



MANIPAL

ACADEMY *of* HIGHER EDUCATION

(Deemed to be University under Section 3 of the UGC Act, 1956)

Manipal College of Health Professions

Manipal Academy of Higher Education, Manipal

Outcome-Based Education (OBE) Framework

**Four years Full time
Undergraduate Program**

**Bachelor of Science in
Cardiovascular Technology
(B.Sc. CVT)**

With effect from July 2020

TABLE OF CONTENTS

SI #	Topic/ Content	Page #
1	Nature and extent of the program	3
2	Program education objective (PEOs)	4
3	Graduate attributes	5
4	Qualifications descriptors.....	6
5	Program outcomes (POs).....	7
6	Course structure, course wise learning objective, and course outcomes (COs)	8
	<ul style="list-style-type: none">• Course objectives• Detailed course information• Course outcomes• Course assessment	
7	Mapping of program outcomes and course learning outcomes	221
8	Program Regulations.....	225

Head of the Department

Dean

Deputy Registrar - Academics

Registrar

1. NATURE AND EXTENT OF THE PROGRAM

Cardiovascular Technology (CVT) is a bachelor program (BSc) in which students are trained with a wide spectrum of knowledge in cardiovascular diseases and its diagnostic tests, every candidate is well trained in various non-invasive techniques of imaging modalities to evaluate cardiac diseases independently, also assist in operating equipment and administration of cardiac catheterization procedures in invasive cardiac setup.

As in whole “cardiovascular technology” deals with both non-invasive and invasive field of work like cardiac sonographer and cardiac interventional technologist. The scope for such allied health workers is boundless in today’s medical sectors and near future.

The mode of study is firm to be a full time program, with eight semester including a period of one year of internship following an ‘outcome based educational’ system. We aim to keep up our objectives in training the candidates with knowledge of Basic Health Science subjects, clinical Cardiology, Electrocardiograms, Cardiac Stress Testing, Ambulatory BP and Holter monitoring, Echocardiography, Cardiac catheterization & Intervention, Biostatistics and Research Methodologies.

The candidate applying for admission to BSc CVT program should have passed 10+2 examination or equivalent / two years of Pre-University / Pre-Degree examination conducted by the Pre University Board of Education of Government of respective State. The applicant/candidate should have studied Physics, Chemistry & Biology (PCB) to enter the program. At the time of entry/admission to the first year BSc CVT program the candidate should be of age 17 years or above OR as per rules of the respective universities with regard to the entry age.

2. PROGRAM EDUCATION OBJECTIVES (PEOs)

The overall objective of the learning outcome-based curriculum framework (LOCF) for BSc Cardiovascular Technology Program are as follows:

PEO No.	Education Objective
PEO 1	Students will be able to use their fundamental knowledge and clinical / technical competence in understanding the clinical concepts in cardiovascular sciences as and when required to achieve professional excellence.
PEO 2	Students will demonstrate strong and well defined clinical / practical skills while performing various diagnostic tests in cardiovascular diseases both non-invasive and invasive, along with diagnostic and therapeutic procedures
PEO 3	Students will be able to practice the profession with highly professional and ethical attitude, strong communication skills, and effective professional skills to work in a inter-disciplinary team.
PEO 4	Students will be able to use interpersonal and collaborative skills to identify, assess and formulate problems and execute the solution while independently handling live cases.
PEO 5	Students will be able to imbibe the culture of research, innovation, entrepreneurship and incubation throughout the learning period.
PEO 6	Students will be able to participate in lifelong learning process for a highly productive career and will be able to relate the concepts of cardiovascular science towards serving the cause of the society.

3. GRADUATE ATTRIBUTES

SI No.	Attribute	Description
1	Professional Knowledge	Demonstrate scientific knowledge and understanding to work as a health care professional
2	Clinical / technical / Laboratory / practical skills	Demonstrate Clinical / technical / practical skills in order to implement the preventive, assessment and management plans for quality health care services
3.	Communication	Ability to communicate effectively and appropriately in writing and orally to patients/clients, care-givers, other health professionals and other members of the community
4.	Cooperation/Team work	Ability to work effectively and respectfully with interdisciplinary team members to achieve coordinated, high quality health care
5.	Professional ethics	Ability to identify ethical issues and apply the ethical values in the professional life
6.	Research / Innovation-related Skills	A sense of inquiry and investigation for raising relevant and contemporary questions, synthesizing and articulating.
7.	Critical thinking and problem solving	Ability to think critically and apply once learning to real-life situations
8.	Reflective thinking	Ability to employ reflective thinking along with the ability to create the sense of awareness of one self and society
9.	Information/digital literacy	Ability to use ICT in a variety of learning situations
10.	Multi-cultural competence	Ability to effectively engage in a multicultural society and interact respectfully
11.	Leadership readiness/qualities	Ability to respond in an autonomous and confident manner to planned and uncertain situations, and should be able to manage themselves and others effectively
12.	Lifelong Learning	Every graduate to be converted into lifelong learner and consistently update himself or herself with current knowledge, skills and technologies. Acquiring Knowledge and creating the understanding in learners that learning will continue throughout life.

4. QUALIFICATION DESCRIPTORS:

- a) Demonstrate (i) a fundamental and systematic knowledge and understanding of an academic field of study as a whole and its applications, and links to related disciplinary areas/subjects of study, including a critical understanding of the established theories, principles and concepts, and of a number of advanced and emerging issues in the field of cardiovascular Technology; (ii) Procedural knowledge that creates different types of professionals related to the field of cardiovascular sciences both clinically and technically including research and development, teaching and in government and public service; (iii) Professional and communication skills in the domain of health care service including a critical understanding of the latest developments, and an ability to use established techniques in the domain of cardiovascular wellness program
- b) Demonstrate comprehensive knowledge about learning integrated concepts in cardiac sciences including current research, scholarly, and/or professional literature, relating to essential and advanced learning areas pertaining to the cardiovascular field of study, and techniques and skills required for identifying problems and issues and to resolve them
- c) Demonstrate skills in i) identifying the issues in cardiovascular health care needs; ii) collection of quantitative and/or qualitative data relevant to client's needs and professional practice; iii) analysis and interpretation of data using methodologies as appropriate for formulating evidence based hypotheses and solutions
- d) Use knowledge, understanding and skills for critical assessment of a wide range of ideas and complex problems and issues relating to the cardiovascular technology
- e) Communicate appropriately with all stakeholders, and provide relevant information to the members of the healthcare team
- f) Address one's own learning needs relating to current and emerging areas of study, making use of research, development and professional materials as appropriate, including those related to new frontiers of knowledge
- g) Apply one's disciplinary knowledge and transferable skills to new/unfamiliar contexts and to identify and analyse problems and issues and seek solutions to real-life problems

5. PROGRAM OUTCOMES (POs):

After successful completion of Bachelor / BSc in Cardiovascular Technology, students will be able to:

PO No.	Attribute	Competency
PO 1	Professional knowledge	Possess and acquire scientific knowledge to work as a health care professional
PO 2	Clinical/ Technical skills	Demonstrate and possess clinical skills to provide quality health care services
PO 3	Team work	Demonstrate team work skills to support shared goals with the interdisciplinary health care team to improve societal health
PO 4	Ethical value & professionalism	Possess and demonstrate ethical values and professionalism within the legal framework of the society
PO 5	Communication	Communicate effectively and appropriately with the interdisciplinary health care team and the society
PO 6	Evidence based practice/learning	Demonstrate high quality evidence based practice/learning that leads to excellence in professional practice
PO 7	Life-long learning	Enhance knowledge and skills with the use of advancing technology for the continual improvement of professional practice
PO 8	Entrepreneurship, leadership and mentorship	Display entrepreneurship, leadership and mentorship skills to practice independently as well as in collaboration with the interdisciplinary health care team

6. COURSE STRUCTURE, COURSE WISE LEARNING OBJECTIVE, COURSE OUTCOMES (COs)

SEMESTER - I

Course Code	Course title	Credit distribution (hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
ANA1001	Anatomy - I	3	-	-	-	3	30	70	100
PHY1101	Physiology - I	2	-	-	-	2	30	70	100
CSK1001	Communication Skills	2	-	-	-	2	100	-	100
EIC1001	Environmental Science & Indian Constitution	2	-	-	-	2	100	-	100
CVT1101	Cardiac Anatomy and Physiology	2	-	-	-	2	50	50	100
CVT1102	Basic ECG	2	1	-	-	3	50	50	100
CVT1103	Cardiac Embryology	2	1	-	-	3	50	50	100
CVT1131	Clinics - I	-	-	-	9	3	100	-	100
TOTAL		15	2	-	3	20	510	290	800

NOTE:
ESE for ANA1001 & PHY1101 will be conducted for 50 marks and normalized to 70 marks.
ESE for CVT1101 will be conducted for 50 marks, CVT1102 And CVT1103 will be conducted for 100 marks and normalized to 50 for grading

SEMESTER - II

Course code	Course title	Credit distribution (hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
ANA1201	Anatomy - II	2	-	-	-	2	30	70	100
PHY1201	Physiology - II	2	-	-	-	2	30	70	100
BIC1201	Biochemistry	3	-	-	-	3	30	70	100
CVT1201	Advanced ECG and Holter Monitoring	2	1	-	-	3	50	50	100
CVT1202	Medical Ethics & Legal Aspects	2	-	-	-	2	100	-	100
CVT1211	ECG Interpretation, Holter Analysis Practical	-	-	10	-	5	50	50	100
CVT1231	Clinics - II	-	-	-	9	3	100	-	100
TOTAL		11	1	5	3	20	390	310	700

Note:
ESE for ANA1201, PHY1201 & BIC1201 will be conducted for 50 marks and normalized to 70
ESE for CVT1201, CVT1211 will be conducted for 100 marks and normalized to 50 for grading

SEMESTER - III

Course code	Course title	Credit distribution (hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
MCB2103	Microbiology	3	-	-	-	3	30	70	100
PAT2103	Pathology	3	-	-	-	3	30	70	100
CVT2101	Ultrasound Physics and Doppler Principles	2	1	-	-	3	50	50	100
CVT2102	Cardiac Stress Tests	2	1	-	-	3	50	50	100
CVT2103	Cardiac Instrumentations	2	-	-	-	2	100	-	100
CVT2131	Clinics - III	-	-	-	9	3	100	-	100
*** ****	Open Elective - I	-	-	-	-	3	S/NS		
TOTAL		12	2	-	3	20	360	240	600

Note:

ESE for MCB2103 & PAT2103 will be conducted for 50 marks and normalized to 70 marks

ESE for CVT2101, CVT2102 will be conducted for 100 marks and normalized to 50 for grading

SEMESTER - IV

Course code	Course title	Credit distribution (hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
PHC2203	Pharmacology	3	-	-	-	3	30	70	100
CPY2201	Clinical Psychology	3	-	-	-	3	30	70	100
BST3201	Biostatistics and Research Methodology	3	-	-	-	3	30	70	100
CVT2201	Cardiac Pacemakers and Defibrillators	3	-	-	-	3	50	50	100
CVT2202	Congenital Heart Disease - I	3	-	-	-	3	50	50	100
CVT2231	Clinics IV	-	-	-	6	2	100	-	100
CVT ****	Program Elective - I	3	-	-	-	3	50	50	100
TOTAL		18	-	-	2	20	340	360	700

Note:

ESE for PHC2203 & CPY2201, will be conducted for 50 marks and normalized to 70 marks; BST3201 will be conducted for 100 marks and normalized to 70 marks grading

ESE for CVT2201, CVT2202 will be conducted for 100 marks and normalized to 50 for grading

SEMESTER - V

Course code	Course title	Credit distribution (hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
CVT3101	Basics in Cardiac Cath and Hardwares	2	1	-	-	3	50	50	100
CVT3102	Miscellaneous cardiovascular diseases	2	1	-	-	3	50	50	100
CVT3103	Congenital Heart Disease - II	2	1	-	-	3	50	50	100
CVT3104	Valvular Heart Disease	2	1	-	-	3	50	50	100
CVT3131	Clinics - V	-	-	-	15	5	100	-	100
*** ****	Open Elective - II	-	-	-	-	3	S/NS		
TOTAL		8	4	-	5	20	300	200	500

Note:
ESE for CVT3101, CVT3102, CVT3103 and CVT3104 will be conducted for 100 marks and normalized to 50 for grading

SEMESTER - VI

Course code	Course title	Credit distribution (L,T,P, CL are hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
CVT3201	Applications of Echocardiography	2	1	-	-	3	50	50	100
CVT3202	Cardiac Cath and Intervention	2	1	-	-	3	50	50	100
CVT3203	General Cardiac Examination and BLS -ACLS	2	1	-	-	3	50	50	100
CVT3231	Clinics in Echocardiography	-	-	-	12	4	50	50	100
CVT3232	Clinics in Cardiac Catheterization	-	-	-	12	4	50	50	100
CVT ****	Program elective - II	3	-	-	-	3	50	50	100
TOTAL		9	3	-	8	20	300	300	600

Note:
ESE for CVT3201, CVT3202, CVT3203, CVT3231 and CVT3232 will be conducted for 100 marks and normalized to 50 for grading

Open Electives

Open elective is credited, choice-based and is graded as satisfactory / not satisfactory (S/NS). Students make a choice from pool of electives offered by MAHE institution / Online courses as approved by the department

Program Electives

Program elective is credited and choice-based. The students make a choice from pool of electives offered by the department. The ESE is conducted for 50 marks.

Semester	Course Code	Course Title	Credit (s) Distribution (L,T,P,CL are hours/week)				
			L	T	P	CL	CR
IV Semester	CVT2241	Cardiac Interventional Hardwares	3	-	-	-	3
	CVT2242	Pacemaker Programming and Analysis	3	-	-	-	3
VI Semester	CVT3241	Cardiac Assist Devices	3	-	-	-	3
	CVT3242	Imaging Modalities in Cardiac Diagnosis	3	-	-	-	3

SEMESTER - VII and VIII

Internship (1 year, 48 hours/week)

Semester VII	Internship - I	Duration 6 months 48 hours in a week / 8 hours in a day
Semester VIII	Internship - II	Duration 6 months 48 hours in a week / 8 hours in a day

OVERALL CREDIT DISTRIBUTION TABLE

SEMESTER	HOURS PER WEEK				TOTAL CREDITS	Marks		
	L	T	P	CL		IAC	ESE	Total
SEMESTER - I	15	2	-	3	20	510	290	800
SEMESTER - II	11	1	5	3	20	390	310	700
SEMESTER - III	12	2	-	3	20	360	240	600
SEMESTER - IV	18	-	-	2	20	340	360	700
SEMESTER - V	8	4	-	5	20	300	200	500
SEMESTER - VI	9	3	-	8	20	300	300	600
SEMESTER- VII	-	-	-	48	NA	-	-	-
SEMESTER - VIII	-	-	-	48	NA	-	-	-
Grand Total	73	12	5	120	120	2200	1700	3900

SEMESTER - I

COUSE CODE	:	COURSE TITLE
ANA1001	:	Anatomy - I
PHY1101	:	Physiology - I
CSK1001	:	Communication Skills
EIC1001	:	Environmental Science & Indian Constitution
CVT1101	:	Cardiac Anatomy and Physiology
CVT1102	:	Basic ECG
CVT1103	:	Cardiac Embryology
CVT1131	:	Clinics - I

Manipal College of Health Professions								
Name of the Department		Cardiovascular Technology (CVT)						
Name of the Program		Bachelor of Science in Cardiovascular Technology						
Course Title		Anatomy - I						
Course Code		ANA1001						
Academic Year		First Year						
Semester		I						
Number of Credits		3						
Course Prerequisite		Basic knowledge of biology						
Course Synopsis		Human anatomy is the study of gross features and relations of various structures of the human body by dissection.						
Course Outcomes (COs): At the end of the course student shall be able to:								
CO1	Explain the General Anatomy in the human body (C2)							
CO2	Explain the Systemic Anatomy of the human body (C2)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x							
CO2	x							

Course Content and Outcomes:

Content	Competencies	Number of Hours (Theory)
Unit 1:		
General Anatomy	<ul style="list-style-type: none"> Define the Anatomical position and Anatomical terms (C1) Explain the epithelium - types and functions (C2) Explain the connective tissue – fibers and cells (C2) Explain the cartilage- types, structure and function(C2) Explain the bone - types, structure and blood supply (C2) Explain the muscle - classification, structure and function (C2) Explain the neurons- types and structure, typical spinal nerve (C2) Explain the blood vessels – arteries, veins, lymph vessels, lymph nodes, structure of lymph node (C2) Explain the joints: Classification, examples , structure of a typical synovial joint (C2) Explain the classification of synovial joints (C2) 	7
Unit 2:		
Respiratory system	<ul style="list-style-type: none"> List the parts of respiratory tract (C1) Explain the boundaries of the Nasal cavity (C2) Explain the Lateral wall of nasal cavity - features, blood supply, nerve supply and lymphatic drainage(C2) 	5

Content	Competencies	Number of Hours (Theory)
	<ul style="list-style-type: none"> • Explain the nasal septum: Formation, blood supply, nerve supply, lymphatic drainage and applied anatomy (C1, C2) • List and Explain the paranasal air sinuses and their function (C1, C2) • Explain the pharynx - extent, parts- nasopharynx, oropharynx and laryngopharynx - internal features (C2) • Explain the cavity of larynx, blood supply, nerve supply (C1, C2) • Explain the vocal cords and their movements, and Rima glottidis (C2) • List the intrinsic muscles of the larynx, their nerve supply and actions (C1) • List the Cartilaginous framework and ligaments (C1) • Explain the trachea: Extent, Structure and nerve supply (C2) • Explain the diaphragm - attachments, nerve supply and actions (C2) • Explain the thoracic cage: thoracic wall, intercostal spaces and their contents (C1, C2) • Explain the Lungs- gross anatomy, roots of the lungs, surface marking of pleura and lungs (C1, C2) • Explain the pleura- parts, pleural cavity, pleural recesses, pulmonary ligament (C2) 	
Unit 3:		
Cardiovascular system	<ul style="list-style-type: none"> • Explain the heart - position, external features, right atrium internal features (C1, C2) • Explain the right ventricle internal features, Blood supply to the heart (C1, C2) • Explain the left atrium and left ventricle, nerve supply of heart (C2) • Explain the pericardium - Parts, blood supply, nerve supply and function (C2) • Explain the mediastinum - boundaries and contents (C2) • List and explain the arteries - Arch of aorta and descending thoracic aorta (extent course and branches) (C1, C2) • Explain the veins -Azygos system of vein (formation, course and termination) (C1, C2) • Define the thoracic duct: formation, course and termination (C2) • Explain the arteries - pulmonary trunk, ascending aorta (extent course and branches) (C2) • Explain the veins - branchiocephalic veins, superior vena cava (formation, course and termination) (C2) • Explain the major arteries and veins of head and neck (name and positions) (C2) • Explain the major arteries and veins of abdomen and pelvis (name and positions) (C2) 	4

Content	Competencies	Number of Hours (Theory)
	<ul style="list-style-type: none"> • Explain the abdominal aorta, inferior vena cava, portal vein (C1, C2) 	
Unit 4:		
Digestive system	<ul style="list-style-type: none"> • List the parts of digestive system (C1) • Explain the tongue – gross anatomy, blood supply and nerve supply (C2) • Explain the salivary glands- Names and location (C2) • Explain the oesophagus- extent, parts, constrictions, blood supply, nerve supply and lymphatic drainage (C2) • Explain the stomach- position, relations, blood supply, nerve supply and lymphatic drainage (C1, C2) • Explain the duodenum- parts, important relations, blood supply and nerve supply (C2) • Explain the pancreas – position, parts, important relations, blood supply and nerve supply (C2) • Explain the small intestine – parts- duodenum, jejunum and ileum- blood supply and nerve supply (C1, C2) • Explain the large intestine – parts, position of each of the parts, extent, blood supply and nerve supply (C2) • List the differences between jejunum and ileum (C1) • List the differences between small intestine and large intestine (C1) • Explain the rectum and anal canal-position, blood supply, nerve supply and lymphatic drainage (C2) • Explain the liver- position, anatomical and physiological lobes, surfaces, relations, porta hepatis, blood supply and nerve supply (C1, C2) • Explain the extrahepatic biliary apparatus – gall bladder and bile duct (C2) 	6
Unit 5:		
Urinary system	<ul style="list-style-type: none"> • List the parts of urinary system (C1) • Explain the kidneys: position, external features, capsules, relations, macroscopic structure, blood supply and nerve supply (C1, C2) • Explain the ureter- length, constrictions and blood supply (C2) • Explain the urinary bladder- position, external features, blood supply and nerve supply (C2) • Explain the urethra- female urethra, male urethra- parts (C2) 	2
Unit 6:		
Male reproductive system	<ul style="list-style-type: none"> • List the parts of male reproductive system (C1) • List the spermatic cord- constituents and coverings (C1) • Explain the testes- position, coverings, gross structure, blood supply, nerve supply and lymphatic drainage (C2) 	2

Content	Competencies	Number of Hours (Theory)
	<ul style="list-style-type: none"> • Explain the vas deferens- commencement, course and termination (C2) • Explain the prostate – position, external features, lobes and structure (C2) • Explain the seminal vesicles and ejaculatory ducts (C2) 	
Unit 7:		
Female reproductive system	<ul style="list-style-type: none"> • Name the parts of female reproductive system (C1) • Explain the uterus-position, parts, external features, relations, blood supply and lymphatic drainage (C2) • Explain the uterine tube- parts, blood supply and nerve supply (C2) • Explain the ovary – position and structure (C2) 	2
Unit 8:		
Endocrine glands	<ul style="list-style-type: none"> • Name the endocrine glands (C1) • Explain the pituitary gland (Hypophysis cerebri)- position, parts, blood supply (C2) • Explain the suprarenal glands- position, relations, parts, blood supply and lymphatic drainage (C2) • Explain the thyroid gland- position, parts, blood supply and lymphatic drainage (C2) • Name the parathyroid glands-their position and blood supply (C1) 	2
Unit 9:		
Central Nervous system	<ul style="list-style-type: none"> • Name the parts of the CNS (C1) • List the features and explain the spinal cord- position, external features, internal structure, brief note on important ascending and descending tracts (C1, C2) • Explain the major motor and sensory pathways (C2) • Explain the pyramidal tract in detail (C2) • Name the parts of brain (C2) • List the external and internal features of medulla oblongata (C1) • List the cranial nerves attached to medulla oblongata(C1) • List the external and internal features pons (C1) • Explain the cranial nerves attached to pons and ponto-medullary junction (C2) • Explain the cerebellum- functional lobes of the cerebellum and its functions (C2) • Explain the midbrain- external features and internal structure – in brief (C1) • Explain the cranial nerves attached to midbrain (C2) • Explain the cerebral hemispheres – lobes, important sulci and functional areas (C2) • List the fiber system of the brain and explain the corpus callosum and internal capsule (C1, C2) • Explain the diencephalon- Thalamus and hypothalamus-position and functions (C2) • Explain the basal nuclei: Corpus striatum – parts and 	12

Content	Competencies	Number of Hours (Theory)
	functions (C2) <ul style="list-style-type: none"> • Explain the blood supply to the central nervous system (C2) • Explain the ventricles: 4th and 3rd ventricles (features, position and communications) (C2) • Explain the lateral ventricles- parts, features, position and communications (C2) • Define the CSF production and circulation (C1) 	
Unit 10:		
Special senses	<ul style="list-style-type: none"> • Recall the gross anatomy of the eye (C1) • Recall the gross anatomy of external, middle and internal ear (C1) • Recall the skin and its features (C1) 	3

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	45	135				
Seminar						
Small group discussion (SGD)						
Self-directed learning (SDL)						
Problem Based Learning (PBL)						
Case Based Learning (CBL)						
Clinic						
Practical						
Revision						
Assessment						
Total	45	135				
Assessment Methods:						
Formative:			Summative:			
Nil			Sessional Exam I / Sessional Exam II (Theory)			
			End Semester Exam (Theory)			
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Sessional Examination 1	x	x				
Sessional Examination 2	x	x				
End Semester Exam	x	x				
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	1. Manipal Manual of Anatomy by Dr. Sampath Madhyastha					
Additional References	1. Human Anatomy by Dr. B. D. Chaurasia (Vol 1,2,3,4) 2. Chaurasia's handbook of human anatomy 3. Netter's Atlas					

Manipal College of Health Professions								
Name of the Department		Cardiovascular Technology (CVT)						
Name of the Program		Bachelor of Science in Cardiovascular Technology						
Course Title		Physiology - I						
Course Code		PHY1101						
Academic Year		First year						
Semester		I						
Number of Credits		2						
Course Prerequisite		Basic knowledge of biology						
Course Synopsis		This module provides a comprehensive knowledge about normal functions of the organ systems of the body to understand the physiological basis of health and disease required for health professional (paramedical) courses.						
Course Outcomes (COs):								
At the end of the course student shall be able to:								
CO1	Know the basic facts and concepts of Physiology (C1)							
CO2	Explain the normal functions of various systems of the body.(C2)							
CO3	Describe the relative contribution of various systems in maintaining the homeostasis.(C2)							
CO4	Explain the physiological basis of disease processes.(C2)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x							
CO2	x							
CO3	x							
CO4	x							

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1. BASIC CONCEPTS AND NERVE PHYSIOLOGY		
Transport across cell membrane	<ul style="list-style-type: none"> Name the various transport mechanisms across cell membrane(C1) Describe passive transport mechanisms such as simple diffusion, facilitated diffusion and osmosis (C2) Describe primary and secondary active transport mechanisms(C2) 	4
Body fluid compartments	<ul style="list-style-type: none"> Mention the total body water as percentage of body weight and its distribution. (C1) Give the ionic composition of body fluids(C1) 	
Physiology of neuron	<ul style="list-style-type: none"> Describe the morphology of a neuron (C2) Mention the structure and functions of myelinated and unmyelinated nerve fibers (C2) 	
Membrane potential	<ul style="list-style-type: none"> Describe resting membrane potential(C2) 	

Content	Competencies	Number of Hours
	<ul style="list-style-type: none"> • Draw and label the action potential (C2) • Describe the ionic basis of the action potential (C2) 	
Unit 2: MUSCLE PHYSIOLOGY		
Skeletal muscle	<ul style="list-style-type: none"> • Describe the characteristic features of skeletal, cardiac and smooth muscles(C2) • Describe the structure of skeletal muscles(C2) • Mention the types of skeletal muscles(C1) • Explain neuromuscular transmission in skeletal muscle(C2) • Explain excitation contraction coupling in skeletal muscle(C2) • Describe rigor mortis (C2) 	4
Smooth muscle	<ul style="list-style-type: none"> • Mention the types of smooth muscle(C1) 	
Unit 3: BLOOD		
Composition and functions of blood	<ul style="list-style-type: none"> • Describe the composition of blood(C2) • List the functions of blood(C1) 	6
Plasma proteins	<ul style="list-style-type: none"> • Name the different types of plasma proteins (C1) • List the functions of plasma proteins(C1) 	
Red blood cells	<ul style="list-style-type: none"> • Mention the morphology and functions of red blood cells (C1) • Mention the normal count of RBC and its variations (C1) • Describe the stages and factors influencing erythropoiesis(C2) • Mention the normal value of hemoglobin concentration and its variations(C1) • Mention the functions of hemoglobin (C1) • Define anemia(C1) 	
White blood cells	<ul style="list-style-type: none"> • Classify White Blood Cells (WBC) (C2) • List the functions of WBCs(C1) • Mention the normal count of various types of WBCs (C1) 	
Hemostasis	<ul style="list-style-type: none"> • Mention the normal range of platelets and its variations(C1) • List the functions of platelets(C1) • Define hemostasis(C1) • Describe the various stages involved in haemostasis (C2) • List the clotting factors(C1) • Describe the intrinsic and extrinsic pathways of coagulation (C2) • Describe hemophilia(C2) • Classify anticoagulants and give examples for each(C2) 	
Blood types/groups	<ul style="list-style-type: none"> • Describe the ABO and Rh systems of blood grouping(C2) • Explain the importance of blood grouping(C2) 	

Content	Competencies	Number of Hours
	<ul style="list-style-type: none"> • Mention the hazards of blood transfusion(C1) • Explain the cause and clinical features of hemolytic disease of the newborn (erythroblastosis fetalis) (C2) 	
Lymph	<ul style="list-style-type: none"> • List the functions of lymph(C1) 	
Unit 4: CARDIOVASCULAR SYSTEM		
Organization of cardiovascular system	<ul style="list-style-type: none"> • Describe the structure of heart (C2) • Describe the innervation of heart and blood vessels(C2) • Describe the properties of cardiac muscle(C2) 	9
Cardiac cycle	<ul style="list-style-type: none"> • Define cardiac cycle (C1) • State the normal duration of cardiac cycle (C1) • Explain the various events occurring during a cardiac cycle with the help of graphs(C2) 	
Heart sounds	<ul style="list-style-type: none"> • Enumerate the differences between first and second heart sounds(C2) 	
Electrocardiogram (ECG)	<ul style="list-style-type: none"> • Define electrocardiogram (ECG) (C1) • Draw a labeled diagram of a normal ECG recorded from limb lead II (C1) • Describe the waves and intervals of ECG (C2) • Mention the uses of ECG(C1) 	
Heart rate	<ul style="list-style-type: none"> • Mention the normal value and variations of heart rate(C1) • Describe the regulation of heart rate(C2) 	
Cardiac output	<ul style="list-style-type: none"> • Define cardiac output (C1) • State the normal value of cardiac output (C1) • Mention the variations of cardiac output(C1) • Describe the regulation of cardiac output(C2) • Mention the effect of muscular exercise on cardiac output (C1) 	
Blood pressure (BP)	<ul style="list-style-type: none"> • Define blood pressure (BP) (C1) • Mention the normal value of BP (C1) • Mention the factors influencing BP(C1) • Mention the variations of blood pressure(C1) • Describe the short term regulation of arterial blood pressure(C2) 	
Unit 5: RESPIRATORY SYSTEM		
Introduction to respiration	<ul style="list-style-type: none"> • Describe the functional anatomy of the respiratory system (C2) 	6
Mechanics of respiration	<ul style="list-style-type: none"> • Mention the muscles of respiration(C1) • Describe the mechanism of inspiration and expiration(C2) • Describe the intra-pulmonary and intra-pleural pressure changes during the various phases of respiration(C2) 	
Lung volumes and capacities	<ul style="list-style-type: none"> • Draw a labelled spiogram(C2) 	

Content	Competencies	Number of Hours
	<ul style="list-style-type: none"> Define various lung volumes and capacities (C1) Mention the normal values of lung volumes and capacities (C1) 	
Ventilation	<ul style="list-style-type: none"> Define pulmonary ventilation (C1) Mention the normal value of pulmonary ventilation (C1) Define alveolar ventilation(C1) Mention the normal value of alveolar ventilation(C1) Define anatomical dead space (C1) Mention the normal value of anatomical dead space (C1) 	
Gas exchange	<ul style="list-style-type: none"> Describe the structure of respiratory membrane (C2) Mention the factors affecting diffusion of gases across it (C1) 	
Transport of gases	<ul style="list-style-type: none"> Mention the forms in which oxygen is transported in the blood(C1) Describe the oxygen-hemoglobin dissociation curve(C2) Mention the factors shifting the oxygen-hemoglobin dissociation curve to the right and to the left(C1) Mention the forms in which carbon dioxide is transported in the blood(C1) Describe the mechanism of carbon dioxide transport(C2) 	
Regulation of respiration	<ul style="list-style-type: none"> Explain the neural regulation of respiration(C2) Explain the chemical regulation of respiration(C2) 	
Applied aspects	<ul style="list-style-type: none"> Define hypoxia(C1) Mention the types of hypoxia with example (C1) Define cyanosis(C1) Mention the cause of cyanosis (C1) Mention the types of hypoxia in which cyanosis occurs (C2) Define apnea, dyspnea and asphyxia(C1) 	
Unit 6: SPECIAL SENSES		
Vision	<ul style="list-style-type: none"> Describe the structure of human eye with the help of a diagram (C2) Mention the functions of aqueous humor (C1) Name the photoreceptors (C1) Mention the differences between the rods and cones (C1) Draw the visual pathway (C2) Explain the defects in field of vision due to lesions of visual pathway at different locations (C2) Describe the mechanism of accommodation(C2) Describe light reflex with the help of a diagram(C2) 	4

Content	Competencies	Number of Hours
	<ul style="list-style-type: none"> Define visual acuity and mention the tests (C2) Describe the cause and correction for refractory errors of the eye(C2) 	
Hearing and vestibular apparatus	<ul style="list-style-type: none"> Describe the structure and functions of external, middle and inner ear (C2) Describe the mechanism of hearing (C2) Mention the parts and functions of vestibular apparatus (C1) 	
Taste and smell	<ul style="list-style-type: none"> Name the receptors for taste and smell (C1) Mention the disorders of taste and smell (C1) 	

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	33	99				
Seminar	-	-				
Small group discussion (SGD)	-	-				
Self-directed learning (SDL)	-	-				
Problem Based Learning (PBL)	-	-				
Case Based Learning (CBL)	-	-				
Clinic	-	-				
Practical	-	-				
Revision	-	-				
Assessment	-	-				
Total	33	99				
Assessment Methods:						
Formative:			Summative:			
Unit Test – Nil			Mid Semester/Sessional Exam (Theory)			
Quiz – Nil			End Semester Exam (Theory)			
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x	x	x	x		
Sessional Examination 2	x	x	x	x		
End Semester Exam	x	x	x	x		
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	1. Basics of Medical Physiology, 4 th edition, D.Venkatesh, H.H.Sudhakar 2. Manipal Manual of Medical Physiology, 1 st edition, C. N. ChandraShekar					
Additional References						

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Communication Skills
Course Code	CSK1001
Academic Year	First Year
Semester	I
Number of Credits	2
Course Prerequisite	Nil
Course Synopsis	1. Equips the students with primary oral and written communication skills in English. 2. Orients students to focus on diverse interactive situations and enhances the interpersonal skills required in a professional environment.

Course Outcomes (COs):

At the end of the course student shall be able to:

CO1	Identify the components of communication skills and apply them in a professional setting (C3)
CO2	Outline effective oral communication skills in diverse context (C2)
CO3	Summarize different ways to write creatively, coherently and effectively on a given topic (C2)
CO4	Develop active listening skills involving feedback in diverse interactive situation. (C3)

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1					x		X	
CO2					x		X	
CO3		x					X	
CO4			x				X	

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Communication Skills	1. Define Communication (C1) 2. Outline the process and barriers in Communication (C2) 3. Explain the types of communication (C2) (Oral, Verbal, non-verbal, dyadic) 4. How to improve spoken skills (C1)(Telephone, face - to- face) 5. How to improve communication (C1) 6. Apply the concepts of communication skills in a professional setting (C3) 7. Identify the difference between formal and informal communication (C3)	6

Content	Competencies	Number of Hours
Unit 2:		
Reading Skills	1. Explain the types of reading (C2) (Oral, Silent, Extensive, Scanning, Skimming) 2. Outline the reading techniques (C2) (3Q3R) 3. What is the difference between scanning and skimming(C1) 4. Define source of information (C1) 5. Explain feedback on LSWR in individual presentation(C2) 6. Summarise the role played by prepositions in understanding what to read (C2)	4
Unit 3:		
Listening Skills	1. Explain the types of listening (C2) 2. Summarize the context and purpose of listening (C2) 3. Explain various types of listening obstacles (C2) 4. How to improve hearing and focused listening (C1) 5. What is facilitating understanding, static & process description-gambits (C1)	8
Unit 4:		
Writing skills	1. What is the difference between spoken and written form (C1) 2. How words are formed into phrases & clauses (C1) 3. Outline writing paragraphs, cohesion, coherence (C2) 4. Explain summary, precise and essay writing (C2) 5. How to write a formal and informal letters (C1) 6. How to write a resume /CV(C1) 7. Explain the role of visual aids and meetings in writing(C2) 8. Explain the importance of abbreviations and punctuations in writing(C2)	8

Learning Strategies, Contact Hours and Student Learning Time (SLT):

Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	26	78
Seminar	-	
Small group discussion (SGD)	-	
Self-directed learning (SDL)	-	
Problem Based Learning (PBL)	-	
Case Based Learning (CBL)	-	
Clinic	-	
Practical	-	
Revision	-	
Assessment	-	
Total	26	78
Assessment Methods:		
Formative:	Summative:	
Assignments	Mid Semester/Sessional Exam (Theory)	

Mapping of Assessment with COs:				
Nature of Assessment	CO1	CO2	CO3	CO4
Assignments	x	x	x	
Mid Semester / Sessional Examination	x	x	x	x
Feedback Process:	Mid-Semester Feedback			
	End-Semester Feedback			
Main Reference:	1. Jain, A K & et al., (2008-5th Edition). <i>Professional Communication Skills</i> , 2008, New Delhi, S Chand and Company			
	2. Raman, M., & Singh, P. (2012). <i>Business communication</i> . New Delhi: Oxford University Press			
Additional References	3. Raman, M & Sharma, S (2014). <i>Technical communication: Principles and Practice</i> . New Delhi: Oxford University			

Manipal College of Health Professions								
Name of the Department		Cardiovascular Technology (CVT)						
Name of the Program		Bachelor of Science in Cardiovascular Technology						
Course Title		Environmental Science						
Course Code		EIC1001						
Academic Year		First Year						
Semester		I						
Number of Credits		1						
Course Prerequisite		Nil						
Course Synopsis		1. Aim to give students a general understanding of environmental science and introduce them to some of the main principles 2. It covers the study of subjects for example understanding of earth procedures, evaluating alternative energy frameworks, mitigation and pollution control, natural resource management, effects of global climate change and so on						
Course Outcomes (COs):								
At the end of the course student shall be able to:								
CO1	Explain the role of Environmental Science, its multidisciplinary nature in conservation of global environment (C2)							
CO2	Describe the natural resources, utility and the role of ecosystems in maintaining planetary cycles (C2)							
CO3	Outline the types, sources, prevention and control measures of pollution (C2)							
CO4	List the laws, acts and policies related to environmental protection in India (C1)							
CO5	Explain the types, mitigation and management techniques of disaster (C2)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x					x		
CO2	x			x				
CO3	x					x		
CO4			x				x	
CO5			x			x		

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Environmental Studies and multi-disciplinary nature	1. Explain the meaning, objectives and major environmental issues (C2) 2. What is sustainable development? (C1) 3. Explain the global environmental concerns (C2)	2
Unit 2:		
Biodiversity, Ecosystem, Energy	1. Classify the natural resources (C2) 2. List the renewable and non-renewable resources	4

Content	Competencies	Number of Hours
and natural resources	(C1) 3. Outline the consumption of renewable and non-renewable resources 4. Explain the conservation methods of renewable and non-renewable resources 5. Outline the availability of water resources, forest, land and mineral resources. 6. Summarize the different types of energy (C2) (Conventional sources & Non-Conventional sources of energy, solar energy, Hydro electric energy, Wind Energy, Nuclear energy, Biomass & Biogas, Fossil Fuels, Hydrogen as an alternative energy) 7. Define Ecosystem (C1) 8. Explain the meaning, structure and functions of ecosystem (C2) 9. Explain the biotic and abiotic components of ecosystem (C2) 10. Describe the trophic levels in ecosystem (C2) 11. What is an energy flow in an ecosystem (C1) 12. Explain Biodiversity and its conservation (C2) (in situ & ex situ, IUCN red list)	
Unit 3:		
Environmental Pollution	1. Explain the various types of Environmental Pollution (C2) (water, air, land, noise, solid waste, Biomedical waste, nuclear pollution, marine pollution)	2
Unit 4:		
Environmental laws and legislations	1. Outline the environmental laws and legislations (C2) (Related to general, air, water, biodiversity and forests) 2. Explain the roles and responsibilities of state and central Pollution control Boards (C2) 3. What is Environmental impact assessment (EIA) (C1)	2
Unit 5:		
Disaster management	1. Define disaster (C1) 2. What is disaster management? (C1) 3. Classify the types of disaster (C2) 4. What is disaster risk formula (C1) 5. Explain the phases in Disaster management phases (C2) (Disaster management cycle, Emergency response and recovery, Hazardous waste spills and dangers posed)	3

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	13	39				
Seminar	-					
Small group discussion (SGD)	-					
Self-directed learning (SDL)	-					
Problem Based Learning (PBL)	-					
Case Based Learning (CBL)	-					
Clinic	-					
Practical	-					
Revision	-					
Assessment	-					
Total	13	39				
Assessment Methods:						
Formative:		Summative:				
Assignments		Mid Semester/Sessional Exam (Theory)				
Mapping of Assessment with COs:						
Nature of Assessment		CO1	CO2	CO3	CO4	CO5
Assignments				x	x	x
Mid Semester / Sessional Examination		x	X	x		
Feedback Process:		Mid-Semester Feedback				
		End-Semester Feedback				
Main Reference:		1. Benny Joseph, Environmental Studies, Tata McGraw-Hill Publishing Company Ltd., New Delhi (2008).				
		2. Aloka Debi, "Environmental Science and Engineering", Universities Press (India) Pvt. Ltd. (2012).				
Additional References		1. Mohan kanda, Disaster Management in India evolution of institutional arrangements & operational strategies. (2017)				
		2. Student guide: Environment Reader for Universities, based on UGC syllabus published by Centre for Science and Environment, (2017).				
		3. G.Swarajya Lakshmi, Environmental science: A Practical Manual, (2010).				

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Indian Constitution
Course Code	EIC1001
Academic Year	First Year
Semester	I
Number of Credits	01
Course Prerequisite	Nil
Course Synopsis	<ol style="list-style-type: none"> 1. To provide understanding of knowledge of the Indian constitution. 2. To familiarize students with the fundamental rights and duties. 3. To understand the importance of constitutional laws. 4. To understand the correlation between Indian constitution, democracy and society.

