MGM INSTITUTE OF HEALTH SCIENCES

(Deemed to be University u/s 3 of UGC Act, 1956)
Grade 'A' Accredited by NAAC
Sector-01, Kamothe, Navi Mumbai -410 209
Tel 022-27432471, 022-27432994, Fax 022 -27431094
E-mail: registrar@mgmuhs.com; Website :www.mgmuhs.com

CHOICE BASED CREDIT SYSTEM

(CBCS)

(with effect from 2025-26 Batches)

Curriculum for

M.Sc. Cardiac Care Technology

Amended as per AC-52/2025, Dated 28/11/2025

Amended History

1. Amended as per AC-51/2025, [Resolution No.3.1(Annexure-3.8)], [Resolution No.3.5, (Annexure-7)]; Dated 29/04/2025.

2. Amended as perAC-52/2025, [Resolution No. 5.1(Annexure-17H)]; [Resolution No. 5.8(Annexure-24G)]; Dated 28/11/2025.

Resolution No. 3.1 of Academic Council (AC-51/2025):

Resolved to approve the CBCS syllabus, including Program Outcomes (POs), Course Outcomes (COs), and PO-CO Mapping for 15 two-year postgraduate programs under MGMSBS for Semesters I and II. These include : M.Sc. Medical Biotechnology , M.Sc. Medical Genetics , M.Sc. Clinical Embryology, M.Sc. Clinical Nutrition, M.Sc. Medical Dialysis Technology, M.Sc. Molecular Biology, M. Sc. Medical Radiology & Imaging Technology , **M.Sc. Cardiac Care Technology** , M.Sc. Operation Theatre and Anaesthesia Technology, M.Sc. Emergency and Trauma Care, M. Optometry, Master in Hospital Administration, Master of Public Health, M.Sc. Health Informatics & M.Sc. Clinical Research to be effective from batch admitted in Academic Year 2025-26 onwards [ANNEXURE-3.1 to 3.30].

Annexure-3.8 of AC-51/2025

MGM SCHOOL OF BIOMEDICAL SCIENCES, NAVI MUMBAI

(A constituent unit of MGM INSTITUTE OF HEALTH SCIENCES)

(Deemed to be University u/s 3 of UGC Act 1956)

Grade "A^{++}" Accredited by NAAC

Sector 1, Kamothe Navi Mumbai-410209, Tel.No.022-27437631, 27437632

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CHOICE BASED CREDIT SYSTEM (CBCS)

(Academic Year 2025 - 26)

Curriculum for

M.Sc. Allied Health Sciences

M.Sc. Cardiac Care Technology

Semester I & II

DIRECTOR'S MESSAGE

Welcome Message from the Director

Dear Postgraduate Students,

Welcome to **MGM School of Biomedical Sciences (MGMSBS), MGMIHS**, a premier institution dedicated to advancing allied and health sciences education. As you embark on this transformative academic journey, you are joining a community that fosters excellence in research, clinical expertise, and innovation**.**

MGMIHS, accredited with **NAAC 'A^{++}' Grade (CGPA 3.55, 2022)** and recognized as a **Category I Institution by UGC**, offers an ecosystem that nurtures both academic and professional growth. With **NIRF (151-200 rank band) recognition, NABH-accredited hospitals, NABL-accredited diagnostic labs, and JCI accreditation for MGM New Bombay Hospital**, we uphold global benchmarks in education and healthcare.

At MGMSBS, our **15 postgraduate programs** are meticulously designed to align with the National Commission for Allied and Healthcare Professionals **(NCAHP)** standards**,** National Education Policy **(NEP)** 2020**,** and the National Credit Framework **(NCrF).** We have implemented the **Choice-Based Credit System (CBCS)** to provide academic flexibility while ensuring rigorous training in clinical and technical skills**.** Our state-of-the-art research laboratories, digital classrooms, and the Central Research Laboratory (CRL) foster an environment that encourages innovation and evidence-based learning**.**

Postgraduate education at MGMSBS goes beyond theoretical learning—our curriculum integrates **hands-on clinical training, interdisciplinary collaboration, and exposure to real-world healthcare challenges**. We emphasize **research-driven education**, encouraging students to actively participate in **scientific discoveries, publications, and international collaborations**.

Beyond academics, we believe in **holistic development**, with initiatives such as the **AARAMBH Science and Wellness Club**, which promotes **mental well-being, leadership, and professional networking**.

As you step into this **next phase of academic and professional growth**, we encourage you to explore new ideas, engage in impactful research, and contribute meaningfully to the **healthcare ecosystem**. We are confident that your journey at MGMSBS will shape you into **skilled, compassionate, and visionary professionals**, ready to lead in the ever-evolving healthcare landscape.

We look forward to witnessing your achievements and contributions!

Dr. Mansee Thakur
Director, MGM School of Biomedical Sciences
MGM Institute of Health Sciences, Navi Mumbai

ABOUT MGM SCHOOL OF BIOMEDICAL SCIENCES

Mission

To improve the quality of life, both at individual and community levels by imparting quality medical education to tomorrow's doctors and medical scientists and by advancing knowledge in all fields of health sciences though meaningful and ethical research.

Vision

By the year 2020, MGM Institute of Health Sciences aims to be top-ranking Centre of Excellence in Medical Education and Research. Students graduating from the Institute will have the required skills to deliver quality health care to all sections of the society with compassion and benevolence, without prejudice or discrimination, at an affordable cost. As a research Centre, it shall focus on finding better, safer and affordable ways of diagnosing, treating and preventing diseases. In doing so, it will maintain the highest ethical standards.

About – School of Biomedical Sciences

MGM School of Biomedical Sciences is formed under the aegis of MGM IHS with the vision of offering basic Allied Science and Medical courses for students who aspire to pursue their career in the Allied Health Sciences, teaching as well as research.

School of Biomedical Sciences is dedicated to the providing the highest quality education in basic medical sciences by offering a dynamic study environment with well-equipped labs. The school encompasses 23 courses each with its own distinct, specialized body of knowledge and skill. This includes 8 UG courses and 15 PG courses. The college at its growing years started with mere 100 students has recorded exponential growth and is now a full-fledged educational and research institution with the student strength reaching approximately **800** at present.

Our consistent theme throughout is to encourage students to become engaged, be active learners and to promote medical research so that ultimately they acquire knowledge, skills, and understanding so as to provide well qualified and trained professionals in Allied Health Sciences to improve the quality of life.

As there is increased need to deliver high quality, timely and easily accessible patient care system the collaborative efforts among physicians, nurses and allied health providers become ever more essential for an effective patient care. Thus the role of allied health professionals in ever-evolving medical system is very important in providing high-quality patient care.

Last but by no means least, School of Biomedical Sciences envisions to continuously grow and reform. Reformations are essential to any growing institution as it fulfills our bold aspirations of providing the best for the students, for us to serve long into the future and to get ourselves updated to changing and evolving trends in the health care systems.

Name of the Degree: M.Sc. Cardiac Care Technology

Duration of Study:

The duration of the study for M.Sc. Cardiac Care Technology will be of 2 years.

Eligibility Criteria:

B.Sc. Cardiac Care/Cardiovascular Technology OR 2 years of Diploma in Cardiovascular Technology (post regular general B.Sc.) with minimum of 3 year experience.

Medium of Instruction:

English shall be the Medium of Instruction for all the Subjects of study and for examinations.

For any query visit the website: www.mgmsbsnm.edu.in

M.Sc. CARDIAC CARE TECHNOLOGY

Program Outcome

Program Code	Program Objective
PO1	**Knowledge and skill:** Nurture the scientific and/or clinical knowledge and skills for development of industrial applications, health care practices and entrepreneurship.
PO2	**Critical Thinking & problem solving:** Develop the ability of critical thinking to analyse, interpret problems and to find out systematic approach for solution.
PO3	**Decision making:** Impart decision making capability for handling various circumstances in their respective areas
PO4	**Research skill:** Demonstrate research skills for planning, designing, implementation and effective utilization of research findings for community.
PO5	**Individual and team work:** Develop an ability to function as an efficient individual and team player in multidisciplinary sectors for effective outcomes
PO6	**Communication skills:** Demonstrate effective written and oral communication skills to communicate effectively in health care sector, industries, Academia and research.
PO7	**Code of ethics:** Inculcate code of ethics in professional and social circumstances to execute them in daily practices and research in respective areas of specialization
PO8	**Lifelong learning:** Develop lifelong learning attitude and values for enhancement of professional and social skills for an overall development

Program Specific Outcome

Program Code	Program Objective
SPO1	The course aims to provide students with the requisite clinical assessment, decision-making skills and management for a range of cardiology conditions and stroke including pharmacological and non-pharmacological therapeutic interventions.
SPO2	This course offers the opportunity to study all aspects of clinical cardiology including expert assessment and management of a range of cardiac conditions, cardiac interventions, interpretation and practical skills.
SPO3	Includes hyper acute stroke, thrombolysis, interpretation of cardiac CT and MRI, TIA management, maximising stroke care, rehabilitation and long term.
SPO4	The programme can be regarded as vital training for the early stages of cardiology or stroke specialist training with clear learning objectives.

