



MANIPAL

ACADEMY of HIGHER EDUCATION

(Institution of Eminence Deemed to be University)

Manipal College of Health Professions

Manipal Academy of Higher Education, Manipal

Outcome-Based Education (OBE) Framework

Four Years Full Time

Undergraduate Program

(Choice-Based Credit System)

Bachelor of Science in Cardiovascular Technology (BSc. CVT)

With effect from July 2024




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1. NATURE AND EXTENT OF THE PROGRAM

Cardiovascular Technology (CVT) is a Bachelor of Science (BSc) program that trains students extensively in cardiovascular diseases and diagnostic tests. Candidates undergo comprehensive training in various non-invasive imaging modalities to independently evaluate cardiac diseases and assist in operating equipment and performing cardiac catheterization procedures in invasive cardiac settings.

CVT encompasses both non-invasive and invasive fields of work, such as cardiac sonography and cardiac interventional technology. The scope for allied health workers in this field is expansive in today's medical sector and the foreseeable future.

The program is structured as a full-time course spanning eight semesters, including a one-year internship, following an outcome-based educational system. Our objectives include equipping candidates with knowledge in Basic Health Science subjects, clinical Cardiology, Electrocardiography, Cardiac Stress Testing, Ambulatory Blood Pressure and Holter Monitoring, Echocardiography, Cardiac Catheterization & Intervention, Biostatistics, and Research Methodologies.

Candidates applying for admission to the BSc CVT program should have passed the 10+2 examination or an equivalent two-year Pre-University/Pre-Degree examination conducted by the respective State's Pre-University Board of Education. Applicants must have studied Physics, Chemistry, and Biology (PCB) to be eligible for the program. Candidates should also be at least 17 years old at the time of admission to the first year of the BSc CVT program, or meet the entry age criteria set by their respective universities



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 noninvasive 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 / Innovationrelated 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
ANA1301	Anatomy - I	3	-	-	-	3	30	70	100
PHY1301	Physiology - I	2	-	-	-	2	30	70	100
CSK1501	Communication Skills	2	-	-	-	2	100	-	100
EIC1501	Environmental Science & Indian Constitution	2	-	-	-	2	100	-	100
CVT1301	Cardiac Anatomy and Physiology	2	-	-	-	2	50	50	100
CVT1302	Basic ECG	2	1	-	-	3	50	50	100
CVT1303	Cardiac Embryology	2	1	-	-	3	50	50	100
CVT1304	Clinics - I	-	-	-	9	3	100	-	100
TOTAL		15	2	-	3	20	510	290	800

NOTE: ESE for ANA1301 & PHY1301 will be conducted for 50 marks and normalized to 70 marks. ESE for CVT1301 will be conducted for 50 marks, CVT1302 And CVT1303 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
ANA1401	Anatomy - II	2	-	-	-	2	30	70	100
PHY1401	Physiology - II	2	-	-	-	2	30	70	100
BIC1401	Biochemistry	3	-	-	-	3	30	70	100
CVT1401	Advanced ECG and Holter Monitoring	3	1	-	-	4	50	50	100
CVT1402	Medical Ethics & Legal Aspects	2	-	-	-	2	100	-	100
CVT1403	ECG Interpretation, Holter Analysis - Practicals	-	-	8	-	4	50	50	100
CVT1404	Clinics - II	-	-	-	9	3	100	-	100
TOTAL		12	1	4	3	20	390	310	700

Note: ESE for ANA1401, PHY1401 & BIC1401 will be conducted for 50 marks and normalized to 70 ESE for CVT1401, CVT1403 will be conducted for 100 marks and normalized to 50 for grading
 Note: By the end of the first year, a student needs to complete a life skill training course offered by the university.