Course Outcomes (COs):

At the end of the course student shall be able to:

CO1	Explain the salient features, importance and need of the Constitution (C2)
CO2	Infer the need of fundamental rights in a democratic system for a holistic development of a society (C2)
CO3	Outline the directions given to the state by the constitution and fundamental duties of a citizen towards the state (C2)
CO4	Explain the working nature of State and Centre, roles and responsibilities of President and Governors, amendments emergency powers enjoyed by the government (C2)
CO5	Explain various laws listed under IPC and CrPC and understand importance of voting in a democracy and RTI (C2)

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x						x	
CO2				x	x			
CO3			x				x	
CO4						x		x
CO5				x			x	

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Introduction to Indian Constitution	1. Outline the evolution of the Legal System (C1) (pre-colonial and colonial times, Common Law, Civil Law and Socialist Legal System)	3

Content	Competencies	Number of Hours
	2. Explain the constitutional history and constitutional assembly (C2) 3. Explain the various organs of the Government (C2) (Executive, Legislature and Judiciary, and Panchayat institutions) 4. Summarise the functions of high court and supreme court of India (C2)	
Unit 2:		
Fundamental Rights	1. Explain the individual rights and fundamental rights (C2) 2. Outline the history of the demand for fundamental rights (C2) 3. Classify the fundamental rights (C2) 4. Explain how fundamental rights are a guarantee against state action (C2) 5. Summarise Article 14 to Article 30 (C2) 6. Explain supreme court as the guardian of Fundamental Rights (C2)	4
Unit 3:		
Fundamental Duties and Directive Principles of State Policy	1. Explain fundamental duties and its enforcement(C2) 2. Summarise the utility and the scope of DPSP(C2) 3. Outline the socialistic pattern of society (C2) 4. Explain the conflict between fundamental rights and DPSP (C2)	3
Unit 4:		
Role of President and Governors/ Cabinet	1. What is the procedure followed while electing a President (C1) 2. Explain the power and duties of the President (C2) 3. Outline the power and duties of the Governors (C2) 4. Explain the role and functions of the council of Ministers (C2)	2
Unit 5:		
Role of citizens, Constitutional laws(IPC and CrPC), RTI	1. Explain the role of citizens in a democracy (C2) 2. Explain constitutional laws (C2) 3. Explain the Indian Penal Code and Code of Criminal Procedure (C2) 4. Summarise right to Information (C2)	3

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	15	45
Seminar	-	
Small group discussion (SGD)	-	
Self-directed learning (SDL)	-	
Problem Based Learning (PBL)	-	

Case Based Learning (CBL)	-				
Clinic	-				
Practical	-				
Revision	-				
Assessment	-				
Total	15	45			
Assessment Methods:					
Formative:	Summative:				
Assignments	Mid Semester/Sessional Exam (Theory)				
Mapping of Assessment with COs:					
Nature of Assessment	CO1	CO2	CO3	CO4	CO5
Assignments		x		x	x
Mid Semester / Sessional Examination	x	x	x		
Feedback Process:	Mid-Semester Feedback				
	End-Semester Feedback				
Main Reference:	1. Subhash C. Kashyap, Our Constitution, National Book Trust. (2011) 2. P. M. Bhakshi. The Constitution of India. Universal Law Publishing.(2017)				
Additional References	1. Dr. B. R. Ambedkar. The Constitution of India. Educreation Publishing. (2020) 2. Bipan Chandra.History of Modern India. Orient BlackSwan. (2009) 3. Dr. Durga Das Basu. Introduction to the Constitution of India. Lexis Nexis.(2013)				

Manipal College of Health Professions								
Name of the Department		Cardiovascular Technology						
Name of the Program		Bachelor of Science						
Course Title		Cardiac Anatomy and Physiology						
Course Code		CVT1101						
Academic Year		2020-21						
Semester		First						
Number of Credits		2						
Course Prerequisite		Knowledge of Basic science						
Course Synopsis		1. This module will bridge the gap between the knowledge acquired in the basic cardiac anatomy and physiology and the clinical conditions. 2. To provide the essential knowledge in cardiac circulatory system (adults and fetal life) and hemodynamic changes in a cardiac cycle, functional and structural information on cardiac valves, equipment in measuring arterial blood pressure 3. To identify, locate the cardiac structures and know definition of the medical terminologies						
Course Outcomes (COs):								
At the end of the course student shall be able to: Relate and Summarize the								
CO1	Defining and understanding the basic medical terminologies (C2)							
CO2	Explaining the cardiac cycle and its phases with event timings (C2)							
CO3	Understanding the cardiac anatomy and its branch anatomy with functions (C2)							
CO4	Remembering the conduction system of the heart and making use of it in understanding heart's rhythm (C2)							
CO5	To apply the knowledge in blood pressure measurements and build skills to learn and monitor blood pressures (C3)							
CO6	Understanding the techniques of palpitations of pulse and determining the abnormalities of pulse (C2)							
CO7	Remembering the heart sounds and murmurs and also to detect them (C3)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x						x	
CO2		x			x			
CO3	x	x						
CO4		x		x				
CO5		x					x	
CO6		x			x			
CO7		x		x				

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Medical terminologies and circulation	1.Recall Medical Terminology (C1) 2.Understand Systemic and pulmonary circulation (C2)	2
Unit 2:		
Cardiac cycle	1.Explain the Phases of systole (C2) 2.Explain the Phases of diastole (C2) 3.Understanding event timings - Stroke volume/cardiac output (C2)	2
Unit 3:		
Cardiac Anatomy	1.Outline the anatomy of Endocardium (C2) 2.Outline the anatomy of Myocardium (C2)	1
Unit 4:		
Anatomy of Valves	1.Outline the anatomy of Mitral valve (C2) 2.Outline the anatomy of Tricuspid valve (C2) 3.Outline the anatomy of Aortic valve (C2) 4.Outline the anatomy of Pulmonary valve (C2)	2
Unit 5:		
Conduction system of the heart	1.Explain the conduction system of SA node (C2) 2.Explain the conduction system of AV node (C2) 3.Explain the conduction system of Bundle of His (C2) 4.Explain the conduction system of Bundle branches (C2) 5.Explain the conduction system of Purkinje fibres (C2)	3
Unit 6:		
Chamber identification and anatomic variance	1.Identify the cardiac anatomical variances of Right atrium (C3) 2.Identify the cardiac anatomical variances of Right ventricle (C3) 3.Identify the cardiac anatomical variances of atrium (C3) 4.Identify the cardiac anatomical variances of Left ventricle (C3)	2
Unit 7:		
Circulatory system of the body	1.Explain and identify the branch anatomy of Arterial supply of the heart (C3) 2.Explain and identify the branch anatomy of Aorta and its branches (C3) 3.Explain and identify the branch anatomy of Peripheral anatomy (C3) 4.Explain and identify the branch anatomy of Vena cava and its branches (C3)	3
Unit 8:		
Blood Pressure	1.Build skills in Blood pressure measurements like systolic and diastolic pressures (C3)	3

Content	Competencies	Number of Hours
	2.Build skills in Direct/ indirect measurement (C3) 3.Build skills in Brachial artery pressure (C3) 4.Build skills in Lower extremity pressures (C3) 5.Build skills in Ambulatory BP monitoring (C3)	
Unit 9:		
Techniques of palpation	1.Apply the techniques of palpitations in Arterial pulse: central aortic and peripheral (C3) 2.Apply the techniques of palpitations in Morphology of pulse (C3) 3.Apply the techniques of palpitations in pulse pressure, mean arterial pressure (C3) 4.Examination of arterial pulse: rate/rhythm/character/volume/vessel wall (C4)	3
Unit 10:		
Abnormal arterial pulse	1.Apply the techniques of palpitations in Abnormalities in pulse volume: Pulses Magnus/ pulses tarsus/ bounding pulse (C3) 2.Apply the techniques of palpitations in Abnormalities in character: Parvus et tardus, collapsing/ water hammer pulse, pulse alternans, dicrotic pulse, bisferience pulse, pulses paradoxus, pulses bigeminy, apex pulse deficit (C3)	3
Unit 11:		
Introduction to heart sounds and murmurs	1.Remember and examine the heart sounds and murmurs like S1, S2, S3, S4 (C4) 2.Remember and examine the heart sounds and murmurs: Diastolic and systolic murmurs (C4)	2

Learning Strategies, Contact Hours and Student Learning Time (SLT):

Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	16	32
Seminar	4	8
Small group discussion (SGD)	-	-
Self-directed learning (SDL)	2	4
Problem Based Learning (PBL)	-	-
Case Based Learning (CBL)	-	-
Clinic	-	-
Practical	-	-
Revision	2	4
Assessment	2	4
Total	26	52

Assessment Methods:							
Formative:	Summative:						
Unit Test	Mid Semester/Sessional Exam (Theory)						
Quiz	-						
Viva	-						
Assignments/Presentations	Presentations, Record Book, Work dairy						
Clinical assessment (OSCE, OSPE, WBPA)	OSCE						
Clinical/Practical Log Book/ Record Book	Clinical record book						
Mapping of Assessment with COs:							
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6	CO7
Mid Semester / Sessional Examination 1	x	x	x				
Sessional Examination 2				x	x	x	x
Quiz / Viva	x	x	x	x	x		
Assignments/Presentations			x	x	x		x
Clinical/Practical Log Book/ Record Book		x	x	x	x		
Any others: WPBA					x	x	x
End Semester Exam	x	x	x	x	x	x	
Feedback Process:	Mid-Semester Feedback						
	End-Semester Feedback						
Main Reference:	1.Manipal Manual of Anatomy						
	2.Gray's Text book of Anatomy						
Additional References	1.The Heart – by Hurst's						

Manipal College of Health Professions								
Name of the Department		Cardiovascular Technology (CVT)						
Name of the Program		Bachelor of Science in Cardiovascular Technology						
Course Title		Basic ECG						
Course Code		CVT1102						
Academic Year		First Year						
Semester		I						
Number of Credits		3						
Course Prerequisite		Knowledge of Basic science and physics						
Course Synopsis		1.This module will exhibit and demonstrate the knowledge acquired by learning the basic concepts of electrocardiogram and the clinical applications. 2.To provide the essential knowledge in interpreting cardiac electro grams by providing descriptions and stating main ideas on ECG interpretation 3.To demonstrate and apply the knowledge in different ways during electro gram interpretation						
Course Outcomes (COs): At the end of the course student shall be able to: To interpret and appraise the								
CO1	Defining and understanding the role of lead system and in placement in ECG (C2)							
CO2	Explaining and applying the skills of electrophysiology and axis of the heart (C3)							
CO3	Interpreting the normal ECG waveforms and its application in identifying hearts rhythm (C4)							
CO4	Interpreting the ECG with respect to chamber enlargement and hypertrophy (C4)							
CO5	Interpreting and analyzing the intra ventricular conduction abnormalities and blocks (C4)							
CO6	Understanding the techniques in interpreting and concluding the diagnosis of ECG in myocardial infarction (C4)							
CO7	Interpreting and analyzing the ECG findings in various other cardiac conditions (C4)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1		x				x		
CO2		x				x		
CO3	x					x		
CO4	x					x		
CO5		x					x	
CO6		x					x	
CO7		x					x	

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Conduction system of the heart	<ol style="list-style-type: none"> 1. To understand and explain the conduction system of the heart in SA node (C2) 2. To understand and explain the conduction system of the heart in AV node (C2) 3. To understand and explain the conduction system of the heart in Bundle of His (C2) 4. To understand and explain the conduction system of the heart in Bundle branches (C2) 5. To understand and explain the conduction system of the heart in Purkinje fibres (C2) 	5
Unit 2:		
Lead system in ECG	<ol style="list-style-type: none"> 1. Define the role of lead system in Unipolar leads (C1) 2. Define the role of lead system in Bipolar (C1) 	2
Unit 3:		
Electrophysiology of the heart	<ol style="list-style-type: none"> 1. Apply the skills of electrophysiology and axis of the heart in Intracellular potential (C3) 2. Apply the skills of electrophysiology and axis of the heart in potential produced by normal cardiac muscle (C3) 3. Apply the skills of electrophysiology and axis of the heart in Relative and absolute refractory period (C3) 4. Apply the skills of electrophysiology and axis of the heart in distribution of electric axis (C3) 5. Apply the skills of electrophysiology and axis of the heart in methods of assessing ECG axis (C3) 	5
Unit 4:		
Interpretation of normal ECG	<ol style="list-style-type: none"> 1. To interpret the normal electrocardiograms Standardization (C4) 2. To interpret the normal electrocardiograms of P wave, QRS morphology (C4) 3. To interpret the normal electrocardiograms of ST segment wave (C4) 4. To interpret the normal electrocardiograms of PR interval, PR segment (C4) 5. To interpret the normal electrocardiograms of QTc interval (C4) 	4
Unit 5:		
ECG in Dextrocardia	<ol style="list-style-type: none"> 1. To discover True Dextrocardia (C4) 2. To discover Technical Dextrocardia (C4) 	2
Unit 6:		
ECG Rhythm	<ol style="list-style-type: none"> 1. To assess the Sinus rhythm (C4) 2. To assess the Regular, Irregular rhythms (C4) 	2
Unit 7:		
ECG in Chamber enlargement and Hypertrophy	<ol style="list-style-type: none"> 1. To assess the ECG with respect to chamber enlargement and hypertrophy in Right atrial enlargement (C5) 	5

Content	Competencies	Number of Hours
	2.To assess the ECG with respect to chamber enlargement and hypertrophy in Left atrial enlargement (C5) 3.To assess the ECG with respect to chamber enlargement and hypertrophy in Left ventricular hypertrophy –Volume/pressure overload (C5) 4.To assess the ECG with respect to chamber enlargement and hypertrophy in Right ventricular hypertrophy – Volume/pressure overload (C5) 5.To assess the ECG with respect to chamber enlargement and hypertrophy in Bi-ventricular hypertrophy (C5)	
Unit 8:		
ECG in Intra ventricular conduction abnormalities and AV blocks	1. To analyse the intra ventricular conduction abnormalities and blocks in Bundle branch block (C4) 2.To analyse the intra ventricular conduction abnormalities and blocks in Fascicular block (C4) 3.To analyse the intra ventricular conduction abnormalities and blocks in Bifascicular block (C4) 4.To analyse the intra ventricular conduction abnormalities and blocks in Trifascicular block (C4) 5.To analyse the intra ventricular conduction abnormalities and blocks in Bundle branch block associated with ventricular hypertrophy (C4) 6.To analyse the intra ventricular conduction abnormalities and blocks in First degree AVB , second degree AVB, third degree AVB (C4)	5
Unit 9:		
Identification of variants of ECG in Myocardial infarction	1.To interpret and conclude the diagnosis of ECG in Ischemia, injury, infarction (C5) 2.To interpret and conclude the diagnosis of ECG in ST-T changes –changes in QRS complex (C5) 3.To interpret and conclude the diagnosis of ECG in Localization of MI (C5) 4.To interpret and conclude the diagnosis of ECG in Identification of culprit vessel (C5) 5.To interpret and conclude the diagnosis of ECG in Right ventricular MI and atrial MI (C5) 6.To interpret and conclude the diagnosis of ECG in MI associated with bundle branch blocks (C5)	5
Unit 10:		
ECG in Miscellaneous	1.To analyse the ECG findings in various other cardiac conditions like Pericarditis (C4) 2.To understand the ECG findings and differentiating with MI (C4)	4

Learning Strategies, Contact Hours and Student Learning Time (SLT):							
Learning Strategies	Contact Hours			Student Learning Time (SLT)			
Lecture	20			40			
Seminar	6			12			
Small group discussion (SGD)	2			4			
Self-directed learning (SDL)	2			4			
Problem Based Learning (PBL)	-			-			
Case Based Learning (CBL)	4			8			
Clinic	-			-			
Practical	-			-			
Revision	3			6			
Assessment	2			4			
Total	39			78			
Assessment Methods:							
Formative:				Summative:			
Unit Test				Mid Semester/Sessional Exam (Theory)			
Quiz				-			
Viva				Viva			
Assignments/Presentations				Presentations, Record Book, Work Dairies			
Clinical assessment (OSCE, OSPE, WBPA)				OSCE, OSPE			
Clinical/Practical Log Book/ Record Book				Clinical record book			
Mapping of Assessment with COs:							
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6	CO7
Mid Semester / Sessional Examination 1	x	x	x				
Sessional Examination 2				x	x	x	x
Quiz / Viva	x			x		x	x
Assignments/Presentations		x					
Clinical/Practical Log Book/ Record Book	x			x	x		x
Any others: WPBA	x	x	x				
End Semester Exam	x	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback						
	End-Semester Feedback						
Main Reference:	1.Leo Schamroth Text Book of Electrocardiography 2.Mervin Goldmann Text Book of Electrocardiography						
Additional References	1.Marriott's practical Electrocardiography						

Manipal College of Health Professions								
Name of the Department	Cardiovascular Technology (CVT)							
Name of the Program	Bachelor of Science in Cardiovascular Technology							
Course Title	Cardiac Embryology							
Course Code	CVT1103							
Academic Year	First Year							
Semester	I							
Number of Credits	3							
Course Prerequisite	Knowledge of basic Anatomy and Physiology							
Course Synopsis	<p>1. To understand the Early development of embryo including mitosis, meiosis, Oogenesis, spermatogenesis, fertilization and development of placenta.</p> <p>2. This course allow to understand the development of the heart such as heart tube formation, cardiac looping, atrial formation, ventricular formation, formation of cardiac valves.</p> <p>3. To understand the fate of truncus arteriosus, pharyngeal arch arteries, formation of great cardiac veins, development of pericardium and formation of coronary arteries</p>							
Course Outcomes (COs):								
At the end of the course student shall be able to:								
CO1	Defining and understanding the early development of embryo(C2)							
CO2	Explaining and understanding the formation of heart tube and cardiac looping(C2)							
CO3	Understanding and classify the formation of atria, and inter atrial septum(C2)							
CO4	Defining and understanding the formation of cardiac valves(C2)							
CO5	Defining and understanding the formation of ventricles and inter ventricle septum(C2)							
CO6	Explaining and understanding the formation of truncus arteriosus, pharyngeal arch arteries, great cardiac veins, pericardium and coronary arteries.(C2)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1		x		x				
CO2		x			x			
CO3		x			x			
CO4		x		x				
CO5		x			x			
CO6		x		x				

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Early development of embryo	<ol style="list-style-type: none"> 1. Define and Explaining the stages of cell division Mitosis and Meiosis(C2) 2. Define and Explaining the stages of spermatogenesis and oogenesis(c2) 3. Explaining the stages of fertilization(C2) 4. Explaining and understanding the formation of Germ layers(C2) 5. Explaining the development of placenta(C2) 	11
Unit 2:		
Development of the heart	<ol style="list-style-type: none"> 1. Explaining and understanding the formation of heart tube(C2) 2. Explaining the formation of cardiac looping(C2) 3. Explaining and development of sinus venosus (C2) 	4
Unit 3:		
Formation of Atria	<ol style="list-style-type: none"> 1. Understanding and formation of atria(C2) 2. Explaining and development of Right atrium(C2) 3. Explaining and understanding the formation of Left atrium(C2) 4. Explaining the stages in formation of Inter atrial septum(C2) 	5
Unit 4:		
Formation of Cardiac Valves	<ol style="list-style-type: none"> 1. Explaining and understanding the formation of AV valves and Semilunar valves(C2) 	1
Unit 5:		
Formation of Ventricles	<ol style="list-style-type: none"> 1. Explaining and development of Ventricles(C2) 2. Explaining and understanding the stages in formation of Inter ventricular septum(C2) 	3
Unit 6:		
Fate of truncus arteriosus	<ol style="list-style-type: none"> 1. Understanding and explaining the development of Pharyngeal arch arteries and their fate(C2) 2. Define and understanding the Anomalous development of pharyngeal arch arteries (C2) 	6
Unit 7:		
Formation of great cardiac veins	<ol style="list-style-type: none"> 1. Define, Understanding and explaining the development of great cardiac veins(C2) 2. Understanding the fate of cardinal veins (C2) 3. Understanding the fate of vitelline veins, umbilical veins(C2) 4. Explaining the fate of Ductus venosus, Superior vena cava, Inferior vena cava(C2) 	7
Unit 8:		
Formation of Pericardium	<ol style="list-style-type: none"> 1. Define, understanding and explaining the formation of Pericardium(C2) 	2

Learning Strategies, Contact Hours and Student Learning Time (SLT)						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	21	42				
Seminar	8	16				
Small group discussion (SGD)	1	2				
Self-directed learning (SDL)	4	8				
Problem Based Learning (PBL)	-	-				
Case Based Learning (CBL)	-	-				
Clinic	-	-				
Practical	-	-				
Revision	3	6				
Assessment	2	4				
Total	39	78				
Assessment Methods:						
Formative:			Summative:			
Unit Test			Mid Semester/Sessional Exam (Theory)			
Quiz			-			
Viva			-			
Assignments/Presentations			Assignments, Record Book			
Clinical assessment (OSCE, OSPE, WBPA)			OSCE			
Clinical/Practical Log Book/ Record Book			Clinical record book			
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x	x	x			
Sessional Examination 2				x	x	x
Quiz / Viva				x		
Assignments/Presentations		x	x	x	x	
Clinical/Practical Log Book/ Record Book	x	x	x	x		
Any others: WPBA						
End Semester Exam	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	1.Human Embryology by Inderbir Singh 2.Heart Diseases in infants, children and adolescents by Moss and Adams					
Additional References	1.The clinical recognition of congenital heart diseases by Perloff					

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Clinics - I
Course Code	CVT1131
Academic Year	First Year
Semester	I
Number of Credits	3
Course Prerequisite	Basic knowledge about the basic ECG interpretation and lead placement
Course Synopsis	<ol style="list-style-type: none"> 1. This module helps to obtain the basic knowledge about interpretation of ECG. In the process of learning basic electrocardiography, it may be useful to understand the importance the importance of ECG lead placement and orientation 2. To provide fundamental knowledge in the diagnosis of normal ECG waves, chamber enlargement/ hypertrophy, AV block and myocardial infarction 3. To analyse, identify and interpretation of ECG connection 4. Record maintenance

Course Outcomes (COs):

At the end of the course student shall be able to: Build skills and perform

CO1	To understand and perform basic lead placement and patient preparation (C1,P4)
CO2	To build the knowledge of lead system and placement(C3, P3)
CO3	Ability to identify and interpret the normal ECG waves(C5, P3)
CO4	Able to measure the waves that would fulfil the criteria to identify abnormal ECG(C5, P3)
CO5	Knowledge to compare the normal and abnormal ECG reports(C5,P4)
CO6	Build skills to develop practical knowledge and ability to interpret given ECG(C5,P4)

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x			x				
CO2		x		x				
CO3		x					x	
CO4					x		x	
CO5						x	x	
CO6		x						x

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Conduction system of the heart	1. Identify the abnormal ECG pattern in SA nodal dysfunction (C3,P3)	15

Content	Competencies	Number of Hours
	2. Identify the abnormal ECG pattern in AV nodal dysfunction (C3,P3) 3. Identify the abnormal ECG pattern in His bundle (C3,P3) 4. Identify the abnormal ECG pattern in Bundle branches(C3,P3) 5. Identify the abnormal ECG pattern in Purkinje fibres(C3,P3)	
Unit 2:		
Lead system	1. Build skills of unipolar and bipolar lead system(C3,P4) 2. Build skills of lead placement (C3,P4)	5
Unit 3:		
Interpretation of normal ECG	1. Identify standardization(C3,P4) 2. Identify P wave, QRS complex, ST segment, PR interval, PR segment and QTc interval(C3,P4)	5
Unit 4:		
Electrophysiology of the heart	1. Develop knowledge to identify abnormal ECG pattern due to intracellular and electrical potential produced by the normal cardiac muscles (C3,P3) 2. Develop knowledge to identify abnormal ECG pattern due to Relative and absolute refractory period(C3,P3)	10
Unit 5:		
Electrical axis	1. Interpret the methods to assess ECG axis(C2,P4)	5
Unit 6:		
Dextrocardia	1. Identify and differentiate between True and Technical Dextrocardia (C3,P3)	5
Unit 7:		
Rate and Rhythm	1. Apply skills to identify sinus rhythm(C3,P4) 2. Apply skills to identify and compare between regular and irregular rhythm(C3,P4) 3. Apply skills to identify and compare between regular and irregular rate(C3,P4)	17
Unit 8:		
Chamber enlargement	1. Identify Right atrial enlargement(C3,P4) 2. Identify Left atrial enlargement(C3,P4)	10
Unit 9:		
Chamber Hypertrophy	1. Identify Left ventricular hypertrophy (C3,P4) 2. Identify Right ventricular hypertrophy (C3,P4) 3. Interpret and compare between volume and pressure overload in ventricular hypertrophy (C3,P4) 4. Identify Bi-ventricular hypertrophy(C3, ,P4)	10

Content	Competencies	Number of Hours
Unit 10:		
Conduction abnormalities	1. Interpret first degree Av block(C2, P4) 2. Interpret second degree Av block(C2,P4) 3. Interpret third degree Av block(C2,P4) 4. Interpret Bundle branch block(C2,P4) 5. Interpret Bi and Tri-Fascicular block(C2,P4) 6. Interpret Bundle branch block associated with ventricular hypertrophy (C2,P4)	10
Unit 11:		
Myocardial infarction	1. Identify ischemia, injury, infarction(C3,P3) 2. Identify ST-T changes (C3,P3) 3. Identify changes in QRS complex (C3,P3) 4. Identify localization of MI(C3,P3) 5. Identify the culprit vessel(C3,P3) 6. Identify Right ventricular myocardial infarction(C3,P3) 7. Identify Atrial myocardial infarction(C3,P3) 8. Identify Myocardial infarction associated with bundle branch block(C3,P3)	20
Unit 12:		
Pericarditis	1. Identify Pericarditis ECG (C3,P3) 2. Compare pericarditis with myocardial infarction(C2,P3)	5

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	-	-
Seminar	-	-
Small group discussion (SGD)	8	16
Self-directed learning (SDL)	20	40
Problem Based Learning (PBL)	8	16
Case Based Learning (CBL)	20	40
Clinic	56	112
Practical	-	-
Revision	-	-
Assessment	5	10
Total	117	234
Assessment Methods:		
Formative:	Summative:	
Unit Test	-	
Quiz	-	
Viva	Viva	
Assignments/Presentations	Work diary	
Clinical assessment (OSCE, OSPE, WBPA)	WBPA	
Clinical/Practical Log Book/ Record Book	Clinical record book	

Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1						
Sessional Examination 2						
Quiz / Viva	x	x	x	x	x	x
Assignments/Presentations				x		
Clinical/Practical Log Book/ Record Book	x	x	x	x	x	x
Any others: WPBA	x	x		x		
End Semester Exam						
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	1.Leo Schamroth Text Book of Electrocardiography 2.Mervin Goldmann Text Book of Electrocardiography					
Additional References	1.Marriott's practical Electrocardiography					

SEMESTER - II

COUSE CODE	:	COURSE TITLE
ANA1201	:	Anatomy - II
PHY1201	:	Physiology - II
BIC1201	:	Biochemistry
CVT1201	:	Advanced ECG and Holter Monitoring
CVT1202	:	Medical Ethics & Legal Aspects
CVT1211	:	ECG Interpretation, Holter Analysis Practical
CVT1231	:	Clinics - II

Manipal College of Health Professions								
Name of the Department		Cardiovascular Technology (CVT)						
Name of the Program		Bachelor of Science in Cardiovascular Technology						
Course Title		Anatomy - II						
Course Code		ANA1201						
Academic Year		First Year						
Semester		II						
Number of Credits		2						
Course Prerequisite		Basic knowledge of general anatomy						
Course Synopsis		Human anatomy is the study of the human body and relations of various structures of the body by dissection.						
Course Outcomes (COs): At the end of the course student shall be able to								
CO1		Explain the musculoskeletal system related to the upper and lower extremities. (C2)						
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x							

Course Content and Outcomes:

Content	Competencies	Number of Hours (Theory)
Unit 1:		
Pectoral region and Axilla	<ul style="list-style-type: none"> Describe the pectoral muscles –pectoralis major, pectoralis minor, serratus anterior with attachments, nerve supply and actions (C1, C2) Explain anatomical basis of winging of scapula (C2) Describe the clavipectoral fascia (C1) Describe the boundaries and contents of axilla (C1,C2) Describe the axillary artery- extent, course and branches (C1, C2) Describe the brachial plexus formation and branches (C1, C2) Describe the Erb's point mentioning the clinical aspects (C2) Describe the Klumpke's paralysis (C2) 	3
Muscles of back and shoulder region	<ul style="list-style-type: none"> Describe the muscles of back and shoulder region- trapezius, deltoid, latissimus dorsi, rhomboidus major and minor, supraspinatus, infraspinatus, teres major and minor (detailed) C1, C2) Describe the deltoid with applied anatomy (C1, C2) Describe the supraspinatus with applied anatomy (C1, C2) Describe the subacromial bursa with applied anatomy (C1, C2) Describe the rotator cuff with its role in limiting shoulder dislocation (C1, C2) 	2

Content	Competencies	Number of Hours (Theory)
	<ul style="list-style-type: none"> Describe each of the intermuscular spaces with boundaries and contents (C1, C2) 	
Arm	<ul style="list-style-type: none"> Describe the muscles of front of arm- biceps brachii, brachialis, coracobrachialis with attachments, nerve supply and actions (C1, C2) Describe the boundaries and contents of cubital fossa (C1, C2) Describe the brachial artery with mention of Volkmann's ischemic contracture and supracondylar fracture (C1, C2) Describe the axillary nerve with applied anatomy(C1,C2) Describe musculocutaneous nerve with applied anatomy (C1, C2) Describe the triceps brachii with the nerve supply & actions (C1, C2) Describe radial nerve with applied anatomy (C1, C2) 	2
Forearm	<ul style="list-style-type: none"> Name the superficial and deep muscles of front of forearm with nerve supply and actions (C1, C2) Describe pronator teres and brachioradialis in detail (C1, C2) Names the muscles of back of forearm with nerve supply and actions (C1, C2) Describe the supinator in detail (C1, C2) Explains tennis elbow (C1, C2) Describe the extensor retinaculum with osseo-fascial compartments in detail (C1) Describe the anatomical snuff box with boundaries and contents (C1, C2) 	2
Palm	<ul style="list-style-type: none"> Describe the flexor retinaculum with applied anatomy (C1, C2) briefly Describe the palm -name thenar and hypothenar muscles with nerve supply and action(C1) Describe adductor pollicis (C1) Describe the lumbricals and interossei (detailed) with nerve supply and actions (C1, C2) 	1
Nerves and vessels of upper limb	<ul style="list-style-type: none"> Describe the ulnar nerve with applied anatomy(C1, C2) Describe the median nerve in detail (C1, C2) Explains carpal tunnel syndrome detailed (C1, C2) Describe each radial and ulnar artery- extent, course and branches (C1, C2) 	3
Joints of upper limb	<ul style="list-style-type: none"> Describe the shoulder joint under type, articular surfaces, ligaments, relations, movements and muscles responsible with a note on applied anatomy (C1, C2)Describe the elbow joint (detailed) (C1, C2) Describe the radioulnar joints (detailed) (C1) Describe the wrist joint (detailed) (C1, C2) Describe the first carpometacarpal joint (detailed) (C1) 	3

Content	Competencies	Number of Hours (Theory)
Venous and lymphatic drainage of upper limb	<ul style="list-style-type: none"> Describe the median cubital vein with applied anatomy (C1, C2) Describe the cephalic vein with applied anatomy(C1,C2) Describe the basilic vein with applied anatomy(C1, C2) Describe the lymphatic drainage of upper limb (C1, C2) 	1
Sternocleidomastoid and Muscles of facial expression	<ul style="list-style-type: none"> Describe the sternocleidomastoid with attachments, relations, nerve supply, actions and applied anatomy (C1, C2) Enumerates the muscles of facial expression (C1) Describe the orbicularis oculi, orbicularis oris and buccinator with nerve supply and actions (C1, C2) 	1
Vertebrae & Vertebral column	<ul style="list-style-type: none"> Describe the curvatures of the vertebral column mentioning lordosis, kyphosis, scoliosis C1, (C2) Explains the structure, functions, regional characteristics of vertebrae (C1, C2) Describe the parts and function of intervertebral disc with applied anatomy (C1, C2) 	1
Unit 2:		
Thigh	<ul style="list-style-type: none"> Describe the fascia lata, iliotibial tract, saphenous opening (C1, C2) Describe the boundaries and content of femoral triangle (C1, C2), Describe the femoral sheath, femoral canal with applied anatomy (C1, C2) Describe great saphenous vein (detailed) with applied anatomy (C1, C2) Describe the femoral artery- extent, course and branches (C1, C2) Describe the femoral nerve with applied anatomy (C1, C2) Describe the inguinal lymph nodes (C1) Describe the muscles of front of thigh with attachment, nerve supply and actions (C1, C2) Describe the adductor canal -boundaries and content with applied anatomy (C1, C2) Describe the adductor compartment muscles with attachment, nerve supply and actions (C1, C2) Describe the adductor magnus with attachment, nerve supply and actions (C1, C2) Describe the obturator nerve with applied anatomy (C1, C2) 	3
Gluteal region	<ul style="list-style-type: none"> Describe the sensory innervation of the quadrants of gluteal region with a note on intramuscular injections (C1, C2) Describe gluteus maximus with attachment, nerve supply and actions (C1, C2) Describe the gluteus medius and minimus with actions and related applied anatomy (C1, C2) 	1

Content	Competencies	Number of Hours (Theory)
	<ul style="list-style-type: none"> Enumerate the structures under cover of gluteus maximus (C1) Describe the relations of piriformis with brief mention of attachment, nerve supply and actions (C1,C2) 	
Back of thigh and Popliteal fossa	<ul style="list-style-type: none"> Describe the hamstring muscles with attachments, nerve supply and actions (C1, C2) Describe the popliteal fossa with boundaries and contents (C1, C2) Describe the popliteus with emphasis on actions (C1, C2) Describe the popliteal artery -extent, course and branches with a note on applied anatomy (C1, C2) 	1
Leg	<ul style="list-style-type: none"> Enumerates the anterior compartment muscles with attachment, nerve supply and actions with applied anatomy (C1, C2) Describe the tibialis anterior in detail with emphasis on actions (C1, C2) Describe the anterior tibial artery –extent, course and branches (C1, C2) Enumerates the lateral compartment muscles with attachment, nerve supply and actions with applied anatomy (C1, C2) Describe the peroneal artery (C1, C2) Enumerates the posterior compartment muscles with attachment, nerve supply and actions (C1, C2) Describe the soleus in detail with a note on applied anatomy (C1, C2) Describe the gastrocnemius in detail with a note on applied anatomy (C1, C2) Describe the tibialis posterior in detail with emphasis on actions (C1, C2) Describe the posterior tibial artery (C1, C2) 	2
Foot	<ul style="list-style-type: none"> Describe the sensory innervation of the dorsum of foot (C1, C2) Enumerates the muscles with nerve supply (C1) Describe the dorsalis pedis artery with reference to peripheral pulse (C1, C2) Enumerates the muscles of first and second layer of sole (C1) Names the sensory innervation of the sole of foot (C1) Describe the arches of foot in detail with applied anatomy (C1, C2) 	2
Joints of lower limb	<ul style="list-style-type: none"> Describe the hip joint under type, articular surfaces, ligaments, relations, movements and muscles responsible with a note on applied anatomy (C1,C2) Describe the knee joint under – type, articular surfaces, ligaments, relations, movements and 	3

Content	Competencies	Number of Hours (Theory)
	muscles responsible with a note on applied anatomy (C1,C2) <ul style="list-style-type: none"> • Describe the tibiofibular joint (detailed) (C1,C2) • Describe the ankle joint (detailed) (C1, C2) • Describe the subtalar joint (detailed) (C1) 	
Nerves of lower limb	<ul style="list-style-type: none"> • Describe the sciatic nerve under origin, root value, course, branches with applied anatomy (C1, C2) • Describe the tibial nerve under origin, root value, course, branches with applied anatomy (C1, C2) • Describe the common peroneal nerve under origin, root value, course, branches with applied anatomy (C1,C2) • Describe the deep peroneal nerve under course, branches and applied anatomy (C1, C2) • Describe the superficial peroneal nerve under course, branches and applied anatomy (C1, C2) 	2
Venous and lymphatic drainage of lower limb	<ul style="list-style-type: none"> • Describe the great saphenous vein (detailed) with applied anatomy (C1, C2) • Describe the small saphenous vein (C1) • Describe the lymphatic drainage of lower limb with a mention of elephantiasis (C1, C2) 	1

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	34	102
Seminar		
Small group discussion (SGD)		
Self-directed learning (SDL)		
Problem Based Learning (PBL)		
Case Based Learning (CBL)		
Clinic		
Practical		
Revision		
Assessment		
Total	34	102
Learning Assessment Methods:		
Formative:	Summative:	
Unit Test	Sessional Exam I and Sessional Exam II	
Quiz	End Semester Exam	
Viva		
Assignments/Presentations		

Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x					
Sessional Examination 2	x					
Quiz / Viva						
Assignments/Presentations						
End Semester Exam	x					
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	<ul style="list-style-type: none"> • B D Chaurasia, Human Anatomy, Volume I & II. 8th edition, CBS Publishers. • Vishram Singh. General anatomy, 3rd ed. • Handbook of General anatomy by B.D. Chaurasia. 					
Additional References	<ul style="list-style-type: none"> • Text book of Anatomy, Vishram singh, 3rd edition • Manipal Manual of Anatomy for allied health students by Dr. Sampath Madyastha. 					

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Physiology - II
Course Code	PHY1201
Academic Year	First Year
Semester	II
Number of Credits	2
Course Prerequisite	Basic knowledge of general physiology
Course Synopsis	This module provides a comprehensive knowledge about normal functions of the organ systems of the body to understand the physiological basis of health and disease required for health professionals.

Course Outcomes (COs):

At the end of the course student shall be able to:

CO1	Know the basic facts and concepts of Physiology (C1).
CO2	To have a knowledge of the normal functions of organ systems of the body to facilitate an understanding of physiological basis of health (C2).
CO3	To integrate the functions of various organ systems & to understand their functions as a body unit (C2).
CO4	Explain the physiological basis of disease processes (C2).

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x							
CO2	x							
CO3	x							
CO4	x							

Course Content and Outcomes:

Topics	Competencies	Number of Hours
Unit 1: Central nervous System		
General organization of nervous system	<ul style="list-style-type: none"> Outline the organization of nervous system (C1) Outline the organization of autonomic nervous system(ANS) C1 Enumerate the functions of ANS (C1) Mention the functional areas of cerebral cortex and their functions (C1) 	1
Receptors	<ul style="list-style-type: none"> Classify sensory receptors according to type and location of stimulus, giving examples for each (C2) Explain the property of 'specificity' and 'adequate 	1

Topics	Competencies	Number of Hours
	stimulus' (C2) • Explain the property of 'adaptation' of sensory receptors (C2)	
Synapse	• Define 'synapse' (C1) • Describe the structure of a synapse (C2) • Explain the events in synaptic transmission (C2)	1
Reflexes	• Define reflex (C1) • Enumerate the components of a reflex arc with the help of a diagram (C1) • Describe the stretch reflex with the help of a diagram(C2) • Describe withdrawal reflex with the help of a diagram(C2) • Explain the importance of withdrawal reflex (C2)	2
Ascending pathways	• Outline the general organization of sensory pathways(C1) • Describe the dorsal column, lateral spinothalamic and anterior spinothalamic tracts with the help of labelled diagrams(C2) • Mention the different sensations that are carried by the above pathways (C1)	2
Descending pathways	• Describe the pyramidal/corticospinal tract with the help of a labelled diagram (C2) • Tabulate the differences between 'upper motor neuron lesion' and 'lower motor neuron lesion (C2)	1
Cerebellum	• Name the functional divisions of cerebellum (C1) • Enumerate the functions of each lobe of cerebellum(C1) • List the clinical features of cerebellar lesion (C1) • List the clinical features of cerebellar lesion (C2)	1
Basal ganglia	• Mention the components of basal ganglia (C1) • Enumerate the functions of basal ganglia (C1) • Explain the cause and clinical features Parkinson's disease (C2) • Explain the basis of treatment of Parkinson's disease (C2)	1
Thalamus and Hypothalamus	• Explain the functions of thalamus (C2) • List the different nuclei of hypothalamus (C1) • Explain the functions of hypothalamus (C2)	2
Cerebrospinal fluid	• Describe the formation, circulation, absorption and functions of CSF (C2) • Mention the method of collection of a sample of CSF and its indications (C1) • Explain the functions of higher centers of brain(C2)	1
Unit 2: Gastrointestinal system		
Salivary secretion	• Mention the composition of saliva (C1)	1

Topics	Competencies	Number of Hours
& Deglutition	<ul style="list-style-type: none"> • Explain the functions of saliva (C2) • Describe the regulation of salivary secretion (C2) • Describe the effects of Xerostomia (C2) • Define deglutition (C1) • Explain the stages of deglutition (C2) • Describe dysphagia (C2) • Describe Achalasia cardia (C2) 	
Stomach	<ul style="list-style-type: none"> • Describe the functions of stomach (C2) • Mention the composition of gastric juice (C1) • Describe functions of gastric juice (C2) • Describe the mechanism of secretion of hydrochloric acid (C2) • Describe the regulation of gastric juice secretion (cephalic, gastric and intestinal phases) (C2) 	1
Exocrine portion of Pancreas; Liver and biliary system	<ul style="list-style-type: none"> • Outline the composition of pancreatic juice (C1) • Describe the functions of pancreatic juice (C2) • Describe the neural and hormonal regulation of pancreatic juice (C2) • Outline the composition of hepatic bile(C1) • Describe the functions of bile(C2) • Enumerate the functions of gall bladder(C1) 	1
Small intestine and large intestine	<ul style="list-style-type: none"> • Composition and functions of small intestinal secretions (C2) • Different types of Intestinal movements and their significance (C2) • Explain different types of small intestinal movements and their significance(C2) • List the functions of large intestine(C1) 	1
Unit 3: Renal system		
Introduction & Glomerular filtration	<ul style="list-style-type: none"> • List the functions of kidneys (C1) • Draw a labelled diagram of a nephron (C1) • Mention the normal value of renal blood flow (C1) • Define glomerular filtration rate(GFR) (C1) • Mention the normal value of GFR (C1) • Explain the factors influencing GFR (C2) • List the substances used for the determination of GFR (C1) 	1
Reabsorption and secretion in renal tubules	<ul style="list-style-type: none"> • Describe tubular reabsorption of sodium, glucose and water (C2) • Define tubular load, renal threshold and tubular/transport maximum (C1) • Mention the normal values for tubular load, renal threshold and tubular/transport maximum (C1) 	1
Mechanism of concentration/dilution of urine	<ul style="list-style-type: none"> • Describe the role of counter current multiplier and counter current exchanger in the formation of urine (C2) 	1

Topics	Competencies	Number of Hours
Physiology of micturition	<ul style="list-style-type: none"> • Describe the nerve supply to urinary bladder (C2) • Describe the micturition reflex (C2) • List the functions of skin 	1
Unit 4: General principles of endocrinology		
Introduction and Pituitary gland	<ul style="list-style-type: none"> • Name the major endocrine glands and their secretions(C1) • Mention the chemical nature of hormones with examples (C2) • List the anterior pituitary hormones (C1) • Describe the actions of growth hormone (C2) • Describe the regulation of secretion of growth hormone(C2) • Describe the cause and clinical features of gigantism (C2) • Describe the cause and clinical features of acromegaly (C2) • Describe the cause and clinical features of dwarfism (C2) • List the hormones of posterior pituitary (C1) • Describe the actions of posterior pituitary hormones (C2) • Describe diabetes insipidus (C2) 	1
Thyroid gland	<ul style="list-style-type: none"> • List the hormones of thyroid gland (C1) • Describe the actions of thyroid hormones(C2) • Describe the regulation of secretion of thyroid hormones (C2) • Describe the cause and clinical features of hyperthyroidism (C2) • Describe the cause and clinical features of cretinism (C2) • Describe the cause and clinical features of myxedema(C2) • Explain the actions of glucocorticoids (C2) 	2
Adrenal cortex & Adrenal medulla	<ul style="list-style-type: none"> • Describe the regulation of secretion of glucocorticoids (C2) • Explain the cause and clinical features of Cushing's syndrome (C2) • Describe the actions of mineralocorticoids (C2) • Describe the cause and clinical features of Addison's disease (C2) • List the hormones of adrenal medulla (C1) • Describe the actions of adrenal medullary hormones (C2) 	1
Parathyroid gland	<ul style="list-style-type: none"> • Describe the actions of PTH (C2) • Describe the regulation of secretion of PTH (C2) • Describe the effects of hyperparathyroidism (C2) 	1
Endocrine Pancreas	<ul style="list-style-type: none"> • Describe the actions of insulin (C2) 	1

Topics	Competencies	Number of Hours
	<ul style="list-style-type: none"> Describe the regulation of secretion of insulin (C2) Describe the cause and clinical features of diabetes mellitus (C2) List the actions of glucagon (C1) Describe the regulation of secretion of glucagon(C2) 	
Unit 5: Reproductive system		
Male Reproductive system	<ul style="list-style-type: none"> Describe the organization of male reproductive system(C2) Describe the structure and functions of testes (C2) Define spermatogenesis (C1) Describe the stages of spermatogenesis (C2) Mention the actions of testosterone (C1) Describe the regulation of secretion of testosterone (C2) 	1
Female Reproductive system	<ul style="list-style-type: none"> Describe the structure of female reproductive system(C2) Explain the actions of Estrogen and Progesterone (C2) Describe the ovarian changes during menstrual cycle(C2) Describe the uterine endometrial changes during menstrual cycle (C2) Explain the hormonal control of ovarian functions (C2) Describe the indicators of ovulation (C2) 	2
Pregnancy and Lactation; Contraceptive methods	<ul style="list-style-type: none"> Enumerate the functions of placenta (C1) Describe milk ejection reflex (C2) Mention various contraceptive methods in males (C1) Mention various contraceptive methods in females (C1) Explain the mechanism of action of various contraceptive methods (C2) 	1

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	30	90
Seminar		
Small group discussion (SGD)		
Self-directed learning (SDL)		
Case Based Learning (CBL)		
Clinic		
Practical		
Revision		
Assessment		
Total	30	90

Assessment Methods:							
Formative:			Summative:				
Unit Test			Sessional Examination I and Sessional Examination II (Theory)				
Class tests (Essay & Short notes)			End Semester Exam (Theory)				
PBL assessment			Viva				
Clinical assessment (OSCE, OSPE, WBPA)							
Clinical/Practical Log Book/ Record Book							
Mapping of Assessment with COs:							
Nature of Assessment		CO1	CO2	CO3	CO4	CO5	CO6
Sessional Examination 1		x	x				
Sessional Examination 2		x	x	x	x		
Quiz / Viva							
Assignments/Presentations							
Clinical/Practical Log Book/ Record Book							
Any others: WPBA							
End Semester Exam		x	x	x	x		
Feedback Process:		Mid-Semester Feedback					
		End-Semester Feedback					
Main Reference:		1. Basics of Medical Physiology- 3rd Edition by D Venkatesh and HH Sudhaker 2. Manipal Manual of Medical Physiology, 1st edition, C. N. ChandraShekar					

Manipal College of Health Professions								
Name of the Department	Cardiovascular Technology (CVT)							
Name of the Program	Bachelor of Science in Cardiovascular Technology							
Course Title	Biochemistry							
Course Code	BIC1201							
Academic Year	First Year							
Semester	II							
Number of Credits	3							
Course Prerequisite	Basic knowledge of Biology and Chemistry							
Course Synopsis	Biochemistry broadly deals with the chemistry of life and living processes. It helps in understanding the building blocks – proteins, carbohydrates, fats, nucleic acids and is necessary for allied health professions students to understand various biochemical mechanisms so as to correlate with or identify the pathological processes. Knowledge of biomolecules is necessary to understand the various laboratory investigations and their relevance in clinical practice							
Course Outcomes (COs):								
At the end of the course student shall be able to:								
CO1	Explain the classification, composition and functions of macromolecules (C2)							
CO2	Describe the process of digestion, absorption and metabolism of carbohydrates, lipids and proteins (C2)							
CO3	Summarize the concepts of nutrition, balanced diet and role of macro and micronutrients in the maintenance of health (C2)							
CO4	Summarize the features and investigations in diabetes mellitus and acid-base disorders (C2)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x							
CO2	x							
CO3	x							
CO4	x							

Course Content and Outcomes:

Unit	Content	Competencies	Number of Hours
Unit 1: ENZYMES			
	At the end of this chapter, a student should be able to 1. Define the term 'enzyme' (C1) 2. Classify enzymes based on reaction specificity (IUBMB classification)(C2) 3. Give one example (names of enzymes & reaction catalyzed) for each class of enzymes (C1) 4. Define the term 'isoenzymes' (C1) 5. Explain isoenzymes with examples (creatine kinase, lactate dehydrogenase) (C2)		2