COURSE OUTCOME
SEMESTER –I

MCCT 101 T & MCCT 104 P	Introduction to Clinical Cardiology	Mapped POs	Teaching-Learning Methodologies	Assessment Tools
CO1	**Student should Understand the Anatomy & Physiology of the Heart:** Describe the structure, function, and conduction system of the heart. Identify common symptoms and examination techniques for cardiovascular diseases.	PO1-PO8	Lecture, Demonstration, Group Discussion, Quiz, Assignment, Seminar	Internal Exam, University Exam (Theory Exam), Seminar, Assignment
CO2	**Cardiovascular Examination Techniques** Students should Assess general and detailed physical appearance for signs of heart disease. Examine arterial pulses, jugular veins, and peripheral veins for diagnostic insights. Measure blood pressure and evaluate its physical determinants.	PO1-PO8	Lecture, Demonstration, Group Discussion, Quiz, Assignment, Seminar	Internal Exam, University Exam (Theory Exam), Seminar, Assignment
CO3	**Students Analyze Cardiovascular Diagnostic Tests:** Interpret ECG, echocardiography, cardiac catheterization, and stress testing results. Use chest roentgenograms (X-rays) to assess cardiac conditions.	PO1-PO8	Lecture, Demonstration, Group Discussion, Quiz, Assignment, Seminar	Internal Exam, University Exam (Theory Exam), Seminar, Assignment
CO4	To understand the role of Cardiac Care technologist while assisting the Cardiologist as well as when performing individually	PO1-PO8	Lecture, Demonstration, Group Discussion, Quiz, Assignment, Seminar	Internal Exam, University Exam (Theory Exam), Seminar, Assignment
MCCT 102 T & MCCT 105 P	**Fundamentals of Cardiac Diagnostic Procedures and Investigations**	**Mapped POs**	**Teaching-Learning Methodologies**	**Assessment Tools**
CO1	To educate and train students to understand, interpret and complex diagnostic cardiac investigations.	P1-P8	Lecture, Demonstration, Group Discussion, Quiz, Assignment, Seminar	Internal Exam, University Exam (Theory Exam), Seminar, Assignment
CO2	**Prepare for Emergencies in the Cardiac Cath Lab** Identify major and minor complications during cardiac catheterization. Apply Basic Life Support (BLS) and Advanced Cardiac Life Support (ACLS) algorithms in emergencies.	P1-P8	Lecture, Demonstration, Group Discussion, Quiz, Assignment, Seminar	Internal Exam, University Exam (Theory Exam), Seminar, Assignment

MCCT 103 T	Introduction to Pacing and Electrophysiology Study Techniques	Mapped POs	Teaching-Learning Methodologies	Assessment Tools
CO1	Identify indications for cardiac pacing based on international guidelines	**P1-P8**	Lecture, Demonstration, Practical, Assignment, Seminar	Internal Exam, University Exam (Experimental), Viva-Voice
CO2	Identify indications for electrophysiological studies with/ without ablation in cases of complex arrhythmias.	**P1-P8**	Lecture, Demonstration, Practical, Assignment, Seminar	Internal Exam, University Exam (Experimental), Viva-Voice
CO3	**Develop Expertise in Cardiac Pacing & Pacemaker Therapy** Describe normal cardiac conduction and the need for pacing. Interpret NBG codes for pacemakers and their application. Differentiate indications for temporary vs. permanent pacing. Understand the components and functioning of pacemakers.	**P1-P8**	Lecture, Demonstration, Practical, Assignment, Seminar	Internal Exam, University Exam (Experimental), Viva-Voice
CC 001 T & CC 001 P	**Research Methodology & Biostatistics (Core Course)**	**Mapped POs**	**Teaching-Learning Methodologies**	**Assessment Tools**
CO1	Student will be able to understand develop statistical models, research designs with the understating of background theory of various commonly used statistical techniques as well as analysis, interpretation & reporting of results and use of statistical software.	**P1,P2,P4,P5, P6,P7,P8**	Lecture, Demonstration, Practical, Assignment, Seminar	Internal Exam, University Exam (Experimental), Viva-Voice
MCCT 106 CP	**MCCT Directed Clinical Education-I**	**Mapped POs**	**Teaching-Learning Methodologies**	**Assessment Tools**
CO1	Build a robust theoretical foundation, enabling students to understand healthcare practices, disease management, and patient care, thereby empowering them to make informed decisions and adapt to evolving medical technologies.	**P1-P8**	Practical, Clinical Posting, Demonstration, Internship, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce
CO 2	Emphasize hands-on training, ensuring proficiency in clinical procedures, diagnostic techniques, and the use of advanced medical equipment. This practical exposure will bridge the gap between theory and practice, enhancing students' confidence and competence in delivering quality patient care.	**P1-P8**	Practical, Clinical Posting, Demonstration, Internship, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce

CO 3	Focus on developing professionalism, empathy, ethical conduct, teamwork, and communication skills—key traits for holistic patient care and effective collaboration in interdisciplinary healthcare teams.	**P1-P8**	Practical, Clinical Posting, Demonstration, Internship, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce

SEMESTER-II

MCCT 107 T & MCCT 109 P	Introduction to Non-Invasive Techniques in Cardiology	Mapped POs	Teaching-Learning Methodologies	Assessment Tools
CO1	Identify indications for non-invasive techniques based on international guidelines.	P1-P8	Lecture, Demonstration, Group Discussion, Quiz, Assignment, Seminar	Internal Exam, University Exam (Theory Exam), Seminar, Assignment
CO2	Develop Expertise in non-invasive techniques. ECG, Echocardiography, Stress Test,	P1-P8	Lecture, Demonstration, Group Discussion, Quiz, Assignment, Seminar	Internal Exam, University Exam (Theory Exam), Seminar, Assignment
MCCT 108 T & MCCT 110 P	Invasive Cardiology	Mapped POs	Teaching-Learning Methodologies	Assessment Tools
CO1	To enable students to not only be a helping hand to those just starting out in the specialty but also to serve as a reference for those who have been working in Invasive field for some time	P1-P8	Lecture, Demonstration, Group Discussion, Quiz, Assignment, Seminar	Internal Exam, University Exam (Theory Exam), Seminar, Assignment
CO2	In-depth knowledge of cardiac diagnostic and interventional procedures, focusing on contrast media, intravascular imaging, coronary interventions, assist devices, peripheral angiography, and cardiac pharmacology.	P1-P8	Lecture, Demonstration, Group Discussion, Quiz, Assignment, Seminar	Internal Exam, University Exam (Theory Exam), Seminar, Assignment
MCCT 111 CP	MCCT Directed Clinical Education-II	Mapped POs	Teaching-Learning Methodologies	Assessment Tools
CO1	Build a robust theoretical foundation, enabling students to understand health are practices, disease management, and patient care, thereby empowering them to make informed decisions and adapt to evolving medical technologies.	P1-P8	Practical, Clinical Posting, Demonstration, Internship, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce
CO 2	Emphasize hands-on training, ensuring proficiency in clinical procedures, diagnostic techniques, and the use of advanced medical equipment. This practical exposure will bridge the gap between theory and practice, enhancing students' confidence and competence in delivering quality patient care.	P1-P8	Practical, Clinical Posting, Demonstration, Internship, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce

CO 3	Focus on developing professionalism, empathy, ethical conduct, teamwork, and communication skills—key traits for holistic patient care and effective collaboration in interdisciplinary healthcare teams.	**P1-P8**	Practical, Clinical Posting, Demonstration, Internship, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce
SEC 001 T	**Innovation and Entrepreneurship**	**Mapped POs**	**Teaching-Learning Methodologies**	**Assessment Tools**
CO1	Students will grasp the concepts of innovation, its ecosystem, and the role of various stakeholders such as government policies, startups, and innovation hubs.	**P1,P2,P4,P5,P6, P7,P8**	Lecture, Demonstration, Group Discussion, Quiz, Assignment, Seminar	Internal Exam, University Exam (Theory Exam), Seminar, Assignment
CO2	Cultivating an entrepreneurial mindset and leadership qualities necessary for driving innovation and leading ventures.	**P1-P8**	Lecture, Demonstration, Practical, Assignment, Seminar	Internal Exam, University Exam (Experimental), Viva-Voice
CO3	Understanding the intersection of technology and innovation and leveraging emerging technologies for entrepreneurial ventures.	**P1-P8**	Lecture, Demonstration, Practical, Assignment, Seminar	Internal Exam, University Exam (Experimental), Viva-Voice

OUTLINE OF COURSE CURRICULUM

M.Sc.Cardiac Care Technology

Semester I

Code No.	Core Course	Credits/Week					Hrs/Semester					Marks		
		Lecture (L)	Tutorial (T)	Practical (P)	Clinical Posing/ Rotation (CP)	Total Credits (C)	Lecture (L)	Tutorial (T)	Practical (P)	Clinical Posing/ Rotation (CP)	Total (hrs.)	Internal Assement (IA)	Semester End Exam (SEE)	Total
Discipiline Specific Core Theory														
MCCT 101 T	Introduction to Clinical Cardiology	2	-	-	-	**2**	30	-	-	-	**30**	20	80	**100**
MCCT 102 T	Fundamentals of Cardiac Diagnostic Procedures and Investigations	2	-	-	-	**2**	30	-	-	-	**30**	20	80	**100**
MCCT 103 T	Introduction to Pacing and Electrophysiology Study Techniques	3	-	-	-	**3**	45	-	-	-	**45**	20	80	**100**
CC 001 T	Research Methodology & Biostatistics (Core Course)	3	-	-	-	**3**	45	-	-	-	**45**	-	**50**	**50**
Discipiline Specific Core Practical														
MCCT 104 P	Introduction to Clinical Cardiology	-	-	4	-	**2**	-	-	60	-	**60**	10	40	**50**
MCCT 105 P	Fundamentals of Cardiac Diagnostic Procedures and Investigations	-	-	4	-	**2**	-	-	60	-	**60**	10	40	**50**
MCCT 106 CP	MCCT Directed Clinical Education-I	-	-	-	12	**4**		-	-	180	**180**	-	50	**50**
CC 001 P	Research Methodology & Biostatistics (Core Course)	-	-	4	-	**2**	-	-	60	-	**60**	-	**50**	**50**
Total		**10**	**0**	**12**	**12**	**20**	**150**	**0**	**180**	**180**	**510**	**80**	**470**	**550**

Resolution No. 5.8 of Academic Council (AC-52/2025):

The Academic Council resolved to approve the continuation of SWAYAM/NPTEL elective courses for postgraduate students, wherever applicable to their respective programmes. Accordingly, students admitted from the Academic Year 2025-26 onwards shall be permitted to choose any one approved elective course. The Council further approved the inclusion of 2 and 3 credit courses in the index. This approach is in alignment with the current NCAHP curriculum guidelines, which recommend flexibility for open electives through recognized national platforms.

Accordingly, the names of individual elective courses shall be removed from the existing syllabi. The links of SWAYAM/NPTEL courses (https://swayam.gov.in/nc_details/NPTEL) shall be incorporated in the syllabus index under the existing course code SEC-002 T, titled: "NPTEL/SWAYAM (Name of the Course Chosen by the Student)"

In alignment with Resolution No. 3.1 of the Academic Council (AC-51/2025), the detailed syllabi of individual courses shall be removed and replaced with the approved links of SWAYAM/NPTEL or common reference pool courses. The complete course content shall remain accessible on the official SWAYAM/NPTEL portals. Students may select any one course from the provided links, in alignment with the credit requirements mentioned in their respective syllabi, as per Annexures 24A, 24B, 24C, 24D, 24E, 24F, 24G, 24H, 24I, 24J, 24K, 24L, 24M, 24N, and 24O.

