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

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MAHE
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576104

Head of the Department

Head
Dept. of Cardiovascular Technology
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Dean

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Deputy Registrar - Academics

Deputy Registrar - Academics
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MANIPAL - 576 104

Registrar

REGISTRAR
MANIPAL ACADEMY OF HIGHER EDUCATION
MANIPAL

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 imagining 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.

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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.

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3. GRADUATE ATTRIBUTES

Sl 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.

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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

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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

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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

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SEMESTER - III

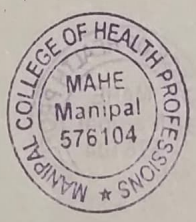
Course code	Course title	Credit distribution (hours/week)					Marks Distribution		
		L	T	P	CL	CR	IAC	ESE	Total
MCB2103	Microbiology	3	-	-	-	3	30	70	100
PAT2103	Pathology	3	-	-	-	3	30	70	100
CVT2101	Ultrasound Physics and Doppler Principles	2	1	-	-	3	50	50	100
CVT2102	Cardiac Stress Tests	2	1	-	-	3	50	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

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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**

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