplasty
4. Quantitative Coronary Angiography for guiding angioplasty and tenting
5. Angiographic measurement of defect sizes
6. Connection of Angiographic contrast injectors and performance of cavity angiography
7. Process the cine films
8. Identification of intra cardiac signals
9. Setting up of Intra cardiac multichannel recordings for Electrophysiology studies
10. To assist in detecting abnormal intra cardiac signals
11. Emergency care of Cardiac patients
12. Cardiac Resuscitation
13. Proper concentration on sterility
14. Maintaining a proper hospital record of the procedures

TEACHING LEARNING ACTIVITIES:

1. Clinical lab postings
2. Group Discussions
3. Practical
4. Demonstrations
5. Seminars
6. Assignments.

VOCATIONAL PAPER VIII:

ORGANIZATION AND SERVICES OF CARDIAC CATHETERISATION LAB

Theory: 40hrs

Practical: 60hrs

Objective and Learning Outcome: To equip with the basic and advanced equipment's in cardiac catheterization lab.

1. Introduction to Cardiac catheterization laboratory
2. X-ray Theory: Electric to Electromagnetic Energy, Electromagnetic Radiation, Quantum Theory & X-Ray photons, X-ray Tube, X-ray Production, Characteristic of radiation, Bremsstrahlung radiation, Radiation Safety-scattering, Classical scattering, Compton scattering, Photoelectric effect, Differential absorption, Biological effects of radiation exposure, X-ray exposure, personal monitoring devices, Image detection in the cath lab, X-ray Image Intensifier Tube, Image recording, Digital Radiography, Subtraction Angiography, Digital storage of Images, DICOM cross platform standard, General cath lab supplies, Specific case supplies, Manifolds, Pulse Oximeter, Defibrillators, Defibrillation Vs. Cardio version, Intra-aortic Balloon pump(IABP), contrast Media, contrast media complications/side effects, contrast media power injector. Methods of preventing contrast complications
3. Coronary Angiography: Coronary Arteries and Veins, Coronary Artery System, Coronary Artery Dominance, Coronary Veins, Coronary Angiography: RAO Projection, LAO projection, AP and Left Lateral projections, AP-cranial, cranio-caudal, hepatojugula review projection view summary, imaging sequence.
4. Theory of Cardiac catheterization: Protocol, Contraindications, Complications, Cardiac catheterization entry sites- arterial access, radial access, cut down, Heart procedures: Left Heart procedure, Right heart procedure, combined heart procedure.
5. Coronary Angiography: Coronary Arteries and Veins, Coronary Artery System, Coronary Artery Dominance, Coronary Veins, Coronary Angiography: RAO Projection, LAO projection, AP and Left Lateral projections, AP-cranial, cranio-caudal, hepatojugular view projection view summary, imaging sequence.
6. Theory of Cardiac catheterization: Protocol, Contraindications, Complications, Cardiac catheterization entry sites- arterial access, radial access, cut down, Heart procedures: Left Heart procedure, Right heart procedure, combined heart procedure.

**VOCATIONAL PAPER IX:
CARDIAC PACEMAKERS AND DEFIBRILLATION:**

Practical: 180 hrs

Objective and Learning Outcome: To learn the operation and use of pacemakers.

1. Basic concepts of the pacemakers
2. Pacemakers modes
3. Temporary pacemakers
4. Permanent Pacemakers
5. Single chamber and dual chamber pacemakers
6. Biventricular Pacemakers
7. Indication of Pacing
8. Coding of Pacemakers
9. Pacemaker parameters
10. Pacemaker programming
11. Pacemaker testing and surveillance
12. Defibrillators

TEXT BOOK RECOMMENDED:

1. Textbook of Cardiac Angiography and Haemodynamics-Grossman.
2. Textbook of Cardiac Catheterization-Morton JKern
3. Angiocardiology-Freedom

TEACHING LEARNING ACTIVITIES:

1. Clinical lab postings
2. Group Discussions
3. Practical
4. Demonstrations
5. Seminars
6. Assignments.

III-YEAR -5thSEMESTER
ENVIRONMENTAL STUDIES
COMPULSORY PAPER [ENVS353]

Theory: 30 hours

Objective and Learning Outcome: To sensitize the students with the need for environment management systems. To make them appreciate environment protection methods.

Unit 1: The Multidisciplinary Nature of Environmental Studies

Unit 2: Natural Resources

Unit 3: Ecosystems

Unit 4: Biodiversity

Unit 5: Pollution

Unit 6: Social Issues and the Environment

Unit 7: Human Population and the Environment

Unit 8: Case Studies

Textbook:

Text book of Environmental Studies for Undergraduate Courses of all Branches of Higher Education

Erach Bharucha

For University Grants Commission

VOCATIONAL PAPER-X:
INTERVENTIONAL CARDIOLOGY/CARDIAC ELECTROPHYSIOLOGY

Theory: 40hrs

Practical: 60hrs

Objective and Learning Outcome: To understand the procedure of Interventional cardiology and electrophysiology.

1. Angioplasty: Percutaneous Coronary Angioplasty, Maintaining Perfusion with Angioplasty, Cutting Balloon angioplasty catheter, Stents-various types
2. Valvuloplasty- Mitral, Pulmonary, Aortic- Principles and Indications, Techniques, Hardware requirement, Procedural Complications.
3. Device Closures-Atrial Septal defects, Patent ductus arteriosus, Ventricular Septal defect, ruptured sinus of Valsalva and other shunt lesions. Principles and Indications, Techniques, Hardware requirement, Procedural Complications
4. Endovascular interventions- Peripheral angioplasty (Lower limb, renal, subclavian, mesenteric and carotid stenting), Embolization treatment-Coils, particles and gel foam. Principles and Indications, Techniques, Hardware requirement, Procedural Complications
5. Electrophysiology-Basics, Intra cardiac electro grams, identifying atrial and ventricular potentials, His bundle electrocardiograms. Indications and Techniques of Single and Dual Chamber Pacemakers. Complications.
6. Intracardiac Defibrillators (ICD)- Indications and Procedure and complications
Cardiac Resynchronization Therapy – Indication, Procedure and complications
7. Radiofrequency ablation- Principles and Techniques of Catheter ablation of Supraventricular and Ventricular arrhythmias

Vocational Paper -XI
INTERNSHIP I
Practical-400hrs

III YEAR -6th SEMESTER

VOCATIONAL PAPER XII: RECENT ADVANCES IN CARDIAC IMAGING

Theory: 40hrs

Practical: 60hrs

Objective and Learning Outcome: To familiarize the students with the recent trends and emerging techniques.

1. Principles of CT and MRI.
2. Indication, Contraindications for Cardiac CT and MRI
3. Protocols, Precautions, Techniques and Equipment for Cardiac CT & MRI
4. Principles of Radio nuclear scanning and Radiation safety
5. Radioactive isotopes and cardiac application
6. Myocardial Viability Scan , Stress Perfusion and Acute Infarction
Scintigraphy
7. Radio nuclear Myocardial scanning, Instruments and Techniques and
Protocols
8. Cardiac CT including CT angio.
9. MRI including CMRI.
10. Nuclear Scan

Vocational Paper-XIII
INTERNSHIP II
Practical-460 hrs