OUTLINE OF COURSE CURRICULUM

M.Sc.Cardiac Care Technology

Semester II

Code No.	Core Course	Credits/Week					Hrs/Semester					Marks		
		Lecture (L)	Tutorial (T)	Practical (P)	Clinical Posing/ Rotation (CP)	Total Credits (C)	Lecture (L)	Tutorial (T)	Practical (P)	Clinical Posing/ Rotation (CP)	Total (hrs.)	Internal Assement (IA)	Semester End Exam (SEE)	Total
Discipiline Specific Core Theory														
MCCT 107 T	Introduction to Non-Invasive Techniques in Cardiology	4	-	-	-	**4**	60	-	-	-	**60**	**20**	**80**	**100**
MCCT 108 T	Invasive Cardiology	4	-	-	-	**4**	60	-	-	-	**60**	**20**	**80**	**100**
Discipiline Specific Core Practical														
MCCT 109 P	Introduction to Non-Invasive Techniques in Cardiology	-	-	4	-	**2**	-	-	60	-	**60**	**10**	**40**	**50**
MCCT 110 P	Invasive Cardiology	-	-	4	-	**2**	-	-	60	-	**60**	**10**	**40**	**50**
MCCT 111 CP	MCCT Directed Clinical Education-II	-	-	-	15	**5**	-	-	-	225	**225**	-	**50**	**50**
Skill Ehancement Course														
SEC 001 T	Innovation and Entrepreneurship	3	-	-	-	**3**	45	-	-	-	**45**	-	**100**	**100**
SEC 002 T	NPTEL Swayam (Course Selected as per Below List)													
Total		**11**	**0**	**8**	**15**	**20**	**165**	**0**	**120**	**225**	**510**	**60**	**390**	**450**

Common Pool of Swayam/NPTEL Coureses offered as elective option (SEC 002)

Course ID	Discipline	Course Name	Institute	Duration	Start date	End date	Exam date	Enrollment End date	Exam Registration End date	UG/PG	Click here to Join the course	NPTEL URL	NPTEL ID
noc25-bt06	Biotechnology and Bioengineering	BioInformatics: Algorithms and Applications	IIT Madras	12 Weeks	20-01-2025	11-04-2025	26-04-2025	27-01-2025	28-02-2025	UG/PG	https://onlinecourses.nptel.ac.in/noc25_bt06/preview	https://nptel.ac.in/courses/102106065	https://nptel.ac.in/courses/102106065
noc25-bt13	Biotechnology and Bioengineering	Computational Genomics	IISER Bhopal	12 Weeks	20-01-2025	11-04-2025	27-04-2025	27-01-2025	28-02-2025	PG	https://onlinecourses.nptel.ac.in/noc25_bt13/preview	https://nptel.ac.in/courses/102106339	https://nptel.ac.in/courses/102106339
noc25-bt29	Biotechnology and Bioengineering	Maternal Infant Young Child Nutrition	IIT Bombay	12 Weeks	20-01-2025	11-04-2025	26-04-2025	27-01-2025	28-02-2025	UG/PG	https://onlinecourses.nptel.ac.in/noc25_bt29/preview	https://nptel.ac.in/courses/102101091	https://nptel.ac.in/courses/102101091
noc25-ge05	Multidisciplinary	Biophotonics	IIT Kharagpur	12 Weeks	20-01-2025	11-04-2025	03-05-2025	27-01-2025	28-02-2025	PG	https://onlinecourses.nptel.ac.in/noc25_ge05/preview	https://nptel.ac.in/courses/127105225	https://nptel.ac.in/courses/127105225
noc25-ge07	Multidisciplinary	Comprehensive Molecular Diagnostics and Advanced Gene Expression Analysis	IIT Kharagpur	12 Weeks	20-01-2025	11-04-2025	03-05-2025	27-01-2025	28-02-2025	UG/PG	https://onlinecourses.nptel.ac.in/noc25_ge07/preview	https://nptel.ac.in/courses/127105391	https://nptel.ac.in/courses/127105391
noc25-ge25	Multidisciplinary	One Health	ICMR - Regional Medical Research Centre, Bhubaneswar	12 Weeks	20-01-2025	11-04-2025	03-05-2025	27-01-2025	28-02-2025	PG	https://onlinecourses.nptel.ac.in/noc25_ge25/preview	https://nptel.ac.in/courses/127106233	https://nptel.ac.in/courses/127106233
noc25-ge27	Multidisciplinary	Qualitative Research Methods and Research Writing	IIT Kharagpur	12 Weeks	20-01-2025	11-04-2025	27-04-2025	27-01-2025	28-02-2025	PG	https://onlinecourses.nptel.ac.in/noc25_ge27/preview	https://nptel.ac.in/courses/109105115	https://nptel.ac.in/courses/109105115
noc25-bt21	Biotechnology and Bioengineering	Host-Pathogen Interaction (Immunology)	IISER Bhopal	12 Weeks	20-01-2025	11-04-2025	04-05-2025	27-01-2025	28-02-2025	PG	https://onlinecourses.nptel.ac.in/noc25_bt21/preview	https://onlinecourses.nptel.ac.in/noc24_bt24/preview	https://onlinecourses.nptel.ac.in/noc24_bt24/preview
noc25-bt22	Biotechnology and Bioengineering	Human Physiology	IISER Pune	12 Weeks	20-01-2025	11-04-2025	26-04-2025	27-01-2025	28-02-2025	PG	https://onlinecourses.nptel.ac.in/noc25_bt22/preview	https://onlinecourses.nptel.ac.in/noc24_bt05/preview	https://onlinecourses.nptel.ac.in/noc24_bt05/preview
noc25-hs61	Humanities and Social Sciences	Patent Law for Engineers and Scientists	IIT Madras	12 Weeks	20-01-2025	11-04-2025	03-05-2025	27-01-2025	28-02-2025	UG/PG	https://onlinecourses.nptel.ac.in/noc25_hs61/preview	https://onlinecourses.nptel.ac.in/noc24_hs155/preview	https://onlinecourses.nptel.ac.in/noc24_hs155/preview
noc25-mg05	Management	AI in Human Resource Management	IIT Guwahati	12 Weeks	20-01-2025	11-04-2025	04-05-2025	27-01-2025	28-02-2025	PG	https://onlinecourses.nptel.ac.in/noc25_mg05/preview	https://nptel.ac.in/courses/110103626	https://nptel.ac.in/courses/110103626
noc25-hs70	Humanities and Social Sciences	Science Communication: Research Productivity and Data Analytics using Open Source Software	IIT Delhi	12 Weeks	20-01-2025	11-04-2025	03-05-2025	27-01-2025	28-02-2025	PG	https://onlinecourses.nptel.ac.in/noc25_hs70/preview	https://nptel.ac.in/courses/109102392	https://nptel.ac.in/courses/109102392
noc25-ag04	Agricultural and Food Engineering	Food Science and Technology	IIT Kharagpur	12 Weeks	20-01-2025	11-04-2025	26-04-2025	27-01-2025	28-02-2025	UG/PG	https://onlinecourses.nptel.ac.in/noc25_ag04/preview		

FIRST YEAR

M.Sc. Cardiac Care Technology

SEMESTER-I

Code No.	Core Subjects
Discipline Specific Core Theory	
MCCT 101 T	Introduction to Clinical Cardiology
MCCT 102 T	Fundamentals of Cardiac Diagnostic Procedures and Investigations
MCCT 103 T	Introduction to Pacing and Electrophysiology Study Techniques
CC 001 T	Research Methodology & Biostatistics (Core Course)
Discipline Specific Core Practical	
MCCT 104 P	Introduction to Clinical Cardiology
MCCT 105 P	Fundamentals of Cardiac Diagnostic Procedures and Investigations
MCCT 106 CP	MCCT Directed Clinical Education-I
CC 001 P	Research Methodology & Biostatistics (Core Course)

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester I**
Name of the Course	**Introduction to Clinical Cardiology**
Course Code	**MCCT 101 T**

Teaching Objective	• To provide a brief introduction to Echocardiography, its techniques and types of Echocardiography. • To provide practically and clinically useful application of Echocardiography. • To explain echo techniques available and to put echo into a clinical perspective.
Course Outcomes	• Student should understand the Anatomy & Physiology of the Heart: Describe the structure, function, and conduction system of the heart. • Identify common symptoms and examination techniques for cardiovascular diseases. • Cardiovascular Examination Techniques: Students should assess general and detailed physical appearance for signs of heart disease. • Examine arterial pulses, jugular veins, and peripheral veins for diagnostic insights. • Measure blood pressure and evaluate its physical determinants. • Students Analyze Cardiovascular Diagnostic Tests: Interpret ECG, echocardiography, cardiac catheterization, and stress testing results. • Use chest roentgenograms (X-rays) to assess cardiac conditions. • To understand the role of Cardiac Care technologist while assisting the Cardiologist as well as when performing individually.

Sr. No.	Topics	No. of Hrs.
1	**Basic Cardiology:** Anatomy of the heart, Conduction system of the heart, Symptoms of the heart diseases, Examination of Cardiovascular diseases	4
2	**Cardiac Auscultation:** The stethoscope: components, working, uses, Heart sound – Types of heart sounds: normal and abnormal, Prosthetic heart sounds	4
3	**Physical Appearance:** General appearance, Gestures and gait **Detailed Appearance:** Face, Eyes—external and internal Mouth—external and internal Hands and feet, Skin, Muscles and tendons, Thorax, Abdomen	5
4	**Arterial pulse:** Information derived from the arterial pulse, Sites of Arterial Pulse, Methods of measuring Arterial pressure, Physical determinants of Arterial pressure **The Jugular and Peripheral Veins:** External and Internal Jugular Veins, Techniques of Examination for External and Internal Jugular Veins, Assessment of Jugular Venous Pressure, Anatomic-Hemodynamic Inferences, Electrophysiologic Inferences—Arrhythmias and Conduction Defects	5
5	**Investigations in Cardiology:** Chest roentgenogram, Electrocardiography, Echocardiography, Cardiac catheterization, Exercise stress testing.	4
6	**Heart failure & Cardiomyopathy:** Heart failure, Cardiogenic shock, Pulmonary edema, Cardiomyopathy	4

7	**Cardiovascular diseases:** Hypertension, Ischemic Heart disease, Rheumatic heart disease, Arrhythmias, Pregnancy and heart diseases	4
Total		**30 hrs**

MCCT 104 P- Introduction to Clinical Cardiology

Sr. No.	Topics	No. of Hrs.
1	Cardiac Auscultation	**15**
2	Physical Examination in Cardiovascular diseases	**15**
3	Chest roentgenogram	**15**
4	Electrocardiography	**15**
Total		**60 hrs**

Recommended Learning Resources:

Text Books:

1. Physical Examination of the Heart and Circulation Fourth Edition, Joseph K. Perloff, M.D.
2. Textbook of Anatomy (Vol.1,2,3): B.D. Chaurasia
3. Ross and Wilson Anatomy & Physiology in Health and Illness, 12th Edition by Anne Waugh and Allison Grant
4. Principles of Anatomy & Physiology ,12th Edition by Gerard J. Tortora & Bryan Derrickson
5. Textbook of Physiology (Vol.1,2): Dr. A.K. Jain

Reference books or related websites:www.osmosis.org

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester I**
Name of the Course	**Fundamentals of Cardiac Diagnostic Procedures and Investigations**
Course Code	**MCCT 102 T**

Teaching Objective	• This course provides a basis for the student to develop a systematic and comprehensive understanding of, and skills in, cardiac investigations and diagnostic procedures
Course Outcomes	• To educate and train students to understand, interpret and complex diagnostic cardiac investigations. • **Prepare for Emergencies in the Cardiac Cath Lab:** Identify major and minor complications during cardiac catheterization. • Apply Basic Life Support (BLS) and Advanced Cardiac Life Support (ACLS) algorithms in emergencies.