Unit	Content	Competencies	Number of Hours
	6. Define the term 'proenzyme or zymogen' with pepsinogen and trypsinogen as examples (C1) 7. Describe the utility of serum enzymes as diagnostic markers (C2) 8. Mention the diagnostic utility of following enzymes (C1) <ul style="list-style-type: none"> • CK • ALP • AST • ALT • LDH 		
Unit 2: CARBOHYDRATE CHEMISTRY			
	At the end of this chapter, a student should be able to <ol style="list-style-type: none"> 1. Define the term 'carbohydrates' (C1) 2. Classify carbohydrates with examples for each class (C2) 3. Classify monosaccharides with examples based on (C2) <ul style="list-style-type: none"> • Number of carbon atoms • Functional groups 4. Mention the source and composition of following disaccharides (C1) <ul style="list-style-type: none"> • Sucrose • Lactose • Maltose 5. Classify polysaccharides based on composition with examples (C2) 6. Explain the structure of starch and glycogen with schematic representation (C2) 7. List the differences between starch and glycogen (C1) 8. Mention the occurrence and functions of heparin and chondroitin sulphate(C1) 		2
Unit 3: CARBOHYDRATE DIGESTION AND ABSORPTION			
	At the end of this chapter, a student should be able to <ol style="list-style-type: none"> 1. Describe the complete digestion of dietary polysaccharides (starch and glycogen) (C2) 2. Describe the reactions catalyzed by the following brush border enzymes (C2) <ul style="list-style-type: none"> • Maltase • Sucrase-isomaltase • Lactase 3. Illustrate the mechanisms of absorption of monosaccharides in the small intestine (C2) 4. Explain the significance of including sodium chloride along with glucose in the oral rehydration solution (C2) 		2
Unit 4: CARBOHYDRATE METABOLISM			
	A. Glycolysis At the end of this chapter, a student should be able to <ol style="list-style-type: none"> 1. Define aerobic and anaerobic glycolysis (C1) 2. Mention the site and subcellular site of glycolysis (C1) 3. Describe the steps of glycolysis with all the enzymes and coenzymes at each step (C2) 4. Mention the regulatory enzymes and list the names of hormones that regulate it in the well-fed state and starvation (C1) 5. Calculate the energetics of aerobic and anaerobic glycolysis (C2) 		2
	B. Gluconeogenesis		2

Unit	Content	Competencies	Number of Hours
	At the end of this chapter, a student should be able to 1. Define gluconeogenesis (C1) 2. Mention the sites & subcellular sites of gluconeogenesis (C1) 3. List the precursors for gluconeogenesis (C1) 4. List the key enzymes of gluconeogenesis (C1) 5. Describe the synthesis of glucose from pyruvate and lactate (C2) 6. Mention the regulatory enzymes and list the names of hormones that regulate it in the well-fed state and starvation (C1) 7. Explain the significance of gluconeogenesis (C2)		
	C. Citric acid cycle At the end of this chapter, a student should be able to 1. Recall the reaction catalyzed by pyruvate dehydrogenase complex and mention its coenzymes (C1) 2. Mention the site and subcellular site of citric acid cycle (C1) 3. Describe the reactions of citric acid cycle with all enzymes and coenzymes (C2) 4. Mention the regulatory enzymes of citric acid cycle (C1) 5. Calculate the energetics of citric acid cycle (C2)		2
	D. Glycogen metabolism At the end of this chapter, a student should be able to 1. Mention the function of glycogen in liver and muscle (C1) 2. Define glycogenesis & glycogenolysis (C1) 3. Mention the site and subcellular site of glycogen metabolism (C1) 4. Mention the fate of end products of glycogenolysis in liver (role of glucose 6-phosphatase) and muscle (C1) 5. Mention the regulatory enzymes and the hormones involved in regulation in well-fed state and starvation (C1) 6. List the glycogen storage disorders mentioning their names, defects and tissues affected (Type I, V & VI) (C1)		1
Unit 5: ELECTRON TRANSPORT CHAIN AND OXIDATIVE PHOSPHORYLATION			
	At the end of this chapter, a student should be able to 1. Define the electron transport chain (ETC) (C1) 2. Name the subcellular site of ETC (C1) 3. Describe the complexes of ETC (with their components and order of arrangement) and mention the mobile electron carriers (C2) 4. Name the inhibitors for each of the complexes of ETC (C1) 5. Define oxidative phosphorylation (C1)		1
Unit 6: LIPID CHEMISTRY			
	At the end of this chapter, a student should be able to 1. Define lipids (C1) 2. Explain the functions of lipids in the body (C2) 3. Classify lipids with examples for all the subclasses (C2) 4. Classify fatty acids with examples-saturated, unsaturated (based on number of double bonds), essential fatty acids (C2)		1
Unit 7: LIPID DIGESTION, ABSORPTION AND ASSOCIATED DISORDERS			
	At the end of this chapter, a student should be able to 1. Explain the process of emulsification of lipids (C2) 2. Describe the digestion of lipids in the stomach and intestine (C2)		2

Unit	Content	Competencies	Number of Hours
	3. Illustrate the process of absorption of lipids (C2) 4. Define steatorrhea and list its causes (C1)		
Unit 8: LIPID METABOLISM			
	A. De novo synthesis of fatty acids At the end of this chapter, students should be able to 1. Mention the site and subcellular site of de novo synthesis of fatty acids (C1) 2. List the sources of acetyl CoA for de novo synthesis of fatty acids (C1) 3. Explain the reaction catalyzed by acetyl CoA carboxylase (C2) 4. Mention the regulatory enzyme and the hormones involved in regulation in well-fed state and starvation (C1)		1
	B. Synthesis of triacylglycerol (TAG) At the end of this chapter, students should be able to 1. Show the schematic structure of triacylglycerol (C1) 2. Mention the site and subcellular site of TAG synthesis (C1) 3. Describe the reactions of TAG synthesis (C2) 4. Mention the fate of TAG in liver and adipose tissue (C1)		1
	C. Lipolysis At the end of this chapter, students should be able to 1. Mention the site and subcellular site of lipolysis (C1) 2. Describe the reactions of lipolysis (C2) 3. Mention the regulatory enzymes and the hormones involved in regulation in well-fed state and starvation (C1)		1
	D. Beta oxidation of fatty acids At the end of this chapter, students should be able to 1. Define beta-oxidation (C1) 2. List the site and subcellular site of beta-oxidation (C1) 3. Describe the activation of palmitic acid (C2) 4. Explain the transport of activated palmitic acid into mitochondria (carnitine shuttle) (C2) 5. Describe the reactions of beta oxidation (C2) 6. Calculate the energetics of beta oxidation of palmitic acid (C2)		2
	E. Lipoproteins At the end of this chapter, student should be able to 1. Classify lipoproteins based on their electrophoretic mobility and ultracentrifugation properties (C2) 2. Mention the site of synthesis and the functions of Chylomicrons, VLDL, LDL and HDL (C1)		1
Unit 9: AMINO ACID & PROTEIN CHEMISTRY			
	At the end of this chapter, student should be able to 1. Recognize the general structure of D and L amino acids (C1) 2. Classify amino acids based on the following with examples (C2) <ul style="list-style-type: none"> • Presence in proteins (standard and non-standard amino acids) • Metabolic fate (glucogenic and ketogenic amino acids) • Nutritional requirement (essential and non-essential amino acids) 3. Classify proteins based on composition, functions and shape with examples (C2) 4. Describe the structure of mature collagen with diagram (C2) 5. Explain with illustrations the biosynthesis of mature collagen emphasizing		3

Unit	Content	Competencies	Number of Hours
	the importance of prolyl hydroxylase, lysyl hydroxylase and lysyl oxidase (C2)		
Unit 10: PROTEIN DIGESTION AND ABSORPTION			
	At the end of the chapter, a student should be able to 1. Outline the activation of zymogens in the GIT (C1) 2. List the endo and exopeptidases in the digestive juices (C1) 3.		1
Unit 11: AMINO ACID METABOLISM			
	At the end of the chapter, a student should be able to 1. Explain transamination of amino acids with suitable examples (C2) 2. Describe the generation of ammonia by oxidative deamination using L-glutamate dehydrogenase. (C2) 3. Study urea cycle as follows a. Name its site and subcellular site (C1) b. Describe its reactions (C2) c. Mention its significance (C1) 4. Recall the physiologically important products derived from the following amino acids (C1) a. Glycine b. Tyrosine c. Methionine d. Tryptophan		2
Unit 12: GENERAL CONCEPTS OF NUTRITION			
	At the end of the chapter, a student should be able to 1. Define the term balanced diet (C1) 2. Define caloric value of food and list the caloric values of carbohydrates, proteins and fats (C1) 3. State the total daily caloric requirements of an adult male and female (for sedentary, moderate and heavy workers) and for pregnant and lactating women (C1) 4. Define recommended dietary allowance (RDA) (C1) 5. Study basal metabolic rate as follows a. Define (C1) b. List the normal values for men and women (C1) c. Explain the factors affecting BMR (C2) 6. Define thermic effect (SDA) of food and recall the values for macronutrients (C1)		2
Unit 13: CARBOHYDRATES, PROTEINS AND FATS IN NUTRITION			
	A. Carbohydrates At the end of the chapter, a student should be able to 1. Mention the RDA (C1) 2. Study dietary fibers as follows a. Define (C1) b. Mention its RDA (C1) c. List the examples with their sources (C1) d. Explain its beneficial effects (C2) B. Proteins At the end of the chapter, a student should be able to		2

Unit	Content	Competencies	Number of Hours
	1. Mention the RDA (C1) 2. Define essential amino acids with examples (C1) 3. Study biological value as follows a. Define (C1) b. Name the protein used as standard for determining it (C1) c. List the protein sources with high and low biologic values (egg albumin, milk, fish, meat, rice, wheat and soy protein) (C1) 4. Define the term nitrogen balance (C1) 5. Explain positive and negative nitrogen balance with conditions during which they occur (C2) 6. Define the term limiting amino acids giving suitable examples (C1) 7. Explain mutual supplementation of proteins with examples (C2) C. FATS At the end of the chapter, a student should be able to 1. Mention the RDA (C1) 2. List the functions of cholesterol in the body (C1) 3. Study essential fatty acids as follows a. Define (C1) b. Mention its RDA (C1) c. Explain their functions and deficiency manifestations (C2) 4. Explain saturated and unsaturated (mono and poly) fatty acids with suitable examples, mentioning its sources and functions (C2)		
Unit 14: MINERALS			
	At the end of this chapter, a student should be able to 1. Define the terms macro and micro minerals with examples. (C1) 2. Mention the sources and RDA for iron (C1) 3. Explain the functions, disorders of deficiency & excess for iron (C2) 4. Mention the sources, RDA and functions for calcium and phosphorus (C1) 5. Mention the normal serum levels of calcium and phosphorus and the hormones which regulate it (C1)		2
Unit 15: VITAMINS			
	At the end of this chapter, a student should be able to 1. Define the term vitamins (C1) 2. List the classes of vitamins based on solubility (C1) 3. Study the water soluble vitamins mentioned below <ul style="list-style-type: none"> • Thiamine • Riboflavin • Niacin • Pantothenic acid • Pyridoxine • Biotin • Cobalamin • Folic acid • Ascorbic acid as follows ➤ List the RDA, sources and coenzyme forms (C1) ➤ Describe the biochemical functions (C2) ➤ List the features of disorders associated with their deficiencies (C1)		3

Unit	Content	Competencies	Number of Hours
	4. Study the fat soluble vitamins A, D, E, K as follows ➤ List the RDA, sources and chemical forms. (C1) ➤ Describe the biochemical functions. (C2) ➤ List the features of disorders associated with their deficiencies and excess. (C1)		
16. MALNUTRITION			
	At the end of this chapter, a student should be able to 1. Define the classes of protein energy malnutrition. (C1) 2. Compare the similarities and differences between marasmus and kwashiorkor (C2)		1
17. CLINICAL BIOCHEMISTRY			
	A. GLUCOSE HOMEOSTASIS AND DIABETES MELLITUS At the end of this chapter, a student should be able to 1. Summarize the effect of the hormones involved in blood glucose homeostasis (C2) 2. Study diabetes mellitus as follows • Define (C1) • Classify and compare the types 1 and 2 (C2) • Mention the signs and symptoms (C1) • Mention the normal plasma levels of fasting, postprandial and random glucose & their utility in diagnosis (C1) • Explain the relevant investigations involved in the diagnosis and management (HbA _{1c} , procedure and interpretation of GTT, microalbuminuria) (C2) • Explain the biochemical basis for features of diabetic ketoacidosis (C2)		2
	B. SIGNIFICANCE OF ESTIMATIONS OF VARIOUS BIOCHEMICAL PARAMETERS IN BLOOD At the end of this chapter, a student should be able to 1. Mention the normal serum levels of glucose, protein, urea, uric acid, bilirubin, cholesterol and creatinine and conditions in which they are altered (C1)		1
	C. ACID BASE BALANCE AND DISTURBANCES At the end of this chapter, a student should be able to: 1. Define the terms acid, base, pH and pKa (C1) 2. Study buffers as follows • Define (C1) • Write the Henderson-Hasselbalch equation for different buffer systems (C1) • List the principal buffer systems in ECF, ICF and in urine (C1) • Mention the pKa value, normal ratio of base/acid in the plasma for bicarbonate and phosphate buffer systems (C1) 3. Study acid-base disorders as follows • Define the different classes (C1) • Explain the conditions causing acidosis & alkalosis (metabolic & respiratory) (C2) 4. Mention the primary and compensatory changes in acid base disorders (C1)		1
Unit 18: MOLECULAR BIOLOGY			
	At the end of this chapter, a student should be able to		2

Unit	Content	Competencies	Number of Hours
	<ol style="list-style-type: none"> Name the purine and pyrimidine bases (C1) Define nucleosides and nucleotides with examples (C1) Illustrate the Watson and Crick model of B-DNA structure (C2) List the different types of RNA (C1) Recall the structural differences between DNA and RNA (C1) Define replication, transcription and translation (C1) 		

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies		Contact Hours	Student Learning Time (SLT)			
Lecture		45	135			
Seminar		-	-			
Small group discussion (SGD)		-	-			
Self-directed learning (SDL)		-	-			
Problem Based Learning (PBL)		-	-			
Case Based Learning (CBL)		-	-			
Clinic		-	-			
Practical		-	-			
Revision		-	-			
Assessment		4	16			
Total		49	151			
Assessment Methods:						
Formative:		Summative:				
		Mid Semester/Sessional Exam (Theory)				
		End Semester Exam (Theory)				
Mapping of Assessment with COs:						
Nature of Assessment		CO1	CO2	CO3	CO4	
Mid Semester / Sessional Examination 1		x	x			
Sessional Examination 2		x	x	x	x	
End Semester Exam		x	x	x	x	
Feedback Process:		Mid-Semester Feedback				
Main Reference:		<ol style="list-style-type: none"> Essentials of Biochemistry, U satyanarayana, U Chakrapani (2nd edition) Handbook of Biochemistry for Allied & Nursing Students, Shivananda Nayak B (2nd edition) 				

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Advanced ECG and Holter Monitoring
Course Code	CVT1201
Academic Year	First Year
Semester	II
Number of Credits	3
Course Prerequisite	Basic knowledge about ECG and its interpretation
Course Synopsis	1. This module will bridge the gap between the knowledge acquired in the basic electro gram interpretation and its clinical applications 2. To apply the knowledge in interpretation of cardiac electro gram in advance settings in critically ill diseased conditions 3. To understand the role of signal averaged ECG in the settings of non-invasive cardiac diagnostic tests.

Course Outcomes (COs):

At the end of the course student shall be able to: Interpret and Appraise the

CO1	Demonstrate the genesis of cardiac arrhythmias with respect to ECGs (C5)							
CO2	Interpreting and analysing the ECGs of Tachy arrhythmia's and Brady arrhythmias (C5)							
CO3	Interpreting and analysing the ventricular Tachy arrhythmias – both narrow and broad on ECGs (C5)							
CO4	Interpreting and analysing the cardiac pacemaker rhythm on ECGs(C5)							
CO5	Interpreting and analysing the ECGs in miscellaneous cardiac conditions (C5)							
CO6	Understanding the role of ambulatory ECG recording and its analysis and interpretation (C2)							
CO7	Understanding the role of signal averaged ECG and its analysis and interpretation(C2)							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x				x			
CO2	x				x			
CO3	x				x			
CO4	x				x			
CO5	x				x			
CO6	x				x			
CO7	x				x			

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Genesis of cardiac arrhythmias	1.To understand and explain the Genesis of cardiac arrhythmias (C2) 2.To understand and explain the Automaticity (C2) 3. To understand and explain the Triggered activity (C2)	4

Content	Competencies	Number of Hours
	4. To understand and explain the Re-entry mechanism (C2)	
Unit 2:		
Premature complexes	1.To identify and interpret the ECGs of Premature beats/Bigeminy/Trigeminy (C3) 2.To identify and interpret the ECGs of Atrial ectopics (C3) 3.To identify and interpret the ECGs of Junctional ectopics (C3) 4.To identify and interpret the ECGs of Ventricular ectopics (C3)	4
Unit 3:		
Narrow complex arrhythmias	1.To Interpret and analyse the ECGs of Narrow complex tachycardia (C3) 2.To Interpret and analyse the ECGs of Atrial fibrillation(C3) 3.To Interpret and analyse the ECGs of Atrial flutter(C3) 4.To Interpret and analyse the ECGs of AVRT and AVNRT (C3) 5.To Interpret and analyse the ECGs of Typical/atypical AVNRT (C3)	5
Unit 4:		
Broad complex arrhythmias	1.To Interpret and analyse the ventricular Tachy arrhythmias in VT in structurally normal heart (C4) 2.To Interpret and analyse the ventricular Tachy arrhythmias in VT in structurally abnormal heart (C4) 3.To Interpret and analyse the ventricular Tachy arrhythmias in Diagnosis of algorithms in VT (C4) 4.To Interpret and analyse the ventricular techy arrhythmias in Ventricular fibrillation (C4) 5.To Interpret and analyse the ventricular Tachy arrhythmias in Torsade pointes (C4)	5
Unit 5:		
Approach to broad complex tachycardia	1.To interpret and analyse the broad complex Tachy arrhythmias in VT vs SVT with aberrancy(C4)	3
Unit 6:		
Pacemaker rhythm	1.To Interpret and analyse the cardiac pacemaker rhythm on ECGs: (C4)	3
Unit 7:		
ECG in miscellaneous condition	1.Interpret and analyse the ECGs in miscellaneous cardiac conditions like Cardiomyopathies (C4) 2.Interpret and analyse the ECGs in miscellaneous cardiac conditions like Myocarditis (C4) 3.Interpret and analyse the ECGs in miscellaneous cardiac conditions like Pulmonary thrombo embolism (C4) 4.Interpret and analyse the ECGs in miscellaneous cardiac conditions like ECG in electrolyte imbalance (C4) 5.Interpret and analyse the ECGs in miscellaneous cardiac conditions like Brugada syndrome (C4)	5

Content	Competencies	Number of Hours
Unit 8:		
Ambulatory ECG	1.The role of ambulatory ECG recording and its analysis and interpretation with Indications (C4) 2.The role of ambulatory ECG recording and its analysis in terms of Lead system (C4)	4
Unit 9:		
Signal averaged ECG	1.To understand the role of signal averaged ECG and its Indications, Lead system (C2) 2. Analysis and interpretation of signal averaged ECG (C4)	3
Unit 10		
Pitfalls of ECG	1.To explain the pitfalls of ECG interpretation (C4)	3

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	22	44
Seminar	6	12
Small group discussion (SGD)	2	4
Self-directed learning (SDL)	2	4
Problem Based Learning (PBL)	-	-
Case Based Learning (CBL)	2	4
Clinic	-	-
Practical	-	-
Revision	3	6
Assessment	2	4
Total	39	78

Assessment Methods:

Formative:	Summative:
Unit Test	Mid Semester/Sessional Exam (Theory)
Quiz	-
Viva	Viva
Assignments/Presentations	Record Book, Work Dairy
Clinical assessment (OSCE, OSPE, WBPA)	OSCE , WBPA
Clinical/Practical Log Book/ Record Book	Clinical Record Book

Mapping of Assessment with COs:

Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6	CO7
Mid Semester / Sessional Examination 1	x	x					
Sessional Examination 2				x	x	x	x
Quiz / Viva	x	x	x	x	x	x	x

Assignments/Presentations		x		x			x
Clinical/Practical Log Book/ Record Book						x	x
Any others: WPBA	x					x	x
End Semester Exam	x	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback						
	End-Semester Feedback						
Main Reference:	1.Leo Schamroth Text Book of Electrocardiography 2.Mervin Goldmann Text Book of Electrocardiography						
Additional References	1.Marriott's practical Electrocardiography						

Manipal College of Health Professions								
Name of the Department	Cardiovascular Technology (CVT)							
Name of the Program	Bachelor of Science in Cardiovascular Technology							
Course Title	Medical Ethics and Legal Aspects							
Course Code	CVT1202							
Academic Year	First Year							
Semester	II							
Number of Credits	2							
Course Prerequisite	NIL							
Course Synopsis	This course will explore the major ethical issues confronting the practices of medicine. The study of ethics prepares health care students to recognize difficult situations and to deal with them in a rational and principled manner.							
Course Outcomes (COs):								
At the end of the course student shall be able to:								
CO1	Apply the principles of medical ethics in day to day practice (C2)							
CO2	Comprehend the concepts of medical ethics (C1)							
CO3	Practice the codes of conduct for healthcare professionals (C1)							
CO4	Choose the right course of action among available choices by recognizing ethical issues that may arise during patient care(C2)							
CO5	Recognize the skills needed to act professionally after making the right choices (C1)							
CO6	Apply the knowledge and skills appropriately in a given situation(C2)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x						x	
CO2	x					x		
CO3				x				
CO4	x						x	
CO5		x						x
CO6	x				x			

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Introduction to Medical Ethics	1. Definition of medical Ethics (C1) 2. Importance of ethical standards in healthcare (C1) 3. Goals of medical intervention and medical ethics(C1) 4. Scope of medical ethics(C1) 5. Components of medical ethics(C1) 6. Moral duties of doctor and moral rights of the patient(C1) 7. Understanding the Medical ethics, Law and Risk management(C2) 8. History of medical ethics (C1)	2

Content	Competencies	Number of Hours
Unit 2:		
Principles of medical ethics	1. Define and Explain Beneficence(C2) 2. Define and Explain Non-maleficence(C2) 3. Define and Explain Autonomy(C2) 4. Define and Explain Justice(C2) 5. Define and Explain Veracity(C2) 6. Define and Explain Confidentiality(C2)	2
Unit 3:		
Medical Malpractice and Medical Negligence	1. What is medical malpractice(C1) 2. Mention the types of medical malpractice(C1) 3. Examples of medical malpractice(C2) 4. Definition of negligence and medical negligence(C2) 5. Action for medical negligence(C2) 6. Types of medical negligence with examples(C2) 7. Indian Penal code and medical negligence(C2)	2
Unit 4:		
Autonomy of the Patient Vs Paternalism	1. Brief overview of Autonomy of patient (C2) 2. Mention the types of Paternalism(C1) 3. Define and Explain Justifiable Paternalism(C2) 4. Understand the Models of doctor-patient relationship(C2)	2
Unit 5:		
Informed consent	1. Definition of Informed consent (C1) 2. Mention the types of consent (C1) 3. Legally Valid Consent(C3) 4. Consent under special circumstances(C3) 5. Informed consent: Definition, why informed consent is necessary, Exceptions to fully informed consent, Elements of fully informed consent, Issues involved in informed consent(C3) 6. Understanding the cases of Medical Negligence related to Consent(C2)	2
Unit 6:		
Confidentiality and Patient Rights	1. Definition of Confidentiality(C1) 2. Need of Confidentiality(C1) 3. Confidentiality and Related Code of Conduct(C2) 4. Breach of confidentiality: Definition, Situations of Breach of confidentiality, Circumstances in which confidentiality might be breached for ethically or legally justifiable (C2) 5. Explaining the importance of Special attention must be given to safeguard the release of information(C2) 6. Disclosure of patient information (C2) 7. Understanding the Fundamentals of confidentiality in research(C1) 8. Understanding the Cases of Confidentiality(C1)	4
Unit 7:		
Medico-Legal Aspects of Health	1. Definition of MLA (C1) 2. Types of MLA (C1)	2

Content	Competencies	Number of Hours
records	3.Procedure of registering medico-legal case(C3) 4.Explain the steps in Receiving an MLC(C3) 5.To understand the time limit for registering medico-legal case(C3) 6.Understanding the precaution to be taken for registering a medico-legal case(C2) 7.Define Medico-legal case report(C1) 8.Explain Medico-legal aspects of health records (C2) 9.Define Ownership of medical records(C2) 10.To explain the Confidentiality of health information (C2) 11.To explain the disclosure of health information (C2) 12.To understand the unauthorized disclosure and safeguard against them(C2) 13.To Define Retention of medical records(C1) 14.To understand the Medical records and court of law in Indian Context(C2)	
Unit 8:		
Irrational Drug Therapy	1.Define Drugs and Rational Drug Therapy(C1) 2.To define rational Drug Therapy(C1) ➤ Prescribing can be irrational under variety of condition ➤ Common patterns of irrational prescribing may be manifested in the following forms: ➤ Factors Underlying Irrational Use of Drugs ➤ Impact of Inappropriate Use of Drugs 3. To understand the Strategies for the Promotion of Rationale Use of Drug(C2) 4. To understand the World Health Organization advocates 12 key interventions to promote more rational use(C2) 5.Define Drug Legislation for Rational Drug Policy(C1) 6. To understand the, The Drug and Cosmetic Act,1940(C2) 7. To understand the Drugs and Magic Remedies (Objectionable Advertisements) Act, 1955(C2) 8.To define drug Promotion(C2)	2
Unit 9:		
Human Organ and Tissue Transplantation	1 To understand the Important Aspect of organ donation (C2) 2. To understand the Allocation of Organs(C2) 3. To understand the Ethics in Allocation of Organs for Transplantation in Humans(C2)	2
Unit 10:		
Research, Human Experimentation and Technology in health care	1. To understand the Ethics in Human Research(C2) 2.To Explain International Instruments and Guidelines(C2) 3.Define Declaration of Helsinki(C1) 4. To understand the Basic Principles of all Medical Research(C2) 5. To understand the Indian Council for Medical	2

Content	Competencies	Number of Hours
	Research Guidelines(C2) 6.To define Technology in Healthcare(C1)	
Unit 11:		
Ethical Issues at the beginning and end of life	1.To define Right to life(C1) 2.To understand Sex Pre- selection: Female foeticide & Infanticide(C2) 3.To define Assisted Reproductive Technologies (C2) 4.To define Care of Terminally ill patient(C1) 5.Define Euthanasia(C1) 6.Define Quality of life(C1)	2
Unit 12:		
Consumer Protection Act	1.To understand Consumer Protection Act, 1986(C2) 2.To explain the Objectives(C2) 3.The salient features of the Act (C2) 4. To understand the Consumer Protection Act & Rights of Consumers(C2) 5. To understand the Needs and Application of Consumer Protection Act to the medical services(C2) 6. To understand the Consumer Protection Act Forums & Commissions(C2) 7.To explain Period of limitation (C2) 8. To understand the Advantages & Disadvantage of CPA(C2)	2

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	16	32
Seminar	4	8
Small group discussion (SGD)	-	-
Self-directed learning (SDL)	-	-
Problem Based Learning (PBL)	-	-
Case Based Learning (CBL)	2	4
Clinic	-	-
Practical	-	-
Revision	2	4
Assessment	2	4
Total	26	72
Assessment Methods:		
Formative:	Summative:	
Unit Test	Mid Semester/Sessional Exam (Theory)	
Quiz	End Semester Exam (Theory)	
Viva	Viva	
Assignments/Presentations	Assignments	

Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x	x			x	x
Sessional Examination 2			x	x	x	x
Assignments/Presentations		x				
End Semester Exam						
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	1. Medical Ethics 3 rd Edition by CM Francis 2. Medical Ethics and Law 3rd Edition by Dominic Wilkinson, Jonathan Herring and Julian Savulescu					
Additional References	1. Medical Ethics: A Very Short Introduction by Michael Dunn & Tony Hope 2. Textbook of Medical Ethics by Erich H. Loewy 3. Text, Cases and Materials on Medical Law and Ethics (6 th edition) by Marc Stauch and Kay Wheat					

Manipal College of Health Professions								
Name of the Department		Cardiovascular Technology (CVT)						
Name of the Program		Bachelor of Science in Cardiovascular Technology						
Course Title		ECG interpretation, Holter analysis - practical						
Course Code		CVT1211						
Academic Year		First Year						
Semester		II						
Number of Credits		5						
Course Prerequisite		Basic knowledge about the basic ECG interpretation and lead placement						
Course Synopsis		1.To explore interpretation skill in diagnosing various arrhythmias 2.To understand the consequences of various abnormal cardiac rhythms 3.To perform Holter connection and interpret the results						
Course Outcomes (COs):								
At the end of the course student shall be able to: Identify and Interpret								
CO1	Understanding the ECG measures and its interpretation (C2)							
CO2	Explaining and applying the skills in performing ECG(C3,P2)							
CO3	Identifying and interpreting the abnormal ECGs(C3,P1)							
CO4	Examine and distinguish between normal and abnormal ECG reports(C4,P4)							
CO5	Ability to identify and analyse the abnormal Holter reports(C4,P4)							
CO6	Ability to evaluate and conclude the abnormal Holter reports(C5,P4)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1		X				X		
CO2		X			X			
CO3		X				X		
CO4		X				X		
CO5		X						X
CO6		X					X	

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Conduction system of the heart	1. Identify the abnormal ECG pattern in SA nodal dysfunction (C3,P3) 2. Identify the abnormal ECG pattern in SA nodal dysfunction (C3,P3) 3. Identify the abnormal ECG pattern in His bundle (C3,P3) 4. Identify the abnormal ECG pattern in bundle branches (C3,P3) 5. Identify the abnormal ECG pattern in purkinje fibers(C3,P3)	10

Content	Competencies	Number of Hours
Unit 2:		
Lead system	1. Build skills of unipolar and bipolar lead system (C3,P4) 2. Build skills of lead placement (C3,P4)	3
Unit 3:		
Interpretation of normal ECG	1. To identify the standardization (C3,P4) 2. To identify the normal P wave, PR interval, QRS duration, QTc interval (C3,P4)	3
Unit 4:		
Electrical axis	1. Interpret the methods to assess ECG axis (C2,P3)	5
Unit 5:		
Dextrocardia	1. Identify and differentiate between true and technical dextrocardia (C3,P3)	5
Unit 6:		
Rhythm and Rate	1. Apply skills to identify the sinus rhythm (C3,P3) 2. Apply skills to identify and differentiate between regular and irregular rhythm (C3,P4) 3. Apply skills to identify and differentiate between regular and irregular Rate (C3,P3)	5
Unit 7:		
Atrial enlargement	1. Analyse Right atrial enlargement ECG (C4,P4) 2. Analyse Left atrial enlargement ECG (C4,P4)	5
Unit 8:		
Ventricular Hypertrophy	1. Analyse and interpret left ventricular hypertrophy (C4,P4) 2. Analyse and interpret right ventricular hypertrophy (C4,P4) 3. Analyse and distinguish between volume and pressure overload of ventricular hypertrophy (C4,P4)	5
Unit 9:		
Conduction abnormalities	1. Evaluate first degree AV block (C5,P4) 2. Evaluate second degree AV block (C5,P4) 3. Evaluate third degree AV block (C5,P4) 4. Evaluate left and right Bundle branch block (C5,P4) 5. Evaluate Bifascicular block (C5,P4) 6. Evaluate trifascicular block (C5,P4) 7. Evaluate bundle branch block associated with ventricular hypertrophy (P4)	5
Unit 10:		
Myocardial Infarction	1. Distinguish between ischemia, injury and infarction ECG patterns (C5,P3) 2. Identify the different stages of MI (C3,P3) 3. Identify and interpret localisation of MI (C5,P3) 4. Identify the culprit vessel (C3,P3) 5. Interpret Right ventricular myocardial infarction (C5,P3) 6. Interpret atrial myocardial infarction (C5,P3) 7. Myocardial infarction associated with bundle branch block (C5,P3)	10

Content	Competencies	Number of Hours
Unit 11:		
Pericarditis	1. Identify the pericarditis ECG(C3,P3) 2. Distinguish pericarditis with myocardial infarction ECG(C5,P3)	3
Unit 12:		
Premature complexes	1. Identify and interpret atrial, junctional, ventricular ectopics(C5,P3)	3
Unit 13:		
Narrow complex tachycardia	1. Make use of algorithm to diagnose and approach Narrow Complex Tachycardia (C3,P3) 2. Identify and distinguish between regular and irregular narrow complex tachycardia(C5,P3) 3. Interpret Sinus and junctional tachycardia (C5,P3) 4. Interpret Atrial, Paroxysmal junctional atrial / low atrial tachycardia(C5,P3) 5. Interpret Multifocal atrial tachycardia (C5,P3) 6. Interpret Atrial fibrillation and Atrial Flutter(C5,P3)	10
AVRT	1. Interpret WPW syndrome (C5,P3) 2. Interpret LGL syndrome(C5,P3) 3. Identify and distinguish between anti/ortho-dromic conduction in AVRT(P3)	2
AVNRT	1. Identify and distinguish between typical/atypical AVNRT(P3)	2
Unit 14:		
Broad complex tachycardia	1. Make use of algorithm to diagnose and approach ventricular arrhythmia (C3,P4) 2. Interpret ventricular tachycardia, ventricular fibrillation, Torsades de pointes(P3) 3. Distinguish between ventricular tachycardia and Supraventricular tachycardia(C3,P3) 4. Interpret Sick sinus syndrome (C5,P3) 5. Identify and Interpret Pacemaker syndrome ECG(P4)	5
Unit 15:		
ECG in miscellaneous condition	1. Interpret different types of cardiomyopathies(C5,P3) 2. Identify and interpret pulmonary thrombo-embolism(P3) 3. Recall and interpret different types of electrolyte imbalance ECGs(P3)	5
Unit 16:		
Ambulatory ECG recording (HOLTER)	1. Recall indications(C1,P3) 2. Perform lead placement system(P4) 3. Analysis and interpretation of holter reports(C5,P4)	5

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	-	-				
Seminar	-	-				
Small group discussion (SGD)	10	20				
Self-directed learning (SDL)	20	40				
Problem Based Learning (PBL)	20	40				
Case Based Learning (CBL)	10	20				
Clinic	10	10				
Practical	17	34				
Revision	-	-				
Assessment	4	8				
Total	91	182				
Assessment Methods:						
Formative:			Summative:			
Unit Test			-			
Quiz			-			
Viva			Viva			
Assignments/Presentations			Work diary			
Clinical assessment (OSCE, OSPE, WBPA)			WBPA			
Clinical/Practical Log Book/ Record Book			Clinical record book			
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1						
Sessional Examination 2						
Quiz / Viva	x		x	x	x	x
Assignments/Presentations				x	x	x
Clinical/Practical Log Book/ Record Book	x	x	x	x	x	x
Any others: WPBA	x	x		x	x	x
End Semester Exam						
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	1.Leo Schamroth Text Book of Electrocardiography 2.Mervin Goldmann Text Book of Electrocardiography					
Additional References	1.Marriott's practical Electrocardiography					

Manipal College of Health Professions								
Name of the Department	Cardiovascular Technology (CVT)							
Name of the Program	Bachelor of Science in Cardiovascular Technology							
Course Title	Clinics - II							
Course Code	CVT1231							
Academic Year	First Year							
Semester	II							
Number of Credits	3							
Course Prerequisite	Basic knowledge about basics in ECG interpretation and lead placement							
Course Synopsis	<p>1.This module helps to obtain the basic as well as advanced knowledge about interpretation and diagnosis of ECG. In the process of learning advanced electrocardiography, it may be useful to understand the importance of ECG lead placement and differentiation and also interpretation.</p> <p>2.To provide fundamental knowledge in the diagnosis of Arrhythmias, electrolyte imbalance, myo-pericardial diseases on ECG</p> <p>3.To perform lead placement system and analyse Holter, signal averaged ECG and interpretation</p>							
Course Outcomes (COs):								
At the end of the course student shall be able to: Build skills and perform								
CO1	To understand and perform Basic lead placement, importance and patient preparation(C1,P4)							
CO2	To Perform and distinguish the changes between normal and abnormal cardiac rhythm(C4,P4)							
CO3	Able to perform and interpret various abnormal narrow and broad complex tachyarrhythmias in ECG (C5,P4)							
CO4	To perform and able to analyse ambulatory ECG recording (HOLTER),signal averaged ECG as well as evaluation by HOLTER monitoring (C4,P4)							
CO5	Understand the pitfalls of ECG and build the skill to interpret it and also manage to correct the problem (C4,C5,)							
CO6	Build skills to develop practical knowledge and able to interpret any given ECG (C5)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x	x						
CO2	x	x						
CO3		x					x	
CO4		x					x	
CO5	x						x	
CO6		x					x	

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Premature beats/Bigeminy/ Trigeminy	1.Perform and analyse the ECG in Atrial Ectopic rhythm (C4, P4) 2.Perform and identify the ECG changes in Junctional ectopic rhythm (C3, P4) 3.Perform and interpret the ECG changes in Ventricular ectopic rhythm (C2,P4)	10
Unit 2:		
Narrow complex tachycardia	1.- Perform and able to distinguish the difference between Regular/ irregular ECG (C4, P4) 2.Perform and interpret the ECG in Sinus tachycardia (C2, P4) 3.Perform and interpret the ECG in Junctional tachycardia (C2, P4) 4.Perform and distinguish the difference between Atrial tachycardia/ PJAT/ Low atrial tachycardia ECG (C4, P4) 5.Perform and interpret the ECG in Multifocal atrial tachycardia (C2,P4)	10
Atrial fibrillation	1.Perform and interpret the ECG changes of atrial fibrillation (C2,P4)	3
Atrial flutter	1.Perform and identify the ECG changes in atrial flutter (C3,P4)	3
AVRT	1.Perform and interpret the ECG in WPW syndrome (C2, P4) 2.Perform and identify the ECG findings in LGL syndrome (C3, P4) 3. To perform and analyse the ECG findings of Anti-dromic/ ortho-dromic conduction in AVRT (C4, P4)	10
AVNRT Typical/ atypical AVNRT	1.Perform and identify AVNRT ECG (C3, P4) 2.Perform and distinguish between Typical and atypical AVNRT (C4,P4)	5
Approach to narrow complex tachycardia	1.Able to identify the ECG changes in narrow complex tachycardia ECG (C3) 2.Distinguish between narrow and broad complex tachycardia.(C4)	5
Unit 3:		
Ventricular tachycardia	1. Perform and interpret the difference between - VT in structurally normal heart and abnormal heart (C5, P4) 2. To understand and make use of algorithms of Ventricular arrhythmia (C3) 3. To perform and able to interpret the ECG findings of Ventricular fibrillation (C2, P4) 4. Perform and interpret the ECG findings of torsade (C2, P4)	10

Content	Competencies	Number of Hours
Fascicular VT	1. Perform and analyse the ECG findings of fascicular VT (C4,P4)	5
Approach to broad complex tachycardia VT vs SVT with aberrancy	2. Interpret the difference between VT and SVT aberrancy (C5)	5
Unit 4:		
Sick sinus syndrome	1. Able to perform and analyse the ECG findings of bradytachyarrhythmias (C4, P4) 2. Identify the difference between bradyarrhythmias such as sinus exit blocks sinus arrhythmia, sinus pause (C3)	5
Pacemaker rhythm	3. Able to perform and distinguish between normal and pacemaker rhythm ECG (C4, P4) 2. Perform and identify the types of pacemaker rhythm and interpret (C4,P4)	3
Unit 5:		
ECG in miscellaneous conditions	1. Able to perform and identify the types of cardiomyopathies (C3, P4) 2. Interpret and distinguish the ECG findings of hypertrophic, restrictive cardiomyopathy ECG (C4, C5) 3. Perform and interpret ECG findings of Myocarditis (C5, P4) 4. Perform and interpret the ECG findings in pulmonary thromboembolism (C4 ,P4) 5. To Recall the basics knowledge about electrolyte imbalance (C1) 6. Perform and identify ECG findings in electrolyte imbalance (C3,P4)	10
Brugada syndrome	1. Able to perform and identify the ECG changes in Brugada syndrome (C3, P4) 2. Able to identify differential diagnosis of Brugada syndrome (C3,P3)	3
Unit 6:		
Ambulatory ECG recording(HOLTER)	1. To build the normal lead system in Ambulatory recording(HOLTER) and patient preparation (C3) 2. Perform and analyse the signal average ECG (C4, P4)	10
Signal averaged ECG	1. To build the knowledge about normal lead system in signal averaged ECG, Patient preparation (C3) 2. Perform and analyse the signal average ECG (C4,P4)	10
Unit 7:		
Pitfalls in ECG interpretation	1. Identify the various pitfalls in ECG lead placement (C3, P3) 2. Able to evaluate the pitfalls in ECG interpretation (C5) 3. Able to correct the changes and interpret it(C5)	10

Learning Strategies, Contact Hours and Student Learning Time (SLT):							
Learning Strategies	Contact Hours	Student Learning Time (SLT)					
Lecture	-	-					
Seminar	-	-					
Small group discussion (SGD)	20	40					
Self-directed learning (SDL)	8	16					
Problem Based Learning (PBL)	8	16					
Case Based Learning (CBL)	20	40					
Clinic	56	112					
Practical							
Revision							
Assessment	5	10					
Total	117	234					
Assessment Methods:							
Formative:			Summative:				
Unit Test			-				
Quiz			-				
Viva			Viva				
Assignments/Presentations			Work dairy				
Clinical assessment (OSCE, OSPE, WBPA)			WBPA				
Clinical/Practical Log Book/ Record Book			Clinical record book				
Mapping of Assessment with COs:							
Nature of Assessment		CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1							
Sessional Examination 2							
Quiz / Viva		x	x	x	x	x	x
Assignments/Presentations					x		
Clinical/Practical Log Book/ Record Book		x	x	x	x	x	x
Any others: WPBA		x	x	x	x		
End Semester Exam							
Feedback Process:		Mid-Semester Feedback					
		End-Semester Feedback					
Main Reference:		1. Text book of Electrocardiography by Leo Schamroth 2. Text book of Electrocardiography by Mervin Goldmann					
Additional References		1. Marriott's Practical Electrocardiography					

SEMESTER - III

COUSE CODE	:	COURSE TITLE
MCB2103	:	Microbiology
PAT2103	:	Pathology
CVT2101	:	Ultrasound Physics and Doppler Principles
CVT2102	:	Cardiac Stress Tests
CVT2103	:	Cardiac Instrumentations
CVT2131	:	Clinics - III
*** ****	:	Open Elective - I

Manipal College of Health Professions								
Name of the Department		Cardiovascular Technology (CVT)						
Name of the Program		Bachelor of Science in Cardiovascular Technology						
Course Title		Microbiology						
Course Code		MCB2103						
Academic Year		Second Year						
Semester		III						
Number of Credits		3						
Course Prerequisite		Nil						
Course Synopsis		1. This course focuses on acquiring the knowledge pertaining to basics of medical microbiology, host immune response, common infectious diseases prevalent in India, healthcare associated infections and aseptic measures to prevent infections						
Course Outcomes (COs): At the end of the course student shall be able to:								
CO1	Explain the process of disease causation by infectious agents and appraise the role of microbiology laboratory in the diagnosis, management and control of infectious diseases with an emphasis on diseases prevalent in India (C2)							
CO2	Explain the development of immune response, its relation to infection and other diseases with an immunological basis (C2)							
CO3	Explain the implications of antibiotic susceptibility (C2)							
CO4	Understanding the principles of asepsis and infection control in clinical practice (C2)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs)								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x							
CO2	x							
CO3	x							
CO4	x	x						

Course Content and Outcomes:

Content	Competencies	Number of Hours
Introduction To Medical Microbiology	i) Historical introduction to microbiology a. Describe the contributions of: (C1) <ul style="list-style-type: none"> • Louis Pasteur • Robert Koch ii) Classify the microorganisms (C2) iii) List the branches of microbiology and their significance (C1)	1
Bacterial Anatomy And Classification	i) Explain the bacterial cell structure, organelles and their functions (C2) ii) Explain the bacterial envelope of gram positive and gram negative bacteria (C2) iii) Explain the following bacterial structure and their significance (C2)	2