SEMESTER - III

Course code	Course title	Credit distribution (hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
MCB2303	Microbiology	3	-	-	-	3	30	70	100
PAT2303	Pathology	3	-	-	-	3	30	70	100
CVT2301	Ultrasound Physics and Doppler Principles	2	1	-	-	3	50	50	100
CVT2302	Cardiac Stress Tests	2	1	-	-	3	50	50	100
CVT2303	Cardiac Instrumentations	2	-	-	-	2	100	-	100
CVT2304	Clinics - III	-	-	-	9	3	100	-	100
*** ****	Open Elective - I	-	-	-	-	3	S/N/S		
TOTAL		12	2	-	3	20	360	240	600

Note: ESE for MCB2303 & PAT2303 will be conducted for 50 marks and normalized to 70 marks
 ESE for CVT2301, CVT2302 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
PHC2403	Pharmacology	3	-	-	-	3	30	70	100
CPY2401	Clinical Psychology	3	-	-	-	3	30	70	100
BST3401	Biostatistics and Research Methodology	3	-	-	-	3	30	70	100
CVT2401	Basics of Cardiac Implantable Electronic Devices	2	-	-	-	2	50	50	100
CVT2402	Congenital Heart Disease - I	3	1	-	-	4	50	50	100
CVT2403	Clinics IV	-	-	-	6	2	100	-	100
CVT2404	Program Elective - I (Cardiac Interventional Hardwares)	3	-	-	-	3	50	50	100
CVT2405	Program Elective - I (Analysis of Cardiac Implantable Electronic Devices)								
	TOTAL	17	1	-	2	20	340	360	700

Note: ESE for PHC2403 & CPY2401, will be conducted for 50 marks and normalized to 70 marks;
 BST3401 will be conducted for 100 marks and normalized to 70 marks grading, ESE for CVT2401
 will be conducted for 50 marks, ESE for CVT2402 will be conducted for 100 marks and normalized to
 50 for grading. ESE for CVT2404, CVT2405 will be conducted for 50 marks.

SEMESTER - V

Course code	Course title	Credit distribution (hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
CVT3301	Basics in Cardiac Cath and Hardwares	3	1	-	-	4	50	50	100
CVT3302	Miscellaneous cardiovascular diseases	2	1	-	-	3	50	50	100
CVT3303	Congenital Heart Disease - II	2	1	-	-	3	50	50	100
CVT3304	Valvular Heart Disease	2	1	-	-	3	50	50	100
CVT3305	Clinics - V	-	-	-	12	4	100	-	100
*** ****	Open Elective - II	-	-	-	-	3	S/NS		
TOTAL		9	4	-	4	20	300	200	500

Note: ESE for CVT3301, CVT3302, CVT3303 and CVT3304 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
CVT3401	Applications of Echocardiography	3	1	-	-	4	50	50	100
CVT3402	Cardiac Cath and Interventions	3	1	-	-	4	50	50	100
CVT3403	General Cardiac Examination and BLS -ACLS	2	1	-	-	3	50	50	100
CVT3404	Practicals in Cardiac Cath and Imaging	-	-	6	-	3	50	50	100
CVT3405	Clinics - VI	-	-	-	9	3	100	-	100
CVT3406	Program elective - II (Cardiac Assist Devices)	3	-	-	-	3	50	50	100
CVT3407	Program elective - II (Imaging Modalities in Cardiac Diagnosis)								
TOTAL		11	3	3	3	20	350	250	600

Note: ESE for CVT3401, CVT3402, CVT3403, CVT3404 will be conducted for 100 marks and normalized to 50 for grading. ESE for CVT3406, CVT3407 will be conducted for 50 marks.

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.

Program Elective

Semester	Course Code	Course Title	Credit (s) Distribution (L,T,P,CL are hours/ week)				
			L	T	P	CL	CR
IV Semester	CVT2404	Cardiac Interventional Hardwares	3	-	-	-	3
	CVT2405	Analysis of Cardiac Implantable Electronic Devices	3	-	-	-	3
VI Semester	CVT3406	Cardiac Assist Devices	3	-	-	-	3
	CVT3407	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	12	1	4	3	20	390	310	700
Semester - III	12	2	-	3	20	360	240	600
Semester - IV	17	1	-	2	20	340	360	700
Semester - V	9	4	-	4	20	300	200	500
Semester - VI	11	3	3	3	20	350	250	600
semester-VII / VIII	-	-		48	NA	-	-	-