Sr. No.	Topics	No. of Hrs.
1	**Cardiac Catheterization in detail:** Types of procedures, Hardware used, Vascular access, Conditions for Cardiac Catheterization	**6**
2	**Physics and Operation of Radiation equipment in Cardiac Cath Lab:** X-RAY tube & its design, Image intensifier, Gantry, Exposure factors, Projections used in various procedures	**6**
3	**Diagnostic Procedures:** Coronary Angiography, Peripheral Angiography, Renal Angiography, Cerebral Angiography	**6**
4	**HEMODYNAMICS:** Introduction to Hemodynamics, Pressure Measurement System, Sources of Error and Artifacts: Fluid Artifacts, Electronic and Electrical Artifacts, Human Error: Leveling and Balancing, Slope calibration, Hemodynamic waveforms, Gradient, Valve Area Calculations, Cardiac output formulas- Fick, Ejection fraction	**6**
5	**Emergencies in the Cardiac Catheterization Laboratory:** Major and Minor complications in CCL, Basic Life support and ACLS algorithms in emergencies	**6**
Total		**30 hrs**

MCCT 105 P- Fundamentals of Cardiac Diagnostic Procedures and Investigations

Sr. No.	Topics	No. of Hrs.
1	Cardiac Catheterization	**10**
2	Angiography& its types	**10**
3	Hemodynamic assessment	**10**
4	BLS & ACLS algorithm	**10**
5	Physics of Radiation Equipment	**10**
6	Hardwares used in CCL	**10**
Total		**60 hrs**

Recommended Learning Resources:

Text Books:

1. Invasive Cardiology- A MANUAL FOR CATH LAB PERSONNEL, 3rd Edition by Sandy Watson

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester I**
Name of the Course	**Introduction to Pacing and Electrophysiology Study Techniques**
Course Code	**MCCT 103 T**

Teaching Objective	• To teach students about common pacemaker problems • Identify indications for ICD and biventricular pacemaker implantation based on international guidelines
Course Outcomes	• Identify indications for cardiac pacing based on international guidelines • Identify indications for electrophysiological studies with/ without ablation in cases of complex arrhythmias. • Develop Expertise in Cardiac Pacing & Pacemaker Therapy • Describe normal cardiac conduction and the need for pacing. • Interpret NBG codes for pacemakers and their application. • Differentiate indications for temporary vs. permanent pacing. • Understand the components and functioning of pacemakers.

Sr. No.	Topics	No. of Hrs.
1.	**Anatomy of conduction system:** SA node, AV node, Intermodal and inter-atrial conduction, AV junctional and inter-ventricular conduction delay, The bundle of His, penetrating portion of the Av bundle, The bundle branches, The branching portion of the AV bundle, Terminal Purkinje fibers, Innervations of the AV node, His bundle & ventricular myocardium	**8**
2.	**Nervous & hormonal control of heart:** Anatomy of ANS, Various hormones involved in control of heart, Effect of vagal stimulation, Effect of sympathetic stimulation	**8**
3.	**Basics of Electrophysiology:** History, Equipment used, Personnel, Procedure, Arrhythmias treated, Differences Between Children and Adults for Electrophysiology	**7**
4.	**Radiofrequency ablation therapy:** Procedure**,** Arrhythmias treated: Atrioventricular Nodal Reentrant Tachycardia (AVNRT), Atrial Fibrillation, Atrial Flutter and Ventricular Tachycardia	**7**
5.	**Introduction to Cardiac Pacing:** Normal conduction, NBG codes for pacemaker, Indications for Temporary and Permanent Pacing, Pacemaker Components	**7**
6.	**Temporary Pacing (in detail):** Myocardial conduction, Pacemaker therapy, Basic terminologies used in Temporary Pacing, Types of Temporary pacemaker, Complications associated	**8**
Total		**45 hrs**

Recommended Learning Resources:

Text Books:

1. Invasive Cardiology- A MANUAL FOR CATH LAB PERSONNEL, 3rd Edition by Sandy Watson
2. Principles of Anatomy & Physiology ,12th Edition by Gerard J. Tortora& Bryan Derrickson

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester I**
Name of the Subject	**Research Methodology & Biostatistics (Core Course)**
Subject Code	**CC 001 T**

Teaching Objective	• The course is intended to give an overview of research and statistical models commonly used in medical and bio-medical sciences. The goal is to impart an intuitive, understanding and working knowledge of research designs and statistical analysis. The strategy would be to simplify, analyze the treatment of statistical inference and to focus primarily on how to specify and interpret the outcome of research.
Course Outcomes	• Student will be able to understand develop statistical models, research designs with the understating of background theory of various commonly used statistical techniques as well as analysis, interpretation & reporting of results and use of statistical software.

Sr. No	Topic	No. of Hrs.
A	**Research Methodology:**	**23**
1	**Scientific Methods of Research**: Definition of Research, Assumptions, Operations and Aims of Scientific Research. Research Process, Significance and Criteria of Good Research, Research Methods versus Methodology	4
2	**Research Designs**: Observational Studies: Descriptive, explanatory, and exploratory, Experimental Studies: Pre-test design, post-test design, Follow-up or longitudinal design, Cohort Studies, Case – Control Studies, Cross-sectional studies, Intervention studies.	5
3	**Sampling Designs**: Census and Sample Survey, Need and importance for Sampling, Implications of a Sample Design, Different Types of Sample Designs (Probability sampling and non-probability sampling), Systematic sampling, Stratified sampling, Cluster sampling, Multi-stage sampling, Sampling with probability proportional to size, Sequential sampling.	5
4	**Measurement in research**: Measurement Scales, Sources of Error in Measurement,	3
5	**Methods of Data Collection**: Types of data, Collection of Primary Data, Observation Method, Interview Method	4
6	Research Ethics and plagiarism	2
B	**Biostatistics**	**22**
7	**Data Presentation**: Types of numerical data: Nominal, Ordinal, Ranked, Discrete and continuous. Tables: Frequency distributions, Relative frequency, Graph: Bar charts, Histograms, Frequency polygons, scatter plots, line graphs	3
8	**Measures of Central Tendency and Dispersion**: Mean, Median, Mode, Range, Inter quartile range, variance and Standard Deviation, Coefficient of variation, grouped mean and grouped standard deviation (including merits and demerits).	3

9	**Testing of Hypotheses**: Definition, Basic Concepts, Procedure for Hypothesis Testing, power of test, Normal distribution, Parametric Tests including Z-test, t-test, and ANOVA	4
10	**Chi-square Test**: Chi-square as a Non-parametric Test, Applications.	2
11	**Measures of Relationship**: Correlation and Simple Regression Analysis	3
12	**Non-parametric test**: Sign test, Wilcoxon signed-Rank Test, Wilcoxon Rank Sum Test: Mann-Whitney U test, Kruskal Walli's test, Friedman's test, and Spearman Rank correlation test.	3
13	**Vital Health Statistics**: rate, crude rate, age specific rate, Measurement of fertility, Rate, Measures of mortality.	4
Total		**45 hrs**

CC 001 P–Research Methodology & Biostatistics (Core Course)

Sr. No.	Topics	No. of Hrs.
A	**Research Methodology**	
1	Research Article Presentation (Seminar)	**5**
B	**Biostatistics**	
2	Data Presentation	**4**
3	Measures of Central Tendency and Dispersion	**6**
4	Testing of Hypotheses	**16**
5	Chi-square Test	**4**
6	Measures of Relationship	**6**
7	Analysis of Variance	**5**
8	Non parametricor Distribution-free Tests	**8**
9	Computer Application Using Statistical Software including SPSS	**6**
Total		**60 hrs**

Reference Books:

1. Daniel WW. Biostatistics: A foundation for analysis in the health sciences. 10th ed. Wiley; 2013.
2. Gupta SC, Kapoor VK. Fundamentals of mathematical statistics. Sultan Chand & Sons; 2020 Sep.
3. Kothari CR, Garg G. Research methodology: Methods and techniques.2019.
4. Mahajan BK. Methods in biostatistics for medical students and research workers. 7th ed. Jaypee Brothers Medical Publishers; 2010.
5. Murthy MN. Sampling theory and methods. Statistical Publishing Society; 1967.
6. Singh YK. Fundamental of research methodology and statistics. New Age International; 2006.

Resolution No. 3.5 of Academic Council (AC-51/2025):

Resolved to approve the submitted list of recommended books for M.Sc. Clinical Nutrition and the course on **Biostatistics and Research Methodology** [ANNEXURE-7].

Annexure-7 of AC-51/2025

Biostatistics & Research Methodology Books List

Subject	Book Name	Author
Biostatistics & Research Methodology	Biostatistics: A Foundation for Analysis in the Health Sciences (10th ed.)	Daniel WW.
	Biostatistical Analysis (5th ed.)	Zar JH.
	Research Methodology: Methods and Techniques	Kothari CR, Garg G.
	Methods in Biostatistics for Medical Students and Research Workers (7th ed.)	Mahajan BK.
	Sampling Theory and Methods	Murthy MN.
	Fundamentals of Research Methodology and Statistics	Singh YK.
	Fundamentals of Biostatistics (8th ed.)	Rosner B.
	An Introduction to Medical Statistics (4th ed.)	Bland M.