Content	Competencies	Number of Hours
	a. Cytoplasm b. Ribosomes c. Mesosomes d. Nucleoid e. Inclusion granules f. Flagella g. Pili h. Capsule i. Plasmid j. Spores iv) Classify bacteria based on morphology and nutrition (C2)	
Growth, Cultivation And Identification Of Bacteria	i) Explain the following: (C2) a. Bacterial growth curve b. Cultivation of bacteria <ul style="list-style-type: none"> • Culture media • Culture methods c. Identification of bacteria <ul style="list-style-type: none"> • Microscopy and Staining techniques • Biochemical reactions • Serology • Molecular techniques 	2
Antimicrobial Susceptibility	i) Explain the disc diffusion methods – Kirby Bauer's and E - test (C2)	1
Introduction To Virology, Mycology & Parasitology	i) Explain the following: (C2) a. General features of viruses b. Virion structure c. Classification of viruses d. Diagnosis of viral diseases e. General properties and classification of fungi (morphological classification) f. Infections produced by fungi and their diagnosis g. General properties and classification of parasites h. Parasitic infections and their diagnosis	3
Sterilization And Disinfection	i) Classify sterilization methods (C2) ii) Explain the following (C2) a. Physical: Heat b. Sterilization by heat c. Dry heat sterilization – <ul style="list-style-type: none"> • Hot air oven and incinerator d. Moist heat sterilization <ul style="list-style-type: none"> • Below 100 °C, • At 100 °C • Above 100 °C e. Classification of disinfectants used in hospital and their mechanism of action	3
Infection & Immunity	i) Define infection (C1) a. List the types, sources, routes	2

Content	Competencies	Number of Hours
	and spread of infectious diseases (C1) ii) Define and classify immunity (C1) iii) Explain the following: (C2) a. Types of immunity b. Types of vaccines iv) List the immunization schedule in India (C1)	
Antigen & Antibody	i) Define antigen (C1) ii) Define (C1) and classify antibodies (C2) iii) Explain the following (C2) a. Functions of antibodies b. Diagnostic importance of antigen-antibody reactions <ul style="list-style-type: none"> • Agglutination • Immunofluorescence • ELISA 	1
Immune Response	i) List the cells of immune system (C1) ii) Explain the following: (C2) a. Humoral Immunity – Primary and secondary immune response b. Cell mediated Immunity -Constituents and significance	2
Hypersensitivity	i) Define (C1) and classify hypersensitivity (C2) ii) Explain the following: (C2) a. Immediate hypersensitivity <ul style="list-style-type: none"> • Mechanisms and mediators of Anaphylaxis and atopy b. Cytotoxic hypersensitivity - Mechanism and associated disorders c. Immune complex hypersensitivity- <ul style="list-style-type: none"> • Arthus reaction, serum sickness and immune complex diseases d. Delayed type hypersensitivity- Mechanism and clinical importance of <ul style="list-style-type: none"> • Contact dermatitis and tuberculin type hypersensitivity 	2
Autoimmunity	i) Define autoimmunity (C1) ii) Explain the mechanisms of autoimmunity (C2) iii) List the diseases involving predominantly one type of cell or organs (C1) iv) List the diseases involving multiple organs (systemic) (C1)	1
Healthcare Associated Infections	i) List the common Healthcare associated infections (C1) ii) Explain the following: (C2) a. Causes b. Sources c. Routes of spread d. Host risk factors e. MRSA and its importance	1

Content	Competencies	Number of Hours
	f. Prevention g. Investigation	
Standard Precautions And Overview Of Laboratory Diagnosis Of Microbial Infections	i) Explain the following (C2) a. Hand hygiene b. Personal protective equipment (PPE) c. Respiratory hygiene d. Sharp safety e. Sterile instruments and devices. f. Clean and disinfected environmental surfaces ii) Explain laboratory diagnosis of microbial infections (C2) a. Specimen Collection b. Specimen transport c. Specimen processing and handling d. Identification of microbes	3
Respiratory Tract Infections	i) Bacterial pneumonia a. List the causative agents associated (C1) b. Explain the pathogenesis and laboratory diagnosis of the following organisms (C2) • Streptococcus pneumoniae • Haemophilus influenzae • Klebsiella pneumoniae c. Describe the preventive measures(C1) ii) Viral pneumonia a. List the causative agents (C1) • Influenza b. Explain the etio-pathogenesis (C2) c. Explain the lab diagnosis (C2) d. Describe the preventive measures(C1) iii) Tuberculosis a. Describe the general properties of etiological agent (C1) b. Explain the pathogenesis (C2) c. Explain the lab diagnosis (C1) d. Describe the preventive measures (C1)	3
CNS Infections	i).Acute bacterial meningitis a. List the causative agents (C1) b. Explain the pathogenesis(C2) c. Explain the laboratory diagnosis(C2) d. Describe the preventive measures (C1) ii). Poliomyelitis a. Describe the general properties of etiological agent (C1) b. Explain the pathogenesis (C2) c. Explain the preventive measures (C2) iii). Tetanus a. Describe the general properties of etiological agent (C1)	3

Content	Competencies	Number of Hours
	b. Explain the pathogenesis (C2) c. Explain the laboratory diagnosis (C2) d. Describe the preventive measures (C1)	
Skin & Muscle Infections	i) Explain the etio-pathogenesis and laboratory diagnosis of following agents: (C2) a. Staphylococcus aureus b. Streptococcus pyogenes c. Clostridium perfringens	3
Cardiovascular System Infections	i) Infective endocarditis and Acute Rheumatic Fever (ARF) a. List the etiological agents (C1) b. Explain the pathogenesis and laboratory diagnosis of infective endocarditis and ARF(C2) c. Describe the preventive measures of ARF(C1) ii) Pyrexia of Unknown Origin (PUO) a. Define (C1) and classify (C2) b. Explain the investigation of classical PUO (C2)	2
GIT Infections	i) List the agents causing food poisoning and food associated infections (C1) ii) Explain the etio-pathogenesis and laboratory diagnosis of the following:(C2) a. Escherichia coli diarrhoea b. Cholera c. Bacillary dysentery d. Enteric fever iii) Describe the preventive measures of cholera and enteric fever (C1) iv) Explain the morphology, transmission, clinical features and laboratory diagnosis of following parasites (C2) a. Entamoeba histolytica b. Ascaris lumbricoides c. Ancylostoma duodenale v) Viral hepatitis a. List the etiological agents (C1) b. Explain the transmission, pathogenesis, laboratory diagnosis and prevention of HBV infection(C2)	6
Urogenital Infection	i) URINARY TRACT INFECTION a. List the etiological agents (C1) b. List predisposing factors - Host factors and Microbial factors (C1) c. Explain the clinical features and laboratory diagnosis (C2) ii) SEXUALLY TRANSMITTED DISEASES a. List the organisms causing STDs (C1) b. Human immunodeficiency virus infections <ul style="list-style-type: none"> • Explain general properties, pathogenesis, clinical features complications and laboratory diagnosis (C2) 	2

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	40	120				
Seminar						
Small group discussion (SGD)						
Self-directed learning (SDL)						
Problem Based Learning (PBL)						
Case Based Learning (CBL)						
Clinic						
Practical						
Revision						
Assessment	3	9				
Total	45	129				
Assessment Methods:						
Formative:			Summative:			
Unit Test- Nil			Mid Semester- First Sessional Examination SEQ (theory) Second Sessional Examination – MTF (theory)			
Quiz - Nil			University Examination – SEQ theory			
Viva - Nil			Viva - Nil			
Assignments/Presentations- Nil			Record book - Nil			
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x	x	x	x	-	-
Sessional Examination 2	x	x	x	x	-	-
End Semester / University Exam	x	x	x	x	-	-
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	1. Textbook of Microbiology for Dental students, Prof: C.P. Baweja 2. Medical Parasitology, D. R. Arora and D. Arora					
Additional References	Review of Medical Microbiology and Immunology by Warren Levinson, 15 th Edition					

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Pathology
Course Code	PAT2103
Academic Year	Second Year
Semester	III
Number of Credits	3
Course Prerequisite	Nil
Course Synopsis	This module is devoted to the structural and functional changes in cells, tissues and organs that underlie disease. Pathology examines diseases and their mechanisms including the what, when, where, why and how of disease. It forms an integral part of clinical medicine and allied streams, as it is required to understand the symptoms and signs of disease, the modes of diagnosis and the rationale for clinical care.

Course Outcomes (COs):

At the end of the course student shall be able to:

CO1	To demonstrate their understanding of the basic principles of pathology both as a medical science and as a clinical discipline (C2)
CO2	To explain the disease mechanisms, which include basic concepts, inflammation and neoplasms of specific systems and organs, and haematological conditions and understand the significance of the mechanisms in the health profession education (C2)
CO3	To use the principles of laboratory tests in the diagnosis of diseases (C4)
CO4	To apply the knowledge of Pathology to clinical situations for understanding the disease process along with clinical manifestations and relate the relevance of knowledge of pathology to the practice of health profession (C4)

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x							
CO2	x							
CO3	x	x						
CO4	x	x						

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1: Basic concepts and general pathology		
Introduction to pathology & basic terminologies	Terminologies 1. Introduction to pathology 2. Recognise the relevance of Pathology (C2) 3. Define the basic terminologies and branches of	1

Content	Competencies	Number of Hours
	Pathology (C1) a. Aetiology b. Pathogenesis c. Pathological and clinical manifestations d. Complications & sequelae e. Prognosis f. Syndrome g. Lesion 4. Explain the scope of the following branches of pathology: (C2) a) Histopathology b) Cytopathology c) Haematology	
Cell injury & adaptation	Cell adaptation Define cell growth, differentiation and cell adaptation (C1) Describe the various cell adaptations with examples (C2) a) Hypertrophy b) Hyperplasia c) Atrophy d) Metaplasia e) Dysplasia Necrosis 1. Define necrosis(C1) 2. Describe the various types of necrosis with clinical examples (C2) a) Coagulative necrosis b) Colliquative necrosis/ Liquefactive necrosis c) Caseous necrosis d) Fibrinoid necrosis e) Fat necrosis f) Gangrene	2
Inflammation	Define inflammation. List the types with examples.(C1) Acute inflammation 1. Define acute inflammation. (C1) 2. Describe the causes and cardinal signs of acute inflammation. (C2) 3. Explain the vascular of acute inflammation. (C2) 4. Describe the cellular events in acute inflammation. (C2) 5. Explain the sequelae of acute inflammation. (C2) 6. Explain the beneficial, harmful and systemic effects of acute inflammation. (C2) Chronic inflammation 1. Define chronic inflammation. (C1) 2. List the causes of chronic inflammation. (C1) 3. Describe the macroscopic and microscopic features in chronic inflammation. (C2) 4. List the cells in chronic inflammation. (C1)	3

Content	Competencies	Number of Hours
	5. Define granulomatous inflammation. (C2) 6. List the components of a granuloma and describe its morphology (C2) 7. List the causes of granulomatous inflammation. (C1)	
Healing & repair	Wound healing 1. Define granulation tissue and describe the formation of granulation tissue. (C2) 2. Describe the following: (C2) a. Healing by first intention. b. Healing by second intention. c. Wound organization, contraction and scarring. 3. Explain the factors which modify (influence) healing and repair. (C2)	1
Fluid & haemodynamic derangements	Oedema 1. Define oedema. (C1) 2. List the types of oedema. (C1) 3. Describe the pathogenesis and clinical features of the different types of oedema. (C2) Shock 1. Define shock. (C1) 2. List the various types of shock. (C1) 3. Describe the pathogenesis of septic and hypovolemic shock. (C2) Thrombosis (Arterial & Venous) 1. Define thrombosis. (C1) 2. Describe the factors influencing pathogenesis of thrombosis. (C2) 3. List causes of arterial and venous thrombosis. (C1) 4. List the fates of thrombus. (C1) Embolism 1. Define embolism. List the types of embolism with examples. (C1) 2. Describe the clinicopathologic consequences of pulmonary thromboembolism (C2) Infarction 1. Define infarction. (C1) 2. Describe the types and clinical significance of infarction. (C2)	4
Neoplasia	1. Define neoplasia (C1) 2. Describe the nomenclature of tumours with examples (C2) 3. Define dysplasia and anaplasia (C1) 4. Describe the differences between benign and malignant tumours (C2) 5. Define carcinogenesis. List the types of carcinogens with example of each (C1) 6. Describe the aetiology & predisposing factors of tumours (C2) 7. Define metastasis. (C1) 8. Describe the routes of metastasis with examples (C2)	4

Content	Competencies	Number of Hours
	9. Describe the prognostic factors of tumours with emphasis on staging & grading (C2) 10. Describe the various modalities for diagnosis of cancer (C2)	
Infectious diseases	Tuberculosis 1. Describe the aetiology and mode of transmission of tuberculosis (C2) 2. Describe the clinical features of tuberculosis. (C2) 3. Describe the morphology of primary, secondary and miliary tuberculosis. (C2) Leprosy 1. List the aetiological factors of leprosy (C1) 2. Classify leprosy (C1) 3. Describe the morphology of lepromatous and tuberculoid leprosy (C2)	4
Genetics	1. Describe the basic concepts of genetics (C2) 2. Define with suitable examples (C1) a. Autosomal dominant b. Autosomal recessive c. X-linked recessive d. Chromosomal abnormalities 3. Define karyotyping (C1)	1
Unit 2: Haematology		
Diseases of RBCs	1. Define anaemia (C1) 2. Classify anaemia based on aetiology and morphology (C4) 3. Describe the clinical features, aetiology and basic investigation of (C2) a. Nutritional anaemias(B12/folate deficiency, iron deficiency) b. Haemolytic anaemias(thalassemia, sickle cell anaemia)	3
Bleeding disorders	1. List the types of bleeding disorders (C1) 2. Describe the clinical features and basic investigation of haemophilia (C2) 3. List the causes of thrombocytopenia (C1) 4. Describe the clinical features and basic investigation of immune thrombocytopenia (C2)	1
Diseases of WBC	1. Define leukemia (C1) 2. List the types of leukemia (C1) Acute Leukaemia (AML, ALL) 1. Describe the clinical features of AML & ALL. (C2) 2. Describe the laboratory diagnosis of AML and ALL (C2)	2
	Chronic leukaemia (CML, CLL) 1. Describe the clinical features, blood findings and chromosomal abnormality in CML (C2) 2. Describe the clinical features and laboratory diagnosis of CLL (C2)	

Content	Competencies	Number of Hours
Unit 3: Systemic Pathology		
Blood vessels & heart	<p>Hypertension</p> <ol style="list-style-type: none"> 1. Define hypertension (C1) 2. Classify hypertension (C4) 3. Describe the effects of hypertension on various organs (C2) <p>Atherosclerosis</p> <ol style="list-style-type: none"> 1. Define atherosclerosis (C1) 2. List the sites of involvement by atherosclerosis(C1) 3. Describe the predisposing factors, complications & clinical effects of atherosclerosis (C2) <p>Ischemic heart disease/Coronary artery disease</p> <ol style="list-style-type: none"> 1. Define ischemic heart disease (C1) 2. Describe the clinical spectrum of the disease (with reference to angina and myocardial infarction) (C2) <p>Aneurysm</p> <ol style="list-style-type: none"> 1. Define aneurysm (C1) 2. List the causes, types and complications of aneurysms (C1) <p>Rheumatic heart disease</p> <ol style="list-style-type: none"> 1. Define rheumatic heart disease (C1) 2. Describe its aetiology & clinical features (C2) <p>Cardiac failure</p> <ol style="list-style-type: none"> 1. Define cardiac failure (C1) 2. List the causes of cardiac failure (C1) 3. Describe its pathophysiology & clinical features (C2) 	5
Respiratory system	<p>Pneumonia</p> <ol style="list-style-type: none"> 1. Define pneumonia (C1) 2. List the types of pneumonia(C1) 3. Describe the aetiology and clinical features of pneumonia (C2) <p>Chronic obstructive airway disease</p> <ol style="list-style-type: none"> 1. Define chronic obstructive airway disease. (C1) 2. List the types of chronic obstructive airway disease.(C1) <p>Emphysema</p> <ol style="list-style-type: none"> 1. Define emphysema(C1) 2. List the types of emphysema (C1) 3. Describe the aetiology and clinical features of emphysema (C2) <p>Chronic bronchitis</p> <ol style="list-style-type: none"> 1. Define chronic bronchitis (C1) 2. Describe the aetiology and clinical features of chronic bronchitis (C2) <p>Bronchiectasis</p> <ol style="list-style-type: none"> 1. Define bronchiectasis (C1) 2. List the types of bronchiectasis. (C1) 3. Describe the aetiology and clinical features of bronchiectasis (C2) 	4

Content	Competencies	Number of Hours
	<p>Asthma</p> <ol style="list-style-type: none"> 1. Define asthma (C1) 2. List the types of asthma (C1) 3. Describe the aetiology and clinical features of asthma (C2) <p>Pneumoconiosis</p> <ol style="list-style-type: none"> 1. Define pneumoconiosis (C1) 2. List the types of pneumoconiosis (C1) 3. Describe the aetiology and clinical features of pneumoconiosis (C2) 	
Gastrointestinal tract & liver	<p>Gastric & duodenal ulcers</p> <ol style="list-style-type: none"> 1. Definition gastric and duodenal ulcer (C1) 2. Describe the aetiology, gross pathology and clinical features of gastric and duodenal ulcer (C2) <p>GIT malignancies</p> <ol style="list-style-type: none"> 1. List the types of common GIT malignancies (C1) 2. Describe their predisposing factors & clinical features (C2) <p>Jaundice</p> <ol style="list-style-type: none"> 1. Define jaundice (C1) 2. List the types of jaundice with examples (C1) <p>Viral hepatitis</p> <ol style="list-style-type: none"> 1. Describe the aetiology of viral hepatitis (C2) 2. List the modes of infection (C1) 3. Describe the clinical features of viral hepatitis (C2) <p>Cirrhosis of liver</p> <ol style="list-style-type: none"> 1. Define cirrhosis (C1) 2. List the causes of cirrhosis (C1) <p>Liver failure</p> <ol style="list-style-type: none"> 1. Define liver failure (C1) 2. List the causes of liver failure (C1) 3. Describe its pathophysiology & clinical features (C2) 	4
Renal system	<p>Define nephrotic syndrome & nephritic syndrome with suitable examples (C1)</p> <p>Renal failure</p> <ol style="list-style-type: none"> 1. Define renal failure (C1) 2. List its types & describe the clinical features (C2) 	1
Endocrine system	<ol style="list-style-type: none"> 1. Define hyperthyroidism & hypothyroidism (C1) 2. Describe the causes, clinical features and laboratory diagnosis of hyperthyroidism and hypothyroidism (C2) 3. Describe the types, causes & clinical features of goitre (C2) <p>Describe types, clinical features, complications & laboratory diagnosis of diabetes (C2)</p>	2
Nervous system	<p>Define Cerebrovascular diseases (C1)</p> <p>Describe its causes and clinical features (C2)</p>	1

Content	Competencies	Number of Hours
Musculoskeletal system	<p>Fracture</p> <ol style="list-style-type: none"> 1. Define fracture (C1) 2. List the types of fracture (C1) 3. Describe the process of fracture healing (C2) 4. List the factors influencing fracture repair (C1) <p>Osteomyelitis</p> <ol style="list-style-type: none"> 1. Define osteomyelitis (C1) 2. Describe the aetiology, types and clinical features of osteomyelitis (C2) <p>Define and list the clinical features of Rheumatoid arthritis, osteoarthritis and osteoporosis (C1)</p>	2

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	45	135				
Seminar	-	-				
Small group discussion (SGD)	-	-				
Self-directed learning (SDL)	-	-				
Problem Based Learning (PBL)	-	-				
Case Based Learning (CBL)	-	-				
Clinic	-	-				
Practical	-	-				
Revision	-	-				
Assessment	-	-				
Total	45	135				
Assessment Methods:						
Formative:	Summative:					
Unit Test - Nil	1 st Sessional Exam - SEQ (theory) 2 nd sessional exam - MTF (theory)					
Quiz - Nil	University exam – SEQ (theory)					
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Sessional Examination 1	x	x	x	x		
Sessional Examination 2	x	x	x	x		
End Semester/University Exam	x	x	x	x		
Feedback Process:	Mid semester feedback End-Semester Feedback					
Main Reference:	1. Essential Pathology for Dental students, Harsh Mohan, 3rd edition, 2010 Jaypee. 2. General and systemic pathology, JCE Underwood and S S Cross, 7 th edition, 2018, Churchill Livingstone.					
Additional References						

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Ultrasound Physics and Doppler Principles
Course Code	CVT2101
Academic Year	Second Year
Semester	III
Number of Credits	3
Course Prerequisite	Basic knowledge of cardiac anatomy, cardiac hemodynamics and basic physics
Course Synopsis	1. This course explains the technical aspect of an Ultrasound equipment and echocardiographic machine 2. This course will make students to understand the cardiac hemodynamic assessment using Doppler principle 3. This course allows students to understand basic cardiac imaging using echocardiography

Course Outcomes (COs):

At the end of the course student shall be able to:

CO1	Recalling the history of echocardiographic evolution (C1)
CO2	Defining and explaining the ultrasound use in obtaining echocardiographic image by understanding the ultrasound and tissue interactions (C2)
CO3	Classifying different ultrasound transducers and their instrumentation (C2)
CO4	Understanding different modes of image acquisition and adjusting resolution with different factors that interfere with image quality(C3)
CO5	Understanding the different Doppler modalities in physiologic assessment of heart (C2)
CO6	Choosing appropriate Doppler mode, (pulsed or continuous wave Doppler) in the assessment of valvular flow, shunt lesions and intracardiac pressures(C4)
CO7	Explaining tissue Doppler imaging and its utilities

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x		x					
CO2	x			x				
CO3		x			x			
CO4		x	x					
CO5		x					x	
CO6		x					x	
CO7		x					x	

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
History of echocardiography	Recall the history of Development of various echocardiographic technologies(C1)	1

Content	Competencies	Number of Hours
	Understanding the Evolution of ultrasound transducer (C2)	2
Unit 2:		
Ultrasound physics and instrumentation	Understanding the physical properties of ultrasound (C2)	2
	Explaining the ultrasound tissue interaction(C2)	2
	Defining specular reflection and specular scattering(C1)	1
Unit 3:		
The transducer	Understanding the types of ultrasound transducers (C2) Linear array and phased array(C2)	2
	Explaining clinical application of transducer(C2)	1
	Understanding the Near field and far field(C2)	1
	Illustrating the instrumentation of 3D echo transducer and Transesophageal echo transducer (C2)	3
Unit 4		
Resolution	Understanding different types of resolution- Spatial resolution, Contrast resolution, Temporal resolution (C2)	1
Unit 5		
Image creation and display option	Explain the steps involved in image creation (C2)	1
	Explain the different mode of image display- 2D, M mode (C2)	2
Unit 6		
Tissue Harmonic imaging	Understanding the tissue harmonic imaging physics (C2) Enumerating the uses and limitations(C2)	1
Unit 7		
Doppler echocardiography Principles	Understanding the different Doppler formats: Pulsed wave Doppler, continuous wave Doppler and colour flow imaging (C2)	3
	Define Aliasing(C1)	1
	Explain Billiard Ball effect (C2)	1
	Defining Doppler artefacts (C1)	1
Unit 8		
2D cardiac chamber examination	To define and diagnose situs (C1)	1
	To Identify the veno-atrial connection (C2)	1
	Understand the atrial, ventricular and valvular anatomy (C3)	1
	Identification of atrioventricular and ventriculo arterial relation (C3)	1

Content	Competencies	Number of Hours
Unit 9		
Hemodynamic assessment by Doppler	Explaining the volume quantification methods: Stroke volume calculation. Defining the formula, uses and limitations (C3)	1
	Understanding the continuity equation (C2) Defining the formula, uses and limitations (C3)	1
	Understanding Bernoulli's equation (C2) Derivation of the formula, uses and limitations (C3)	1
	Understanding Pressure half time(PHT) assessment (C3) Brief method, application of PHT in the assessment of valve area and aortic regurgitation (C4)	1
	Illustrating the method of proximal iso velocity surface area(PISA), in evaluating regurgitant and stenotic valvular lesions (C3) Brief steps, Uses and limitations of PISA method (C4)	1
	Evaluation of intracardiac pressure using doppler flow velocities. (C3)	1
Unit 10		
Tissue Doppler imaging (TDI)	Defining the physical principles of TDI (C3) Obtaining tissue annular velocity waveforms, Uses and limitations (C4)	3

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	32	64
Seminar	7	14
Small group discussion (SGD)	-	-
Self-directed learning (SDL)	-	-
Problem Based Learning (PBL)	-	-
Case Based Learning (CBL)	-	-
Clinic	-	-
Practical	-	-
Revision	-	-
Assessment	-	-
Total	39	78
Assessment Methods:		
Formative:	Summative :	
Unit Test	Mid Semester (Theory)	
Quiz	-	
Viva	-	

Assignments/Presentations	Assignments and presentations						
Clinical assessment (OSCE, OSPE, WBPA)	-						
Clinical/Practical Log Book/ Record Book	Record Book						
Mapping of Assessment with COs:							
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6	CO7
Mid Semester Examination 1	X	X	X	X	X		
Assignments/Presentations						X	X
End Semester Exam	X	X	X	X	X	X	X
Feedback Process:	Mid-Semester Feedback						
	End-Semester Feedback						
Main Reference:	Feigenbaum's Echocardiography, Book by Harvey Feigenbaum						
	Textbook of clinical Echocardiography: Book by Catherine Otto, Latest Edition						
Additional References	The Echo Manual, Latest edition, Book by Jae K. Oh, James B Seward, A Jamil Tajik						

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Cardiac stress tests
Course Code	CVT2102
Academic Year	Second Year
Semester	III
Number of Credits	3
Course Prerequisite	Basic knowledge on cardiac hemodynamics and functioning
Course Synopsis	<ol style="list-style-type: none"> 1. This module will bridge the gap between the knowledge acquired in the technical and clinical aspects of treadmill stress test and pharmacological stress test 2. To provide fundamental knowledge in the assessment of coronary artery diseases and myocardial viability 3. To diagnose and interpret various stress tests in myocardial diseases

Course Outcomes (COs):

At the end of the course student shall be able to: build skills and perform

CO1	Explain the cardiovascular and pulmonary Responses to exercise(C2)
CO2	Describe the various types, indications and contraindications for stress tests(C2)
CO3	To illustrate Stress test Equipment, protocol and procedure(C2)
CO4	Describe the clinical responses in stress test(C2)
CO5	To identify and analyse normal and abnormal ECG responses(C3,C4)
CO6	Explain various drugs used in stress test(C2)

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x	x						
CO2	x	x						
CO3		x	x					
CO4		x		x				
CO5		x						x
CO6	x						x	

Course Content and Outcomes

Content	Competencies	Number of Hours
Unit 1:		
Introduction to exercise tress test	Explain cardiovascular and pulmonary responses to exercise(C2) List out types of exercise(C1) Define maximum oxygen uptake (C1) Define myocardial oxygen uptake(C1) Explain heart rate and BP response to exercise(C2)	8

Content	Competencies	Number of Hours
	Describe indications(coronary and non-coronary) and contraindications of Exercise stress test(C2)	2
Unit 2:		
Exercise stress test techniques and procedure	Describe patient preparation and procedure(C2) Explain the stress protocol and test supervision(C2) Name the equipment used for stress test(C1) Interpreting stress ECG(C2) Explain complications of exercise stress test and four levels of angina scale for exercise tolerance test(C2)	4
Unit 3:		
Interpretation and uses of exercise stress test	Describe clinical response, symptoms, subject appearance and exercise capacity during stress test(C2)	2
	Explain BP and HR response during exercise(C2)	2
	Interpret normal and abnormal ECG responses to exercise stress test(C4)	2
	Illustrate uses of exercise stress test(C2)	3
	Explain uses of various drugs in exercise stress test like beta blockers, vasodilators, ACE inhibitors, calcium antagonists, digitalis and other drugs(C2)	5
Unit 4		
Dobutamine stress test	List out indications and contraindications(C1) Explain subject preparation, procedure, ECG recording, Echo recording test supervision(C2) Interpretation of ECG and Echo images in stress test(C4)	4
Unit 5		
Atropine test	List out indications and contraindications(C1) Explain uses and procedure(C2)	1
Unit 6		
Dipyridamole Test	List out indications, contraindications and uses(C1) Describe the procedure and complications(C2)	2
Unit 7		
SPECT scan	Explain various radiotracers, protocols and technical artifacts (C2) Interpret and analyse SPECT images(C4) Describe MUGA scan(C2)	2
Unit 8		
PET scan	Explain perfusion and metabolic tracers(C2) Interpretation and analysis of images(C4)	2

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	18	36				
Seminar	8	16				
Small group discussion (SGD)	3	6				
Self-directed learning (SDL)	3	6				
Problem Based Learning (PBL)	-	-				
Case Based Learning (CBL)	-	-				
Clinic	-					
Practical	2	4				
Revision	2	4				
Assessment	3	6				
Total	39	78				
Assessment Methods:						
Formative:			Summative:			
Unit Test			Mid Semester/Sessional Exam			
Quiz			-			
Viva			-			
Assignments/Presentations			Record Book, work dairy			
Clinical assessment (OSCE, OSPE, WBPA)			OSCE			
Clinical/Practical Log Book/ Record Book			Clinical Record book			
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x	x				
Sessional Examination 2		x	x			
Quiz / Viva				x		
Assignments/Presentations		x				
Clinical/Practical Log Book/ Record Book						
Any others: WPBA						
End Semester Exam	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	Cardiovascular medicine The heart- by Hurst's The Brounwald's Heart disease					
Additional References						

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Cardiac Instrumentation
Course Code	CVT2103
Academic Year	Second Year
Semester	III
Number of Credits	2
Course Prerequisite	Basic Knowledge about human anatomy and physiology.
Course Synopsis	<ol style="list-style-type: none"> 1. This module helps to obtain knowledge about the working principles & applications of various transducers and electrodes. 2. To gain knowledge about the working principles of various diagnostic equipment's used in the cardiac field. 3. To gain knowledge of working principles of various therapeutic equipment's used in the cardiac field.

Course Outcomes (COs):

At the end of the course student shall be able to: Build knowledge and utilize

CO1	Understand the different types of Transducers and their selection for clinical applications (C2)
CO2	Develop knowledge on types of electrodes and their applications (C2)
CO3	Utilize the principles of origin of physiological signals and make use of the instrumentation for recording the same (C3)
CO4	Ability to choose the appropriate mode of pacemaker (C3)
CO5	Understanding the working principle of Heart-Lung machine (C2)
CO6	Understand the working principles and clinical applications of X-ray, CT & MRI (C2)

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x	x						
CO2		x				x		
CO3		x			x			
CO4	x						x	
CO5			x			x		
CO6		x		x				

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Transducers	<ol style="list-style-type: none"> 1.Explain the classification and selection of transducer(C2) 2.Name and explain the different types of transducers(C2) 3.Explain the Pressure transducers(C2) 4.Explain the Photoelectric transducers (C2) 	4

Content	Competencies	Number of Hours
Unit 2:		
Electrodes & Amplifiers	<ol style="list-style-type: none"> 1. Understand and Explain the working principles of Electrodes (C2) 2. Name and Explain the types of electrodes(C2) 3. Understanding the Amplifiers for biomedical instrumentation(C2) 	3
Unit 3:		
Physiological Signals & Measurements	<ol style="list-style-type: none"> 1. Remember and summarize the basics of ECG and PCG(C2) 2. Understanding the Instrumentation for measuring the ECG & PCG signals (C2) 3. Build skills in measurement of Blood pressure (C3) 4. Build skills in the measurement of blood flow by using Electromagnetic & Doppler methods(C3) 	4
Unit 4:		
Cardiac Pacemakers	<ol style="list-style-type: none"> 1. Name and explain the types of pacemakers (C2) 2. Understand External and Implantable pacemakers(C2) 3. Choose the appropriate mode of pacemaker and explain the working application(C3) 4. Summarize the Pacemaker Electrodes (C2) 	3
Unit 5:		
Defibrillators	<ol style="list-style-type: none"> 1. Name and Explain the types of Defibrillators (C2) 2. Compare the working principles of AC and DC defibrillators (C4) 3. Outline the types of electrodes and their features (C2) 4. Explain the working principle of cardioverters (C2) 	3
Unit 6:		
Ultrasound	<ol style="list-style-type: none"> 1. Explain the working principle of Ultrasound (C2) 2. Understand and summarize the clinical applications of Ultrasound(C2) 	2
Unit 7:		
Heart-Lung Machine	<ol style="list-style-type: none"> 1. Understand the working principle of Heart-lung machine (C2) 	2
Unit 8:		
Principles of radiation	<ol style="list-style-type: none"> 1. Understand and summarize the working principle of X-ray, CT & MRI (C2) 	5

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	15	30
Seminar	3	6
Small group discussion (SGD)	2	4
Self-directed learning (SDL)	2	4
Problem Based Learning (PBL)	-	-

Case Based Learning (CBL)	-	-				
Clinic	-	-				
Practical	-	-				
Revision	2	4				
Assessment	2	4				
Total	26	42				
Assessment Methods:						
Formative:	Summative:					
Unit Test	Sessional Exam I & II					
Quiz	-					
Viva	-					
Assignments/Presentations	Assignment					
Clinical assessment (OSCE, OSPE, WBPA)	WBPA					
Clinical/Practical Log Book/ Record Book	-					
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Sessional Examination 1	x	x	x			
Sessional Examination 2				x	x	x
Quiz / Viva						
Assignments/Presentations						x
Clinical/Practical Log Book/ Record Book						
End Semester Exam						
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	1. John G Webster, "Medical Instrumentation Applications and Design", John Wiley and Sons, New York, Edition 3, 2011 2. R S Khandpur, "Handbook of Biomedical Instrumentation", McGraw Hill, Delhi, Edition 3, 2014 3. Joseph J Carr, John M Brown, "Introduction to Biomedical Equipment technology", Prentice Hall, New Jersey, Edition 4, 2003.					
Additional References	1. L A Geddes, L E Baker, "Principles of Applied Medical Instrumentation", Wiley India, New Delhi, Edition 3, 2008. 2. Richard Aston, "Principles of biomedical Instrumentation and measurement", Merrill, New York, 1991.					

Manipal College of Health Professions								
Name of the Department	Cardiovascular Technology (CVT)							
Name of the Program	Bachelor of Science in Cardiovascular Technology							
Course Title	Clinics - III							
Course Code	CVT2131							
Academic Year	Second Year							
Semester	III							
Number of Credits	3							
Course Prerequisite	Basic knowledge about obtaining ECG, interpretation and analysis							
Course Synopsis	<ol style="list-style-type: none"> 1. This module helps to obtain the basic knowledge about technical and clinical aspects of treadmill stress test and pharmacological stress test 2. To provide fundamental knowledge in the diagnosis of coronary artery diseases and myocardial viability 3. To analyse, identify and interpretation of various stress test 							
Course Outcomes (COs):								
At the end of the course student shall be able to: build skills and perform								
CO1	To build knowledge in obtaining ECG, interpretation and analysis(C3,P3)							
CO2	To understand the indications, basic lead placement and patient preparation(C1,P4)							
CO3	Ability to identify and interpret normal ECG waveforms in cardiac stress test(C5,P3)							
CO4	Knowledge to distinguish normal and abnormal ECG responses(C4,P4)							
CO5	Able to measure BP and heart rate during stress test(C5,P3)							
CO6	Build skills to develop practical knowledge and ability to interpret stress test(C5,P4)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1		X	X					
CO2	X	X						
CO3		X		X				
CO4	X	X						
CO5	X		X					
CO6		X					X	

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Introduction to exercise stress test	To build knowledge about BP and heart rate responses to exercise stress test(C3 P3)	10
Unit 2:		
Exercise stress test	Demonstrate patient preparation and	10

Content	Competencies	Number of Hours
techniques and procedure	procedure(C2 P2) Build ability to use various stress protocol To demonstrate test procedure(C2 P2)	
	To Name the equipment used in stress test(C1 P1) Interpretation of stress ECG(C2 P2) To understand the complications of exercise stress test(C2 P2)	10
Unit 3:		
Interpretation and uses of exercise stress test	To identify and evaluate clinical responses, symptoms and exercise capacity during stress test(C5 P5)	6
	To analyse normal and abnormal ECG responses to exercise stress test(C4 P4)	10
	To apply exercise stress test in various conditions(C3 P3)	9
	Build knowledge about usage of various drugs in emergency conditions(C3 P3)	10
Unit 4		
Dobutamine stress test	To build knowledge about indications and contraindications(C3 P3)	5
	To Perform and analyse subject preparation, procedure, ECG recording, Echo recording test (C4 P4)	5
Unit 5		
Atropine test	To build knowledge about indications and contraindications (C3 P3)	8
Unit 6		
Dipyridamole Test	To know the indications, contraindications and uses(C1 P1)	5
	Able to perform and analyse procedure and complications(C2 P2)	5
Unit 7		
SPECT scan	To build knowledge about various radiotracers, protocols and technical artifacts (C3 P3)	6
	To Interpret and analyse SPECT images(C4 P4)	6
Unit 8		
PET scan	To identify various perfusion and metabolic tracers(C3 P3)	6
	To Interpret and analyse PET images(C4 P4)	6
Total hours		117

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	-	-				
Seminar	-	-				
Small group discussion (SGD)	20	40				
Self-directed learning (SDL)	8	16				
Problem Based Learning (PBL)	8	16				
Case Based Learning (CBL)	20	40				
Clinic	56	112				
Practical	-	-				
Revision	-	-				
Assessment	5	10				
Total	117	234				
Assessment Methods:						
Formative:			Summative:			
Unit Test			-			
Quiz			-			
Viva			-			
Assignments/Presentations			work dairy			
Clinical assessment (OSCE, OSPE, WBPA)			WBPA			
Clinical/Practical Log Book/ Record Book			Clinical Record book			
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1						
Sessional Examination 2						
Quiz / Viva						
Assignments/Presentations				x		
Clinical/Practical Log Book/ Record Book	x	x	x	x	x	x
Any others: WPBA						
End Semester Exam						
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	Manual of Cardiovascular medicine by Griffin The textbook of 'The heart' - by Hurst's The Brounwald's textbook of Heart disease					
Additional References						

SEMESTER - IV

COURSE CODE	:	COURSE TITLE
PHC2203	:	Pharmacology
CPY2201	:	Clinical Psychology
BST3201	:	Biostatistics and Research Methodology
CVT2201	:	Cardiac Pacemakers and Defibrillators
CVT2202	:	Congenital Heart Disease - I
CVT2231	:	Clinics - IV
CVT****	:	Program Elective - I

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Pharmacology
Course Code	PHC2203
Academic Year	Second Year
Semester	IV
Number of Credits	3
Course Prerequisite	Basic knowledge of Anatomy, Physiology, Biochemistry, Microbiology and Pathology
Course Synopsis	The course briefly addresses the classes of drugs acting on various systems of human body. This module will be delivered through lectures. Theory examination will be used to assess the students' transferable skills and learning outcomes. This module helps the students to understand the kinetics, dynamics and therapeutics of drugs that are relevant to allied health practice. Emphasis is laid on drugs that are commonly used by allied health practitioners. This module provides the background for decision making and treatment based on basic knowledge of drugs.