Course code- MCCT 106 CP: MCCT Directed Clinical Education – I

Course Outcomes	• Build a robust theoretical foundation, enabling students to understand healthcare practices, disease management, and patient care, thereby empowering them to make informed decisions and adapt to evolving medical technologies. • Emphasize hands-on training, ensuring proficiency in clinical procedures, diagnostic techniques, and the use of advanced medical equipment. This practical exposure will bridge the gap between theory and practice, enhancing students' confidence and competence in delivering quality patient care. • Focus on developing professionalism, empathy, ethical conduct, teamwork, and communication skills—key traits for holistic patient care and effective collaboration in interdisciplinary healthcare teams.

Students will gain additional skills in interventional procedures, cardiac pharmacology and recent advancements. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate pharmacological and invasive techniques. **(Total-180 hrs.)**

FIRST YEAR

M.Sc. Cardiac Care Technology

SEMESTER-II

Code No.	Core Subjects
Discipline Specific Core Theory	
MCCT 107 T	Introduction to Non-Invasive Techniques in Cardiology
MCCT 108 T	Invasive Cardiology
Discipline Specific Core Practical	
MCCT 109 P	Introduction to Non-Invasive Techniques in Cardiology
MCCT 110 P	Invasive Cardiology
MCCT 111 CP	MCCT Directed Clinical Education-II
Skill Enhancement Course	
SEC 001 T	Innovation and Entrepreneurship
SEC 002 T	NPTEL Swayam

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester II**
Name of the Course	**Introduction to Non-Invasive Techniques in Cardiology**
Course Code	**MCCT 107 T**

Teaching Objective	• To teach students about common non-invasive techniques, investigations carried out with indications and complications
Course Outcomes	• Identify indications for non-invasive techniques based on international guidelines • Develop Expertise in non-invasive techniques. ECG, Echocardiography, Stess Test,

Sr. No.	Topics	No. of Hrs.
1	**BASICS OF ELECTRODE PLACEMENT AND LEAD SELECTION AND AXIS DEVIATION:** Basics of Electrodes and Leads, ECG deflections: Isoelectric, Upright, Negative and Biphasic, Types of ECG leads- Standard limb leads, Precordial leads and the Wisdom central, Augmented limb leads, Unipolar V/S Bipolar leads, Placement of leads with universal color code, Hexa-axial reference frame and Electrical axis, X axis – time presentation, Y axis – voltage presentation, Right & Left axis in normal ECG, Einthoven's Triangle, Deviation of Axis.	**10**
2	**STRESS TEST:** Protocols, lead placement, instruction to the patient, rhythm analysis, Types of Exercise stress tests.	**10**
3	**ECG COMPONENTS-WAVES AND INTERVALS:** ECG waveforms: Rate, Rhythm and Normal time intervals-The Normal Electrocardiogram, The Normal P wave & Atrial repolarization, Atrioventricular node conduction and the PR segment, Ventricular activation and the QRS complex, Genesis of QRS complex, Ventricular recovery and ST-T wave, Normal variants and Rotation of the heart, ECG PAPER,Rate measurement: Six second method, Large box method, Small box method	**10**
4	**ECHOCARDIOGRAPHY TECHNIQUES: BASIC PRINCIPLES, INDICATIONS AND USES OF:** 2D Transthoracic Echocardiography, M-mode, Echo windows and views used in Transthoracic echocardiography, Doppler echocardiography in detail: Pulsed, Continuous wave and Color flow mapping	**10**
5	**KNOBOLOGY AND INSTRUMENTATION:** Transducer: Basic principle and working, Types of Transducers, Piezoelectric crystals and its effect, Various knobs used on Echo machine with its description and application	**10**
6	**BASICS OF TOE, STRESS ECHO & CONTRAST ECHO:** Advantages & Disadvantages, Applications, Indications & Contraindications, Complications, Patient positioning and medications used	**10**
Total		**60 hrs**

MCCT 109 P- Introduction to Non-Invasive Techniques in Cardiology

Sr. No.	Topics	No. of Hrs.
1	Steps to perform an 12 lead ECG	**15**
2	Patient positioning according to various conditions.	**15**
3	Proper communication with patient to find out the history	**15**
4	ECG machine operating and maintenance	**15**
Total		**60 hrs**

Recommended Learning Resources:

Text Books:

1. ECG Made Easy –AtulLuthra
2. Reference by PGDCC – IGNOU Handbooks for ECG, ECHO and Stress Test
3. Echo Made Easy: Sam Kaddoura
4. Reference by PGDCC – IGNOU Handbooks for ECG, ECHO and Stress Test.
5. Feigen Baum's Echocardiography Tajik Jamil for Echocardiography.

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester II**
Name of the Course	**Invasive Cardiology**
Course Code	**MCCT 108 T**

Teaching Objective	• To enable students, understand new techniques for procedures in and around the heart emerge that again need expert knowledge and manual dexterity. • To understand such interventions which include diagnostic and therapeutic electrophysiology; implantation or exchange of complex pacemaker systems or percutaneous cardioverter-defibrillator-pacers; percutaneous valve repairs or replacements etc.
Course Outcomes	• To enable students to not only be a helping hand to those just starting out in the specialty but also to serve as a reference for those who have been working in Invasive field for some time • In-depth knowledge of cardiac diagnostic and interventional procedures, focusing on contrast media, intravascular imaging, coronary interventions, assist devices, peripheral angiography, and cardiac pharmacology.

Sr. No.	Topics	No. of Hrs.
1	**CONTRAST MEDIA:** Basics, Definition of Hydrophilicity, Osmolarity, and Viscosity, Contrast Agents used in the CCL, Uses, Complications, Contrast medium reactions: Mild, Moderate, Severe, Allergies: Anaphylactic and Anaphylactoid Reaction, Contrast-Induced Nephropathy (CIN)	**8**
2	**IVUS:** History, Angiography vs. IVUS, IVUS systems, Diagnostic Applications of IVUS, Complications of IVUS, Optical Coherence Tomography (OCT)	**8**
3	**FUNCTIONAL ASSESSMENT OF CORONARY DISEASE:** Intravascular Pressure Measurement: Coronary Pressures and Fractional Flow Reserve	**8**
4	**PTCA:** History, Indications, Materials used, Types of Angioplasty balloons (OTW, SOE, Fixed-wire balloons, Perfusion balloons, Compliant and Non-Compliant balloons, Stent Implantation, Contraindications, Complications	**8**
5	**IC HARDWARES:** Stents: Composition, Types, Guidewires: Composition, Types, Catheters: Diagnostic and Guiding	**8**
6	**IABP AND OTHER CARDIAC ASSIST DEVICES:** IABP- Physiologic Principles of Counter pulsation, Indications, Contraindications, Insertion, Timing: Timing errors, Troubleshooting, Weaning and Balloon Removal, Complications, Basics of Percutaneous ventricular assist devices: Tandem Heart, Impella, Percutaneous Coronary Bypass	**8**

7	**PERIPHERAL CAROTID ANGIOGRAPHY:** Introduction, Cerebrovascular Anatomy and pathology, Diagnosis and patient selection, Patient preparation, Diagnostic procedure, Post procedure Care	**6**
8	**CARDIAC PHARMACOLOGY:** Local Anesthetics, Analgesics And Sedatives: Opioids, Morphine, Fentanyl, Diazepam, Midazolam, Lorazepam, Vasodilators: Nitroglycerine, Sodium Nitroprusside, Beta receptor blockers: Metoprolol, Propranolol, Esmolol, Labetalol, Calcium Channel Blockers: Diltiazem, Verapamil, Nicardipine, Anticoagulation Agents: Platelet Aggregation Inhibitors, Aspirin, Clopidogrel, Glycoprotein IIb/IIIa Inhibitors, Tirofiban, Heparin, Warfarin, Thrombolytics: Streptokinase, Urokinase, Anistreplase, rTPA, Reteplase, Tenecteplase	**6**
Total		**60 hrs**

MCCT 110 P- Invasive Cardiology

Sr. No.	Topics	No. of Hrs.
1	Learn about Probe and Scanner settings.	**15**
2	Learn about Structural and Functional assessment of the heart.	**15**
3	Learn about various windows and views used in Echocardiography.	**15**
4	Learn about qualitative reporting system along with various software's associated with Echo reporting.	**15**
Total		**60 hrs**

Recommended Text Books:

1. Invasive Cardiology, 3rd Edition by Sandy Watson.

Reference books or related websites:

1. THE INTERVENTIONAL CARDIAC CATHETERIZATION HANDBOOK, 3rd Edition by Morton J. Kern

Course code- MCCT 111 CP: MCCT Directed Clinical Education – II

Course Outcomes	• Build a robust theoretical foundation, enabling students to understand healthcare practices, disease management, and patient care, thereby empowering them to make informed decisions and adapt to evolving medical technologies. • Emphasize hands-on training, ensuring proficiency in clinical procedures, diagnostic techniques, and the use of advanced medical equipment. This practical exposure will bridge the gap between theory and practice, enhancing students' confidence and competence in delivering quality patient care. • Focus on developing professionalism, empathy, ethical conduct, teamwork, and communication skills—key traits for holistic patient care and effective collaboration in interdisciplinary healthcare teams.

Students will gain additional skills in interventional procedures, cardiac pharmacology and recent advancements. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate pharmacological and invasive techniques. **(Total-225 hrs.)**

SKILL ENHANCEMENT COURSES

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester II**
Name of the Subject	**Innovation and Entrepreneurship**
Subject Code	**SEC 001 T**

Course Outcome	• Students will grasp the concepts of innovation, its ecosystem, and the role of various stakeholders such as government policies, startups, and innovation hubs. • Cultivating an entrepreneurial mindset and leadership qualities necessary for driving innovation and leading ventures. • Understanding the intersection of technology and innovation and leveraging emerging technologies for entrepreneurial ventures.

Sr. No.	Topics	No. of Hrs.
1	Innovation and Innovation Eco-System, The Policy Framework, Startup Landscape and Innovation Hubs, - Digital India and Make in India, - Linking Innovation with Intellectual Property Rights, Raising Finance for Startups in India, Innovation in Indian Context, Writing a business plan	**15**
2	Creativity and Research, Converting Researches to Innovation: Innovation Types and Models, Product Development, IPR and its Commercialisation, Support System to Develop Culture of Research and Innovation, Commercialisation of research and innovation, Fund raising – Research and Innovation, Envisioning Innovation and Scenario Building	**15**
3	Introduction to Innovation in Entrepreneurship, Idea Generation and Validation, Design Thinking in Entrepreneurship, Business Model Innovation, Technology and Innovation, Funding Innovation, Entrepreneurial Mindset, Leadership & amp; Intellectual Property, Scaling and Growth Strategies, sustainability & amp; Social Innovation	**15**
Total		**45 hrs**

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester II**
Name of the Course	**NPTEL Swayam**
Course Code	**SEC 002 T**

Note: The links of SWAYAM/NPTEL courses (https://swayam.gov.in/nc_details/NPTEL)

Scheme of University Examination Theory for PG Program:

General structure / patterns for setting up question papers for Theory / Practical courses, their evaluation weightages for PG programs of MGMSBS are given in the following tables

Marks scheme for the University exam:

Final theory marks will be 100 marks (80 marks University Theory exam + 20 Marks Internal assessment).

Question		Marks distribution	Marks allotted per section	Marks
Sec: A	MCQ	10 x 1 M = 10	10	10
Sec: B	SAQ	3/4x 5 M = 15	15	35
Sec: B	LAQ	2/3 x 10 M = 10	20	
Sec: C	SAQ	3/4x 5 M = 15	15	35
Sec: C	LAQ	2/3x 10 M = 10	20	
Total				**80 Marks**

Marks Scheme for the University Examination (50 Marks)

Final theory marks will be 50 marks University Theory exam pattern Research Methodology & Biostatistics (Core course)

Question	Question No.	Question Type	Marks Distribution	Marks
Sec: A	1.	LAQ (2 out of 3)	2 X 10 Marks = 20	20
Sec: B	2.	SAQ (6 out of 8)	6 X 05 Marks = 30	30
Total				**50 Marks**

Marks Scheme for the University Examination (100 Marks)

Final theory marks will be 100 marks University Theory exam pattern Elective Course

Question	Question No.	Question Type	Marks Distribution	Marks
Sec: A	1.	LAQ (10 out of 12)	10 X 10 Marks = 100	100
Total				**100 Marks**

Practical exam pattern: Total 40 marks with following breakup:

Exercise	Description	Marks
Q No 1	Practical exercise - 1	1 x15=15 M
Q No 2	Station exercise	2x5M=10 M
Q No 3	VIVA	10 M
Q No 4	Journal	5M
Total		**40 Marks**

Practical exam pattern Research Methodology & Biostatistics (Core course)

Total 50-mark distribution:

Exercise	Description	Marks
Q No 1	**Practical/Problem-Solving:** These questions can assess statistical analysis, research design, hypothesis testing, or interpretation of data etc.	2 × 10 marks each) = **20 marks**
Q No 2	Identification of study designs, Critical appraisal of research papers, Application of biostatistical tools, Sampling techniques etc.	(4 × 5 marks each) = **20 marks**
Q No 3	**Viva Voce (Oral Examination)** Assessing conceptual clarity, application of research methodology, and statistical reasoning.	**10 marks**
Total		**50 Marks**

Practical to be conducted at respective departments and marks submitted jointly by the parent department to the university.

Breakup of theory IA calculation for 20 marks

Description	Marks
Internal exam (at department)	15 marks
Seminar	5 marks
Total	**20 Marks**

Breakup of practical IA calculation:

Description	Marks
Internal exam (at department)	10 marks
Viva	5 marks
Journal	5 marks
Total	**20 Marks**

Note –20 marks to be converted to 10 marks weightage for submission to the university.

Model Checklist for Evaluation of the Clinical Directed Posting (PG)

Name of the student: _____Date:_____
Program:_____
Semester: _____ Name of the Internal faculty/Observer:_____
Name of the External Faculty/Observer:_____

Core Competencies	Marks allotted	Marks obtained
Students will begin to develop critical thinking abilities utilizing the allied health personnel roles of communicator and caregiver. Students will learn principles of professional allied health personnel practice and provide direct care to individuals within a medical surgical setting while recognizing the diverse uniqueness of individuals with health alterations.		
Clinical Teaching		
a. Demonstrate beginning competency in technical skills.	10	
Independent Work by Student guided by faculty		
a. Develop effective communication skills (verbally and through charting) with patients, team members, and family	2.5	
b. Identify intra and inter-professional team member roles and scopes of practice. Establish appropriate relationships with team members.	2.5	
Hands on practical work by students		
a. Protect confidentiality of electronic/manual health records data, information, and knowledge of technology in an ethical manner	05	
Independent work by student		
a. Demonstrate expected behaviors and complete tasks in a timely manner. Arrive to clinical experiences at assigned times. Maintain professional behavior and appearance.	05	
Log book	10	
Viva	10	
Attendance	05	
Total	**50 Marks**	

Sign of Internal Examiner: _____
Sign of External Examiner: _____

Resolution No. 5.1 of Academic Council (AC-52/2025):
Resolved to approve the CBCS syllabus , including Program Outcomes (POs) and Course Outcomes (COs), for Postgraduate (PG) 2-year programs under MGMSBS (semester III & IV) for M.Sc. Medical Biotechnology , M.Sc. Medical Genetics , M.Sc. Clinical Embryology , M.Sc. Clinical Nutrition , M.Sc. Medical Dialysis Technology , M.Sc. Molecular Biology, M.Sc. Medical Radiology & Imaging Technology, M.Sc. Cardiac Care Technology, M.Sc. Operation Theatre and Anaesthesia Technology , M.Sc. Emergency and Trauma Care , M. Optometry , Masters in Hospital Administration , Masters of Public Health , M.Sc. Health Informatics , M.Sc. Medical Laboratory Technology , M.Sc. Clinical Research , to be effective from batch admitted in the Academic Year 2025-26 onwards . Guidelines for selected programmes as per National Commission for Allied & Healthcare Professions will be adopted for the given programmes from academic year 2026-27 onwards [ANNEXURE-17A, 17B, 17C, 17D, 17E, 17F, 17G, 17H, 17I, 17J, 17K, 17L, 17M, 17N, 17O & 17P and ANNEXURE-18A, 18B, 18C, 18D, 18E, 18F, 18G, 18H, 18I, 18J, 18K, 18L, 18M, 18N, 18O & 18P].

Annexure-17H of AC-52/2025

MGM SCHOOL OF BIOMEDICAL SCIENCES

(A constituent unit of MGM INSTITUTE OF HEALTH SCIENCES)

(Deemed to be University u/s 3 of UGC Act 1956)
Grade "A^{++}" Accredited by NAAC
Sector 1, Kamothe, Navi Mumbai-410209, Tel.No.:022-2743763, 27437632, 27432890
Email. sbsnm@mgmuhs.com/Website : www.mgmsbsnm.edu.in

CHOICE BASED CREDIT SYSTEM (CBCS)

(Academic Year 2025 - 26)

Curriculum for

M.Sc. Allied Health Sciences

M.Sc. Cardiac Care Technology

Semester III & IV

Course Outcome
SEMESTER-III

MCCT 112 T	Echocardiography: Advanced	Mapped POs	Teaching-Learning Methodologies	Assessment Tools
CO1	**Apply advanced principles of echocardiography:** To assess complex cardiac pathologies including congenital, valvular, ischemic, and cardiomyopathic conditions.	PO1, PO2, PO3, PO4 PO5, PO6, PO7, PO8	Lecture, Practical, Journal, Assignment, E-Learning and Poster / Videos	Internal Assessment and University Exam, Theory exam, MCQ, Seminar, Assignment
CO2	**Perform and interpret specialized echocardiographic modalities: s**uch as Doppler, color flow mapping, tissue Doppler imaging, contrast echocardiography, and stress echocardiography.	PO1, PO2, PO3, PO4 PO5, PO6, PO7, PO8	Lecture, Journal, Assignment, E-Learning and Poster / Videos	Internal Assessment and University Exam, Theory exam, MCQ, Seminar, Assignment
CO3	Correlate echocardiographic findings with clinical and hemodynamic data: to assist in diagnosis, therapeutic planning, and follow-up in cardiology and cardiac surgery.	PO1, PO2, PO3, PO4 PO5, PO6, PO7, PO8	Lecture, Journal, Assignment, E-Learning and Poster / Videos	Internal Assessment and University Exam, Theory exam, MCQ, Seminar, Assignment
CO4	Demonstrate professional competence in advanced echocardiography practice by adhering to safety protocols, patient care ethics, and evolving technological advancements in cardiac imaging.	PO1, PO2, PO3, PO4 PO5, PO6, PO7, PO8	Lecture, Journal, Assignment, E-Learning and Poster / Videos	Internal Assessment and University Exam, Theory exam, MCQ, Seminar, Assignment
MCCT 113 T	**Quality Assurance, Standardization & Accreditation (Cardiac Care)**	**Mapped POs**	**Teaching-Learning Methodologies**	**Assessment Tools**
CO1	Understand and explain the principles of quality assurance, standardisation, and accreditation in healthcare, with emphasis on cardiac care services.	PO1, PO2, PO3, PO4 PO5, PO6, PO7, PO8	Lecture, Practical, Demonstration, Assignment, Journal	Internal Assessment, University Exam, Theory exam, Seminar, Assignment
CO2	Apply quality control protocols and accreditation standards (NABH, NABL, AERB, BARC, JCI) to ensure accuracy, patient safety, and compliance in clinical practice.	PO1, PO2, PO3, PO4 PO5, PO6, PO7, PO8	Lecture, Practical, Demonstration, Assignment, Journal	Internal Assessment, University Exam, Theory exam, Seminar, Assignment
CO3	Demonstrate competency in documentation, audits, and continuous quality improvement processes to maintain standardised and accredited cardiac care facilities.	PO1, PO2, PO3, PO4 PO5, PO6, PO7, PO8	Lecture, Practical, Demonstration, Assignment, Journal	Internal Assessment, University Exam, Theory exam, Seminar, Assignment
MCCT 114	**Research Project / Dissertation**	**Mapped POs**	**Teaching-Learning Methodologies**	**Assessment Tools**
CO1	Demonstrate the ability to identify, formulate, and justify a clinically	PO1, PO2, PO3, PO4	Demonstration, Case-study	Viva-voce, Case-Study