Course Outcomes (COs):

At the end of the course student shall be able to:

CO1	Explain indications, rationale, pharmacological actions, pharmacokinetic features, adverse effects, contraindications and drug interactions of commonly used medications in allied health practice (C1)
CO2	Describe mechanism of action, uses, adverse effects, contraindications and drug interactions of clinically important drugs that are used in allied health practice which may directly or indirectly influence management of health and diseases by allied health practitioners (C1)
CO3	Apply fundamental pharmacology knowledge in allied health sciences (C2)
CO4	Use pharmacology knowledge in decision making of patient/client management. (C2)

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x							
CO2	x							
CO3	x							
CO4	x							

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1		
General Pharmacology	A. Introduction : 1. Define the following terms: pharmacology, pharmacokinetics, pharmacodynamics,	7

Content	Competencies	Number of Hours
	<p>pharmacotherapeutics, clinical pharmacology and toxicology (C1)</p> <ol style="list-style-type: none"> 2. Define drug with examples. (C1) 3. Describe the following with examples: chemical name, non-proprietary/generic name and proprietary (brand) name of a drug. (C2) 4. List various sources of drug information. (C1) 5. List different sources of drugs with examples. (C1) 6. Explain different parts of a prescription. (C2) 7. Describe the various standard abbreviations used in prescription. (C1) <p>B. Routes of drug administration:</p> <ol style="list-style-type: none"> 1. Explain the advantages and disadvantages of the following routes of drug administration with examples of drugs administered by these routes: oral, sublingual, subcutaneous, intramuscular, intravenous, intradermal, topical, transdermal, inhalational and rectal. (C2) <p>C. Pharmacokinetics:</p> <ol style="list-style-type: none"> 1. Describe drug transport mechanisms. (C2) 2. Explain the factors affecting drug absorption. (C2) 3. Define bioavailability. (C1) 4. Explain first pass metabolism with examples of drugs having high first pass metabolism. (C2) 5. Define volume of distribution. (C1) 6. Explain the factors affecting volume of distribution. (C2) 7. Define biotransformation. (C1) 8. List the organs involved in biotransformation. (C1) 9. List the types of biotransformation reactions. (C1) 10. List different routes of drug excretion. (C1) 11. Define the following terms: plasma half-life, first order kinetics and zero order kinetics (C1) <p>D. Pharmacodynamics:</p> <ol style="list-style-type: none"> 1. Describe the different types of non-receptor mediated mechanisms of drug action with examples. (C2) 2. List different types of receptors with examples. (C1) 3. Define the following terms: affinity, intrinsic activity, efficacy, potency, agonist and antagonist. (C1) 4. Define the following terms with examples: competitive antagonist and non-competitive antagonist. (C1) 5. Explain synergism with an example. (C2) 6. Explain the following factors modifying drug action with examples: age, genetics, psychological states, pathological states, presence of other drugs and tolerance (C2) <p>E. Drug toxicity and safety:</p> <ol style="list-style-type: none"> 1. Define therapeutic index. (C1) 2. Define adverse drug reactions. (C1) 3. Describe the following terms with examples: 	

Content	Competencies	Number of Hours
	predictable adverse drug reactions, unpredictable adverse drug reactions, side effects, toxic effects, idiosyncrasy, hypersensitivity, teratogenicity, iatrogenic disease, photosensitivity, dependence(C2)	
Unit 2		
Autonomic nervous system including skeletal muscle relaxants	<p>A. Cholinergic drugs:</p> <ol style="list-style-type: none"> 1. Name the parasympathetic neurotransmitter. (C1) 2. List the types of different cholinergic receptors. (C1) 3. Name the locations of different cholinergic receptors. (C1) 4. Describe the responses mediated through different cholinergic receptors at various sites. (C2) 5. Tell the classification of cholinergic drugs based on their mechanism of action. (C1) 6. Describe the mechanism of action of anticholinesterases. (C2) 7. List the therapeutic uses of anticholinesterases. (C1) 8. List the adverse effects of anticholinesterases. (C1) <p>B. Anticholinergic drugs:</p> <ol style="list-style-type: none"> 1. Tell the classification of anticholinergic drugs based on their source. (C1) 2. Describe the pharmacological actions of atropine (C2) 3. List the therapeutic uses of atropine and its substitutes. (C1) 4. List the adverse effects of anticholinergic drugs.(C1) <p>C. Neuromuscular blocking drugs:</p> <ol style="list-style-type: none"> 1. Tell the classification of skeletal muscle relaxants based on their mechanism of action. (C1) 2. List the uses of the following: centrally acting skeletal muscle relaxants, peripherally acting skeletal muscle relaxants. (C1) 3. List the adverse effects of the following: centrally acting skeletal muscle relaxants, peripherally acting skeletal muscle relaxants. (C1) <p>D. Adrenergic drugs:</p> <ol style="list-style-type: none"> 1. Name the sympathetic neurotransmitters. (C1) 2. List the types of different adrenergic receptors. (C1) 3. Name the locations of different adrenergic receptors. (C1) 4. Describe the responses mediated through different adrenergic receptors at various sites. (C2) 5. Describe the effects of adrenaline on: CVS, smooth muscle, eye, metabolism (C2) 6. List commonly used adrenergic drugs. (C1) 7. List the common therapeutic uses of adrenergic drugs. (C1) <p>E. Adrenergic receptor antagonists:</p> <ol style="list-style-type: none"> 1. Tell the classification of adrenergic receptor antagonists based on their receptor selectivity. (C1) 2. Describe the pharmacological actions of 	7

Content	Competencies	Number of Hours
	propranolol on: CVS, respiratory system and eye. (C2) 3. List the important uses of α -blockers. (C1) 4. List the important uses of β -blockers. (C1) 5. List the adverse effects of β -blockers. (C1)	
Unit 3		
Central nervous system	<p>A. General anaesthetics (GAs) :</p> <ol style="list-style-type: none"> 1. Define general anaesthetics. (C1) 2. Tell the classification of general anaesthetics based on their route of administration. (C1) 3. List indications of general anaesthetics. (C1) 4. List the complications of general anaesthesia. (C1) 5. Describe preanaesthetic medication. (C1) 6. List the drugs used in preanaesthetic medication. (C1) <p>B. Local anaesthetics (LAs) :</p> <ol style="list-style-type: none"> 1. Define local anaesthetics. (C1) 2. Explain the mechanism of action of LAs. (C2) 3. List the LAs. (C1) 4. List the indications of LAs. (C1) 5. List the different techniques of local anaesthetics. (C1) <p>C. Sedative & hypnotics :</p> <ol style="list-style-type: none"> 1. Define the following terms with examples: sedative and hypnotics. (C1) 2. List the benzodiazepines. (C1) 3. List the therapeutic uses of benzodiazepines. (C1) 4. List the adverse effects of benzodiazepines. (C1) <p>D. Opioids:</p> <ol style="list-style-type: none"> 1. List the commonly used opioids. (C1) 2. Explain the pharmacological actions of morphine. (C2) 3. List the uses of morphine. (C1) 4. List the adverse effects of morphine. (C1) 5. List the contraindications of morphine. (C1) 6. Mention the antidote used for the opioid poisoning. (C1) <p>E. NSAIDs :</p> <ol style="list-style-type: none"> 1. Tell the classification of NSAIDs based on their selectivity to COX. (C1) 2. Explain the mechanism of action of NSAIDs. (C2) 3. Explain the pharmacological actions of aspirin. (C2) 4. List the uses of aspirin. (C1) 5. List the adverse effects of aspirin. (C1) 6. List the contraindications of aspirin. (C1) 7. Explain the advantages and disadvantages of selective COX-2 inhibitors over aspirin. (C2) 8. Explain the mechanism of action of paracetamol. (C2) 9. List the uses of paracetamol. (C1) 10. Mention the differences between aspirin and paracetamol. (C2) 	9

Content	Competencies	Number of Hours
	<p>F. Drug treatment of rheumatoid arthritis (RA):</p> <ol style="list-style-type: none"> 1. List NSAIDs, DMARDs and steroids used in the treatment of RA. (C1) 2. Explain the mechanism of action of methotrexate. (C2) 3. List the adverse effects of methotrexate. (C1) <p>G. Drug treatment of gout:</p> <ol style="list-style-type: none"> 1. List the drugs used for acute and chronic gout.(C1) 2. Explain the mechanism of action of the following: Allopurinol, probenecid, sulfipyrazone (C2) 3. List the adverse effects of the following: Allopurinol, probenecid, sulfipyrazone (C1) <p>H. Psychopharmacology :</p> <ol style="list-style-type: none"> 1. List the antipsychotics. (C1) 2. Explain the mechanism of action of chlorpromazine. (C2) 3. List the uses of chlorpromazine. (C1) 4. List the adverse effects of chlorpromazine. (C1) <p>I. Parkinsonism :</p> <ol style="list-style-type: none"> 1. List antiparkinsonian drugs. (C1) 2. List the adverse effects of levodopa. (C1) 3. Explain the pharmacological basis for combining levodopa with carbidopa. (C2) <p>J. Alcohol :</p> <ol style="list-style-type: none"> 1. Explain the management of methanol poisoning. (C2) <p>K. Antiepileptic drugs :</p> <ol style="list-style-type: none"> 1. List the drugs used in various types of seizures(C1) 2. List the adverse effects of phenytoin. (C1) 	
Unit 4		
GIT	<p>A. Drugs for peptic ulcer :</p> <ol style="list-style-type: none"> 1. Tell the classification of drugs used in peptic ulcer based on their mechanism of action. (C1) 2. Explain the mechanism of action of the following: proton pump inhibitors (PPIs), H₂ blockers, antacids and ulcer protectives. (C2) 3. List the therapeutic uses of the following: proton pump inhibitors (PPIs), H₂ blockers, antacids and ulcer protectives. (C1) 4. List the adverse effects of the following: proton pump inhibitors (PPIs), H₂ blockers, antacids and ulcer protectives. (C1) <p>B. Antiemetics:</p> <ol style="list-style-type: none"> 1. List various classes of antiemetics with examples. (C1) 2. List the therapeutic uses of the following: prokinetics, 5-HT₃ antagonists, anticholinergics and H₁ antihistaminics. (C1) 3. List the adverse effects of the following: prokinetics, 5-HT₃ antagonists, anticholinergics and H₁ antihistaminics. (C1) 	2

Content	Competencies	Number of Hours
	<p>C. Laxatives and antidiarrhoeals :</p> <ol style="list-style-type: none"> 1. List various classes of laxatives with examples. (C1) 2. List the therapeutic uses of laxatives. (C1) 3. List the composition of WHO-ORS. (C1) 4. List the antimotility and antisecretory agents used in diarrhea. (C1) 	
Unit 5		
Blood	<p>A. Haematinics :</p> <ol style="list-style-type: none"> 1. List oral and parenteral iron preparations. (C1) 2. List the therapeutic and prophylactic uses of oral and parenteral iron preparations. (C1) 3. List the adverse effects of oral and parenteral iron preparations. (C1) 4. List various preparations of vitamin B₁₂ and folic acid. (C1) 5. Mention the therapeutic uses of the following: vitamin B₁₂ and folic acid. (C1) <p>B. Anticoagulants :</p> <ol style="list-style-type: none"> 1. Tell the classification of anticoagulants based on their routes of administration. (C1) 2. Explain the mechanism of action of the following: heparin and warfarin. (C2) 3. List the therapeutic uses of the following: heparin and warfarin. (C1) 4. List the adverse effects of the following: heparin and warfarin. (C1) <p>C. Antiplatelet drugs :</p> <ol style="list-style-type: none"> 1. List antiplatelet drugs. (C1) 2. Explain the antiplatelet action of the aspirin. (C2) 3. List the therapeutic uses of antiplatelet drugs. (C1) <p>D. Fibrinolytics and antifibrinolytics:</p> <ol style="list-style-type: none"> 1. List fibrinolytics and antifibrinolytics. (C1) 2. List the therapeutic uses of fibrinolytics and antifibrinolytics. (C1) 	3
Unit 6		
Cardiovascular system	<p>A. Diuretics:</p> <ol style="list-style-type: none"> 1. Define the term diuretics. (C1) 2. Tell the classification of diuretics based on their mechanism of action. (C1) 3. Explain the mechanism of action of following: loop diuretics, thiazides, potassium sparing diuretics and carbonic anhydrase inhibitors. (C2) 4. List the important therapeutic uses and adverse effects of the following: loop diuretics, thiazides, osmotic diuretics and potassium sparing diuretics. (C1) <p>B. Drugs used in congestive heart failure (CHF):</p> <ol style="list-style-type: none"> 1. Tell the classification of drugs used in the treatment of congestive heart failure based on their mechanism of action. (C1) 2. Explain the mechanism of action of cardiac 	5

Content	Competencies	Number of Hours
	<p>glycosides. (C2)</p> <p>C. Antihypertensives:</p> <ol style="list-style-type: none"> 1. Tell the classification of antihypertensive agents based on mechanism of action (C1) 2. Explain the antihypertensive action of the following: ACEIs/ARBs, calcium channel blockers, thiazides, beta blockers (C2) 3. List the uses of the following: ACEIs and calcium channel blockers. (C1) 4. List the adverse effects of the following: ACEIs and calcium channel blockers. (C1) <p>D. Antianginal drugs:</p> <ol style="list-style-type: none"> 1. List the drugs used for acute attack and chronic prophylaxis of angina. (C1) 2. Explain the mechanism of action of nitrates. (C2) 3. List the therapeutic uses of nitrates (C1) 4. List the adverse effects of nitrates (C1) <p>E. Hypolipidemics:</p> <ol style="list-style-type: none"> 1. Tell the classification of hypolipidemics based on their mechanism of action. (C2) 2. Explain the mechanism of action of the following: statins and fibrates. (C2) 3. List the uses and adverse effects of the following: statins and fibrates. (C1) 	
Unit 7		
Respiratory System	<p>A. Pharmacotherapy of bronchial asthma :</p> <ol style="list-style-type: none"> 1. Tell the classification of drugs used in the treatment of bronchial asthma based on their mechanism of action. (C1) 2. Explain the antiasthmatic action of the following: β_2-agonists, anticholinergics, mast cell stabilizers and inhaled glucocorticoids. (C2) 3. List the adverse effects of the following: β_2 agonists, anticholinergics, mast cell stabilizers and inhaled glucocorticoids. (C1) <p>B. Pharmacotherapy of cough :</p> <ol style="list-style-type: none"> 1. List drugs used in dry and productive cough. (C1) 2. Define the following terms with examples: mucolytics, expectorants, antitussives (C1) <p>C. Antihistaminics :</p> <ol style="list-style-type: none"> 1. List first generation and second generation antihistaminics. (C1) 2. List the uses of H₁ antihistaminics. (C1) 3. List the adverse effects of H₁ antihistaminics. (C1) 4. Describe the advantages of second generation antihistaminics over the first generation antihistaminics. (C2) 	3
Unit 8		
Chemotherapy	<p>A. General aspects:</p> <ol style="list-style-type: none"> 1. Define the following terminologies with examples: antimicrobial agents (AMAs), antibiotic, 	7

Content	Competencies	Number of Hours
	<p>bacteriostatic, bactericidal, chemoprophylaxis and suprainfection. (C1)</p> <p>2. List the problems that arise from using AMAs with examples. (C1)</p> <p>B. Beta lactam antibiotics:</p> <ol style="list-style-type: none"> 1. List the groups of beta lactams with examples. (C1) 2. Explain the mechanism of action of beta lactam antibiotics. (C2) 3. Tell the classification of penicillins with examples .(C1) 4. List the uses of penicillins (C1) 5. List the adverse effects of penicillins (C1) <p>C. Cotrimoxazole:</p> <ol style="list-style-type: none"> 1. Explain the mechanism of action of cotrimoxazole (C2) 2. List the uses of cotrimoxazole (C1) 3. List the adverse effects of cotrimoxazole (C1) <p>D. Macrolides :</p> <ol style="list-style-type: none"> 1. List macrolides (C1) 2. List the uses of macrolides (C1) 3. List the adverse effects of macrolides (C1) <p>E. Fluoroquinolones:</p> <ol style="list-style-type: none"> 1. List commonly used fluoroquinolones (C1) 2. List the uses of fluoroquinolones (C1) 3. List the adverse effects of fluoroquinolones (C1) <p>F. Antifungal agents:</p> <ol style="list-style-type: none"> 1. List azole antifungals. (C1) 2. List the uses of azoles. (C1) 3. List the adverse effects of azoles. (C1) <p>G. Antiviral drugs :</p> <ol style="list-style-type: none"> 1. List classes of anti-retroviral drugs (anti-HIV) with examples. (C1) 2. List the commonly used antiviral drugs with examples. (C1) 3. Explain the mechanism of action of acyclovir. (C1) 4. List the uses of acyclovir. (C1) 5. List the adverse effects of acyclovir. (C1) <p>H. Antitubercular drugs :</p> <ol style="list-style-type: none"> 1. Tell the classification of antitubercular drugs with examples. (C1) 2. Explain the mechanism of action of the following: isoniazid, rifampicin, pyrazinamide, ethambutol (C2) 3. List the adverse effects of the following: isoniazid, rifampicin, pyrazinamide, ethambutol. (C1) 4. Explain the pharmacological basis for short course chemotherapy. (C2) 5. List the drugs used for short course chemotherapy of pulmonary TB. (C1) <p>I. Antileprotic drugs :</p>	

Content	Competencies	Number of Hours
	<ol style="list-style-type: none"> 1. List antileprotic drugs. (C1) 2. List the drugs used for multidrug therapy (MDT) for paucibacillary and multibacillary leprosy. (C1) <p>J. Aminoglycosides:</p> <ol style="list-style-type: none"> 1. List aminoglycosides. (C1) 2. Mention the common features of aminoglycosides. (C1) 3. List the uses of aminoglycosides. (C1) 4. List the adverse effects of aminoglycosides. (C1) <p>K. Antiamoebic drugs:</p> <ol style="list-style-type: none"> 1. List antiamoebic drugs. (C1) 2. List the uses of nitroimidazoles. (C1) 3. List the adverse effects of nitroimidazoles. (C1) <p>L. Anthelmintics:</p> <ol style="list-style-type: none"> 1. List anthelmintic drugs. (C1) 2. List the uses of the following: albendazole, mebendazole and DEC. (C1) 3. List the adverse effects of the following: albendazole, mebendazole and DEC. (C1) <p>M. Anticancer drugs:</p> <ol style="list-style-type: none"> 1. Give examples for anticancer drugs. (C1) 2. List the general toxicities of anticancer agents.(C1) <p>N. Antimalarial drugs:</p> <ol style="list-style-type: none"> 1. List antimalarial drugs. (C1) 2. List the uses of chloroquine. (C1) 3. List the adverse effects of chloroquine. (C1) 	
Unit 9		
Hormones and related drugs	<p>A. Glucocorticoids:</p> <ol style="list-style-type: none"> 1. List glucocorticoids based on their duration of action. (C1) 2. Explain the anti-inflammatory and immunosuppressant actions of glucocorticoids.(C2) 3. List the therapeutic uses of glucocorticoids. (C1) 4. List the adverse effects of glucocorticoids. (C1) <p>B. Antidiabetic drugs:</p> <ol style="list-style-type: none"> 1. List insulin preparations based on their duration of action. (C1) 2. List the adverse effects of insulin. (C1) 3. Tell the classification of oral antidiabetic drugs based on their chemistry. (C1) 4. List the adverse effects of various classes of oral antidiabetic drugs. (C1) <p>C. Thyroid and anti-thyroid drugs:</p> <ol style="list-style-type: none"> 1. List the thyroid hormone preparations. (C1) 2. List the uses of thyroid hormone preparations.(C1) 3. List the anti-thyroid drugs acting at different steps of thyroid hormone synthesis. (C1) 4. List the uses of anti-thyroid drugs. (C1) 	2

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	45	90				
Seminar	-	-				
Small group discussion (SGD)	-	-				
Self-directed learning (SDL)	-	-				
Problem Based Learning (PBL)	-	-				
Case Based Learning (CBL)	-	-				
Clinic	-	-				
Practical	-	-				
Revision	-	-				
Assessment	-	-				
Total	45	90				
Assessment Methods:						
Formative: Nil			Summative:			
			Sessional I & Sessional II Exam (Theory)			
			End Semester Exam (Theory)			
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4		
Mid Semester / Sessional Examination 1	x	x	x	x		
Sessional Examination 2	x	x	x	x		
Quiz	x	x				
Unit Test	x	x	x	x		
End Semester Exam	x	x	x	x		
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	1. Essentials of Medical Pharmacology, K.D. Tripathi, Jaypee brothers medical publishers (P) Ltd., 8 th edition, 2018 2. Pharmacology for medical graduates, Tara Shanbag and Smita Shenoy, Elsevier Publications, 4 th edition, 2019					
Additional References	1. Principles of Pharmacology: H L Sharma and K. K Sharma, Paras Medical Publishers, 3 rd edition, 2017 2. Lippincott Illustrated Reviews: Pharmacology, Karen Whalen, Wolters Kluwer, 7 th edition, 2018					

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Clinical Psychology
Course Code	CPY2201
Academic Year	Second year
Semester	IV
Number of Credits	3
Course Prerequisite	Nil
Course Synopsis	<ol style="list-style-type: none"> 1. Orients and familiarises students towards the basic psychological processes 2. Enables the students to understand how psychological principles are applied in day to day life. 3. Introduce the students to the field of clinical psychology 4. Orients and familiarise them towards various psychological disorders and psychological interventions.

Course Outcomes (Cos):

At the end of the course student shall be able to:

CO1	Explain the basic concepts in Psychology. (C2)
CO2	Explain how the processes of perception , learning, memory , thinking and intelligence contributes to the uniqueness of the individual (C2)
CO3	Outline the role of motivation , emotion and personality in shaping human behaviour (C2)
CO4	Develop an understanding of normality and abnormality in clinical psychology (C3)
CO5	Outline the various signs and symptoms of psychiatric disorders (C2)
CO6	Explain the various psychological interventions for various mental health conditions (C2)

Mapping of Course Outcomes (Cos) to Program Outcomes (POs):

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x						x	
CO2						x	x	
CO3						x	x	
CO4	x							
CO5	x					x		
CO6	x					x		

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Introduction to Psychology	<ol style="list-style-type: none"> 1. Define Psychology(C1) 2. Outline the evolution of Psychology as a scientific 	3

Content	Competencies	Number of Hours
	discipline (C2) 3. Summarise the modern schools of Psychology 4. Enumerate the different branches of Psychology(C1) 5. What is Introspection? List the merits and demerits of introspection (C1) 6. Explain the importance of Experimental method in the field of Psychology(C2) 7. Explain the observation method in Psychology (C2)	
Unit 2:		
Perception	1. Define Perception (C1) 2. Describe the various principles of Perceptual groupings (C2) 3. Illustrate the Gestalt laws of perception (C2) 4. Define Perceptual constancy and explain its types(C2) 5. Explain Monocular and Binocular cues in Perception (C2) 7. Explain types of motion perception (C2)	3
Unit 3:		
Learning	1. Define Learning (C1) 2. Explain Pavlov's Classical Conditioning(C2) 3. Summarize the various processes of Classical Conditioning with examples (C2) 4. Explain the applications of Classical Conditioning(C2) 5. What is Operant Conditioning (C1) 6. Compare the types of reinforcement and Punishment(C2) 7. Explain with the examples the schedules of Reinforcement (C2) 8. Explain the applications of Operant Conditioning(C2) 8. Explain observation learning with its classic experiment (C2) 9. Illustrate the processes in observation learning (C2)	3
Unit 4:		
Memory	1. Define Memory (C1) 2. List the processes that underlie memory (C1) 3. Explain the characteristics of different types of memory(C2) (sensory, STM, LTM) 4. Summarise the different theories of forgetting (C2) (Decay, motivated forgetting, interference, cue dependant displacement) 5. List the various strategies to improve memory (C1)	3
Unit-5:		
Thinking & Problem solving	1. Define thinking (C1) 2. How thoughts are represented (C1) 3. Define concepts(C1)	2

Content	Competencies	Number of Hours
	<ol style="list-style-type: none"> 4. Compare the different types of concept (C2) 5. Enumerate the steps in creative thinking (C1) 6. List the steps involved in problem solving (C1) 7. What are the different strategies used to solve problems (C1) (Trial & error, Heuristics, Algorithm) 	
Unit-6:		
Intelligence	<ol style="list-style-type: none"> 1. Define Intelligence (C1) 2. Summarise the various theories of Intelligence (C2) (Two factor, Crystallised and Fluid, Multiple intelligence) 3. List the different types of Intelligence tests (C1) 4. Define Emotional Intelligence (C1) 5. What are the different components of emotional intelligence? (C1) 	3
Unit-7:		
Motivation & Conflict	<ol style="list-style-type: none"> 1. Define Motivation (C1) 2. Summarize the biological theories of Motivation (C2) (Drive reduction theory, Optimal arousal theory, Instinct theory) 3. Explain the Psychological theories of Motivation (C2) (Maslow's hierarchy theory) 4. Define Conflict (C1) 5. Explain the types of Conflict with examples (C2) (Approach- Approach conflict, Avoidance-Avoidance conflict, Approach- Avoidance conflict and Double Approach- Avoidance conflict) 6. Summarise the different ways to handle conflict (C2)(Task and defense oriented) 	3
Unit-8:		
Emotion	<ol style="list-style-type: none"> 1. Define Emotion (C1) 2. List the characteristics of Emotion (C1) 3. Explain the various theories of Emotion (C2)(James-Lange, Cannon- Bard, Schachter- Singer) 	2
Unit-9:		
Personality	<ol style="list-style-type: none"> 1. Define Personality(C1) 2. Explain the Psychodynamic theory of Personality (C2) 3. Explain the trait approach towards Personality (C2) 4. Summarize Rogers' humanistic approach in understanding Personality (C2) 5. Enumerate the various assessment methods in studying Personality (C1) 	4
Unit-10:		
Introduction to Clinical Psychology	<ol style="list-style-type: none"> 1. Define clinical Psychology (C1) 2. Outline the scope of clinical psychology (C2) 3. Explain the methods in clinical psychology (C2) (case history, observation, survey and interview) 4. Explain the concept of normality and abnormality 	2

Content	Competencies	Number of Hours
	(C2) 5. Identify the differences between various models of mental disorders (C3) (biological, psychodynamic, learning, cognitive, social cultural)	
Unit-11:		
Psychiatric disorders: an overview	<ol style="list-style-type: none"> 1. Compare mental disorders based on DSM V & ICD 10 classificatory systems. (C2) 2. Compare DSM V & ICD 10 classificatory systems. (C2) 3. Outline various psychotic disorders (C2) (Schizophrenia and delusional disorders) 4. Summarise mood disorders (C2) (Depression, Mania and Bipolar disorders) 5. Summarise various substance use Disorder (C2) (Intoxication, Abuse, harmful use and Dependence) 6. Outline the various psychoactive substances and it corresponding symptoms (C2) 7. Outline the various anxiety disorders (C2) (GAD, SAD, OCD, Phobias and Panic disorder) 8. Identify the difference between fear and anxiety (C3) 9. Outline the various personality disorders based on ICD 10 (C2) 10. Outline the various child hood behavioural disorders (C2) (ADHD, CD, ODD, MR, Autism, SLD) 	7
Unit-12:		
An overview of psychological interventions	<ol style="list-style-type: none"> 1. Define counselling (C1) 2. Outline various types of counselling (C2) 3. Explain the theoretical framework of behaviour therapy (C2) 4. Explain the various behaviour therapy techniques (C2) (Shaping, chaining, time-out, token economy, desensitisation and aversive techniques) 5. What is psychodynamic psychotherapy (C1) 6. Outline the various concepts in psychodynamic psychotherapy (C2) (Free association, Dream analysis, transference and counter transference) 7. Outline various principles of supportive therapy (C2) 8. Define crisis (C1) 9. List the steps in crisis intervention (C1) 	4

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	39	-
Seminar	-	-
Small group discussion (SGD)	-	-
Self-directed learning (SDL)	-	-
Problem Based Learning (PBL)	-	-

Case Based Learning (CBL)	-	-				
Clinic	-	-				
Practical	-	-				
Revision	-	-				
Assessment	-	-				
Total	39	117				
Assessment Methods:						
Formative:			Summative:			
Nil			Mid Semester/Sessional Exam (Theory)			
Nil			End semester exam (Theory)			
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester/Sessional examination	x	x				
End semester examination	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	<ol style="list-style-type: none"> Baron, R. A., Byrne, D., & Mankowitz, B. H. (1977). <i>Psychology: Understanding behaviour</i>. Philadelphia: W.B. Saunders Co. Feldman, R. S. (1993). <i>Understanding psychology</i>. New York: McGraw-Hill. Korchin, S.J. (2004) <i>Modern Clinical Psychology</i>. New Delhi: CBS Publishers & Distributors Ahuja, N. (2011) <i>A Short Textbook Of Psychiatry</i>. New Delhi: Jaypee Brothers Medical Publishers 					
Additional References	<ol style="list-style-type: none"> Myers, D. G. (2005). <i>Exploring psychology</i>. New York, NY: Worth Publishers. 					

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Biostatistics and Research Methodology
Course Code	BST3201
Academic Year	Second Year
Semester	IV
Number of Credits	3
Course Prerequisite	Nil
Course Synopsis	1. To provide necessary foundation on <ul style="list-style-type: none"> • Introductory level biostatistics • Demography, vital statistics and epidemiology • Survey sampling methods • Fertility, morbidity, and mortality indices 2. To introduce the steps involved in research process

Course Outcomes (COs):

At the end of the course student shall be able to:

CO1	Explain characteristics of statistical data, types of variables, scales of measurement, presentation of data, normal distribution. (C2)
CO2	Apply measures of location and variation for statistical data (C3)
CO3	Outline the sources of demographic data and vital statistics, merits and demerits of probability and non-probability sampling techniques. (C2)
CO4	Explain the indices of fertility, morbidity and mortality, Epidemiology, observational study designs (C2)
CO5	Explain the concept of correlation and regression. (C2)
CO6	Summarize the steps involved in a research process (C2)

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x							
CO2	x							
CO3	x							
CO4		x						
CO5	x							
CO6	x							

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Introduction to Biostatistics	<ul style="list-style-type: none"> • Define biostatistics (C1) • Describe the characteristics of statistical data (C2) • Explain the role of statistics in health sciences (C2) 	2

Content	Competencies	Number of Hours
Variables	<ul style="list-style-type: none"> • Distinguish between qualitative & quantitative with appropriate examples (C2) • Distinguish between continuous & discrete variables with appropriate examples (C2) • Distinguish between nominal & ordinal variables with appropriate examples (C2) 	4
Scales of Measurement	<ul style="list-style-type: none"> • Describe nominal scale of measurement of variables with appropriate examples (C2) • Describe ordinal scale of measurement of variables with appropriate examples (C2) • Describe interval scale of measurement of variables with appropriate examples (C2) • Describe ratio scale of measurement of variables with appropriate examples (C2) 	4
Unit 2:		
Tabular presentation of data	<ul style="list-style-type: none"> • Describe the three types of class intervals – inclusive, exclusive and open ended (C2) • Explain the concepts of relative and cumulative frequencies (C2) • Construct the frequency table (C3) 	2
Graphical presentation of data	<ul style="list-style-type: none"> • Explain the concepts of Histogram, Frequency Polygon, Frequency Curve (C2) • Construct Histogram, Frequency Polygon, Frequency Curve for statistical data (C3) 	2
Diagrammatic presentation of data	<ul style="list-style-type: none"> • Explain the concepts of Bar diagram and Pie diagram (C2) • Construct Bar diagram and Pie diagram for statistical data (C3) 	2
Unit 3:		
Measures of Location	<ul style="list-style-type: none"> • Explain the concepts of Mean, Median, Mode (C2) • Explain the concepts of Quartiles and Percentiles (C2) 	2
Unit 4:		
Measures of Variation	Describe the concepts of Range, Inter-quartile range, Variance, Standard deviation and Coefficient of variation (C2)	2
Unit 5:		
Sampling	<ul style="list-style-type: none"> • Explain sampling and non-sampling error (C2) • Define and distinguish probability and non-probability sampling methods (C1) • Explain each sampling technique by stating their merits and demerits (C2) 	4
Unit 6:		
Normal Distribution	<ul style="list-style-type: none"> • Explain the characteristics of normal distribution (C2) • Compute the area under the normal distribution curve (C3) 	2

Content	Competencies	Number of Hours
Skewness and Kurtosis	<ul style="list-style-type: none"> • Explain the concept of skewness and describe three types of skewness (C2) • Explain the concept of kurtosis and describe three types of kurtosis (C2) 	2
Unit 7:		
Correlation	<ul style="list-style-type: none"> • Define correlation (C2) • Explain positive and negative correlation with appropriate examples (C2) • Explain the Pearson's correlation coefficient and outline its properties (C2) • Explain the Spearman's correlation coefficient and outline its properties (C2) • Illustrate using scatter plot the different types of correlation (C3) 	2
Regression	<ul style="list-style-type: none"> • Distinguish between dependent and independent variables. (C2) • Explain the simple linear regression model along with the assumptions involved. (C2) • Identify the slope and intercept coefficient from the model. (C2) • Predict the dependent variable from the model for a given set of independent variables. (C3) 	2
Unit 8:		
Demography and Vital statistics	<ul style="list-style-type: none"> • Define Demography and Vital statistics (C1) • What are the sources of demographic data and vital statistics (C1) • Define and distinguish rate, ratio and proportion (C1) 	2
Morbidity, mortality and fertility rates	<ul style="list-style-type: none"> • Explain prevalence and incidence (C2) • Explain each measure of morbidity, mortality and fertility rates by stating the formula (C2) 	4
Unit 9:		
Research	<ul style="list-style-type: none"> • Explain sampling and non-sampling error (C2) • Define and distinguish probability and non-probability sampling methods (C1) • Explain each sampling technique by stating their merits and demerits (C2) 	3
Unit 10:		
Epidemiology	<ul style="list-style-type: none"> • Define Epidemiology (C1) • Explain the observational study designs (case report, case series, cross-sectional, ecological) (C2) 	4

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	45	135				
Seminar	-	-				
Small group discussion (SGD)	-	-				
Self-directed learning (SDL)	-	-				
Problem Based Learning (PBL)	-	-				
Case Based Learning (CBL)	-	-				
Clinic	-	-				
Practical	-	-				
Revision	-	-				
Assessment	-	-				
Total	45	135				
Assessment Methods:						
Formative:			Summative:			
Unit Test			Mid Semester/Sessional Exam II (Theory)			
End Semester Exam (Theory)						
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester Examination 1	x	x				
End Semester Exam	x	x	x	x	x	X
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	<ol style="list-style-type: none"> 1. Lwanga SK, Tye CY, Ayeni O. Teaching health statistics: lesson and seminar outlines. World Health Organization, Marketing and Dissemination, 1211 Geneva 27, Switzerland; 1999. 2. Health research methodology: a guide for training in research methods. World Health Organization; 2001. 3. Bonita R, Beaglehole R, Kjellström T. Basic epidemiology. World Health Organization; 2006. 4. Campbell MJ, Swinscow TD. Statistics at square one. John Wiley & Sons; 2011. 					
Additional References	<ol style="list-style-type: none"> 1. Degu G, Tessema F. Biostatistics [Internet]. Gondor: University of Gondar; January 2005. Available from: http://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/ln_biostat_hss_final.pdf 2. Kebede Y. Epidemiology [Internet]. Gondor: University of Gondar; 2004. Available from: http://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/env_occupational_health_students/Epidemiology.pdf 					

	<ol style="list-style-type: none">3. Degu G, Yigzaw T. Research Methodology [Internet]. Gondar: University of Gondar; 2006. Available from: http://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/ln_research_method_final.pdf8. Morris JN. Uses of epidemiology. Edinburgh, UK: Churchill Livingstone; 1975.9. Campbell MJ, Machin D, Walters SJ. Medical statistics: a textbook for the health sciences. John Wiley & Sons; 2010.10. Rao PS, Richard J. An Introduction to Biostatistics: A manual for students in health sciences. Prentice/Hall of India; 1996.11. Mahajan BK, Khanal AB. Methods in biostatistics: for medical students and research workers. Jaypee Brothers Medical Publishers; 2010.
--	---

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Cardiac Pacemaker and Defibrillators
Course Code	CVT2201
Academic Year	Second Year
Semester	IV
Number of Credits	3
Course Prerequisite	Basic knowledge about cardiac conduction system and its abnormalities
Course Synopsis	<ol style="list-style-type: none"> 1. This course builds Knowledge in understanding the working principle and functioning of cardiac pacemakers. 2. To analyse the post procedural programming and functioning of cardiac pacemakers on long term follow ups 3. To develop the knowledge on importance and functioning of cardiac devices like ICDs and CRTs

Course Outcomes (COs):

At the end of the course student shall be able to: Identify and Assess

CO1	Explains the basic electrical concepts and pacing physics in cardiac pacemakers (C2)
CO2	To construct the various techniques in different pacing nomenclatures and identifying various pacemakers(C3)
CO3	To develop the knowledge on indications, equipment and lead system and procedure in temporary pacemakers (C3)
CO4	To Identify and assess the complications of pacemakers during procedure and post implant follow ups and take necessary steps in programming (C5)
CO5	To determine patient selection, preparation and procedure of permanent pacemaker implants in single and dual chambers (C5)
CO6	To build and distinguish the various types of implantable cardiac devices like ICDs and CRTs (C4)

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x	X						
CO2		X				x		
CO3		X				x		
CO4						x	x	
CO5			x		x			
CO6		X					x	

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Basic concepts of pacemaker	<ol style="list-style-type: none"> 1. To interpret the Basic electrophysiology (C2) 2. To explain Strength–duration relation (C2) 3. To understand Intra cardiac electrograms (C2) 	5

Content	Competencies	Number of Hours
	4.To define Electrical aspects of pacing (C2) 5.To make use of Pacing Nomenclature and various modes (C3)	
Unit 2:		
Pacing physics	1.To explain the Power source (C2) 2.To understand the Connections (C2) 3.To outline the Ohms law applications 4.To identify PG circuits (C3)	4
Unit 3:		
Temporary pacemakers	1.To summarise the Indication (C2) 2.To identify the Components (C3) 3.To relate and understand the Procedures (C3) 4.to Explain the Pacing methods (C2)) 5.To outline the Lead testing (C2) 6.To construct skills in Trouble shooting (C3) 7. To understand the Complications (C2)	5
Unit 4:		
Permanent pacemaker	1.To understand the Cardiac hemodynamics (C2) 2.To Examine the Basic components (C4) 3.To illustrate the Classifications NBG coding (C3) 4. Explain the Indications (C2) 5.To apply the knowledge in Physiology of cardiac pacing (C3) 6.To understand the Lead thresholds (C2) 7.To assess the Factors affecting threshold (C3)	5
Unit 5:		
Single chamber pacemaker	1.To explain the Pacemaker implantation procedure (C3) 2.To Understand Lead testing (C2) 3.Build Knowledge in Procedures and Programming parameters (C3) 4.Explain Pacemaker timing cycle and intervals (C2) 5.To illustrate the Base-rate behaviour and upper rate -behaviour (C2) 6.To understand the Magnet function (C3)	4
Unit 6:		
Dual chamber pacemaker	1.Explain the Time circuits (C2) 2.understanding the programming Parameters (C2) 3.Outline the Functioning (C2) 4.To Identify the Rate adaptive pacemakers (C3) 5.Explain the Sensors in RAP(C3) 6.Identify the role of Hysteresis (C3)	4
Unit 7:		
Cardiac Resynchronization Therapy (Biventricular pacing)	1.To outline the Indications (C3) 2.To apply the knowledge in understanding Functioning (C3) 3.To Explain the (C3)	3

Content	Competencies	Number of Hours
Unit 8:		
Pacemaker problems	1. To analyse the Acute and chronic complications (C4) 2. To test for Malfunctioning (C4) 3. To choose Pre-operative patients (C5) 4. To understand the EMI in hospitals (C2) 5. To Understand Environmental EMI (C2) 6. To Apply Minimizing ventricular pacing (MVP) (C3)	4
Unit 10:		
Implantable cardioverter Defibrillators	1. To illustrate Sudden cardiac death (C2) 2. To outline Indications (C2) 3. Outline the Contraindications (C2) 4. To Utilize the System components and functions (C3) 5. To apply knowledge in Implantation and testing procedures (C3) 6. To Relate Devise programming for arrhythmia recognition (C2) 7. To Explain Devise therapy (C2) 8. Explain the Magnet function (C2) 9. To Plan Management and follow-up (C3)	5

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	20	40
Seminar	4	8
Small group discussion (SGD)	-	-
Self-directed learning (SDL)	8	16
Problem Based Learning (PBL)	-	-
Case Based Learning (CBL)	3	6
Clinic	-	-
Practical	-	-
Revision	2	4
Assessment	2	4
Total	39	78
Assessment Methods:		
Formative:	Summative:	
Unit Test	Mid Semester/Sessional Exam	
Quiz	-	
Viva	-	
Assignments/Presentations	Record Book, Work dairy	
Clinical assessment (OSCE, OSPE, WBPA)	OSCE	
Clinical/Practical Log Book/ Record Book	Clinical Record book	

Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x	x	x			
Sessional Examination 2				x	x	
Quiz / Viva						x
Assignments/Presentations			x			
Clinical/Practical Log Book/ Record Book			x			
Any others: WPBA		x	x			
End Semester Exam	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	Cardiac pacing and ICD's - Kenneth A. Ellenbogen Cardiovascular medicine – Griffins					
Additional References	Text book of Interventional Cardiology by Eric J Topol Braunwald's heart disease- A textbook of cardiovascular medicine					

Manipal College of Health Professions								
Name of the Department	Cardiovascular Technology (CVT)							
Name of the Program	Bachelor of Science in Cardiovascular Technology							
Course Title	Congenital Heart Diseases I							
Course Code	CVT2202							
Academic Year	Second Year							
Semester	IV							
Number of Credits	3							
Course Prerequisite	Basic knowledge on cardiac anatomy, embryology and cardiac hemodynamic,							
Course Synopsis	1. This course elucidates the Acyanotic congenital heart diseases 2. This course will make students to understand the pathophysiology and clinical presentation of all the acyanotic congenital heart disease 3. This course allows students to understand the diagnostic methods involved in the diagnosis and management of acyanotic congenital heart disease 4. This course enables the students in understanding the Chest X-Ray theory and interpretation							
Course Outcomes (COs):								
At the end of the course student shall be able to:								
CO1	Understanding the cardiac embryology, anatomic orientation and possible malposition (C3)							
CO2	Understanding brief embryology, anatomic classification, pathophysiology, clinical presentation, Diagnosis and management of pre tricuspid shunt lesions (C3)							
CO3	Understanding brief embryology, anatomic classification, pathophysiology, clinical presentation, Diagnosis and management of post tricuspid shunt lesions(C3)							
CO4	Explaining the brief embryology, anatomic classification, pathophysiology, clinical presentation, Diagnosis and management of Anomalous pulmonary venous connection(C3)							
CO5	Discussing brief embryology, anatomic classification, pathophysiology, clinical presentation, Diagnosis and management of Left ventricular inflow and outflow anomalies (C3)							
CO6	Discussing brief embryology, anatomic classification, pathophysiology, clinical presentation, Diagnosis and management of Right ventricular inflow and outflow anomalies (C3)							
CO7	Discussing brief embryology, anatomic classification, pathophysiology, clinical presentation, Diagnosis and management of Coarctation of aorta (C3)							
CO8	Understanding the basic theory of chest X-Ray and interpretation of various cardiac diseases by chest X-ray(C3)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x					x		
CO2	x			x				
CO3		x			x			
CO4		x				x		

CO5		X			X		
CO6		X			X		
CO7		X			X		
CO8		X				X	

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Cardiac malposition	• Understanding normal and abnormal visceral and cardiac situs (C3)	1
	• To know the association between cardiac malposition and possible congenital heart disease (C1)	1
Unit 2:		
Atrial Septal defect (ASD)	• To know the prevalence and types(C1) • Explaining the embryology, classification and pathophysiology(C1)	1
	• Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3)	1
	• To understand the natural history, prognosis and management(C3)	1
Unit 3:		
Ventricular Septal Defect (VSD)	• To know the prevalence and types(C1) • Explaining the embryology, classification and pathophysiology(C1)	1
	• Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3)	1
	• To understand the natural history, prognosis and management(C3)	1
Unit 4		
Patent Ductus Arteriosus(PDA)	• To know the prevalence and types(C1) • Explaining the embryology, classification and pathophysiology(C1) • Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3) • To understand the natural history, prognosis and management(C3)	2
Unit 5		
Total anomalous pulmonary venous connection (TAPVC)	• To know the prevalence and types(C1) • Explaining the embryology, classification (supra cardiac, intracardiac, infracardiac, mixed type; Obstructive/non obstructive type) and pathophysiology(C1)	2
	• Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath	1

Content	Competencies	Number of Hours
	findings(C3) • To understand the natural history, prognosis and management(C3)	
Unit 6		
Partial anomalous pulmonary venous connection (PAPVC)	• To know the prevalence and types(C1) • Explaining the embryology, classification and pathophysiology(C1)	1
	• Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3)	1
	• To understand the natural history, prognosis and management(C3)	1
Unit 7		
Ebsteins anomaly	• To know the prevalence and types(C1) • Explaining the embryology, classification, GOSE score and pathophysiology(C1)	1
	• Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3)	1
	• To understand the natural history, prognosis and management(C3)	1
Unit 8		
Atrio-ventricular canal defect (AVCD)	• To know the prevalence and types(C1) • Explaining the embryology, classification (Partial, intermediate, transitional, complete AVCD) and pathophysiology(C1)	1
	• Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3)	1
	• To understand the natural history, prognosis and management(C3)	1
Unit 9		
Aorto pulmonary Window (AP window)	• To know the prevalence and types(C1) • Explaining the embryology, classification and pathophysiology(C1)	1
	• Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3)	1
	• To understand the natural history, prognosis and management(C3)	1
Unit 10		
Co-arctation of Aorta(CoA)	To know the prevalence and types(C1)	1
	• Explaining the embryology, classification and pathophysiology(C1)	
	• Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3)	1

Content	Competencies	Number of Hours
	<ul style="list-style-type: none"> To understand the natural history, prognosis and management(C3) 	1
Unit 11		
Left ventricular inflow obstruction	<ul style="list-style-type: none"> To know brief anatomy, embryology, classification, clinical presentation, diagnosis and management of Cor triatriatum (C2) 	1
	<ul style="list-style-type: none"> To know brief anatomy, embryology, classification, clinical presentation, diagnosis and management of Supra valvular mitral annular ring (C2) To know brief anatomy, embryology, classification, clinical presentation, diagnosis and management of Parachute mitral valve (C2) 	1
Unit 12		
Anomalous left coronary artery from pulmonary artery(ALCAPA)	<ul style="list-style-type: none"> To know the prevalence(C1) Explaining the embryology and pathophysiology(C1) 	1
	<ul style="list-style-type: none"> Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3) 	1
	<ul style="list-style-type: none"> To understand the natural history, prognosis and management(C3) 	1
Unit 13		
Congenital semilunar valve stenosis	<ul style="list-style-type: none"> To understand prevalence, pathophysiology, classification, diagnosis and management of Congenital aortic stenosis(AS) -Supra valvular AS -Valvular AS -Sub valvular AS (C3) 	1
	<ul style="list-style-type: none"> To understand prevalence, pathophysiology, classification, diagnosis and management of Congenital pulmonary stenosis(PS) -Supra valvular PS -Valvular PS -Sub valvular PS (C3) 	1
Unit 15		
Chest X-ray	<ul style="list-style-type: none"> Understanding the standard approach to chest x-ray (C3) -Projection -Rotation -Exposure -Inspiration film 	1
	<ul style="list-style-type: none"> To understand the pulmonary arterial flow and venous flow (C3) -Pulmonary plethora -Pulmonary Oligemia -Grades of pulmonary venous hypertension 	1
	<ul style="list-style-type: none"> Interpretation of Cardiac chamber 	1

Content	Competencies	Number of Hours
	enlargement(C3) -Right atrial enlargement -Left atrial enlargement -Right ventricular enlargement -Left ventricular enlargement -Cardiomegaly in DCM Cardiomegaly in pericardial effusion	
	Interpreting Chest X-ray in heart diseases (C3) Interpretation of Xray in congenital, valvular heart diseases and cardiomyopathies	1

Learning Strategies, Contact Hours and Student Learning Time (SLT):

Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	28	56
Seminar	5	10
Small group discussion (SGD)	-	-
Self-directed learning (SDL)	-	-
Problem Based Learning (PBL)	-	-
Case Based Learning (CBL)	-	-
Clinic	-	-
Practical	-	-
Revision	3	6
Assessment	3	6
Total	39	78

Assessment Methods:

Formative:	Summative:
Unit Test	Mid Semester (Theory)
Quiz	Quiz
Viva	-
Assignments/Presentations	Assignments and presentations
Clinical assessment (OSCE, OSPE, WBPA)	-
Clinical/Practical Log Book/ Record Book	Record book

Mapping of Assessment with COs:

Nature of assessment	CO1	CO2	CO3	CO4	CO5	CO6	CO7	CO8
Mid semester / sessional examination 1	x	x	x	x	x			
Sessional examination 2								
Quiz / viva						x	x	x
Assignments/presentations						x	x	x
Clinical/practical log book/ record book								
End semester exam	x	x	x	x	x	x	x	x

Feedback Process:	Mid-Semester Feedback
	End-Semester Feedback
Main Reference:	Latest edition of Moss and Adams' Heart disease in Infants, Children and Adolescents including the Fetus and Young Adult Park's Pediatric cardiology for practitioners- Myung D Park
Additional References	Perloff's Clinical recognition of congenital heart disease: Joseph K. Perloff, Ariane J. Marelli

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Clinics - IV
Course Code	CVT2231
Academic Year	Second Year
Semester	IV
Number of Credits	2
Course Prerequisite	Basic knowledge in cardiac diagnostic tests
Course Synopsis	1. Able to obtain basic echocardiographic views as per the guidelines. 2. To apply the knowledge in identifying basic cardiac Hardwares, its utility and understanding the steps in cardiac Procedures 4.To apply and follow basic aseptic precautions before performing any clinical procedures.

Course Outcomes (COs):

At the end of the course student shall be able to:

CO1	To understand and individually obtain basic echocardiographic views (C1, P4)
CO2	To explain the structures in respective echocardiographic views for any given valvar/ ischemic/ congenital disease (C2,P5)
CO3	To build up knowledge in selecting appropriate Hardwares for respective cardiac procedures (C3,P3)
CO4	Ability to identify the structural and functional abnormalities and grade them by various echocardiographic methods (C5,P5)
CO5	To compare the normal cardiac structures with diseased conditions in respective views and grade its severity (C4,P6)
CO6	To select the desired cardiac hard wares and explain the advantages and disadvantages (C5,P6)

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1		X		X				
CO2		X			X			
CO3	X	X						
CO4		X				X		
CO5				X		X		
CO6		X			X			

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
ECG	1. Should list the basic steps in interpretation of any given ECG (P3) 2. Able to comment on the management strategy of abnormal ECGs (P4)	10

Content	Competencies	Number of Hours
	3. Should be aware of technical errors and apply technical skills to overcome them (P4) 4. Able to correlate ECG with the clinical presentation (P4) 5. Should assess the severity of arrhythmias and timely management (P4)	
Unit 2:		
TMT	1. Should know the standard protocol of performing TMT and use of emergency drugs (P5) 2. To clinically correlate patient's symptoms, history with ECG (P4) 3. To analyse the test results and compare it with the baseline findings (P4) 4. To build knowledge in TMT interpretation and discuss on the management (P4) 4. Should develop technical skills in patient rescue during emergency (P6)	8
Unit 3:		
Ambulatory ECG monitoring	1. Should know to utilize different methods of lead placement in recording ECG (P4, A2) 2. Able to analyse and interpret stored ECG data (P4, A2) 3. To build knowledge in identifying serious arrhythmias and look for treatment options (P4, A3)	4
Unit 4:		
Basics of Echocardiography	1. To apply the learnt principles of echocardiography during clinical practice (A3, P4) 2. To build knowledge about ethics and minimize the ethical issues (A1, P2) 3. Should be able to perform routine echocardiography independently (A3, P5) 4. Should choose appropriate 2D echo views to visualize LV segments and identify wall motion abnormality (P5, A3) 5. Should interpret the Doppler studies with newer methods (A3, P5)	25
Unit 5:		
Pacemaker analysis	1. Should classify the type of pacemaker based on the ECG recording (P2, A2) 2. Able to assess the parameters and their importance during analysis (P4, A2) 3. To perform pacemaker analysis individually based on the mode implanted (P5, A3) 4. To add findings based on analysis, history and a frame a new diagnosis (P6, A3) 5. to diagnose pacemaker related problems and finding an appropriate solution (P7, A3)	8
Unit 6:		
Basic catheterization	1. To apply basic principles of X-ray during catheterization procedures (A1, P1)	23

Content	Competencies	Number of Hours
	2. Should know the purpose of hard wares during routine cardiac procedures (P3, A2) 3. To observe and know the functioning and mechanism of the hard wares and other equipments (P3, A3) 4. Should be able to explain step wise approach to any given procedure (P5, A3) 5. Perform assigned tasks independently (P5, A3) 6. Should build knowledge in working principle of equipments and apply during clinical procedures (P7, A4)	

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	--	--
Seminar	--	--
Small group discussion (SGD)	10	30
Self-directed learning (SDL)	10	60
Problem Based Learning (PBL)	10	30
Case Based Learning (CBL)	20	50
Clinic	25	120
Practical	--	--
Revision	--	--
Assessment	3	10
Total	78	156

Assessment Methods:	
Formative:	Summative:
Unit Test	--
Quiz	--
Viva	Viva
Assignments/Presentations	Record Book
Clinical assessment (OSCE, OSPE, WBPA)	WBPA
Clinical/Practical Log Book/ Record Book	Clinical record book, Case presentation

Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1						
Sessional Examination 2						
Quiz / Viva	x	x				
Assignments/Presentations	x	x	x	x	x	x

Clinical/Practical Log Book/ Record Book		x	x	x	x	x
Any others: WPBA		x	x		x	x
End Semester Exam						
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	1. Congenital heart disease: 1. Myung Park 2. J K Perloff 3. Moss and Adam 2. Valvar heart disease: Echocardiography: 1. Harvey Feigenbaum 2. Arthur Weyman 3. Gee K Oh Tajik 4. Ottos 3. Cardiac catheterization: 1. William Grossman 2. Eric Topols 3. Morten B Kern					
Additional References	1. Cardiac stress testing: Cardio vascular medicine 2. Electrocardiography: Leo Schamroth 2. Mervin Goldman 3. Marriott's Practical Electrocardiography					

Manipal College of Health Professions								
Name of the Department	Cardiovascular Technology (CVT)							
Name of the Program	Bachelor of Science in Cardiovascular Technology							
Course Title	Cardiac Interventional Hardwares							
Course Code	CVT2241							
Academic Year	Second Year							
Semester	IV							
Number of Credits	3							
Course Prerequisite	Basic knowledge of anatomy, physiology and concepts of ECG							
Course Synopsis	<p>1. This module helps to obtain the basic knowledge about various cardiac interventional catheter design and importance of hard wares. In the process of learning, it may be useful to understand the importance of catheter use and their properties.</p> <p>2.To provide fundamental knowledge in route of access, clinical applications, utilization and able to explain their complications.</p> <p>3.Understand and build the knowledge about the complication and method of technique.</p>							
Course Outcomes (COs):								
At the end of the course student shall be able to: summarize and recall								
CO1	To understand and build the knowledge about basic in cardiac interventional catheters and hard wares (C3)							
CO2	To explain characteristics of commonly used catheters, stents, various interventional catheters and their uses (C2)							
CO3	To explain technique ,route of access used in catheter insertion (C2)							
CO4	To identify various types of catheters, and their uses ,designs, properties and complications (C3)							
CO5	To identify various types of stents and able to explain stent designs ,properties, uses and complications (C3)							
CO6	Able to distinguish and identify types of interventional catheters and hard wares (C4)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x	x						
CO2	x	x						
CO3		x					x	
CO4		x					x	
CO5		x					x	
CO6		x					x	

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Introduction to Cardiac Cath	To understand basic knowledge about cardiac cath and approach to cath (C2)	1
X-ray theory	To define electric and electromagnetic energy (C1) To define and explain electromagnetic radiation(C2) To define and explain quantum theory and X-ray photons (C1,C2) To explain the features and properties of X-ray tube (C2) To understand and able to explain X-ray production (C2) To understand the characteristic of radiation (C2) To understand the importance of radiation dose and exposure (C4)	2
Vascular access route and access hard wares	<u>Arterial</u> 1)To understand and name the various vascular approach such as Axillary, Brachial, Femoral, radial, subclavian and trans lumbar access route(C2) <u>Venous -</u> 2)To understand and name the venous access route such as Brachial, Femoral, Intrajugular, Subclavian (C2)	2
Introduction to Diagnostic and Interventional Hardwares	1)Diagnostic hardwares -To explain the design and properties of introducer set (C2) -To identify and explain the characteristics and properties, structure of diagnostic catheter (C3) -Able to identify wires and accessories (C3)	3
	2) Interventional hard wares - To list and explain the properties, design and uses of guiding catheters (C2) -To list and explain the properties, designs and uses of guide wires (C2) - To list and explain the design and properties of drug balloons and balloons Stent system such as bare metal stent (C2) -To list and identify drug eluting stent and their properties, uses.(C1,C3)	3
Unit 2:		
Catheters	1) Able to explain the Catheter Design-French unit, Internal and external diameter, catheter length. (C2) 2) Able to explain the design and properties, uses of Introducer set(C2)	1
Right heart catheters	1) Able to explain the Types, design, site, complications, and properties of right heart catheters (C2) 2) Able to List the names of right heart catheters and explain their designs, properties such as Gensini, NIH, Lehman ventriculography, Grollman catheter, Pigtail catheter, Sones catheter, cournand catheters, Berman	3

Content	Competencies	Number of Hours
	angiographic catheters, swan ganz catheters etc (C2) 3) List the Catheters used in oxymetry, Pressure recording (C1) 4) List the types and explain the properties, designs and uses of Balloon tip flotation and Non flotation catheters (C2)	
Left heart catheters	1)To identify the Types and explain the design complications of left heart catheters. (C2,C3) 2)To understand the basic approach to vascular access route such as Femoral brachial radial, Direct TTLV puncture, Transeptal puncture (C2) 3)To list and explain the properties and uses of Femoral catheters such as Judkins, Amplatzer, Multipurpose, Schoomaker, EIGumal, IMA, Veingarft catheters. (C1,C2) 4)To list and explain the properties ,uses and complications of Brachial/Radial catheters such as Sones, Amplatzer, Castillo, IMA (C1,C2)	3
Unit 3:		
Guidewires	1)To identify and able to explain Commonly used guidewires and their designs (length and width) Building blocks-Core diameter, core tapper, core material, core tip style, coils and covers, coatings.(C2,C3) 2)To explain the Method of puncture (C2) 3)To understand and explain the Materials which is used in guidewire design such as Teflon, heparin coated (C2) 4)To understand the clinical characteristics such as Flexibility, support, steering (Torque, tip shaping) lubricity, tracking, tendency to prolapse, visibility, tactile feedback (C2)	3
Unit 4:		
Interventional catheters	1) To build the basic knowledge about the designs, properties, uses and complications of interventional catheters. (C3) 2) Able to explain the Materials used in interventional catheters such as Dacron, Polyethylene, Teflon, PVC Curve shaped, Flexibility, Memory, Catheter tip, End and side holes, catheter hub (C2)	2
Pacing catheters	1) List the Types of Unipolar/Bipolar Balloon flotation catheters (C1) 2) To explain the design properties, uses of pacing catheters, Zucker pacing catheters, EP catheters, The chamber catheters, The CS catheters, and Others-the Lasso, The Halo catheters etc.(C2) 3) Able to distinguish between unipolar and bipolar pacing catheters.(C4)	2
PTCA Hard wares	1) To understand the Three basic components of Guiding catheters (leading guidewires, Non elastomeric	3

Content	Competencies	Number of Hours
	balloon, Dilator catheters) (C2) 2) Able to explain the Guiding catheters construction and design and complications. (C2) 3) To explain the properties of Balloon dilatation catheters-size and preparation (C2)	
Unit 5		
Stents- Stent design	1) To explain the Composition of (stainless steal, titanium, nitinol) Architecture-(slotted tube, coiled wires)Mode of implantation-(Self/balloon expandable), Designs (C2)	1
Balloon expandable stents	1) To List the Types of balloon expandable stents and explain their designs and properties -wire coils, slotted tubes, Modulated stents (C2)	
Self -expanding stents	1) List the types of self-expanding stents. (C1) 2) Able to understand the importance of Technologic advances(C4) 3) To explain the types, properties, complications of Drug eluting stents, coated stents, Radioactive stents, covered stents, Bio absorbable stents. (C2) 4) To understand and able to explain the importance of Stent system such as Geometry (open cell, closed cell, intermediate cell) Material/surface, Delivery system, stent visibility(C4)	4
Unit 6		
Endo-luminal stent grafts	1)List the types of Stent for CTO, Stent in Acute MI, Stents in small and aorto-ostial lesions, Bifurcation lesions and explain the properties and design. (C2) 2)Explain the methods of stenting methods, multi vessel stenting (C2)	2
Complication of stenting	1)Able to explain complications of stenting such as Thrombotic and haemorrhagic Instant restenosis Side branch occlusion, Stent embolization, Incomplete expansion Perforation, Infectious endarteritis (C2)	1
Unit 7		
Peripheral stents	1) List the Types of peripheral stents (C1) 2) To explain the properties and designs, complications of Renal stents, subclavian stents, vertebral stents, Peripheral stents, carotid stents (C2) 3) To explain the Methods of stenting (C2) 4) To explain the types and importance of aortic arch anomalies, IVC Filters etc (C4)	3
Total hours		39

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	15	30				
Seminar	5	10				
Small group discussion (SGD)	2	4				
Self-directed learning (SDL)	5	10				
Problem Based Learning (PBL)	-	-				
Case Based Learning (CBL)	-	-				
Clinic	-	-				
Practical	8	16				
Revision	2	4				
Assessment	2	4				
Total	39	78				
Assessment Methods:						
Formative:			Summative:			
Unit Test			Mid Semester/Sessional Exam (Theory)			
Quiz			-			
Viva			-			
Assignments/Presentations			Record Book, Work dairy			
Clinical assessment (OSCE, OSPE, WBPA)			WBPA			
Clinical/Practical Log Book/ Record Book			Clinical record book			
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x	x	x			
Sessional Examination 2				x	x	x
Quiz / Viva		x	x	x	x	
Assignments/Presentations		x	x	x	x	
Clinical/Practical Log Book/ Record Book		x	x	x	x	x
Any others: WPBA			x	x	x	x
End Semester Exam	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	1. William Grossman – Interventional cardiology					
	2. Eric Topols – Cardiac Interventional Textbook					
Additional References	3. Morten B Kern – cardiac catheterization handbook					

Manipal College of Health Professions								
Name of the Department		Cardiovascular Technology (CVT)						
Name of the Program		Bachelor of Science in Cardiovascular Technology						
Course Title		Pacemaker Programming and Analysis						
Course Code		CVT2242						
Academic Year		Second Year						
Semester		IV						
Number of Credits		3						
Course Prerequisite		Basic knowledge about basics of ECG and advance cardiac sciences						
Course Synopsis		<ol style="list-style-type: none"> 1. This module will bridge the gap between the knowledge acquired in the technical and clinical aspects of cardiac pacemakers 2. To provide fundamental knowledge about procedure and technique in implants of cardiac devices 3. To interpret and analyse cardiac pacemakers and devices post procedural and follow ups 						
Course Outcomes (COs):								
At the end of the course student shall be able to: Interpret and Analyse								
CO1	Explain indications, equipment and lead system in temporary pacemakers(C2)							
CO2	To construct the various techniques in different pacing nomenclatures and procedural details (C3)							
CO3	To Identify and assess the complications of pacemakers during and post implant (C5)							
CO4	Importance of preliminary settings and post procedural hemodynamics and follow ups (C5)							
CO5	To determine patient selection, preparation and procedure of permanent pacemaker implants (C5)							
CO6	To evaluate and take necessity steps in programming and follow-up analysis (C5)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x	x						
CO2		x	x					
CO3	x	x						
CO4		x	x					
CO5	x	x						
CO6	x	x						

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Basics of temporary pacemaker	<ul style="list-style-type: none"> • List out various Equipment (C1) • Explain Lead system and hemodynamics of cardiac pacing(C2) • Determine various pacing nomenclature(C5) 	4

Content	Competencies	Number of Hours
Unit 2		
Indications of temporary pacemaker	<ul style="list-style-type: none"> To enumerate indications in acute myocardial infarction(C2) To understand Temporary pacing for procedural interventions(C2) To identify Drug induced bradycardia(C3) To identify Other indications for temporary pacing(C3) To examine Temporary pacing for tachycardia 	5
	<ul style="list-style-type: none"> Explain Preliminary setting in Cath lab(C2) To identify complications(C3) 	2
	<ul style="list-style-type: none"> Describe Post procedural setting in ICU as per hemodynamic requirement(C2) 	2
Unit 3:		
Permanent pacemaker		
Indications	<ul style="list-style-type: none"> To identify indications for permanent pacemaker in conditions like Sinus node dysfunction, Acquired atrioventricular block, Reflex syncope, orthostatic hypotension, genetic cardiomyopathy, systolic heart failure and various other conditions (C3) 	2
Pacemaker Hardware	<ul style="list-style-type: none"> To understand lead designs , materials and functional characteristics(C2) 	1
	<ul style="list-style-type: none"> Identify Pacemaker monitoring, detecting and reporting of lead malfunction (C3) 	1
	<ul style="list-style-type: none"> To understand parts and circuits in pulse generator(C2) To Explain the MRI compatible pacemaker and leads(C2) 	1
Rate adaptive pacing and other sensors	<ul style="list-style-type: none"> To explain types of sensors(C2) 	1
	<ul style="list-style-type: none"> To choose right sensor(C1) 	1
	<ul style="list-style-type: none"> To understand programming of pacemaker sensor(C2) 	1
	<ul style="list-style-type: none"> Analyse dynamic AV and VV interval programming(C4) 	1
Unit 4		
Hemodynamics	<ul style="list-style-type: none"> To determine hemodynamics of cardiac pacing and pacing mode selection(C5) 	2
Unit 5		
Techniques of pacemaker implantation Lead extraction	<ul style="list-style-type: none"> Selection of patient and preparation(C1) To choose Various Access(C3) Importance of pacemaker pocket and lead implantation(C5) Explain Generator insertion(C2) To analyse Post procedural management and 	6

Content	Competencies	Number of Hours
	complications(C4)	
	<ul style="list-style-type: none"> To explain General principles indications and risks(C2) 	1
	<ul style="list-style-type: none"> Determine Techniques and tools used for extraction(C5) 	1
Unit 6		
Pacemaker timing cycles and special features	<ul style="list-style-type: none"> Defining Pacing nomenclature(C1) Choosing Pacing modes(C3) Explain Timing cycles(C2) Describe the Rate modulated pacing(C2) 	3
Unit 7		
Evaluation, troubleshooting and management of pacing system	<ul style="list-style-type: none"> Approach to evaluate pacemaker(C4) Explain Differential diagnosis of device malfunction(C2) 	2
	<ul style="list-style-type: none"> Examine abnormalities In the mechanical components of a pacing system(C4) Analyze Electrocardiographic manifestations of pacer malfunction(C4) To inspect Problems with sensing(C4) To test for Pacing at an unexpected rate or sudden change in pacing rate(C4) Analysis of stored device data(C4) 	2

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	16	32
Seminar	8	16
Small group discussion (SGD)	3	6
Self-directed learning (SDL)	3	6
Problem Based Learning (PBL)	-	-
Case Based Learning (CBL)	2	4
Clinic	-	-
Practical	2	4
Revision	2	4
Assessment	3	6
Total	39	78
Assessment Methods:		
Formative:	Summative:	
Unit Test	Mid Semester/Sessional Exam	
Quiz	-	
Viva	-	
Assignments/Presentations	Record Book, work dairy	
Clinical assessment (OSCE, OSPE, WBPA)	WBPA	

Clinical/Practical Log Book/ Record Book	Clinical Record book					
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x	x				
Sessional Examination 2			x	x		
Quiz / Viva						
Assignments/Presentations				x		x
Clinical/Practical Log Book/ Record Book				x	x	
Any others: WPBA					x	x
End Semester Exam	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	<ul style="list-style-type: none"> • Cardiac pacing and ICD's-Kenneth A. Ellenbogen • Grossman and Baim's- cardiac catheterization and intervention • Text book of Interventional Cardiology by Eric J Topol 					
Additional References	<ul style="list-style-type: none"> • Brounwald's heart disease- A textbook of cardiovascular medicine 					

SEMESTER - V

COUSE CODE : COURSE TITLE

CVT3101 : Basics in Cardiac Cath and Hardwares

CVT3102 : Miscellaneous Cardiovascular Diseases

CVT3103 : Congenital Heart Disease - II

CVT3104 : Valvular Heart Disease

CVT3131 : Clinics - V

***** **** : Open Elective - II**

Manipal College of Health Professions								
Name of the Department	Cardiovascular Technology (CVT)							
Name of the Program	Bachelor of Science in Cardiovascular Technology							
Course Title	Basics in Cardiac Cath and Hardwares							
Course Code	CVT3101							
Academic Year	Third Year							
Semester	V							
Number of Credits	3							
Course Prerequisite	Basic knowledge of cardiac interventional suit							
Course Synopsis	1.This module helps to obtain basic knowledge about X-ray physics and its application in cardiac catheterization, also knowledge about radiation and its pros and cons 2. This provide knowledge about interventional and therapeutic Hardwares used in interventional cardiology 3.To provide fundamental knowledge about the hemodynamic assessment of cardiac diseases by invasive tests							
Course Outcomes (COs):								
At the end of the course student shall be able to:								
CO1	To understand the basic knowledge about X-ray physics and its technical application in cardiac catheterization (C2)							
CO2	To apply the knowledge in understanding the importance of radiation in cardiac interventional procedures and take adequate measures to prevent the adverse effects (C3)							
CO3	Ability to choose appropriate Hardwares and to have knowledge on its uses during cardiac interventional procedure(C4)							
CO4	To apply the knowledge in the assessment of invasive hemodynamic data to understand various cardiac diseases conditions (C4)							
CO5	To understand the uses of various types of contrast agents and its effects in the field of cardiovascular diseases (C3)							
CO6	To construct an outline of cardiovascular drugs and its pharmacological effects (C4)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1		x					x	
CO2				x		x		
CO3	x		x					
CO4		x	x					
CO5	x					x		
CO6					x		x	

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
X-ray theory and physics	1. To outline the image formation (C2) 2.To illustrate the cinefluorographic system (C3) 3.To classify the various Imaging modes (C4) 4.To develop knowledge on image detection and processing (C4)	4
Unit 2:		
Radiation Physics and effects	1.To classify the Biological effects of radiation (C2) 2. To explain the radiation exposure dose(C2) 3.To construct strategies to limit radiation exposure(C3) 4.To list the radiation safety measures (C4)	2
Unit 3:		
Medical asepsis	1.To name the Corner stones of Medical asepsis (C1) 2.To understand the principles (C2) 3. To explain the elements and surgical aspects(C2) 4. To remember the standard precautions (C2)	2
Unit 4:		
Catheterization Hardwares	1. Identify and demonstrate the Diagnostic hardwares – introducer set, catheters, wires and other accessories (C4) 2. Identify and demonstrate the interventional hardwares guiding catheters, guide wires, balloons, stent system, bare metal stent, drug eluting stent and covered stents (C4)	4
Unit 5:		
Closure Devices and coils	1. Identify and demonstrate the Devices for ASD, VSD, PDA, PFO, LAA, RSOV (C4)	2
Unit 6:		
Introduction to cardiac cath procedures	1.To explain the guidelines for diagnostic Cath (C3) 2.To illustrate the premedication, anesthesia and sedation (C2) 3.To Apply the skills in understanding the equipment and technique (C4) 4. Identify the selection of catheters(C3) 5. Examine the standard angiographic views (C4) 6. Applying the knowledge in interpretation of angiograms (C3)	8
Unit 7:		
Vascular access	1. Relate and explain the umbilical approach (C3) 2. Relate and explain the femoral approach (C3) 3. Relate and explain the Subclavian approach (C3) 4. Relate and explain the Radial approach (C3) 5. Relate and explain the Internal jugular approach (C3)	2
Unit 8:		
Right heart and left heart study	1. apply knowledge in catheters selection (C4) 2. To define the indications, contra-indications and	4

Content	Competencies	Number of Hours
	common uses (C3) 3. To illustrate the technique (C4) 4. develop knowledge in pressure tracing and waveforms with normal values (C4) 5. Interpretation and identification of pressure tracings in various diseased conditions (C5) 5. Interpretation of pitfalls and to take corrective actions (C5)	
Unit 9:		
Measurement of hemodynamic variables	1. Functioning of Pressure measurements and its equipment (C4) 2. Explain the cardiac output measurements by various techniques (C3) 3. To calculate the vascular resistance measurements (C4) 4. To assess the shunt detection and quantification (C4) 5. calculation of stenotic valve orifice area (C4) 6. To analyze the pitfalls in hemodynamic variables (C5) 7. To take corrective measures in pressure measurement (C5)	4
Unit 10:		
Contrast media and radiation dose	1. To understand the pharmacology of contrast agents (C3) 2. Classifications of contrast agents (C2) 3. To explain the (C2) 4. To illustrate the indication and uses of contrast agents (C3) 5. outline the anaphylatoc reactions of contrast agents (C3) 6. To remember the contrast dose for various procedures (C2) 6. Identification of contrast related complications (C4) 7. Explain contrast induced nephropathy (C4)	3
Unit 11:		
Cardiac pharmacology	To define and explain the various cardiac drugs in terms of mechanism and uses (C2) -beta blockers -calcium channel blockers -bronchodilators -diuretics -narcotics -thrombolytic -nitrates -vasodilators -antiplatelet -steroids	4

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	22	44				
Seminar	4	8				
Small group discussion (SGD)	4	8				
Self-directed learning (SDL)	4	8				
Problem Based Learning (PBL)	-	-				
Case Based Learning (CBL)	-	-				
Clinic	-	-				
Practical	-	-				
Revision	3	6				
Assessment	2	4				
Total	39	78				
Assessment Methods:						
Formative:			Summative:			
Unit Test			Mid Semester/Sessional Exam (Theory)			
Quiz			-			
Viva			Viva			
Assignments/Presentations			Record Book			
Clinical assessment (OSCE, OSPE, WBPA)			WBPA			
Clinical/Practical Log Book/ Record Book			Work Dairy			
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x	x	x			
Sessional Examination 2				x	x	
Quiz / Viva					x	x
Assignments/Presentations		x		x		
Clinical/Practical Log Book/ Record Book	x	x				
Any others: WPBA			x	x		
End Semester Exam	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	<ul style="list-style-type: none"> • Textbook of interventional Cardiology – By Grossman • Manual of cardiovascular medicine – By Griffin • Practical handbook of advance interventional cardiology 					
Additional References	<ul style="list-style-type: none"> • Handbook of interventional Cardiology – Morten J kern 					

Manipal College of Health Professions								
Name of the Department		Cardiovascular Technology (CVT)						
Name of the Program		Bachelor of Science in Cardiovascular Technology						
Course Title		Miscellaneous Cardiovascular Diseases						
Course Code		CVT3102						
Academic Year		Third Year						
Semester		V						
Number of Credits		3						
Course Prerequisite		Basic knowledge in cardiovascular diseases						
Course Synopsis		<ol style="list-style-type: none"> 1. This module will bridge the gap between the knowledge acquired in structural heart disease and its associations with vascular diseases. 2. To build knowledge in identifying the structure and functioning of vascular structures and its positive and negative effects on cardiac function 3. To know the extent of cardiac involvement in endocrine, connective tissue disorders and role of echocardiographic techniques in assessing cardiac function. 4. To understand the secondary effects on heart due to primary underlying conditions and opine on the cardiac status 						
Course Outcomes (COs):								
At the end of the course student shall be able to:								
CO1	To list the common aetiologies for individual diseases and to know the basic parameters to be assessed by echocardiography (C1)							
CO2	To understand and explain the pathology and pathophysiology of a given disease (C2)							
CO3	Ability to identify similar pathological conditions and thereby differentiate them by echocardiographic techniques (C3)							
CO4	To classify the type of disease, assess the degree of cardiac involvement based on the echocardiographic criteria (C4)							
CO5	Able to put together all the echocardiographic findings in any given cardiovascular disease and provide a precise diagnosis(C5)							
CO6	To build up knowledge in identifying the possible treatment and its outcome (C6)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1		x	x					
CO2		x	x					
CO3					x			x
CO4			x			x		
CO5						x		x
CO6		x	x					

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Systemic Hypertension	<ol style="list-style-type: none"> 1. Able to list the causes, define systemic hypertension and hypertensive crisis (C1) 2. Able to understand and explain the pathophysiology (C2) 3. To identify and differentiate systemic hypertension from other conditions based on the clinical presentation (C3) 4. To categorize the types of systemic hypertension (C4) 5. To look for structural and functional changes of heart secondary to systemic hypertension by 2D echocardiographic technique (C5) 6. To build knowledge in identifying the treatment of choice considering patients benefits (C6) 	3
Unit 2:		
Endocrine / metabolic diseases Diabetes mellitus	<ol style="list-style-type: none"> 1. Able to list the causes, define Diabetes mellitus (C1) 3. To identify and differentiate forms of diabetes based on the clinical presentation and other determinants (C3) 3. To clinically classify diabetes mellitus and grade its severity based on the criteria (C4) 4. To look for structural and functional changes of heart secondary to diabetes mellitus by 2D echocardiographic technique (C5) 5. To build knowledge in identifying the treatment of choice considering patients benefits (C6) 	3
Carcinoid heart disease	<ol style="list-style-type: none"> 1. Able to list the causes, define Carcinoid disease (C1) 2. To clinically differentiate other pathological states having similar clinical presentation (C3) 3. To look for structural and functional changes of heart secondary to carcinoid disease by 2D echocardiographic technique (C5) 4. To build knowledge in providing a precise diagnosis for better prognosis (C6) 	1
Hypo/ Hyperthyroidism	<ol style="list-style-type: none"> 1. Able to list the causes, define Hypo/ Hyperthyroidism (C1) 2. Able to understand and explain the pathophysiology of the disease (C2) 3. To clinically differentiate other pathological states having similar clinical presentation (C3) 4. To classify the severity based on lab investigations (C4) 5. To look for cardiac function secondary to abnormal thyroid levels by basic and advanced 2D echocardiographic techniques by (C5) 6. To build knowledge in early diagnosis by providing 	3

Content	Competencies	Number of Hours
	precise information on management (C6)	
Unit 3:		
Connective tissue / Auto immune disorders Systemic Lupus erythematosus	<ol style="list-style-type: none"> 1. Should list the causes, define SLE (C1) 2. Able to understand and explain the pathophysiology of the disease (C2) 3. To differentiate other pathological conditions mimicking similar clinical presentation (C3) 4. To look for cardiac function by basic and advanced 2D echocardiographic techniques based on diagnostic criteria (C5) 5. To build knowledge in early diagnosis by providing precise information on management (C6) 	2
Scleroderma	<ol style="list-style-type: none"> 1. Should list the causes, define Scleroderma (C1) 2. Able to understand and explain the pathophysiology of the disease (C2) 3. To differentiate other pathological conditions mimicking similar clinical presentation based on history and clinical examination (C3) 4. To look for cardiac function secondary to scleroderma by basic and advanced 2D echocardiographic techniques (C5) 5. To build knowledge in diagnosis by providing precise information on deciding management (C6) 	1
Marfan syndrome	<ol style="list-style-type: none"> 1. Able to list the causes and define Marfan syndrome (C1) 2. Able to understand and explain the pathophysiology of the disease (C2) 3. To differentiate other pathological conditions mimicking similar clinical presentation based on history and clinical examination (C3) 4. To look for cardiac function secondary to Marfan syndrome by 2D echocardiography based on diagnostic criteria (C5) 5. To build knowledge in making diagnosis for further management (C6) 	3
Unit 4:		
Chronic Liver disease	<ol style="list-style-type: none"> 1. Able to list the causes and define Chronic liver disease (C1) 2. Able to understand and explain the pathophysiology of the disease (C2) 3. To differentiate other pathological conditions mimicking similar clinical presentation based on history and clinical examination (C3) 4. To classify the stages of liver disease based upon diagnostic criteria (C4) 5. To build knowledge in making diagnosis for further management (C6) 	3
Unit 5:		
Pulmonary Hypertension	<ol style="list-style-type: none"> 1. Able to list the causes and provide definition on PHTN (C1) 	3

Content	Competencies	Number of Hours
	2. Able to understand and explain the pathophysiology of the disease (C2) 3. To differentiate other pathological conditions mimicking similar clinical presentation based on history and clinical examination (C3) 4. To classify pulmonary hypertension on basis of primary or secondary lesions (C4) 5. To look for cardiac function secondary to pulmonary hypertension by ECG and 2D echocardiographic techniques (C5) 6. To build knowledge in early diagnosis of disease by providing precise information on management (C6)	
Unit 6 :		
Sarcoidosis	1. Able to list the causes and provide definition on sarcoidosis (C1) 2. Able to understand and explain the pathophysiology of the disease (C2) 3. To differentiate other pathological conditions mimicking similar clinical presentation based on history and clinical examination (C3) 4. To look for cardiac function secondary to sarcoidosis by ECG and 2D echocardiographic imaging (C5) 5. To build knowledge in early diagnosis of disease by providing precise information on management (C6)	2
Unit 7:		
Haemochromatosis	1. Able to list the causes and provide definition on haemochromatosis (C1) 2. Able to understand and explain the pathophysiology of the disease (C2) 3. To differentiate other pathological conditions mimicking similar clinical presentation based on history and clinical examination (C3) 4. To classify haemochromatosis as primary and secondary (C4) 5. To look for cardiac function secondary to Haemochromatosis by ECG and 2D echocardiographic imaging (C5) 6. To build knowledge in early diagnosis of disease by providing precise information on management (C6)	2
Unit 8:		
Muscular dystrophy	1. Able to list the causes and provide definition on muscular dystrophy (C1) 2. Able to understand and explain the pathophysiology of the disease (C2) 3. To differentiate other pathological conditions mimicking similar clinical presentation based on	2

Content	Competencies	Number of Hours
	<p>history and clinical examination (C3)</p> <p>4. To classify Muscular dystrophies based on genetics (C4)</p> <p>5. To look for any cardiac function impairment secondary to muscular dystrophy by ECG and 2D echocardiographic imaging (C5)</p> <p>6. To build knowledge in early diagnosis of disease by providing precise information on management (C6)</p>	
Unit 9:		
Haematological conditions Hypereosiniphilia	<p>1. Able to list the causes and provide definition on Hypereosiniphilia (C1)</p> <p>2. Able to understand and explain the pathophysiology of the disease (C2)</p> <p>3. To differentiate other pathological conditions mimicking similar clinical presentation based on history and clinical examination (C3)</p> <p>4. Should be able to classify hyper eosinophilia (C4)</p> <p>5. To look for any cardiac function impairment secondary to hyper eosinophilia by ECG and 2D echocardiographic imaging (C5)</p> <p>6. To build knowledge in early diagnosis of disease by providing precise information on management (C6)</p>	2
Sickle cell anemia	<p>1. Able to list the causes and provide definition on Hypereosiniphilia (C1)</p> <p>2. Able to understand and explain the pathophysiology of the disease (C2)</p> <p>3. To differentiate other pathological conditions mimicking similar clinical presentation based on history and clinical examination (C3)</p> <p>4. Should be able to provide classification of hyper eosinophilia (C4)</p> <p>5. To look for any cardiac function impairment secondary to hyper eosinophilia by ECG and 2D echocardiographic imaging (C5)</p> <p>6. To build knowledge in early diagnosis of disease by providing precise information on management (C6)</p>	2
Unit 10: Infectious diseases		
Human immune deficiency virus	<p>1. Able to list the causes and provide definition on HIV (C1)</p> <p>2. Able to understand and explain the pathophysiology of the disease (C2)</p> <p>3. To differentiate other pathological conditions mimicking similar clinical presentation based on history and clinical examination (C3)</p> <p>4. To look for any cardiac function impairment secondary to HIV by ECG and 2D</p>	1

Content	Competencies	Number of Hours
	echocardiographic imaging (C5) 6. To build knowledge in early diagnosis of disease by providing precise information on palliative management (C6)	
Unit 11: vascular conditions		
Takayasu arteritis	1. Able to list the causes and provide definition on the Takayasu arteritis (C1) 2. Able to understand and explain the pathophysiology of the disease (C2) 3. To differentiate other pathological conditions mimicking similar clinical presentation based on history and clinical examination (C3) 4. Should be able to provide classification of Takayasu arteritis based on vessel involvement (C4) 4. Should look for structural and functional changes secondary to arteritis by ECG and 2D echocardiographic imaging (C5) 6. To build knowledge in early diagnosis of disease by providing precise information on palliative management (C6)	2
Kawasaki disease	1. Able to list the causes and provide definition on the Kawasaki disease (C1) 2. Able to understand and explain the pathophysiology of the disease (C2) 3. To differentiate other pathological conditions mimicking similar clinical presentation based on history and clinical examination (C3) 4. Should look for structural and functional changes secondary to arteritis by ECG and 2D echocardiographic imaging (C5) 5. To build knowledge in early diagnosis of disease by providing precise information on palliative management and risk stratify them(C6)	1
Annul ectasia	1. Able to list the causes and provide definition on the Annulo ectasia (C1) 2. Able to understand and explain the pathophysiology of the disease (C2) 3. To differentiate other pathological conditions mimicking similar clinical presentation based on history and clinical examination (C3) 4. Should look for structural and functional changes secondary to Annulo ectasia by ECG and 2D echocardiographic imaging (C5) 5. To build knowledge in early diagnosis of disease by providing precise information on management (C6)	1
Giant cell arteritis	1. Able to list the causes and provide definition on the giant cell arteritis (C1) 2. Able to understand and explain the	1

Content	Competencies	Number of Hours
	pathophysiology of the disease (C2) 3. To differentiate other pathological conditions mimicking similar clinical presentation based on history and clinical examination (C3) 4. Able to provide classification of giant cell arteritis (C4) 5. Should look for structural and functional changes secondary to giant cell arteritis by ECG and 2D echocardiographic imaging (C5) 6. To build knowledge in early diagnosis of disease by providing precise information on management (C6)	
Cardiac trauma	1. Able to list the causes and provide definition on cardiac trauma (C1) 2. Able to understand and explain the pathophysiology of the disease (C2) 3. To differentiate other pathological conditions mimicking similar clinical presentation based on history and clinical examination (C3) 4. Able to provide classification of cardiac trauma (C4) 5. Should look for structural and functional changes secondary to cardiac trauma by ECG and 2D echocardiographic imaging (C5) 6. To build knowledge in early diagnosis of disease by providing precise information on management (C6)	1

Learning Strategies, Contact Hours and Student Learning Time (SLT):

Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	18	36
Seminar	6	12
Case Based Learning (CBL)	8	16
Practical	-	-
Revision	4	8
Assessment	3	6
Total	39	78

Assessment Methods:

Formative:	Summative:
Unit Test	Mid Semester/Sessional Exam (Theory)
Viva	Viva
Assignments/Presentations	Record Book
Clinical assessment (OSCE, OSPE, WBPA)	-
Clinical/Practical Log Book/ Record Book	Record book

Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x	x	x			
Sessional Examination 2				x	x	x
Quiz / Viva			x	x	x	
Assignments/Presentations		x	x	x	x	x
Clinical/Practical Log Book/ Record Book		x	x	x	x	x
Any others: WPBA						
End Semester Exam	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	1. Feigen Baum's Echocardiography 2. Manual of cardiovascular medicine – Brian P Griffin					
Additional References	3. Comprehensive text book of Echocardiography					

Manipal College of Health Professions								
Name of the Department	Cardiovascular Technology (CVT)							
Name of the Program	Bachelor of Science in Cardiovascular Technology							
Course Title	Congenital Heart Disease - II							
Course Code	CVT3103							
Academic Year	Third Year							
Semester	V							
Number of Credits	3							
Course Prerequisite	Basic knowledge on cardiac anatomy, embryology and cardiac hemodynamics							
Course Synopsis	1. This course elucidates the cyanotic congenital heart diseases 2. This course will make students to understand the pathophysiology and clinical presentation of all the cyanotic congenital heart disease and complex heart anomalies 3. This course allows students to understand the diagnostic methods involved in the diagnosis and management of cyanotic congenital heart disease							
Course Outcomes (COs):								
At the end of the course student shall be able to:								
CO1	Understanding the cardiac embryology, anatomic orientation and possible cardiac anomalies associated with decreased pulmonary blood flow (C3)							
CO2	Understanding brief embryology, anatomic classification, pathophysiology, clinical presentation, Diagnosis and management of Tetralogy of Fallot and its variants (C3)							
CO3	Understanding brief embryology, anatomic classification, pathophysiology, clinical presentation, Diagnosis and management of double outlet right ventricle(C3)							
CO4	Explaining the brief embryology, anatomic classification, pathophysiology, clinical presentation, Diagnosis and management of anomalies of great artery and trans position of great arteries(C3)							
CO5	Discussing brief embryology, anatomic classification, pathophysiology, clinical presentation, Diagnosis and management of admixture physiology (C3)							
CO6	Discussing brief embryology, anatomic classification, pathophysiology, clinical presentation, Diagnosis and management of Duct dependent pulmonary and systemic circulation (C3)							
CO7	Discussing brief embryology, anatomic classification, pathophysiology, clinical presentation, Diagnosis and management of single ventricle physiology (C3)							
CO8	Discussing brief embryology, anatomic classification, pathophysiology, clinical presentation, Diagnosis and management of aortic arch anomalies and coronary anomalies (C3)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x					x		
CO2	x			x				
CO3	x				x			
CO4	x					x		

CO5	x					x		
CO6	x					x		
CO7	x					x		
CO8	x					x		

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Decreased pulmonary blood flow (PBF)	<ul style="list-style-type: none"> Brief pathophysiology of congenital heart diseases with decreased PBF(C2) To know the clinical presentation of prognosis of patients with decreased PBF at different ages. (C1) 	1
Unit 2:		
Tetralogy of Fallot (TOF)	<ul style="list-style-type: none"> To know the prevalence and types(C1) Explaining the embryology, classification and pathophysiology(C1) 	1
	<ul style="list-style-type: none"> Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3) 	1
	<ul style="list-style-type: none"> To understand the natural history, prognosis and management(C3) 	1
Unit 3:		
TOF Variants- TOF with pulmonary atresia	<ul style="list-style-type: none"> To know the prevalence and types(C1) Explaining the embryology, classification and pathophysiology (MAPCA classification) (C1) 	1
	<ul style="list-style-type: none"> Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3) 	1
	<ul style="list-style-type: none"> To understand the natural history, prognosis and management(C3) 	1
Unit 4:		
TOF with absent pulmonary valve and dysplastic valve	<ul style="list-style-type: none"> To know the prevalence and types(C1) Explaining the embryology, and pathophysiology(C1) Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3) To understand the natural history, prognosis and management(C3) 	1
Unit 5:		
Pulmonary atresia with intact ventricular septum (PAIVS)	<ul style="list-style-type: none"> To know the prevalence and types(C1) Explaining the embryology, classification (Unipartite, bipartite, tripartite RV) and pathophysiology(C1) 	1
	<ul style="list-style-type: none"> Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath 	1

Content	Competencies	Number of Hours
	findings(C3) • To understand the natural history, prognosis and management(C3)	
Unit 6:		
Double outlet right ventricle (DORV)	• To know the prevalence and types(C1) • Explaining the embryology, classification (Based on VSD location and Great artery relation) and pathophysiology(C1)	1
	• Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3)	1
	• To understand the natural history, prognosis and management(C3)	1
Unit 7:		
Complete transposition of great artery (DTGA)	• To know the prevalence and anatomy(C1) • Explaining the embryology, associated anomalies and pathophysiology(C1)	1
	• Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3)	1
	• To understand the natural history, prognosis and management(C3)	1
Unit 8:		
Congenitally corrected transposition of great artery (cCTGA / LTGA)	• To know the prevalence and anatomy(C1) • Explaining the embryology, associated anomalies and pathophysiology(C1)	1
	• Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3)	1
	• To understand the natural history, prognosis and management(C3)	1
Unit 9:		
Aorto pulmonary Window (AP window)	• To know the prevalence and types(C1) • Explaining the embryology, classification and pathophysiology(C1)	1
	• Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3)	1
	• To understand the natural history, prognosis and management(C3)	1
Unit 10:		
Tricuspid atresia	• To know the prevalence and types(C1) • Explaining the embryology, classification and pathophysiology(C1)	1
	• Understand the clinical presentation, Clinical	1

Content	Competencies	Number of Hours
	evaluation, ECG, X ray, echo findings and cath findings(C3)	
	<ul style="list-style-type: none"> To understand the natural history, prognosis and management(C3) 	1
Unit 11:		
Hypoplastic left heart syndrome (HLHS)	<ul style="list-style-type: none"> To know brief anatomy, embryology, classification/ variants, clinical presentation, diagnosis and management of HLHS (C2) Understand the difference between hypoplastic and rudimentary left ventricle (C2) 	1
	<ul style="list-style-type: none"> To know brief anatomy, embryology, classification, clinical presentation, diagnosis and management of Parachute mitral valve (C2) 	1
Unit 12:		
Single ventricle/ Univentricular heart	<ul style="list-style-type: none"> To know the prevalence and brief pathophysiology(C1) Explaining the embryology and anatomy(C1) Variants like Double inlet LV, Atresia of one of the AV valves, Unbalanced AVCD and Hypoplasia of on ventricle To know Shone's complex (C1) 	1
	<ul style="list-style-type: none"> Understand the clinical presentation, Clinical evaluation, ECG, X ray, echo findings and cath findings(C3) 	1
	<ul style="list-style-type: none"> To understand the natural history, prognosis and management- Both palliative and corrective (Fontan surgery) (C3) 	1
Unit 13:		
Truncus arteriosus	<ul style="list-style-type: none"> To understand prevalence, pathophysiology, classification, diagnosis and management of Truncus arteriosus (C2) 	2
Unit 14:		
Ruptured sinus of Valsalva (RSOV)	<ul style="list-style-type: none"> To understand prevalence, pathophysiology, classification, diagnosis and complication of aneurysmal sinus of valsalva (C2) 	1
	<ul style="list-style-type: none"> Brief pathophysiology, diagnosis and management of RSOV (C3) 	1
Unit 15:		
Aortic arch anomalies	<ul style="list-style-type: none"> To understand prevalence, classification, pathophysiology diagnosis and management of aortic arch anomalies (C2) 	2
Unit 16:		
Coronary anomalies	<ul style="list-style-type: none"> To know brief anatomy, embryology, classification/ variants, clinical presentation, diagnosis and management of coronary anomalies (C2) 	1

Content	Competencies	Number of Hours
Unit 17:		
Palliative shunts	<ul style="list-style-type: none"> • Indication, anatomic connections, advantages and disadvantages of Aorto-pulmonary shunts (C2) <ul style="list-style-type: none"> - Classic and modified Blalock Taussig (BT) shunt - Potts shunt - Waterston's shunt/ Cooley shunt - Central shunt 	1
	<ul style="list-style-type: none"> • Indication, anatomic connections, advantages and disadvantages of Cavo pulmonary shunts (C2) <ul style="list-style-type: none"> - Glenn shunt (Unilateral unidirectional, unilateral bidirectional, bilateral bidirectional) 	1

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	20	40
Seminar	10	20
Small group discussion (SGD)	-	-
Self-directed learning (SDL)	-	-
Problem Based Learning (PBL)	-	-
Case Based Learning (CBL)	-	-
Clinic	-	-
Practical	-	-
Revision	5	10
Assessment	4	8
Total	39	79

Assessment Methods:	
Formative:	Summative:
Unit Test	Mid Semester (Theory)
Quiz	Quiz
Viva	-
Assignments/Presentations	Assignments and presentations
Clinical assessment (OSCE, OSPE, WBPA)	-
Clinical/Practical Log Book/ Record Book	Record book , work dairy

Mapping of Assessment with COs:								
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6	CO7	CO8
Mid Semester / Sessional Examination 1	x	x	x	x	x			
Sessional Examination 2								
Quiz / Viva						x	x	x
Assignments/Presentations						x	x	x

Clinical/Practical Log Book/ Record Book		x	x	x	x	x	x	
Any others: WPBA								
End Semester Exam	x	x	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback							
	End-Semester Feedback							
Main Reference:	<ul style="list-style-type: none"> • Latest edition of Moss and Adams' Heart disease in Infants, Children and Adolescents including the Foetus and Young Adult • Park's Paediatric cardiology for practitioners- Myung D Park 							
Additional References	Perloff's Clinical recognition of congenital heart disease: Joseph K. Perloff, Ariane J. Marelli							