	relevant research problem in the field of cardiac care technology using evidence-based resources.	PO5, PO6, PO7, PO8		
CO2	Apply appropriate research methodology, data collection techniques, and statistical tools to analyze and interpret findings in cardiac sciences.	PO1, PO2, PO3, PO4 PO5, PO6, PO7, PO8	Demonstration, Case-study	Viva-voce, Case-Study
CO3	Communicate research outcomes effectively through scientific writing, presentations, and defend the dissertation with ethical integrity and academic rigor.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Demonstration, Case-study	Viva-voce, Case-Study
MCCT 115 P	**Echocardiography: Advanced**	**Mapped POs**	**Teaching-Learning Methodologies**	**Assessment Tools**
CO1	Perform and optimize advanced echocardiographic techniques (2D, Doppler, strain imaging, contrast echo) with accuracy in diverse clinical scenarios.	PO1, PO2, PO3, PO4,PO5,PO6,PO7,PO8	Practical and Problem Based Learning	Internal Exam, University Exam (Practical Exam), Viva
CO2	Analyze and interpret complex echocardiographic findings to aid in the diagnosis and management of structural, valvular, and congenital heart diseases.	PO1, PO2, PO3, PO4,PO5,PO6,PO7,PO8	Practical and Problem Based Learning	Internal Exam, University Exam (Practical Exam), Viva
CO3	Demonstrate proficiency in patient preparation, equipment handling, image acquisition, and adherence to safety and ethical standards during echocardiographic procedures.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Practical and Problem Based Learning	Internal Exam, University Exam (Practical Exam), Viva
MCCT 116 CP	**MCCT Directed Clinical Education-III**	**Mapped POs**	**Teaching-Learning Methodologies**	**Assessment Tools**
CO1	Apply advanced theoretical knowledge to real-world clinical scenarios in the cath lab, echocardiography lab, and cardiac critical care settings.	PO1, PO2, PO3, PO4,PO5,PO6,PO7,PO8	Practical, Clinical Posting, Demonstration, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce.
CO2	Demonstrate proficiency in assisting advanced cardiac procedures such as interventional cardiology techniques, electrophysiology studies, and peri-procedural echocardiography.	PO1, PO2, PO3, PO4,PO5,PO6,PO7,PO8	Practical, Clinical Posting, Demonstration, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce.
CO3	Integrate patient data, imaging, and hemodynamic parameters to support accurate diagnosis, therapeutic decisions, and procedural planning.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Practical, Clinical Posting, Demonstration, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce.
CO4	Exhibit professional and ethical clinical practice by ensuring patient safety, maintaining sterile technique, and adhering to institutional and accreditation protocols	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Practical, Clinical Posting, Demonstration, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce.

SEMESTER-IV

MCCT 117 T	Cardiac Cathterization: Advanced	Mapped POs	Teaching-Learning Methodologies	Assessment Tools
CO1	Demonstrate advanced knowledge of hemodynamics, coronary angiography, structural heart evaluations, and apply theoretical concepts to clinical practice in the cath lab.	PO1, PO2, PO3, PO4,PO5,PO6,PO7,PO8	Lecture, Practical, Journal, Assignment, E-Learning and Poster / Videos	Internal Assessment and University Exam, Theory exam, MCQ, Seminar, Assignment
CO2	Perform and assist in complex diagnostic and interventional cardiac catheterisation procedures, applying appropriate techniques for coronary, structural, and peripheral interventions.	PO1, PO2, PO3, PO4,PO5,PO6,PO7,PO8	Lecture, Journal, Assignment, E-Learning and Poster / Videos	Internal Assessment and University Exam, Theory exam, MCQ, Seminar, Assignment
CO3	Analyze hemodynamic data, angiographic findings, and physiological assessments (FFR/iFR) to support accurate diagnosis, clinical decision-making, and patient management in collaboration with the cardiac team.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Lecture, Journal, Assignment, E-Learning and Poster / Videos	Internal Assessment and University Exam, Theory exam, MCQ, Seminar, Assignment
CO4	Adhere to standards of radiation safety, infection control, and quality assurance while managing complications effectively and demonstrating ethical and professional responsibility in the cath lab.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Lecture, Journal, Assignment, E-Learning and Poster / Videos	Internal Assessment and University Exam, Theory exam, MCQ, Seminar, Assignment
MCCT 118 T	**Pediatric and Congenital Cardiology**	**Mapped POs**	**Teaching-Learning Methodologies**	**Assessment Tools**
CO1	Demonstrate comprehensive knowledge of paediatric and congenital cardiovascular anatomy, physiology, and common heart defects.	PO1, PO2, PO3, PO4,PO5,PO6,PO7,PO8	Lecture, Practical, Journal, Assignment, E-Learning and Poster / Videos	Internal Assessment and University Exam, Theory exam, MCQ, Seminar, Assignment
CO2	Perform and interpret diagnostic cardiac catheterisation, hemodynamic measurements, shunt calculations, and angiography in children.	PO1, PO2, PO3, PO4,PO5,PO6,PO7,PO8	Lecture, Journal, Assignment, E-Learning and Poster / Videos	Internal Assessment and University Exam, Theory exam, MCQ, Seminar, Assignment
CO3	Assist in interventional procedures including balloon valvuloplasty, device closure of ASD/VSD/PDA, stenting, and	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Lecture, Journal, Assignment, E-Learning and Poster / Videos	Internal Assessment and University Exam, Theory exam, MCQ, Seminar, Assignment

	hybrid procedures in paediatric patients			
CO4	Identify, manage, and prevent complications in congenital cardiology practice.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Lecture, Journal, Assignment, E-Learning and Poster / Videos	Internal Assessment and University Exam, Theory exam, MCQ, Seminar, Assignment
MCCT 119 CP	**MCCT Directed Clinical Education-IV**	**Mapped POs**	**Teaching-Learning Methodologies**	**Assessment Tools**
CO1	Apply theoretical knowledge of cardiac catheterisation, pediatric, and congenital cardiology to real-world clinical settings through supervised training and case-based learning.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Practical, Clinical Posting, Demonstration, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce
CO2	Demonstrate competency in assisting diagnostic and interventional catheterisation procedures in adults and children, including evaluation of congenital heart diseases and shunt assessments.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Practical, Clinical Posting, Demonstration, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce
CO3	Interpret hemodynamic data, angiographic findings, and clinical presentations in pediatric and congenital cases to contribute effectively to diagnostic and therapeutic decision-making.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Practical, Clinical Posting, Demonstration, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce
CO4	Exhibit effective teamwork, communication skills, adherence to safety standards, and ethical responsibility while engaging in direct patient care in the cath lab and pediatric cardiology units.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Practical, Clinical Posting, Demonstration, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce
MCCT 114	**Research Project/ Dissertation**	**Mapped POs**	**Teaching-Learning Methodologies**	**Assessment Tools**
CO1	Design and execute a research study in cardiac sciences by applying appropriate experimental or clinical methodologies.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Demonstration, Case-study	Viva-voce, Case-Study
CO2	Collect, manage, and analyze	PO1, PO2,	Demonstration, Case-	Viva-voce, Case-

	research data using suitable biostatistical tools, ensuring validity and reliability of results.	PO3, PO4, PO5, PO6, PO7, PO8	study	Study
CO3	Present and defend research findings effectively through dissertation writing, viva-voce, and scientific presentations, while upholding ethical and professional standards.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Demonstration, Case-study	Viva-voce, Case-Study

OUTLINE OF COURSE CURRICULUM

M.Sc. Cardiac Care Technology

Semester III

Code No.	Core Course	Credits/Week					Hrs/Semester					Marks		
		Lecture (L)	Tutorial (T)	Practical (P)	Clinical Posing/ Rotation (CP)	Total Credits (C)	Lecture (L)	Tutorial (T)	Practical (P)	Clinical Posing/ Rotation (CP)	Total (hrs.)	Internal Assement (IA)	Semester End Exam (SEE)	Total
Discipiline Specific Core Theory														
MCCT 112 T	Echocardiography: Advanced	4	-	-	-	**4**	60	-	-	-	**60**	**20**	**80**	**100**
MCCT113 T	Quality Assurance, Standardization & Accrediation (Cardiac Care)	4	-	-	-	**4**	60		-	-	**60**	**20**	**80**	**100**
MCCT 114	Research Project/ Dissertation	-	-	10	-	**5**	-	-	150	-	**150**	**50**	-	**50**
Discipiline Specific Core Practical														
MCCT 115 P	Echocardiography: Advanced	-	-	2	-	**1**	-	-	30	-	**30**	**10**	**40**	**50**
MCCT 116 CP	MCCT Directed Clinical Education-III	-	-	-	18	**6**	-	-	-	270	**270**	-	**50**	**50**
Total		**8**	**0**	**12**	**18**	**20**	**120**	**0**	**180**	**270**	**570**	**100**	**250**	**350**

OUTLINE OF COURSE CURRICULUM

M.Sc. Cardiac Care Technology

Semester IV

Code No.	Core Course	Credits/Week					Hrs/Semester					Marks		
		Lecture (L)	Tutorial (T)	Practical (P)	Clinical Posing/ Rotation (CP)	Total Credits (C)	Lecture (L)	Tutorial (T)	Practical (P)	Clinical Posing/ Rotation (CP)	Total (hrs.)	Internal Assement (IA)	Semester End Exam (SEE)	Total
Discipiline Specific Core Theory														
MCCT 117 T	Cardiac Cathterization: Advanced	2	-	-	-	**2**	30	-	-	-	**30**	**20**	**80**	**100**
MCCT 118 T	Pediatric and Congenital Cardiology	2	-	-	-	**2**	30	-	-	-	**30**	**20**	**80**	**100**
Discipiline Specific Core Practical														
MCCT 119 CP	MCCT Directed Clinical Education-IV	-	-	-	15	**5**	-	-	-	225	**225**	-	**50**	**50**
MCCT 114	Research Project/ Dissertation	-	-	22	-	**11**	-	-	-	-	**330**	-	**200**	**200**
Total		**4**	**0**	**22**	**15**	**20**	**60**	**0**	**0**	**225**	**615**	**40**	**410**	**450**

SECOND YEAR

M.Sc. Cardiac Care Technology

SEMESTER-III

Code No.	Core Subjects
Discipline Specific Core Theory	
MCCT 112 T	Echocardiography: Advanced
MCCT113 T	Quality Assurance, Standardization & Accrediation (Cardiac Care)
MCCT 114	Research Project / Dissertation
Discipline Specific Core Practical	
MCCT 115 P	Echocardiography: Advanced
MCCT 116 CP	MCCT Directed Clinical Education-III

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester III**
Name of the Course	**Echocardiography- Advanced**
Course Code	**MCCT 112 T**

Teaching Objective	• Toprovide practically and clinically useful application of Echocardiography. • To explain echo techniques available and to put echo into a clinical • perspective.
Course Outcomes	• Apply advanced principles of echocardiography: To assess complex cardiac pathologies including congenital, valvular, ischemic, and cardiomyopathic conditions. • Perform and interpret specialized echocardiographic modalities : such as Doppler, color flow mapping, tissue Doppler imaging, contrast echocardiography, and stress echocardiography. • Correlate echocardiographic findings with clinical and hemodynamic data: to assist in diagnosis, therapeutic planning, and follow-up in cardiology and cardiac surgery. • Demonstrate professional competence in advanced echocardiography practice by adhering to safety protocols, patient care ethics, and evolving technological advancements in cardiac imaging.