Manipal College of Health Professions								
Name of the Department	Cardiovascular Technology (CVT)							
Name of the Program	Bachelor of Science in Cardiovascular Technology							
Course Title	Valvular Heart disease							
Course Code	CVT3104							
Academic Year	Third Year							
Semester	V							
Number of Credits	3							
Course Prerequisite	Basic knowledge in cardiovascular diseases							
Course synopsis	<ol style="list-style-type: none"> 1. This module will bridge the gap between the knowledge acquired in cardiac valve anatomy and correlation with diseased conditions. 2. To apply the knowledge in identifying a diseased valve, assessment of valve apparatus and grading its severity. 3. To know the echocardiographic techniques in severity assessment of a given valvular lesion and associated conditions. 4. To understand the importance of grading a disease and to focus/ comment on the management and outcome. 							
Course Outcomes (COs):								
At the end of the course student shall be able to:								
CO1	To memorize the common aetiologies for individual valve diseases and to know the basic assessing parameters by echocardiography (C1)							
CO2	To understand and explain the pathology and pathophysiology of a given valve disease (C2)							
CO3	Ability to identify similar pathological conditions and thereby differentiate them by echocardiographic techniques (C3)							
CO4	To classify the type of disease, explore echo views that help to locate the lesion from multiple windows (C4)							
CO5	Able to put together all the echocardiographic findings in diseased valve condition and comment on the severity of the lesion (C5)							
CO6	To build up knowledge in identifying the possible treatment and its outcome (C6)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1		x	x					
CO2		x	x					
CO3						x		x
CO4			x			x		
CO5						x		x
CO6		x	x					

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Rheumatic Fever	<ol style="list-style-type: none"> 1. Able to understand and explain the pathophysiology (C2) 2. To identify and differentiate rheumatic fever from other conditions with their clinical presentation (C3) 3. To identify the valve pathology by 2D echocardiography and assess the severity (C5) 4. To build knowledge in identifying the treatment of choice considering patients benefits (C6) 	3
Unit 2:		
Mitral stenosis	<ol style="list-style-type: none"> 1. Able to list the possible causes and define Mitral stenosis (C1) 2. Able to understand and explain the pathophysiology of mitral stenosis (C2) 3. To identify and differentiate mitral stenosis from other conditions that mimic similar clinical presentation (C3) 4. To further evaluate the diseased state by analysing the root pathological cause (C4) 5. Build knowledge in application of diagnostic methods to assess severity (C5) 6. To add valuable comment on decision making before intervention (C6) 	4
Unit 3:		
Mitral regurgitation	<ol style="list-style-type: none"> 1. Make a list of the possible causes and define mitral regurgitation (C1) 2. Able to understand and explain the pathophysiology of mitral incompetency (C2) 3. To differentiate MR from other conditions that mimic similar clinical presentation (C3) 4. To discover new findings and correlate with existing MR (C4) 5. Build knowledge in application of 2D diagnostic methods to assess severity of MR (C5) 6. Make a firm diagnosis in view of further management (C6) 	4
Unit 4:		
Aortic stenosis	<ol style="list-style-type: none"> 1. List of the possible causes and define Aortic stenosis (C1) 2. Able to understand and explain the pathophysiology of mitral incompetency (C2) 3. To differentiate AS from other conditions that mimic similar clinical presentation (C3) 4. To discover new findings which may add up the diagnosis of AS (C4) 5. Build knowledge in application of 2D diagnostic methods to assess severity of AS (C5) 6. Able to make a valuable decision on treatment and 	4

Content	Competencies	Number of Hours
	evaluate them post procedural (C6)	
Unit 5:		
Low flow low gradient in AS	<ol style="list-style-type: none"> 1. To understand and explain the terms Low flow low gradient AS (C2) 2. To apply the previously learnt methods to assess the severity of aortic valve stenosis (C3) 3. To understand the physiology in low flow AS to AS with preserved LV function (C4) 4. To interpret the results obtained from test to baseline results (C5) 5. To evaluate and comment on the lesion severity and opine on management (C6) 	4
Unit 6:		
Aortic regurgitation	<ol style="list-style-type: none"> 1. To make a list of the causes and define aortic regurgitation (C1) 2. Able to understand and explain the pathophysiology of Aortic insufficiency (C2) 3. To differentiate AR from other conditions that mimic similar clinical presentation (C3) 4. To discover new findings which may add up the diagnosis of AR (C4) 5. Build knowledge in application of 2D diagnostic methods to assess severity of AR (C5) 6. Able to make a valuable decision on treatment and evaluate them post procedural (C6) 	3
Unit 7:		
Pulmonary stenosis	<ol style="list-style-type: none"> 1. To make a list of the possible causes and define Pulmonary stenosis (C1) 2. Able to understand and explain the pathophysiology of PS (C2) 3. To differentiate PS from other conditions that mimic similar clinical presentation (C3) 4. To discover new findings which may add up the diagnosis of AR (C4) 5. Build knowledge in application of 2D diagnostic methods to assess severity of PS (C5) 6. Able to make a valuable decision on treatment and evaluate them post procedural (C6) 	2
Unit 8 :		
Pulmonary regurgitation	<ol style="list-style-type: none"> 1. To make a list of the possible causes and define PR (C1) 2. Able to understand and explain the pathophysiology of PR (C2) 3. To differentiate PR from other conditions that mimic similar clinical presentation (C3) 4. To identify new findings which may add up the diagnosis of PR (C4) 5. Build knowledge in application of 2D diagnostic methods to assess severity of PR (C5) 	2

Content	Competencies	Number of Hours
	6. Able to make a valuable decision on treatment and evaluate them post procedural (C6)	
Unit 9:		
Tricuspid stenosis	<ol style="list-style-type: none"> 1.To make a list of the possible causes and define TS (C1) 2. Able to understand and explain the pathophysiology of TS (C2) 3. To differentiate TS from other conditions that mimic similar clinical presentation (C3) 4. To identify new findings which may add up the diagnosis of TS (C4) 5. Build knowledge in application of 2D diagnostic methods to assess severity of TS (C5) 6. Able to make a valuable decision on treatment and evaluate them post procedural (C6) 	2
Unit 10:		
Tricuspid Regurgitation	<ol style="list-style-type: none"> 1. To make a list of the possible causes and define TR (C1) 2. Able to understand and explain the pathophysiology of TR (C2) 3. To differentiate TR from other conditions that mimic similar clinical presentation (C3) 4. To identify new findings which may add up the diagnosis of TR (C4) 5. Build knowledge in application of 2D diagnostic methods to assess severity of TR (C5) 6. Able to make a valuable decision on treatment and evaluate them post procedural (C6) 	3
Unit 11:		
Infective Endocarditis	<ol style="list-style-type: none"> 1. To make a list of the possible causes and define IE (C1) 2. Able to understand and explain the pathophysiology of infective endocarditis (C2) 3. To differentiate endocarditis from other conditions that mimic similar clinical presentation (C3) 4. To identify new findings which may add up the diagnosis of IE (C4) 5. To build knowledge in application of multiple 2D views to localize the lesion (C5) 6. To make a confirmed diagnosis and evaluate other conditions pre procedural (C6) 	3
Unit 12:		
Prosthetic valve	<ol style="list-style-type: none"> 1. To define and list possible causes for implantation of valve (C1) 2. To classify the types, understand and explain the functioning of valves (C2) 3. To differentiate prosthetic valves anatomically and functionally (C3) 4. To identify new findings that add up in diagnosis (C4) 	3

Content	Competencies	Number of Hours
	5. Build knowledge in assessing the valve functioning by various echo methods (C5) 6. To evaluate and make a firm diagnosis on the condition of valve pre and post procedural (C6)	
Unit 13:		
ACC/AHA Guidelines for valvular surgery	1. To have knowledge about the guidelines and its importance (C1) 2. Understand and explain the learnt guideline (C2) 3. To apply the learnt guidelines in any given valvular heart disease (C3) 4. To obtain echocardiographic data and compare it with the guidelines (C4) 5. To compile the echocardiographic data and guideline to comment on disease severity (C5) 6. To come up with a valuable decision that helps in decision making (C6)	2

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	22	44				
Seminar	4	8				
Small group discussion (SGD)	4	8				
Self-directed learning (SDL)	4	8				
Problem Based Learning (PBL)	-	-				
Case Based Learning (CBL)	-	-				
Clinic	-	-				
Practical	-	-				
Revision	3	6				
Assessment	2	4				
Total	39	78				
Assessment Methods:						
Formative:	Summative:					
Unit Test	Mid Semester/Sessional Exam (Theory)					
Quiz	-					
Viva	Viva					
Assignments/Presentations	Record Book					
Clinical assessment (OSCE, OSPE, WBPA)	WBPA					
Clinical/Practical Log Book/ Record Book	Work Dairy					
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x	x	x			
Sessional Examination 2				x	x	
Quiz / Viva					x	x

Assignments/Presentations		x		x		
Clinical/Practical Log Book/ Record Book	x	x				
Any others: WPBA			x	x		
End Semester Exam	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	1. Harvey Feigenbaum's echocardiography 2. Arthur Weyman book of cardiology 3. Text book of cardiology by Gee K Oh Tajik, Ottos					
Additional References	1. Essential echocardiography – Scott D Solomon 2. Text book of Echocardiography – Dr. Navin C Nanda					

Manipal College of Health Professions								
Name of the Department	Cardiovascular Technology (CVT)							
Name of the Program	Bachelor of Science in Cardiovascular Technology							
Course Title	Clinics - V							
Course Code	CVT3131							
Academic Year	Third Year							
Semester	V							
Number of Credits	5							
Course Prerequisite	Basic knowledge in cardiovascular diseases, diagnostic tests and procedure							
Course Synopsis	<ol style="list-style-type: none"> 1. Able to obtain basic echocardiographic views as per the guidelines. 2. This module will help to know about basic knowledge acquired in cardiac valve anatomy and correlation with diseased conditions. 3. To apply the knowledge in identifying basic cardiac hardwares, its utility and the procedures where in used. 4. To systematically approach for any given congenital heart disease by echocardiography and correlate with cath findings. 5. To apply and follow basic aseptic precautions before performing any clinical procedures. 							
Course Outcomes (COs):								
At the end of the course student shall be able to:								
CO1	To understand and individually obtain basic echocardiographic views (C1, P4)							
CO2	To explain the structures in respective echocardiographic views for any given valvar/ ischemic/ congenital disease (C2,P5)							
CO3	To build up knowledge in selecting appropriate hardwares for respective cardiac procedures (C3,P3)							
CO4	Ability to identify the structural and functional abnormalities and grade them by various echocardiographic methods (C5,P5)							
CO5	To compare the normal cardiac structures with diseased conditions in respective views and grade its severity (C4,P6)							
CO6	To select the desired cardiac hard wares and explain the advantages and disadvantages (C5,P6)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x	x						
CO2				x				x
CO3					x		x	
CO4			x			x		
CO5						x		x
CO6					x		x	

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
ECG	<ol style="list-style-type: none"> 1. Should list the basic steps in interpretation of any given ECG (P3) 2. Able to comment on the management strategy of abnormal ECGs (P4) 3. Should be aware of technical errors and apply technical skills to overcome them (P4) 4. Able to correlate ECG with the clinical presentation (P4) 5. Should assess the severity of arrhythmias and timely management (P4) 	10
Unit 2:		
TMT	<ol style="list-style-type: none"> 1. Should know the standard protocol of performing TMT and use of emergency drugs.(P2) 2. To clinically correlate patient's symptoms, history with ECG (P4 A2) 3. To analyse the test results and compare it with the baseline findings (P4 A2) 4. To build knowledge in TMT interpretation and discuss on the management (P4 A2) 4. Should develop technical skills in patient rescue during emergency (P4 A2) 	15
Unit 3:		
Ambulatory ECG monitoring	<ol style="list-style-type: none"> 1. Should know to utilize different methods of lead placement in recording ECG (P4, A2) 2. Able to analyse and interpret stored ECG data (P4, A2) 3. To build knowledge in identifying serious arrhythmias and look for treatment options (P4, A3) 	15
Unit 4:		
Clinical OPD practice	<ol style="list-style-type: none"> 1. Should know to utilize the basic clinical equipment (P4,A2) 2. Ability to perform activity independently (P5, A3) 3. To build knowledge in identifying cases with clinical examination (P6, A3) 4. To perform new skills in performing clinical examination (P7,A2) 	20
Unit 5:		
Bedside Rounds	<ol style="list-style-type: none"> 1. Should be able to evaluate patient based on the case history (P2,A1) 2. Ability to perform basic patient examination steps (P4,A2) 3. Should perform tasks or activity under the supervision of physician (P4, A3) 4. Should make a evaluation of a given case based on the routine investigations (P5, A4) 	10

Content	Competencies	Number of Hours
Unit 6:		
Basics of Echocardiography	<ol style="list-style-type: none"> 1. To apply the learnt principles of echocardiography during clinical practice (A3, P4) 2. To build knowledge about ethics and minimize the ethical issues (A1,P2) 3. Should be able to perform routine echocardiography independently (A3, P5) 4. Should choose appropriate 2D echo views to visualize LV segments and identify wall motion abnormality (P5,A3) 5. Should interpret the Doppler studies with newer methods (A3 ,P5) 	40
Unit 7:		
Pacemaker analysis	<ol style="list-style-type: none"> 1. Should classify the type of pacemaker based on the ECG recording (P2, A2) 2. Able to assess the parameters and their importance during analysis (P4,A2) 3. To perform pacemaker analysis individually based on the mode implanted (P5, A3) 4. To add findings based on analysis, history and a frame a new diagnosis (P6, A3) 5. to diagnose pacemaker related problems and finding an appropriate solution (P7, A3) 	25
Unit 8:		
Basic Cardiac Catheterization	<ol style="list-style-type: none"> 1. To apply basic principles of X-ray during catheterization procedures (A1, P1) 2. Should know the purpose of hard wares during routine cardiac procedures (P3, A2) 3. To observe and know the functioning and mechanism of the hard wares and other equipments (P3, A3) 4. Should be able to explain step wise approach to any given procedure (P5, A3) 5. Perform assigned tasks independently (P5, A3) 6. Should build knowledge in working principle of equipments and apply during clinical procedures (P7, A4) 	30
Unit 9:		
Advanced Cardiac catheterization	<ol style="list-style-type: none"> 1.Should be aware of the routine angiographic views (P1, A1) 2.Should understand the drug mechanism and conditions in which its administered (P3, A2) 3. Should explain advantages and disadvantages of the hard wares and equipment used (P2, A2) 4. Take part actively in valvar procedure BMV, BPV, BAV (P4, A2) 5. Should categorize hard wares used for specific valvar / congenital lesions (P6, A3) 6. Should build knowledge views to visualize defect during procedure (P7, A4) 	30

Learning Strategies, Contact Hours and Student Learning Time (SLT):							
Learning Strategies	Contact Hours	Student Learning Time (SLT)					
Lecture	--	--					
Seminar	--	--					
Small group discussion (SGD)	20	40					
Self-directed learning (SDL)	30	60					
Problem Based Learning (PBL)	20	40					
Case Based Learning (CBL)	60	120					
Clinic	60	120					
Practical	--	--					
Revision	--	--					
Assessment	5	10					
Total	195	390					
Assessment Methods:							
Formative:			Summative:				
Unit Test			--				
Quiz			--				
Viva			Viva				
Assignments/Presentations			Record Book				
Clinical assessment (OSCE, OSPE, WBPA)			WBPA				
Clinical/Practical Log Book/ Record Book			Clinical record book, Case presentation				
Mapping of Assessment with COs:							
Nature of Assessment		CO1	CO2	CO3	CO4	CO5	CO6
Assignments/Presentations		x	x	x	x	x	x
Clinical/Practical Log Book/ Record Book			x	x	x	x	x
Any others: WPBA		x	x	x	x	x	x
Feedback Process:		Mid-Semester Feedback					
		End-Semester Feedback					
Main Reference:		<ul style="list-style-type: none"> • Congenital heart disease: 1. Myung Park 2. J K Perloff 3. Moss and Adam • Valvar heart disease: Echocardiography: 1. Harvey Feigenbaum 2. Arthur Weyman 3. Gee K Oh Tajik 4. Ottos • Cardiac catheterization: 1. William Grossman 2. Eric Topols 3. Morten B Kern 					
Additional References		<ul style="list-style-type: none"> • Cardiac stress testing: Cardio vascular medicine • Electrocardiography: Leo Schamroth 2. Mervin Goldman 3. Marriott's Practical Electrocardiography 					

SEMESTER - VI

COUSE CODE	:	COURSE TITLE
CVT3201	:	Applications of Echocardiography
CVT3202	:	Cardiac Cath and Intervention
CVT3203	:	General Cardiac Examination and BLS - ACLS
CVT3231	:	Clinics in Echocardiography
CVT3232	:	Clinics in Cardiac Catheterization
CVT****	:	Program Elective - II

Manipal College of Health Professions								
Name of the Department	Cardiovascular Technology							
Name of the Program	Bachelor of Science in Cardiovascular Technology							
Course Title	Applications of Echocardiography							
Course Code	CVT3201							
Academic Year	Third Year							
Semester	VI							
Number of Credits	3							
Course Prerequisite	Basic knowledge about Congenital & Valvular heart disease, Hemodynamics, Instrumentation of Ultrasound and Doppler principles							
Course Synopsis	1. This module helps to obtain knowledge about the Hemodynamics of Congenital & Valvular heart disease and its clinical application 2. To develop knowledge and utilize the Advanced Techniques in assessing the state of cardiac function 3. To provide essential knowledge about the diagnostic methods to identify the miscellaneous heart disease							
Course Outcomes (COs):								
At the end of the course student shall be able to: Build knowledge and utilize								
CO1	Understanding and Identifying the abnormal & normal M –Mode pattern in various cardiac diseases (C3)							
CO2	Knowledge to identify the limitations of 2 Dimensional echocardiography and choose the advanced diagnostic techniques (C6)							
CO3	Build knowledge to understand the anatomy & hemodynamic and evaluate the Congenital Heart Disease(C5)							
CO4	Develop knowledge to examine, evaluate and assess the severity grades of various Valvular heart disease and to make of the values to decide on the management(C5)							
CO5	To apply the knowledge on choosing the appropriate Recent Advanced Techniques in identifying and evaluating the myocardial function(C5)							
CO6	Build skills in Identifying and evaluating the Miscellaneous heart disease (C5)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x						x	
CO2	x	X						
CO3		X						x
CO4	x							x
CO5		X				x		
CO6		X				x		

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
M- mode echocardiography	<ol style="list-style-type: none"> 1. Identify and Explain the normal and abnormal motion patterns at Left ventricular, mitral valve and aortic valve level M-mode(C5) 2. Identify and Explain the M- mode patterns in normal and in diseased condition of Mitral Valve, Pulmonary valve and Aortic valve(C5) 3. Identify and Explain the normal and abnormal M- mode pattern of Tricuspid Annular Plane Systolic Excursion and Inferior Vena cava(C5) 4. Explain the applications of M-mode in Left Ventricular systolic and diastolic function assessment(C5) 	2
Unit 2:		
Color M-mode	<ol style="list-style-type: none"> 1. Explain the applications of Color M-mode in Aortic, Mitral regurgitation, Velocity propagation and LV dyssynchrony(C5) 	2
Unit 3:		
Transesophageal echocardiography (TEE)	<ol style="list-style-type: none"> 1. List and Explain the Indications, Contraindication and Complications of TEE(C5) 2. Outline the Instrumentations, Monoplane, Biplane and Multiplane probes (C2) 3. Summarize and Explain the examination techniques including Patient preparation, Probe insertion and Technical problems (C5) 4. Apply skills to Identify and Explain the Multiplane Transesophageal echocardiography imaging views(C5) 	2
Unit 4:		
Contrast echocardiography	<ol style="list-style-type: none"> 1. List the indications of contrast echocardiography(C4) 2. List the properties of Ideal contrast agent(C4) 3. Summarize the ultrasound interaction with contrast agent(C2) 4. Explain the clinical applications of contrast echocardiography in various diseased condition(C5) 5. Explain Myocardial contrast echocardiography(C5) 	2
Unit 5:		
3D echocardiography (3DE)	<ol style="list-style-type: none"> 1. List the steps involved in 3D imaging technology(C4) 2. Explain the clinical applications in assessment of left ventricle, right ventricle, mitral valve, tricuspid valve, aortic valve, pulmonary valve, Interatrial septum and left atrial appendage(C5) 	2
Unit 6:		
Echocardiography in pulmonary hypertension	<ol style="list-style-type: none"> 1. Identify and Explain the 2- Dimensional Echocardiography (2DE) and M–mode findings in pulmonary hypertension(C5) 	2

Content	Competencies	Number of Hours
	2. Identify and Explain the Doppler flow pattern and its limitations(C5) 3. Methods to measure Right atrial pressure(C5)	
Unit 7:		
Echo in congenital heart disease	1. Examine and Explain the 2DE, M-mode, Hemodynamic and Doppler patterns in Pre tricuspid shunt(C5) 2. Examine and Explain the 2DE, M-mode, Hemodynamic and Doppler patterns in Post tricuspid shunts(C5) 3. Examine and Explain the 2DE, M-mode, Hemodynamic and Doppler patterns in Increases pulmonary blood flow(C5) 4. Examine and Explain the 2DE, M-mode, Hemodynamic and Doppler patterns in Decreased pulmonary blood flow(C5) 5. Examine and Explain the 2DE, M-mode, Hemodynamic and Doppler patterns in Pulmonary venous anomalies(C5) 6. Identify and Explain straddling/ overriding(C5)	6
Unit 8:		
Echo in valvular heart disease	1. Identify and Explain the 2DE, M-mode, Doppler pattern and methods to assess the severity grades of Mitral valve disease(C5) 2. Identify and Explain the 2DE, M-mode, Doppler pattern and methods to assess the severity grades of Aortic valve disease(C5) 3. Identify and Explain the 2DE, M-mode, Doppler pattern and methods to assess the severity grades of Tricuspid valve disease(C5) 4. Identify and Explain the 2DE, M-mode, Doppler pattern and methods to assess the severity grades of Pulmonary valve disease(C5)	4
Unit 9:		
Tissue Doppler imaging(TDI)	1. Build skills in Analysing, Measuring and Evaluating the Tissue annular velocity(C5) 2. Build skills in Analysing, Measuring and Evaluating the Myocardial Strain and Strain rate (C5) 3. Build skills in Analysing, Measuring and Evaluating the Tissue dyssynchrony imaging (C5)	2
Unit 10:		
Echo in Dyssynchrony	1. Analyse and Explain the Conventional Doppler & TDI measures to assess interventricular dyssynchrony(C5) 2. Analyse and Explain the M-mode, Color M-mode, Conventional Doppler, TDI, Speckle tracking and Tissue synchronization imaging measures to assess intraventricular dyssynchrony(C5) 3. Analyse and Explain the Doppler parameters to measure Atrio-ventricular dyssynchrony(C5)	2

Content	Competencies	Number of Hours
Unit 11:		
Echo in cardiomyopathies	<ol style="list-style-type: none"> 1. Identify and Explain the 2DE, M –mode, Conventional Doppler, TDI and recent advance techniques to assess Dilated cardiomyopathy(C5) 2. Identify and Explain the 2DE, M –mode, Conventional Doppler, TDI and recent advance techniques to assess Restrictive cardiomyopathy(C5) 3. Identify and Explain the 2DE, M –mode, Conventional Doppler, TDI and recent advance techniques to assess Hypertrophied cardiomyopathy(C5) 4. Identify and Explain the 2DE, Color and Doppler Findings to assess LV non compaction(C5) 	4
Unit 12:		
Echo in cardiac mass and tumors	<ol style="list-style-type: none"> 1. Build skills to identify and classify the type of cardiac tumors by location and appearance in 2DE and Doppler criteria(C5) 2. Identify and Examine the cardiac mass by 2DE criteria(C5) 	2
Unit 13:		
Echo in pericardial diseases	<ol style="list-style-type: none"> 1. Examine and Evaluate the 2DE criteria to identify Congenitally absent pericardium and pericardial cyst (C5) 2. Identify and Explain the 2DE, M-mode, Conventional Doppler, TDI criteria and recent advance techniques to distinguish Pericardial effusion and Cardiac Tamponade(C5) 3. Apply the technique in evaluating Echocardiographically guided Pericardiocentesis(C5) 4. Identify and Explain the 2DE, M-mode, Conventional Doppler, TDI criteria and recent advance techniques in Constrictive pericarditis(C5) 5. Identify and Explain the 2DE, M-mode, Conventional Doppler, TDI criteria and recent advance techniques to distinguish Restrictive vs constrictive physiology(C5) 	3
Unit 14:		
Echo in aortic diseases	<ol style="list-style-type: none"> 1. Analyse and Evaluate the location of Aortic aneurysm by 2DE, Doppler parameters and recent advanced techniques to make of the values to decide on management(C5) 2. Analyse, Evaluate and classify based on location of Aortic dissection by 2DE, Doppler parameters and recent advanced techniques to make of the values to decide on management(C5) 	2
Unit 15:		
Speckle tracking	<ol style="list-style-type: none"> 1. Apply technique in analysing the methods to 	2

Content	Competencies	Number of Hours
echocardiograph	assess Automated Function Imaging (C5) 2. Apply technique in analysing the methods to assess Strain and strain rate (C5) 3. Apply technique in analysing the methods to assess LV torsion (C5)	

Learning Strategies, Contact Hours and Student Learning Time (SLT):

Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	25	50
Seminar	3	6
Small group discussion (SGD)	4	8
Self-directed learning (SDL)	3	6
Problem Based Learning (PBL)	-	-
Case Based Learning (CBL)	-	-
Clinic	-	-
Practical	-	-
Revision	2	4
Assessment	2	4
Total	39	78

Assessment Methods:

Formative:	Summative:
Unit Test	Mid Semester/Sessional Exam (Theory)
Quiz	-
Viva	-
Assignments/Presentations	Record Book
Clinical assessment (OSCE, OSPE, WBPA)	OSCE
Clinical/Practical Log Book/ Record Book	Clinical record book

Mapping of Assessment with COs:

Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x	x	x			
Sessional Examination 2				x	x	x
Quiz / Viva	x	x	x	x		x
Assignments/Presentations			x	x	x	x
Clinical/Practical Log Book/ Record Book	x	x	x	x		x
Any others: WPBA		x	x		x	
End Semester Exam	x	x	x	x	x	x

Feedback Process:	
	Mid-Semester Feedback
	End-Semester Feedback

<p>Main Reference:</p>	<ul style="list-style-type: none"> • Congenital heart disease: 1. Myung Park 2. J K Perloff 3. Moss and Adam • Valvar heart disease: Echocardiography: 1. Harvey Feigenbaum 2. Arthur Weyman 3. Gee K Oh Tajik 4. Ottos • Cardiac catheterization: 1. William Grossman 2. Eric Topols 3. Morten B Kern
<p>Additional References</p>	<ul style="list-style-type: none"> • Cardiac stress testing: Cardio vascular medicine • Electrocardiography: Leo Schamroth 2. Mervin Goldman 3. Marriott's Practical Electrocardiography

Manipal College of Health Professions								
Name of the Department	Cardiovascular Technology (CVT)							
Name of the Program	Bachelor of Science in Cardiovascular Technology							
Course Title	Cardiac Cath and intervention							
Course Code	CVT3202							
Academic Year	Third Year							
Semester	VI							
Number of Credits	3							
Course Prerequisite	Basic knowledge about Hardwares used in cardiac interventional suit, X-Ray physics, cardiac invasive hemodynamic measurement techniques, contrast agents and cardiac pharmacology							
Course Synopsis	1.This module helps to obtain basic knowledge about cardiac and peripheral interventional procedures. 2.To provide fundamental knowledge about the hemodynamics in various congenital heart diseases, Valvular heart diseases and Coronary artery diseases. 3.This provide knowledge about interventional and therapeutic techniques with the help of various diagnostic modalities.							
Course Outcomes (COs):								
At the end of the course student shall be able to:								
CO1	To apply the knowledge in understanding the diagnostic and therapeutic procedures like angiography and angioplasty(C4).							
CO2	To assess the severity of Valvular and congenital heart diseases during cardiac Cath and angiography(C5).							
CO3	To construct and make use of interventional Hardwares in various procedures(C3)							
CO4	To take measures to interpret various interventional complications and its management(C5).							
CO5	To understand the various procedural techniques of all cardiac diseases and interpret the results using various imaging modalities(C5).							
CO6	To understand the various procedural techniques of peripheral intervention and other cardiac procedures in intervention(C5)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x	x						
CO2		x	x					
CO3		x				x		
CO4		x				x		
CO5		x			x			
CO6		x	x					

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Coronary vascular system	<ol style="list-style-type: none"> 1.Understanding the formation of atherosclerotic plaque(C2) 2.Define and explain the coronary artery and venous anomaly(C2) 3.Understanding the benign and malignant coronary anomalies(C2). 	3
Unit 2:		
Coronary Angiography	<ol style="list-style-type: none"> 1.To identify the importance of ACC/AHA guidelines for coronary angiography(C3) 2.To have knowledge about choosing the appropriate hardwares for the procedures(C4) 3.To understand the various techniques and angiographic views(C2) 4.To interpret the angiographic results in coronary artery disease(C5) 5. To illustrate the complications of all interventional procedure(mechanical and procedural related) and its management (C3) 	3
Unit 3:		
Coronary Angioplasty	<ol style="list-style-type: none"> 1.To identify and understand the lesion classification(C3) 2.To apply and understand the techniques and hardwares used in primary angioplasty procedure(C3) 3.To apply and understand the techniques of adjuvant PCI using IABP, VADs, ECMO and Impella (C4) 4.To apply and understand the techniques of complex PCI like Bifurcation lesions, LMCA,CTO's, DVD,TVD and MVD(C4) 5.To apply and understand the techniques of conventional PCI(C3) 	8
Unit 4:		
Cath and Angiography in CHD VHD and cardiomyopathies.	<ol style="list-style-type: none"> 1. Determine the importance of cardiac ventriculography and procedural techniques in evaluating various heart diseases(C5) 2. Determine the importance of Aortogram and PA angiogram in evaluating various heart diseases(C5) 3. To understand the criteria's in interpreting various cardiac angiograms(C5) 	4
Unit 5:		
Cardiac Cath and intervention in CHD, VHD and cardiomyopathies	<ol style="list-style-type: none"> 1.To elaborate the indications , contraindications, hardwares , procedural techniques ,complication and management in ASD and PFO(C5) 2.To elaborate the indications , contraindications, hardwares , procedural techniques ,complication 	9

Content	Competencies	Number of Hours
	and management in VSD(C5) 3.To elaborate the indications , contraindications, hardwares , procedural techniques ,complication and management in PDA(C5) 4.To elaborate the indications , contraindications, hardwares , procedural techniques ,complication and management in RSOV(C5) 5.To elaborate the indications , contraindications, hardwares , procedural techniques ,complication and management in LAA(C5) 6.To elaborate the Indications , contraindications, hardwares , procedural techniques ,complication and management in BMV(C5) 7.To elaborate the Indications , contraindications, hardwares , procedural techniques ,complication and management in BPV(C5) 8.To elaborate the Indications , contraindications, hardwares , procedural techniques ,complication and management in BAV(C5) 9.To elaborate the Indications , contraindications, hardwares , procedural techniques ,complication and management in TAVI(C5) 10.To elaborate the indications , contraindications, hardwares , procedural techniques ,complication and management in PTSMA(C5)	
Unit 6:		
Cardiac cath and angiography in peripheral vascular diseases	1.To define and understand various types and diseases of peripheral vascular system(C2) 2. To explain the angiographic Hardwares(catheters, stents, balloons) and procedure in PVD's (C3) 3. To understands the classification of PVDs (C2) 4.To identify the strategy for procedure related complications(C2) 5.To explain the use of snare kit in management of complications (C2) 6. Elaborate the indications , steps and procedure of IVC filter implant (C2) 7.To illustrate the classification and procedural uses of embolic protection devices (C2)	5
Unit 7:		
Pericardiocentesis	1.To explain the indications and contraindications (C2) 2. To elaborate the steps in the procedure (C3) 3.To interpret the sample obtained and categorise the results (C3)	1
Unit 8:		
Fractional Flow Reserve	1. To outline the indications and contraindications (C2) 2. To demonstrate the importance of achieving hyperemia during FFR (C3) 3.To understand the role of FFR by its equipment and technique of working principle (C3)	1

Content	Competencies	Number of Hours
	4.To explain the instrumentation and methods to handle (C3) 5.To interpret the images obtained and its advantages (C3)	
Unit 9:		
Intravascular ultrasound	1.To outline the indications and contraindications (C2) 2.To understand the role of Intravascular ultrasound by its equipment and technique of working principle (C3) 3.To explain the instrumentation and methods to handle (C3) 4.To interpret the images obtained and its advantages (C3)	1
Unit 10:		
Rotablation	1.To outline the indications and contraindications (C2) 2.To understand the role of ROTA by its equipment and technique of working principle (C3) 3.To explain the instrumentation and methods to handle (C3) 4.To understand the complications and its management (C3)	2
Unit 11:		
TAVR (Transcatheter aortic Valve Replacement)	1.To outline the indications and contraindications (C2) 2. To understand the various approaches and techniques of implant (C2) 3.To identify the artificial valve structure(C2)	1
Unit 12:		
Introduction to EP studies	1.To outline the indications and contraindications (C2) 2. To explain the common views and catheter placements (C2) 3. To remember the normal intervals and values in EP studies(C2)	1

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	22	44
Seminar	4	8
Small group discussion (SGD)	4	8
Self-directed learning (SDL)	4	8
Problem Based Learning (PBL)	-	-
Case Based Learning (CBL)	-	-
Clinic	-	-
Practical	-	-
Revision	3	6
Assessment	2	4
Total	39	78

Assessment Methods:								
Formative:			Summative:					
Unit Test			Mid Semester/Sessional Exam (Theory)					
Quiz			-					
Viva			Viva					
Assignments/Presentations			Assignments and presentations					
Clinical assessment (OSCE, OSPE, WBPA)			WBPA					
Clinical/Practical Log Book/ Record Book			Record book and Work dairy					
Mapping of Assessment with COs:								
Nature of Assessment			CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1			x	x	x			
Sessional Examination 2						x	x	
Quiz / Viva							x	x
Assignments/Presentations				x		x		
Clinical/Practical Log Book/ Record Book			x	x				
Any others: WPBA				x	x	x	x	x
End Semester Exam			x	x	x	x	x	x
Feedback Process:		Mid-Semester Feedback						
		End-Semester Feedback						
Main Reference:		<ul style="list-style-type: none"> • Textbook of interventional Cardiology – By Grossman • Manual of cardiovascular medicine – By Griffin • Practical handbook of advance interventional cardiology 						
Additional References		Handbook of interventional Cardiology – Morten J kern						

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	General Cardiac Examination and BLS-ACLS
Course Code	CVT3203
Academic Year	Third Year
Semester	VI
Number of Credits	3
Course Prerequisite	Basic knowledge of evaluating echocardiographic with clinical aspects
Course Synopsis	1.This program elucidates more about clinical and assessing the clinical scenario , comparing the clinical findings and diagnostic test results 2.To assess the various scenario of cardiac arrest and respiratory arrest 3.To explore the knowledge of basic Life Support 4.Asessing various life threatening arrhythmias and immediate management

Course Outcomes (COs):

At the end of the course student shall be able to:

CO1	To understand the clinical scenarios and correlating these findings with diagnostic tests(C2)
CO2	To understand the presentation and differentiate from cardiac or non-cardiac etiology(C2)
CO3	To understand Instrumentations, Indications and Methods of performing the test
CO4	To understand the etiology and evaluation of hypertension (systemic hypertension/pulmonary artery hypertension)(C2)
CO5	To understand the basic life support and its importance(C2)
CO6	To assess the infesting various conditions of cardiac arrest and immediate response(C2)

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x	x						
CO2		x				x		
CO3	x	x						
CO4	x	x						
CO5		x				x		
CO6		x				x		

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
History taking	1..Identify the normal and abnormal patient history (C3,P3) 2.Identify the clinical findings and comparing these	2

Content	Competencies	Number of Hours
	with the diagnostic tests (C3,P3)	
Unit 2:		
NYHA functional class	1.To identify and understand the different NYHA functional class(C3,P3)	1
Unit 3:		
Chest pain	1. To know the etiology, Cardiovascular causes and Non Cardiac causes (C1) 2.Explaining the duration, radiation,location and character (C1) 3.To understand the Chronic stable angina and Unstable angina (C3,P3)	2
Unit 4:		
Palpitation	1. To understand the Cardiac etiology and evaluation (C3,P3) 2.To understand the Non-Cardiac etiology and evaluation (C3,P3)	2
Unit 5:		
Fatigue	1. To understand the etiology and evaluation(C3,P3)	1
Unit 6:		
Syncope	1. To understand the Cardiac etiology and evaluation (C3,P3) 2. To understand the Non-Cardiac etiology and evaluation (C3,P3) 3. To know the unknown cause (C1)	2
Unit 7:		
Tilt Table Testing	1.To understand Instrumentations, Indications and Methods of performing the test(C3,P3) 2.To interpret the tilt table test results whether Positive / negative (C5)	2
Unit 8:		
Dyspnea	1. To understand etiology, Cardiovascular causes and Non-Cardiac causes(C3,P3) 2.Explaining the pathogenesis(C1) 3.To know the Paroxysmal nocturnal dyspnea and – Orthopnea(C1)	2
Unit 9:		
Arterial pulse	1. To know the Definition, Genesis and Pulse wave pattern(C1) 2,Explaining the examination of arterial pulse, Irregularly irregular pulse, Regularly irregular pulse, Pulsus paradoxus ,Volume of the pulse(C1) 3.Understand the characteristic features of pulse in common clinical conditions(C3,P3)	2
Unit 10:		
Jugular venous pulse	1. Identify and understand the waves of JVP in normal and abnormal –conditions(C5)	1

Content	Competencies	Number of Hours
Unit 11:		
Heart sound	1. Identify and understand the normal and disease conditions(C5) 2. Identify and understand the Heart murmur in various disease and conditions(C5)	2
Unit 12:		
Hemoptysis	1. To know the etiology and evaluation(C1)	1
Unit 13:		
Hoarseness of voice	1. To know the etiology and evaluation(C1)	1
Unit 14:		
Cyanosis	1. To know the definition and evaluation(C1) 2. Explaining the types: Peripheral cyanosis, Central cyanosis, Mixed cyanosis and differential cyanosis(C1)	2
Unit 15:		
Hypertension	To know the etiology and types(C1)	1
Unit 16:		
Pulmonary artery hypertesion	To know the etiology and diagnosis(C1)	2
Unit 17:		
Basic life support	1. To know the introduction ,course objectives, age definition, high quality CPR, in hospital /out of hospital cardiac arrest and sudden cardiac arrest verses heart attack(C1) 2. Explaining the adult cardiac arrest algorithm, adult rescuer BLS sequence, assessment of breathing and pulse, locating carotid pulse, adult chest compression, adult breaths, head tilt chin lift, jaw thrust, barrier devices, bag-mask devices ,rescuer task in one or two rescuer(C1) 3. Explaining the AED for adults and children, special circumstances and universal steps of operating AED (C1)	5
	4. Understand the Team dynamics(C3,P3) 5. Explaining the BLS for infants and children(C1) -Infants/child chest compression -Paediatric cardiac arrest algorithm 6. explaining the ventilation techniques(C1) 7. Understand the opioid associated life threatening emergencies(C3,P3)	
Unit 18:		
Advanced cardiac life support	1. To know the introduction, ECG rhythm interpretation for core ACLS rhythms(C1) 2. Understanding the effective high performance team dynamics ,clear roles and responsibilities, knowledge sharing, clear messages and closed loop communication(C3,P3)	8

Content	Competencies	Number of Hours
	3. Understanding the ACLS cases , management of respiratory arrest, airway management , hardwares in airway management, acute coronary syndrome, acute stroke and fibrinolytic therapy(C3,P3) 4. Understanding the cardiac arrest , adult cardiac arrest algorithm, pulseless electrical activity, cardiac asystole, Bradycardia, Tachycardia, adult tachycardia with pulse algorithm and post cardiac arrest algorithm(C3,P3)	

Learning Strategies, Contact Hours and Student Learning Time (SLT):						
Learning Strategies	Contact Hours	Student Learning Time (SLT)				
Lecture	23	46				
Seminar	8	16				
Small group discussion (SGD)	-	-				
Self-directed learning (SDL)	-	-				
Problem Based Learning (PBL)	-	-				
Case Based Learning (CBL)	-	-				
Clinic	-	-				
Practical	-	-				
Revision	4	8				
Assessment	4	8				
Total	39	78				
Assessment Methods:						
Formative:	Summative:					
Unit Test	Mid Semester/Sessional Exam (Theory)					
Quiz	-					
Viva	-					
Assignments/Presentations	Assignments, Record Book					
Clinical assessment (OSCE, OSPE, WBPA)	OSCE					
Clinical/Practical Log Book/ Record Book	Clinical record book					
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x	x	x			
Sessional Examination 2				x	x	x
Quiz / Viva				x		
Assignments/Presentations		x	x	x	x	
Clinical/Practical Log Book/ Record Book	x	x	x	x		
Any others: WPBA						
End Semester Exam	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	1. Text book of Braunwald's Heart Disease 2. Vijay Raghavas's Clinical cardiology					
Additional References	1. Alagappa's text book of Clinical Cardiology 2. ACC/AHA guidelines for ACLS and BLS					

Manipal College of Health Professions								
Name of the Department	Cardiovascular Technology (CVT)							
Name of the Program	Bachelor of Science in Cardiovascular Technology							
Course Title	Clinic in Echocardiography							
Course Code	CVT3231							
Academic Year	Third Year							
Semester	VI							
Number of Credits	4							
Course Prerequisite	Basic knowledge on Echocardiographic approach in the assessment of various cardiac diseases.							
Course Synopsis	1.This course allow students to expose to skill based learning during echocardiographic examination 2.This course boost student to confidently perform echocardiography individually and independently, thus enhancing students practical knowledge 3.This course allow students to explore to various forms of echocardiography such as paediatric echo, trans oesophageal echo, pharmacological stress echo etc.							
Course Outcomes (COs):								
At the end of the course student shall be able to:								
CO1	To perform echocardiographic examination to evaluate chamber quantification, cardiac chamber function, and hemodynamics (P5)							
CO2	To learn and perform anatomical inspection of cardiac chamber connection and diagnose possible abnormal cardiac development/connection specific to various congenital heart disease. (P4)							
CO3	Understanding the echocardiographic evaluation in the diagnosis and severity assessment of valvular heart diseases(P4)							
CO4	To learn the echocardiographic examination in the evaluation of patients with ischemic heart disease, analysing extent of cardiac damage and its complications(P4)							
CO5	Acquiring knowledge on various cardiomyopathies, their brief evaluation, diagnosis and risk stratification along with role of echocardiography in deciding therapeutic strategies.(P4)							
CO6	To study the brief echocardiographic evaluation of patients with pericardial diseases, aortic diseases and cardiac tumours (P4)							
CO7	To acquire the knowledge on standard procedure in trans oesophageal echocardiography, contrast echo and pharmacological stress echo (P5)							
CO8	To understand the advanced echocardiographic techniques in the evaluation of cardiac function such as tissue doppler imaging, analysis of train and strain rate and 3D echocardiography (P3)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1		X					X	
CO2		X		X				
CO3	X					X		
CO4	X	X						

CO5	x	x					
CO6		x				x	
CO7		x			x		
CO8	x				x		

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Standard echocardiographic examination	<ul style="list-style-type: none"> Identifying chamber, Quantifying chamber dimensions and assessment of cardiac function (P5) Application of different echocardiographic modes in routine evaluation such as M-mode, 2D echo, Doppler flow assessment (P5) Measuring ejection fraction of left and right ventricle, Evaluating valvular flow velocities, estimation chamber pressures and assessment inferior venacava (P5) 	18
Unit 2:		
Echo in congenital heart disease (CHD)	<ul style="list-style-type: none"> To determine congenital cardiac anomalies (P4) To classify the specific CHD anatomically and physiologically (P4) To assess direction of shunt, pulmonary to systemic flow ratio, pulmonary and systemic vascular resistance, PA pressure assessment (P4) To evaluate associated anomalies, cardiac function, chamber enlargement and correlating echocardiographic diagnosis with other clinical parameters. (P4) 	15
Unit 3:		
Echo in valvular heart disease (VHD)	<ul style="list-style-type: none"> To diagnose valvular stenosis/ regurgitation with its severity assessment (P4) To estimate pressure gradients across stenotic valve, assessment of valve area, regurgitant volume/fraction (P4) Assessment of associated lesions, ventricular function and pulmonary pressure(P4) To evaluate the patients suspecting infective endocarditis(P3) Evaluation of prosthetic heart valves(P3) 	14
Unit 4		
Echo in ischemic heart disease (IHD)	<ul style="list-style-type: none"> Evaluating the patients with suspected coronary artery disease by quantifying global and regional cardiac function (P4) Assessment of patients with acute coronary syndrome and their complications (P4) Follow-up assessment of patients with prior 	12

Content	Competencies	Number of Hours
	percutaneous coronary intervention/ CABG (P4)	
Unit 5		
Echo in cardiomyopathies	<ul style="list-style-type: none"> To evaluate causes, myocardial dysfunction, valvular regurgitation in various forms of dilated cardiomyopathies (P4) Complete evaluation of myocarditis (P3) To examine causes, and diagnose various types of restrictive cardiomyopathy and their clinical correlation (P3) To examine causes, and diagnose various types of hypertrophic cardiomyopathy and their clinical correlation (P3) 	8
Unit 6		
Echo in pericardial diseases	<ul style="list-style-type: none"> To diagnose pericardial effusion and cardiac tamponade echoacardiographically along with clinical findings (P4) To evaluate patients with constrictive pericarditis (P3) To differentiate Chronic constrictive pericarditis and restrictive cardiomyopathy (P3) 	8
Unit 7		
Echo in aortic diseases	<ul style="list-style-type: none"> To diagnose and classify aortic aneurysm and dissection (P3) Assessment of aortic root and entire artery in various connective tissue disorders associated with aortic diseases (P3) 	8
Unit 8		
Echo in cardiac tumours	<ul style="list-style-type: none"> To examine primary and secondary cardiac tumours (P3) Evaluating site of mass, morphology, mobility in the identification of type of cardiac tumor (P3) Assessing valvular obstruction/ regurgitation, ventricular dysfunction in the presence of cardiac tumour (P3) 	5
Unit 9		
Trans esophageal echocardiography (TEE)	<ul style="list-style-type: none"> Instrumentation and probe setting prior to TEE examination Preparation of patients for TEE (P5) Assisting TEE procedure and acquiring data for further assessment (P4) 	4
Unit 10		
Pharmacological stress echocardiography	<ul style="list-style-type: none"> Preparing patient for Dobutamine stress echo (P3) Setting drug dosage rate appropriate for weight of the patient (P3) To understand the brief procedure and interpretation of results (P3) 	4

Content	Competencies	Number of Hours
Unit 11		
Contrast echocardiography	<ul style="list-style-type: none"> • Patient preparation for contrast echocardiography (P4) • Preparation and injection of agitated saline bubble intra venously (P4) • To analyse presence/absence of intra/extra cardiac shunts (P4) 	4
Unit 11		
Recent advances	<ul style="list-style-type: none"> • To obtain tissue annular velocity and assess ventricular function using tissue Doppler imaging (P3) • To understand the method to evaluate strain and strain rate echocardiography and their uses (P3) • To understand the utility and techniques of 3D echocardiography (P3) 	4

Learning Strategies, Contact Hours and Student Learning Time (SLT):								
Learning Strategies	Contact Hours	Student Learning Time (SLT)						
Lecture	20	40						
Seminar	-	-						
Small group discussion (SGD)	10	20						
Self-directed learning (SDL)	10	20						
Problem Based Learning (PBL)	10	20						
Case Based Learning (CBL)	10	20						
Clinic	-	-						
Practical	36	72						
Revision	4	8						
Assessment	4	8						
Total	104	208						
Assessment Methods:								
Formative:	Summative:							
Unit Test	Mid Semester (Practical viva-voce)							
Quiz	-							
Viva	Viva							
Assignments/Presentations	-							
Clinical assessment (OSCE, OSPE, WBPA)	WBPA							
Clinical/Practical Log Book/ Record Book	Record Book							
Mapping of Assessment with COs:								
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6	CO7	CO8
Mid Semester Examination	x	x	x	x	x	x		
Quiz / Viva		x	x	x	x	x		
Any others: WPBA				x	x	x	x	x
End Semester Exam	x	x	x	x	x	x	x	x

Feedback Process:	Mid-Semester Feedback
	End-Semester Feedback
Main Reference:	<ul style="list-style-type: none"> • Feigenbaum's Echocardiography, Book by Harvey Feigenbaum • Textbook of clinical Echocardiography: Book by Catherine Otto, Latest Edition • Park's Paediatric cardiology for practitioners- Myung D Park
Additional References	<ul style="list-style-type: none"> • The Echo Manual, Latest edition, Book by Jae K. Oh, James B Seward, A Jamil Tajik

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Clinics in Cardiac Catheterization
Course Code	CVT3232
Academic Year	Third Year
Semester	VI
Number of Credits	4
Course Prerequisite	Basic knowledge of Cardiac Catheterization
Course Synopsis	1. This course allow students to expose to skill based learning during assistance in interventional cardiac procedures in cathlab 2. To actively take part in assistance of hardware selection and equipment handling individually and independently, thus enhancing students practical knowledge 3. This course allow students to explore to various forms of cardiovascular interventional procedures with advance treating techniques

Course Outcomes (COs):

At the end of the course student shall be able to:

CO1	To involve mechanical in cath lab setup with standard guidelines and to follow according during procedures (P3)
CO2	To develop the ability to create perceptions and follow the verbal instructions in selection of hardwares and equipment handling(P4)
CO3	To build skills in interpreting the normal and abnormal coronary angiograms (P5)
CO4	To build skills in assisting the cardiac and non-cardiac procedures technical and practical calculations (P5)
CO5	To create and co-ordinate task with the operating team with appropriate knowledge on the procedure attending (P4)
CO6	To have knowledge in performing echo and administering emergency drugs when required in the team task (P5)

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x			x				
CO2		x	x					
CO3	x					x		
CO4		x					x	
CO5					x			x
CO6		x	x					

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Standard guidelines for cardiac interventional suit	1. Adapt the radiation safety protocols and measures(P4) 2. Handling of lead aprons and its uses (P4)	10

Content	Competencies	Number of Hours
	3. Appropriate handling and preparation of patient and their care (P5) 4. To adapt the importance of consent for every procedure (P4) 5. To prioritise the sterility guidelines and follow them (P5) 6. To document all data related to the procedure in the register book (P5)	
Unit 2:		
Equipment handling	1.To construct skills in handling the Cath lab operating table (P3) 2.To assist in handling the IABP, IVUS, FFR/RFR, OCT power injectors (P3) 3. To actively handle Cardiac defibrillators, monitors, 2D echo machine, ACT monitor (P5)	10
Unit 3:		
Cardiac Interventional Hardwares	1.To choose required hardwares for the elective procedure(P5) 2. To develop knowledge in selection of appropriate hardwares of assisting equipment's (P5)	10
Unit 4:		
Basic cardiac catheterization procedure for	1.To understand the steps and procedure of coronary angiograms (P4) 2. To interpret the angiograms and understand the reports (P3) 3. Readiness to act during the procedure with hardwares and equipment (P2) 4.To understand the steps and procedure of coronary angioplasty (P4) 5. To interpret the angiograms and understand the reports of angioplasty (P3) 6. Readiness to act during the procedure with hardwares and equipment (P2)	10
Unit 5:		
Cath study and procedures for IHD	1.To understand the steps and procedure of cardiac ventriculography (P4) 2. To assess the wall motion abnormalities and interpretation of angiograms (P4) 3. To actively involve in various types of PCI procedures and understand the techniques (P4)	10
Unit 6:		
Cath study and procedure for VHD	1.To understand the steps and procedure of Valvular interventions (P4) 2. To assess the severity of Valvular regurgitation by cath study (P5) 3. To calculate the valve areas using Gorlin's formula (P5)	10

Content	Competencies	Number of Hours
	4.To understand the steps in calculation, preparations and selection of balloon catheters for intervention (P4)	
Unit 7:		
Cath study and procedure for CHD	<ol style="list-style-type: none"> 1.To understand the steps and procedure of congenital device closure interventions (P4) 2. To assess the types of CHDs by cath study (P5) 3. To calculate the Qp, Qs, SVR, PVR and their ratios (P5) 4.To understand the preparations and selection of devices for intervention (P4) 5. To interpret the Oximetry run results and report the results (P5) 	10
Unit 8:		
Miscellaneous cardiovascular interventions	<ol style="list-style-type: none"> 1.To understand the steps and procedure of PT SMA in HOCM cases (P4) 2. To understand the steps and procedure of pericardiocentesis (P4) 3. To understand the steps and procedure of peripheral intervention (P4) 4. To understand the steps and procedure of Co-A interventions (P4) 5. To understand the steps and procedure of AAAs interventions (P4) 	10
Unit 9:		
Pacemaker and device implantation procedure	<ol style="list-style-type: none"> 1. To understand the steps and procedure of temporary Pacemaker insertion (P4) 2. To understand the steps and procedure of permanent pacemaker implantation (P4) 3. To identify the hardwares and respond actively during the case (P3) 	10
Unit 10:		
Cardiac emergency drugs handling	<ol style="list-style-type: none"> 1.To act readiness to emergency drug injections (P2) 2. To identify the drugs in crash cart and to remember the appropriate dosage (P4) 	8
Unit 11:		
Role of echo in Cardiac interventional suit	<ol style="list-style-type: none"> 1.To perform echocardiography quickly on emergency instructions (P4) 2. To assist with screeing echo during interventional procedure (P4) 	6

Learning Strategies, Contact Hours and Student Learning Time (SLT):

Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	20	40
Seminar	-	-
Small group discussion (SGD)	10	20

Self-directed learning (SDL)	10	20				
Problem Based Learning (PBL)	10	20				
Case Based Learning (CBL)	10	20				
Clinic	-	-				
Practical	36	72				
Revision	4	8				
Assessment	4	8				
Total	104	208				
Assessment Methods:						
Formative:	Summative:					
Unit Test	Mid Semester/Sessional Exam (Practical)					
Quiz	End Semester Exam (Practical - spotters)					
Viva	Viva					
Assignments/Presentations	Record Book					
Clinical assessment (OSCE, OSPE, WBPA)	WBPA					
Clinical/Practical Log Book/ Record Book	WORK DAIRY					
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Mid Semester / Sessional Examination 1	x	x	x			
Sessional Examination 2			x	x	x	x
Quiz / Viva		x	x	x		
Assignments/Presentations	x	x	x	x		
Clinical/Practical Log Book/ Record Book		x	x	x		
Any others: WPBA	x	x	x	x	x	x
End Semester Exam	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	<ul style="list-style-type: none"> • Textbook of interventional Cardiology – By Grossman • Manual of cardiovascular medicine – By Griffin • Practical handbook of advance interventional cardiology 					
Additional References	Handbook of interventional Cardiology – Morten J kern					

Manipal College of Health Professions	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Cardiac Assist Devices
Course Code	CVT3241
Academic Year	Third Year
Semester	VI
Number of Credits	3
Course Prerequisite	Basic knowledge on cardiac failure mechanism and hemodynamics
Course Synopsis	<ol style="list-style-type: none"> 1. This course elucidates the Acyanotic congenital heart diseases 2. This course will make students to understand the pathophysiology and clinical presentation of all the acyanotic congenital heart disease 3. This course allows students to understand the diagnostic methods involved in the diagnosis and management of acyanotic congenital heart disease

Course Outcomes (COs):

At the end of the course student shall be able to:

CO1	Understanding the burden of heart failure globally, associated complications and need for mechanical support (C1)
CO2	Understanding causes, brief pathophysiology of established heart failure and standard of care available (C2)
CO3	To understand the role of intra-aortic balloon pump in supporting left ventricle(C3)
CO4	To explain the impact of cardiac resynchronization therapy in patients with heart failure(C2)
CO5	Discussing evolution of various ventricular assisting devices (C3)
CO6	Discussing brief impact of extra corporeal membrane oxygenation (C3)

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x				x			
CO2	x			x				
CO3	x		x					
CO4		x				x		
CO5	x	x						
CO6	x	x						

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Heart failure	<ul style="list-style-type: none"> • To understand the burden of heart failure and its consequences (C2) 	4
	<ul style="list-style-type: none"> • To understand the complications associated with heart failure and prognosis (C3) 	2

Content	Competencies	Number of Hours
Unit 2:		
Types of heart failure	<ul style="list-style-type: none"> To understand heart failure with reduced and preserved heart failure (C2) Explaining the various cause for systolic and diastolic heart failure (C1) 	3
	<ul style="list-style-type: none"> To understand congestive heart failure (C3) 	1
	<ul style="list-style-type: none"> To explain various causes for heart failure and their management (C3) 	1
Unit 3:		
Intra-aortic Balloon Pump (IABP)	<ul style="list-style-type: none"> To know the various indication for IABP (C1) To know about the IABP instrumentation and techniques(C1) 	3
	<ul style="list-style-type: none"> To understand the concepts of supporting left ventricular function i.e systolic unloading of pressure and diastolic augmentation of pressure (C3) 	2
	<ul style="list-style-type: none"> To understand the positioning IABP in aorta and apply different operational modes present in the dashboard of IABP machine along with interpretation of waveforms (C4) 	2
	<ul style="list-style-type: none"> To evaluate and manage the complications of IABP implantation (C3) 	2
Unit 4		
Cardiac resynchronization therapy(CRT)	<ul style="list-style-type: none"> To understand mechanism and brief pathophysiology of intraventricular dyssynchrony(C2) To explain indications for CRT (C2) 	4
	<ul style="list-style-type: none"> To understand brief procedure, lead placement, programming (C3) 	2
	<ul style="list-style-type: none"> Understanding Long term effects of CRT, Follow up assessment and identifying responders and non-responders(C3) 	2
Unit 5		
Ventricular assist devices (VAD)	<ul style="list-style-type: none"> Understanding the instrumentation, procedure, physiology of various VAD (C2) Explaining the bridge to device, bridge to transplant and bridge to recovery VAD implantation scenarios (C2) 	3
	<ul style="list-style-type: none"> Understanding the duration of use specific to type of VAD and complications (C2) 	2
Unit 6		
Extra corporeal membrane oxygenation (ECMO)	<ul style="list-style-type: none"> Understanding the instrumentation, procedure, physiology of various forms of ECMO (C2) Explaining the veno arterial(V-A) ECMO, veno venous(V-V) ECMO(C2) 	4
	<ul style="list-style-type: none"> Understanding the duration of use specific to type of ECMO and their complications (C2) 	2

Learning Strategies, Contact Hours and Student Learning Time (SLT):							
Learning Strategies	Contact Hours	Student Learning Time (SLT)					
Lecture	20	40					
Seminar	12	24					
Small group discussion (SGD)	-	-					
Self-directed learning (SDL)	-	-					
Problem Based Learning (PBL)	-	-					
Case Based Learning (CBL)	-	-					
Clinic	-	-					
Practical	-	-					
Revision	4	8					
Assessment	3	6					
Total	39	78					
Assessment Methods:							
Formative:				Summative:			
Unit Test				Mid Semester (Theory)			
Quiz				-			
Viva				-			
Assignments/Presentations				Assignments and presentations			
Clinical assessment (OSCE, OSPE, WBPA)				-			
Clinical/Practical Log Book/ Record Book				-			
Mapping of Assessment with COs:							
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6	CO7
Sessional Examination 1	x	x	x				
Sessional Examination 2				x	x	x	
Quiz / Viva							x
Assignments/Presentations							x
Clinical/Practical Log Book/ Record Book		x	x	x	x	x	
Any others: WPBA							
End Semester Exam	x	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback						
	End-Semester Feedback						
Main Reference:	<ul style="list-style-type: none"> • Oxford specialist handbook in surgery (Cardio thoracic surgery), Indian Edition, Joanna Chikwe, Emma Beddow, Brain Glenville • Cardiac assist devices , Daniel Goldstein, Mehmet Oz 						
Additional References	<ul style="list-style-type: none"> • Echocardiography by Feigenbaum (Latest Edition) • Cardiology by Braunwald and Hurst (Latest edition) 						

Manipal College of Allied Health Professional	
Name of the Department	Cardiovascular Technology (CVT)
Name of the Program	Bachelor of Science in Cardiovascular Technology
Course Title	Imaging Modalities in Cardiac Diagnosis
Course Code	CVT3242
Academic Year	Third Year
Semester	VI
Number of Credits	3
Course Prerequisite	Basic knowledge on cardiac catheterization
Course Synopsis	1. This module help to obtain basic knowledge on intra vascular ultrasound and fractional flow reserve. 2. This course will make students to understand the instrumentation and procedure of optical coherence tomography 3. This provide knowledge about interventional and therapeutic techniques with the help of various diagnostic modalities.

Course Outcomes (COs):

At the end of the course student shall be able to:

CO1	To understand the diagnostic and therapeutic procedure like intravascular ultrasound(C2)
CO2	To assess the plaque extent and morphology(C2)
CO3	To guide the interventional procedures- stent placement and stent opposition(C2)
CO4	To assess the significant borderline lesions by using fractional flow reserve(C2)
CO5	To understand the procedure and interpretation of Optical coherence tomography(C2)
CO6	To assess the significant borderline lesions by using instant flow reserve(C2)

Mapping of Course Outcomes (COs) to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x	x						
CO2	x	x						
CO3	x				x			
CO4	x					x		
CO5		x	x					
CO6	x					x		

Course Content and Outcomes:

Content	Competencies	Number of Hours
Unit 1:		
Intra vascular ultrasound	1. Explaining the ultrasound principles(C2) 2. Identification and classification of atherosclerotic plaques: soft plaque, fibrotic plaque, calcific plaque, vulnerable plaque, mixed plaque and thrombus and its characteristics (C2)	12

Content	Competencies	Number of Hours
	3. Define and explaining the basic measurements, perivascular landmarks, stents and instents restenosis(C2) 4. Identification of artifacts(C2) 5. Explaining the safety of IVUS(C2) 6. To understand the branching patterns in the LAD and perivascular landmarks(C3) 7. To understand the stented/non-stented artery and artefact assessment(C3) 8. To know the relative contraindications(C1) 9. Explaining the potential uses of IVUS(C2) 10. To understand IVUS guided stent placement(C3) 11. To understand the virtual histology:IVUS based virtual coronary artery histology(C3) 12. Explaining aneurysm assessment:true/false aneurysm(C2)	
Unit 2:		
Fractional flow reserve	1. To know the indications Contraindications(C1) 2. To know the Hardware's, technical aspects, Operating system and Handling of equipment(C1) 3. To understand the procedural assessment, Post procedural assessment, Reporting , Complications and it's management(C3)	9
Unit 3:		
Resting full cycle flow ratio	1. To know the indications Contraindications(C1) 2. To know the Hardware's, technical aspects, Operating system and Handling of equipment(C1) 3. To understand the procedural assessment, Post procedural assessment, Reporting , Complications and it's management(C3)	9
Unit 4:		
Optical coherence tomography	1. To know the indications Contraindications(C1) 2. To know the Hardware's, technical aspects, Operating system and Handling of equipment(C1) 3. To understand the procedural assessment, Post procedural assessment, Reporting , Complications and it's management(C3)	9

Learning Strategies, Contact Hours and Student Learning Time (SLT):		
Learning Strategies	Contact Hours	Student Learning Time (SLT)
Lecture	22	44
Seminar	8	16
Small group discussion (SGD)	-	-
Self-directed learning (SDL)	-	-

Problem Based Learning (PBL)	-	-				
Case Based Learning (CBL)	-	-				
Clinic	-	-				
Practical	-	-				
Revision	5	10				
Assessment	4	8				
Total	39	78				
Assessment Methods:						
Formative:	Summative:					
Unit Test	Mid Semester/Sessional Exam (Theory)					
Quiz	-					
Viva	-					
Assignments/Presentations	Assignments, Record Book					
Clinical assessment (OSCE, OSPE, WBPA)	OSCE					
Clinical/Practical Log Book/ Record Book	Clinical record book					
Mapping of Assessment with COs:						
Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Sessional Examination 1	x	x	x			
Sessional Examination 2				x	x	x
Quiz / Viva				x		
Assignments/Presentations		x	x	x	x	
Clinical/Practical Log Book/ Record Book	x	x	x	x		
Any others: WPBA						
End Semester Exam	x	x	x	x	x	x
Feedback Process:	Mid-Semester Feedback					
	End-Semester Feedback					
Main Reference:	<ul style="list-style-type: none"> • Textbook of interventional Cardiology – By Grossman • Manual of cardiovascular medicine – By Griffin 					
Additional References	<ul style="list-style-type: none"> • Practical handbook of advance interventional cardiology • Handbook of interventional Cardiology – Morten J kern 					

SEMESTER VII & Semester VIII

INTERNSHIP PROGRAM

Manipal College of Health Professions								
Name of the Department		Cardiovascular Technology (CVT)						
Name of the Program		Bachelor of Science in Cardiovascular Technology						
Course Title		Internship						
Academic Year		Fourth Year						
Semester		VII & VIII						
Course Prerequisite		Student should have complete knowledge on interpretation and reporting of ECG, TMT and Holter, to self-diagnose and report by performing echocardiographic test, to analyze and report pacemaker programming and to possess knowledge on hardware and equipment's used during the assistance of cardiac interventional procedures						
Course Synopsis		During internship, students will get the necessary hands on exposure to all the professional aspects pertaining to cardiovascular technological practice. The training centres can be internal (MAHE) or external. The external organisation will be chosen based on the quality of clinical exposure facility. Students are expected to spend their training in various specialities such as non-invasive cardiac diagnostic areas like ECG, TMT, Holter, Pacemaker Analysis and Echocardiographic room also attending bedside, ICUs and emergency call duties and invasive areas like cardiac interventional suit in order to assist the planned and emergency procedures. Clinical competency of the interns will be assessed continuously. Comprehensive clinical logbook and detailed clinical portfolio will be maintained and evaluated.						
Course Outcomes (COs):								
At the end of the internship student shall be able to:								
CO1	Build skills to perform ECG and develop practical knowledge and ability to interpret and report any given ECG (P5)							
CO2	Perform and able to analyse ambulatory ECG recording (HOLTER) as well as evaluation of HOLTER monitoring (P4, A2)							
CO3	Perform and able to analyse TMT as well as evaluation and reporting (P4, A2)							
CO4	Perform and able to analyse and program in pacemaker implanted patients (P4, A3)							
CO5	Perform echocardiographic examination, to interpret and report in the evaluation of cardiovascular diseases (P5, A3)							
CO6	Handel and co-ordinate task with the operating team with appropriate knowledge on the procedure attending in cardiac interventional suit (P5, A2)							
Mapping of Course Outcomes (COs) to Program Outcomes (POs):								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1		x				x		
CO2	x	x						
CO3	x				x			
CO4			x				x	
CO5		x						x
CO6			x			x		

Course Content and Outcomes:
Area 1 : Electrocardiogram non-invasive practice
<ol style="list-style-type: none"> 1. To set the practice area for daily activities (P2) 2. Able to place leads and perform ECG and to report (P4) 3. Build skills to develop practical knowledge and ability to interpret and report any given ECG (P4) 4. To report ECGs online which is receive from outside clinical centres under the supervision of the faculty (P4)
Area 2 : Tread mill non-invasive practice
<ol style="list-style-type: none"> 1. Should know the standard protocol of performing TMT and use of emergency drugs (P2) 2. To know the operations of TMT machine and programmed computers with different protocol and procedures (P4, A2) 3. To clinically correlate patient's symptoms, history with ECG and to perform TMT under the supervision (P4, A2) 4. To analyse the test results and compare it with the baseline findings and report (P4, A2) 5. To Know the termination indication, complication and its management of TMT (P4, A2) 6. To build knowledge in TMT interpretation and discuss on the management (P4, A2) 7. Should develop technical skills in patient rescue during emergency (P4, A2)
Area 3 : Holter analysis practice
<ol style="list-style-type: none"> 1. Should know to utilize different methods of lead placement in recording ambulatory ECG (P4, A2) 2. Able to analyse and interpret stored ECG data (P4, A2)
Area 4 : Pacemaker and Device analysis practice
<ol style="list-style-type: none"> 1. Should classify the type of pacemaker based on the ECG recording and functioning of the device (P2, A2) 2. To know the operations of pacemaker programmer/analyser with different protocols various various devices (P4, A2) 3. Able to assess the parameters and their importance during analysis (P4, A2) 4. To perform pacemaker analysis under the supervision of a staff/faculty (P5, A3) 5. To add findings based on analysis and document in the patient file (P4, A3) 6. To diagnose pacemaker related problems and tackle in troubleshooting (P7, A3)
Area 5 : Echocardiography non-invasive practice at OPD
<ol style="list-style-type: none"> 1. To set the practice area for daily activities (P2) 2. To know the basic principle of ultrasound (P4, A2) 3. To know the operations of echo machine, entry of patient details, to record and save images (P4, A2) 4. To document the patient details before performing echo in register books (P4, A2) 5. To explain the patient and prepare them for the test (P4, A2) 6. To perform the test and diagnose the normal and abnormal heart diseases under the guidance/supervision of faculty (P4, A2) 7. To provide written report and document it, in the online system and excel data for further reference and clarification (P4, A2)
Area 6 : Bedside Echocardiography non-invasive practice at ICUs
<ol style="list-style-type: none"> 1. To take all necessary equipment's along with the echo machine and handle it carefully (P4, A2) 2. To document the patient details before performing echo (P4, A2) 3. To perform the test and diagnose the normal and abnormal heart diseases under the guidance/supervision of faculty (P4, A2)

<p>Course Content and Outcomes:</p> <ol style="list-style-type: none"> To provide written report and document it (P4, A2) To report to the concerned physician in care of clinical emergency or life threatening situations (P4, A2) To report the work done at the end of duty hours to the duty faculty in the presence of next shift duty interns in order to update the cases handled (P4, A2)
<p>Area 7 : Bedside Echocardiography non-invasive practice at Emergency Triage</p> <ol style="list-style-type: none"> To take all necessary equipment's along with the echo machine and handle it carefully (P4, A2) To document the patient details before performing echo (P4, A2) To perform the test and diagnose the normal and abnormal heart diseases under the guidance/supervision of faculty (P4, A2) To provide written report and document it (P4, A2) To report to the concerned physician in care of clinical emergency or life threatening situations (P4, A2) To report the work done at the end of duty hours to the duty faculty in the presence of next shift duty interns in order to update the cases handled (P4, A2)
<p>Area 8 : Bedside Echocardiography non-invasive practice at peripheries</p> <ol style="list-style-type: none"> To take all necessary equipment's along with the echo machine and handle it carefully (P4, A2) To document the patient details before performing echo (P4, A2) To perform the test and diagnose the normal and abnormal heart diseases under the guidance/supervision of faculty (P4, A2) To provide written report and document it (P4, A2) To report to the concerned physician in care of clinical emergency or life threatening situations (P4, A2) To report the work done at the end of duty hours to the duty faculty in the presence of next shift duty interns in order to update the cases handled (P4, A2)
<p>Area 9 : Invasive Cardiac Interventional Suit (Cath Lab) Practices</p> <ol style="list-style-type: none"> To set the practice area for daily activities (P2) To check and keep the required hardware for the elective and emergency procedures (P6, A2) To obtain informed consent from Patient and their bystander (P3, A2) To develop skills in Cath lab equipment (operating table) handling under supervision of staff/ faculty (P5, A2) To actively involve in the procedure and assist the interventional team (P6, A2) To document the items used for the procedure in register book as well as patients file (P5, A4) To apply BLS/ACLS skills whenever necessary (P5, A4) To know post procedural care (removal of sheath/ compression) (P5, A4) To know the operating systems of FFR, IVUS, OCT, ROTA, IABP, TPI, PPI, Defibrillators (P5, A4)
<p>Area 10 : Clinical Ward Rounds</p> <ol style="list-style-type: none"> Should be able to evaluate patient based on the case history (P2, A1) Ability to perform basic patient examination steps (P4, A2) Should perform tasks or activity under the supervision of physician (P4, A3) Should make an evaluation of a given case based on the routine investigations (P5, A4)
<p>Project Work:</p> <ol style="list-style-type: none"> A project work to be completed on topic related to Cardiology, under the guidance of the HOD and Faculties (C4, A4)

Course Content and Outcomes:

2. The assigned study has to be approved by institutional ethical committee (IEC) and a CRTI registration to be done if applicable (C3, A4)
3. Appropriate literature survey to be done and reported in the study (C5, A4)
4. Collection of Study data and sample size to be done within the stipulated time given for the study (C5, A4)
5. A written Thesis to be submitted reporting the study results and observations (C6, A4)

Learning Strategies: Small group discussion (SGD), Problem Based Learning (PBL), Case Based Learning (CBL), Clinics, Seminars.

Formative Assessment:

- Quiz, Viva, Clinical assessment (OSCE, OSPE, WBPA), Clinical Log Book, Interns work dairy
- The Interns should present at least 10 academic presentations on topic related to the programme before completing the internship which will be added to the assessment, the topic for presentation will be given to the Intern by the HOD/In-charge faculty
- Interns will be evaluated periodically i.e. in every quarter of 12 months and aggregate marks of all four assessments will be used to issue internship completion certificate.
- Internship completion certificate will be issued from Dean's office, only after successfully clearing all four assessment exams and obtaining satisfactory completion certificate from the head/ In-charge of the department at the end of internship.

7. Program Outcomes (POs) and Course Outcomes (COs) Mapping

SEM	Course Code	Course Title	Credits	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
I	ANA1001	Anatomy - I	3	CO1							
I	PHY1101	Physiology - I	2	CO1 CO2 CO3 CO4							
I	CSK1001	Communication Skills	2	-	CO2	CO4	-	CO1 CO2	-	CO1 CO2 CO3 CO4	-
I	EIC1001	Environmental Science	2	CO1 CO2 CO3	-	CO4 CO5	CO2	-	CO1 CO3 CO5	CO4	-
		Indian Constitution		CO1	-	CO3	CO2	CO2 CO5	CO2 CO4	CO1 CO3 CO5	CO4
I	CVT1101	Cardiac anatomy and physiology	2	CO1 CO3	CO2 CO3 CO4 CO5 CO6 CO7	-	CO4 CO7	CO2 CO6	-	CO1 CO5	-
I	CVT1102	Basic ECG	3	CO3 CO4	CO1 CO2 CO5 CO6 CO7	-			CO1 CO2 CO3 CO4	CO5 CO6 CO7	
I	CVT1103	Cardiac Embryology	3	-	CO1 CO2 CO3 CO4 CO5 CO6	-	CO1 CO4 CO6	CO2 CO3 CO5	-	-	-
I	CVT1131	Clinics	3	CO1	CO2 CO3 CO6	-	CO1 CO2	CO4	CO5	CO3 CO4 CO5	CO6
II	ANA1201	Anatomy - II	2	CO1	-	-	-	-	-	-	-
II	PHY1201	Physiology - II	2	CO1 CO2 CO3 CO4							
II	BIC1201	Biochemistry	3	CO1 CO2 CO3 CO4							
II	CVT1201	Advance ECG and Holter Monitoring	3	CO1 CO2 CO3 CO4 CO5 CO6	-	-	-	CO1 CO2 CO3 CO4 CO5 CO6	-	-	-

SEM	Course Code	Course Title	Credits	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
				CO7				CO7			
II	CVT1202	Medical Ethics & legal Aspects	2	CO1 CO2 CO4 CO6	CO5	-	CO3	CO6	CO2	CO1 CO4	CO5
II	CVT1211	ECG interpretation, Holter Analysis Practical	5	-	CO1 CO2 CO3 CO4 CO5 CO6	-	-	CO2	CO1 CO3 CO4	CO6	CO5
II	CVT1231	Clinics	3	CO1 CO2 CO5	CO1 CO2 CO3 CO4 CO6	-	-	-	-	CO3 CO4 CO5 CO6	-
II	MCB2103	Microbiology	3	CO1 CO2 CO3 CO4	-	-	-	-	-	-	-
II	PAT2103	Pathology	3	CO1 CO2 CO3 CO4	CO3 CO4	-	-	-	-	-	-
III	CVT2101	Ultrasound Physics and Doppler Principles	3	CO1 CO2	CO3 CO4 CO5 CO6 CO7	CO1 CO4	CO2	CO3	-	CO5 CO6 CO7	-
III	CVT2102	Cardiac Stress Test	3	CO1 CO2 CO6	CO1 CO2 CO3 CO4 CO5	CO3	CO4	-	-	CO6	CO5
III	CVT2103	Cardiac Instrumentation	2	CO1 CO4	CO1 CO2 CO3 CO6	CO5	CO6	CO3	CO2 CO5	CO4	-
III	CVT2131	Clinics - III	3	CO2 CO4 CO5	CO1 CO2 CO3 CO4 CO6	CO1 CO5	CO3	-	-	CO6	-
III	*** ****	Open Elective - I	3	<i>Open elective is credited, choice-based and is graded as satisfactory / not satisfactory (S/NS). Students make a choice from pool of electives offered by MAHE institution / Online courses as approved by the department</i>							
IV	PHC2203	Pharmacology	3	CO1 CO2 CO3 CO4	-	-	-	-	-	-	-
IV	CPY2201	Clinical Psychology	3	CO1 CO4 CO5	-	-	-	-	CO2 CO3 CO5	CO1 CO2 CO3	-

SEM	Course Code	Course Title	Credits	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
				CO6					CO6		
IV	BST3201	Biostatistics and Research Methodology	3	CO1 CO2 CO3 CO5 CO6	CO4	-	-	-	-	-	-
IV	CVT2201	Cardiac pacemakers and defibrillators	3	CO1	CO1 CO2 CO3 CO6	CO5	-	CO5	CO2 CO3 CO4	CO4 CO6	
IV	CVT2202	Congenital Heart Disease I	3	CO1 CO2	CO3 CO4 CO5 CO6 CO7 CO8	-	CO2	CO3	CO1 CO4 CO5 CO6 CO7	CO8	-
IV	CVT2231	Clinics IV	2	CO3	CO1 CO2 CO3 CO4 CO6	-	CO1 CO5	CO2 CO6	CO4 CO5	-	-
IV	CVT2241	Cardiac Interventional Hardwares	3	CO1 CO2	CO1 CO2 CO3 CO4 CO5 CO6	CO3 CO4 CO5 CO6	-	-	-	-	-
IV	CVT2242	Pacemaker Programming and Analysis		CO1 CO3 CO5 CO6	CO1 CO2 CO3 CO4 CO5 CO6	CO2 CO4	-	-	-	-	-
V	CVT3101	Basics In Cardiac Cath and Hardware	3	CO3 CO5	CO1 CO4	CO3 CO4	CO2	CO6	CO2 CO5	CO1 CO6	-
V	CVT3102	Miscellaneous Heart Diseases	3	-	CO1 CO2 CO6	CO1 CO2 CO4 CO6	-	CO3	CO4 CO5	-	CO3 CO5
V	CVT3103	Congenital Heart Disease - II	3	CO1 CO2 CO3 CO4 CO5 CO6 CO7 CO8	-	-	CO2	CO3	CO1 CO4 CO5 CO6 CO7 CO8	-	-
V	CVT3104	Valvular Heart Disease	3	-	CO1 CO2 CO6	CO1 CO2 CO4 CO6	-	-	CO3 CO4 CO5	-	CO3 CO5
V	CVT3131	Clinics - V	5	CO1	CO1	CO4	CO2	CO3 CO6	CO4 CO5	CO3 CO6	CO2 CO5

SEM	Course Code	Course Title	Credits	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
V	*** **	Open Elective - II	3	<i>Open elective is credited, choice-based and is graded as satisfactory / not satisfactory (S/NS). Students make a choice from pool of electives offered by MAHE institution / Online courses as approved by the department</i>							
VI	CVT3201	Applications of Echocardiography	3	CO1 CO2 CO4	CO2 CO3 CO5 CO6	-	-	-	CO5 CO6	CO1	CO3 CO4
VI	CVT3202	Cardiac Cath and Intervention	3	CO1	CO1 CO2 CO3 CO4 CO5 CO6	CO2 CO6	-	CO5	CO3 CO4	-	-
VI	CVT3203	General Cardiac Examination and BLS-ACLS	3	CO1 CO3 CO5	CO1 CO2 CO3 CO4 CO5 CO6	-	-	-	CO2 CO5 CO6	-	-
VI	CVT3231	Clinic in Echocardiography	4	CO3 CO4 CO5 CO8	CO1 CO2 CO4 CO5 CO6 CO7	-	CO2	-	CO3 CO7 CO8	CO1 CO7	-
VI	CVT3232	Clinics in Cardiac Catheterization	4	CO1 CO3	CO2 CO4 CO6	CO2 CO6	CO1	CO5	CO3	CO4	CO5
VI	CVT3241	Cardiac Assist Devices	3	CO1 CO2 CO3 CO5 CO6	CO4 CO5 CO6	CO3	CO2	CO1	CO4	-	-
	CVT3242	Imaging Modalities in Cardiac Diagnosis		CO1 CO2 CO3 CO4 CO6	CO1 CO2 CO5	CO5	-	CO3	CO4 CO6	-	-
VII & VIII		Internship	1 year	C02 C03	C01 C02 C05	C04 C06		C03	C01 C06	C04	C05

8. PROGRAM REGULATIONS

1. Program Structure

- 1.1. The program is a choice based credit system.
- 1.2. An academic year consists of two semesters – Odd semester (July - December) and Even semester (January – June)
- 1.3. Each semester shall extend over a minimum period of 13 weeks (a maximum up to 15 weeks) of academic delivery excluding examination days, semester breaks, declared holidays and non-academic events.
- 1.4. Medium of instruction shall be in English

2. Credit Distribution

- 2.1 Each semester would consist of 20 credits.
- 2.2 The credit distribution hours for Lecture, Tutorial, Practical, and Clinics are as follows:

Lecture (L) :	1 Hour /week = 1 credit = 13 hours
Tutorial (T) :	1 Hour /week = 1 credit
Practical (P) :	2 Hours/week = 1 credit
Clinics (CL) :	3 Hours/week = 1 credit

Note: For Basic sciences & Biostatistics course, 1 credit =15 hours (maximum)
- 2.3 A semester has courses structured as theory, practical, and clinics. Each course is of minimum 2 credits.
- 2.4 The maximum credits for theory course is 4; theory and practical combined is 5.
- 2.5 Internship is not credited.
- 2.6 Abbreviations / Symbols used in the credit distribution table:
L - Lectures, T - Tutorials, P -Practical, CL - Clinics, C - Total credits, IAC - Internal assessment component, ESE - End-Semester Exam,*Open Elective, #Program Electives

3. Weightage for Internal Assessment Component (IAC) and End Semester Exam (ESE)

- 3.1. Any one or a combination of marks distribution criteria applicable to a course.

IAC Weightage (%)	ESE Weightage (%)
30	70
50	50
100	Nil
Nil	100

- 3.2 The IAC component weightage for theory & practical is:
 - 50% from Mid-semester examination
 - 50% through Continuous assessment (as applicable to course)
- 3.3 For courses without continuous evaluation components, two sessional exams are conducted and the average of both sessional exams shall be considered as the final IAC.

4. Attendance

- 4.1 Minimum attendance requirements for each course is:
 - i. Theory : 75 %
 - ii. Clinics / Practical : 85 %
- 4.2 As per the directives of MAHE, there will be no consideration for leave on medical grounds. The student will have to adjust the same in the minimum prescribed attendance. No leverage will be given by the department for any attendance shortage.
- 4.3 Students requiring **leave** during the academic session should apply for the same through a formal application to the Head of Department through their respective

Class In-charge/ Coordinator. The leave will be considered as absent and reflected in their attendance requirements.

- 4.4 No leverage will be given by the department for any attendance shortage.
- 4.5 Students, Parents/ guardians can access the attendance status online periodically. Separate intimation regarding attendance status would not be sent to parents/students.
- 4.6 Students having attendance shortage in any course (theory & practical) will not be permitted to appear for the End-semester exam of the respective course.

5. Examination

- 5.1 Exams are in two forms – Sessional examination (conducted as a part of internal assessment) and End semester examination.
- 5.2 The final evaluation for each course shall be based on Internal Assessment Components (**IAC**) and the End-semester examinations (**ESE**) based on the weightage (as indicated in clause 3.1) given for respective courses.
- 5.3 IAC shall be done on the basis of a continuous evaluation after assessing the performance of the student in mid semester exam, class participation, assignments, seminars or any other component as applicable to a course (as indicated in clause 3.2)
- 5.4 All the ESE for the odd semesters (**regular ESE**) will be conducted in November-December. All the ESE for the even semesters (**regular ESE**) will be conducted in May-June.
- 5.5 For those who failed to clear any course during regular ESE, a **supplementary exam** is conducted 2 weeks immediately after the ESE result declaration to enable him / her to earn those lost credits. When a student appears for supplementary examination, the **maximum grade awarded is “C”** grade or below irrespective of their performance.
- 5.6 For core courses, the duration of ESE for a 2 credit course would be 2 hours (50 marks) and for a course with 3 or more credits, 3 hours (100 marks).
- 5.7 For pre / para clinical course and program elective, irrespective of credit (2 or 3), the ESE is conducted out of 50.
- 5.8 For non-core courses such as Communication skills, Open electives, Indian constitution, Environmental sciences or courses as specified in curriculum, only internal assessment is conducted.

6. Minimum Requirements for Pass

- 6.1. Pass in a course will be reflected as grades. No candidate shall be declared to have passed in any course unless he/she obtains not less than **“E” grade**
- 6.2. For core courses (theory / practical), candidate should obtain a minimum of 50% (IAC + ESE or as applicable to course) to be declared as pass.
- 6.3. For non-core including psychology, pre and para clinical course, a candidate should secure a minimum of 40% in ESE to be declared as pass.
- 6.4. For students who fail to secure a minimum of ‘E’ grade for a course, an **improvement examination** is conducted to improve their IAC marks. The student can appear for these examination along with the subsequent batches’ mid semester / sessional exams. The marks obtained in other components of IAC can be carried forward without reassessment.

7. Calculation of GPA and CGPA

- 7.1. Evaluation and Grading (**Relative Grading**) of students shall be based on GPA (Grade Point Average) & CGPA (Cumulative Grade Point Average).
- 7.2. The overall performance of a student in each semester is indicated by the Grade Point Average (GPA). The overall performance of the student for the entire program is indicated by the Cumulative Grade Point Average (CGPA).

7.3. A ten (10) point grading system (**Credit value**) is used for awarding a letter grade in each course.

Letter Grade	A+	A	B	C	D	E	F/I/DT
Grade points	10	9	8	7	6	5	0

DT – Detained/Attendance shortage, I – Incomplete

7.4 Calculation of GPA & CGPA: An example is provided

Course code	Course	Credits (a)	Grade obtained by the student	Credit value (b)	Grade Points (a x b)
AHS 101	Course - 1	4	B	8	32
AHS 103	Course - 2	4	B	8	32
AHS 105	Course - 3	3	A+	10	30
AHS 107	Course - 4	4	C	7	28
AHS 109	Course - 5	5	A	9	45
TOTAL		20	-	-	167

1st Semester GPA = Total grade points / total credits
 $167/20 = 8.35$

Suppose in **2nd semester GPA = 7** with respective course credit 25

Then, **1st Year CGPA** = $\frac{(8.35 \times 20) + (7 \times 25)}{20 + 25} = 7.6$

8. Progression Criteria to higher semesters

8.1 The eligibility for promotion to the next academic year is subject to securing the minimum academic performance as specified below:

- First to second year: a minimum of 70% of the credits at the end of the first year (includes first and second semester)
- Second to third year: a cumulative minimum of 80% of the credits at the end of the second year (includes first, second, third and fourth semester)
- Third year to Internship/externship: Student will be eligible for internship/externship only after successful completion of the entire course work, i.e. 100% credits to be accrued by the end of the third year.

8.2 First year students who have failed to secure a minimum credit (as specified in 8.1), will be on **probation for next one year**. During that period, he / she will not be permitted to attend the second year / III semester classes and have to appear only for exam (during December / May) in order to acquire the missing credits. In the event of failure to acquire the required credits even by the end of second year (70%), he / she has to **exit the program**. Exit from the program is applicable only for first year students failing to acquire the required credits.

8.3 From second year onwards, in the event of failing to acquire required credits (80% or 90%), the students will be on probation. During that period, he / she will not be permitted to attend the classes and have to appear only for exam (during December / May) in order to acquire the missing credits. From second year onwards, failure to acquire the required credits by the end of subsequent year will not result in exit from program.

8.4 However, the student must complete all the course work requirements and credits by a **maximum of double the program duration**. For e.g. 4 years' program, all

the academic course work needs to be completed within 8 years. Failure to do so will result in exit from the program.

9. Semester Break

9.1 Students will have a semester break following their odd and even end-semester examinations.

10. Internship

- 10.1 Internship will not carry any credits. Marks are based on continuous assessment of clinical competencies and other internship requirements.
- 10.2 Any components/ activities that need to be evaluated as part of internship will be assigned a grade without reflecting it in the CGPA.
- 10.3 During internship the student will be under the supervision of a qualified person in the organization where the student is posted for clinical training
- 10.4 The intern should maintain a clinical logbook and portfolio as per the internship guidelines.
- 10.5 To ensure that theoretical knowledge gain goes on concurrently with the gain of practical skills. A project work is included during the Internship. The Interns must submit a project study (which is compulsory) on topic related to Cardiology before completing the first six-month Internship programme at Kasturba Hospital, Manipal. The project study topic will be given to the Intern in the first month of Internship by the Head of the department.
- 10.6 The intern should present atleast 10 academic presentation on topic related to the program before completing 6 month internship. The topic for presentation will be given by the HOD / Incharge faculty.
- 10.7 The intern should abide by the rules and regulations of the organization during the period of internship.
- 10.8 An internship certificate with details of clinical/relevant areas of postings with hours will be issued to a candidate on completion of the Internship. The certificate must be authenticated by the HOD/Coordinator and HOI.
- 10.9 **Degree is awarded** only on successful completion of internship.

Head of the Department

Dean

Deputy Registrar - Academics

Registrar