Sr. No.	Topics	No. of Hrs.
1	**ECHOCARDIOGRAPHY FOR CORONARY ARTERY DISEASE:** **a.** Understanding coronary circulation: Coronary anatomy and physiology, pathogenesis of atherosclerotic plaques, abnormalities of coronary perfusion, wall thickening **b.** Wall motion segmentation, analysis and scoring: Segmental analysis for wall motion defects, coronary artery territories, detection and quantitation of Ischemic muscle-wall motion scoring, Ischemic Cardiomyopathy **c.** Myocardial infarction: Detecting and assessing MI, co-relation with coronary anatomy, prognostication following MI. Complications of MI: Aneurysm, pseudo aneurysm, Ventricular Septal Defect, thrombi-embolic potential, right ventricular involvement **d.** Stress echocardiography: Protocols for stress echocardiography, detection of reversible Ischemic, detecting inducible ischaemia/viability, specificity and sensitivity **e.** Newer echo techniques and their application in CAD: Tissue Doppler, Speckle echo & Contrast echo - indications, contraindications, drug dosage, delivery of contrast, interpretation with study of myocardial perfusion and LV opacification **f.** Role of CT Angiography, MRI and Nuclear perfusion & myocardial viability in CAD **g.** LVAD: indications, technique and post-op evaluation	20

2	**ECHOCARDIOGRAPHY FOR VALVULAR HEART DISEASE**: **a.** Haemodynamic information derived from Normal Echocardiography **b.** Mitral stenosis: Etiopathogeneisis, pathophysiology and haemodynamics, diagnosis, assessing severity, secondary effects, assessment for balloon mitral valvotomy- Transesophageal echocardiography and its uses **c.** Mitral regurgitation: Mitral valve prolapse and analysis of segments, Haemodynamics of MR, diagnosis of MR, assessing severity and secondary effects, pre-op, intra-op and postoperative, assessment for mitral valve repair, use of three dimensional echocardiography for mitral valve surgery, flail mitral valve, papillary muscle dysfunction. mitral annular calcium. **d.** Aortic stenosis: Etiopathogenesis and haemodynamics, sub-valvar, valvar and supravalvar lesions, cuspal morphology, diagnosis and assessment of secondary effects, time course and prognostication, pre-operative and post- operative assessment **e.** Aortic regurgitation: Etiopathogenesis and haemodynamics, diagnosis, assessing severity, secondary effects, relevant aspects of left ventricular function, timing of surgery, preoperative and post-operative assessment. **f.** Tricuspid & Pulmonary valve disease: Anatomy and physiology of the healthy valve, structural and functional changes in various disease states organic and functional involvement, tricuspid stenosis, tricuspid regurgitation and assessment of severity, infundibular, valvar, supra valvar and peripheral pulmonic stenosis, approach to pulmonary artery hypertension. **g.** Prosthetic valves: Types and normal function of mechanical valves, stenosis regurgitation, use of tranesophageal echo for prosthetic valves, endocarditis: and its sequelae in native and prosthetic heart valves.	20
3	**ECHOCARDIOGRAPHY IN MYO-PERICARDIAL, AORTIC, SYSTEMIC DISORDERS & CARDIAC MASSES:** **a.** Hypertrophic Cardiomyopathy: Morphological variants, diagnosis, hemodynamics, assessing intracavitary and outflow tract gradients, evaluation of therapy, pre and postprocedural evaluation. **b.** Idiopathic dilated cardiomyopathy: Diagnosis and differentiation from other disorders such as IHD, ventricular functions and secondary effects, pre and post-procedural evaluation for cardiac re-synchronization therapy. Overview of cardiac transplantation **c.** Restrictive Cardiomyopathy: Diagnosis and haemodynamics, infiltrative cardiomyopathies, miscellaneous- myocardial diseases in neuromuscular disorders, infectious agents and toxins. **d.** Diseases of the pericardium: Pericardial effusion: Detection of fluid, diagnosis-pleural versus pericardial fluid, quantitation, loculated effusions, cardiac tamponade-diagnosis, haemodynamicsetiology, pericardiocentesis Constrictive pericarditits: Diagnosis and haemodynamics. Differentiation from restrictive Cardiomyopathy, pre and post-surgical evaluation.	20

	Miscellaneous: acute pericarditis, pericardial thickening, pericardial cysts, absent pericardium. **e.** Diseases of the Aorta: Aortic dilatation and aneurysms, Aortic dissection-diagnosis and classification, false aneurysms, aneurysms of the aortic sinuses-rupture, haemodynamics, pre-and post surgical evaluation. Miscellaneous-trauma, infections, aorta-left-ventricular tunnel, atherosclerosis, Role of transesophageal echocardiography. **f.** Echocardiography in systemic disorders **g.** Cardiac masses: Normal variants, primary cardiac neoplasms and secondaries involving the heart, secondary effects, extra cardiac masses, intra cardiac thrombi, ultrasonic typing, manmade objects in the heart **h.** Electrophysiology: echo in bundle branch blocks and Wolf-Parkinson-White syndrome, Atrial fibrillation, ectopic rhythm-ventricular and supra-ventricular, pacemakers, CRT & ICD **i.** Use of TEE in intensive care setup	
Total		**60 hrs**

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester III**
Name of the Course	**Echocardiography- Advanced**
Course Code	**MCCT 115 P**

Course Outcome	• Perform and optimize advanced echocardiographic techniques (2D, Doppler, strain imaging, contrast echo) with accuracy in diverse clinical scenarios. • Analyze and interpret complex echocardiographic findings to aid in the diagnosis and management of structural, valvular, and congenital heart diseases. • Demonstrate proficiency in patient preparation, equipment handling, image acquisition, and adherence to safety and ethical standards during echocardiographic procedures.

Sr. No.	Topics	No. of Hrs.
1	i. Linear measurements: indirect M-Mode markers of left ventricular function. ii. Assessing global LV function. iii. Regional left ventricular function: wall motion scoring, relationship to vascular supply, use of tissue Doppler where indicated. iv. Evaluation of diastolic function: Methods for evaluating diastolic function, Doppler evaluation of diastolic function, Evaluation of mitral inflow, determination of isovolumic relaxation time, Evaluation of pulmonary vein flow, Doppler tissue imaging. v. Complications of IHD such as aneurysms, VSD, clots & MR especially from a surgical perspective.	10
2	Intensive care setup, protocols to follow in emergency situations & CPR, IV-line insertion	5
3	Administrative issues – maintenance of quality & standards in hospitals, record maintenance, stocks & purchase, medico legal issues	5
4	How to prepare a report in various procedure - Routine trans-thoracic echo: adult and congenital/pediatric, TEE, contrast echo, vascular study & advanced echo	5
5	Archiving of clinical data and images & research: Basics	5
Total		**30 hrs.**

Recommended Learning Resources:

Text Books:

1. Echocardiography by Feigenbaum (Latest Edition)
2. Echo manuals by Mayo Clinic Lecture notes.
3. Text book of Clinical Echocardiography, Catherine M. Otto (Hardcover International)
4. Cardiology by Braunwald and Hurst (Latest edition)
5. Journal articles Cardiology by Braunwald and Hurst (Latest edition)
6. Echo made easy by Sam Kaudora

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester III**
Name of the Course	**Quality Assurance, Standardization& Accreditation (Cardiac Care)**
Course Code	**MCCT 113 T**

Teaching Objective	• The course enables the students understand the concept to quality, its dimensions, methodology to assess it, implement quality control, understand what is quality assurance and its process, healthcare audits, patients a care, total quality management and continues quality improvement as applicable to healthcare.
Course Outcomes	• Understand and explain the principles of quality assurance, standardisation, and accreditation in healthcare, with emphasis on cardiac care services. • Apply quality control protocols and accreditation standards (NABH, NABL, AERB, BARC, JCI) to ensure accuracy, patient safety, and compliance in clinical practice. • Demonstrate competency in documentation, audits, and continuous quality improvement processes to maintain standardised and accredited cardiac care facilities.

Sr. No.	Title	Details	No. of Hrs.
1	Concept of Quality	• Introduction • Quality management philosophies • The leading edge of the modern approach to quality in healthcare • Performance • Evaluation	10
2	Quality Indicators	• Quality Audits of QC and caliberation performed	15
3	Standardization of quality	• Quality Assurance in Medical Imaging: Implementation & operation, Evaluation and implementation of AERB guidelines	10
4	Accreditation of Center	• Quality Accrediation in Echocardiography Laboratory • NABH Rules and Regulations • AERB Rules and Regulations • BARC Rules and Regulations • Joint Commission International (JCI)	15
5	Accreditation of Personnel	Americanregistry, Canadian Registry, European Registry, Australianregistry	10
Total			**60 hrs.**

Recommended Learning Resources:

Recommended textbooks:

1. Hospitals & Health service Accreditation –Principles & Practices S.A tatrish-2010 edition.

Reference books or related websites:

1. Quality Management in the Imaging Sciences Jeffrey Papp
2. Continuous Quality Improvement in Health Care, Theory Implementation and applications: Second edition, Curtis P. McLaughlin, Arnold D. Kaluzny.

Additional readings: Details of journal/Magazine articles, Whitepapers, Case–Studies, Web-casts, Podcasts etc. supporting the topics of the course.

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester III**
Course Code	**MCCT 114**
Name of the Course	**RESEARCH PROJECT / DISSERTATION**

Course Outcome	• Demonstrate the ability to identify, formulate, and justify a clinically relevant research problem in the field of cardiac care technology using evidence-based resources. • Apply appropriate research methodology, data collection techniques, and statistical tools to analyze and interpret findings in cardiac sciences. • Communicate research outcomes effectively through scientific writing, presentations, and defend the dissertation with ethical integrity and academic rigor.

***The Dissertation work will begin from 3rd Semester, and will continue through the 4thSemester. (150 hrs.)**

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester III**
Course Code	**MCCT 116 CP**
Name of the Course	**MCCT Directed Clinical Education – III**

Course Outcome	• Apply advanced theoretical knowledge to real-world clinical scenarios in the cath lab, echocardiography lab, and cardiac critical care settings. • Demonstrate proficiency in assisting advanced cardiac procedures such as interventional cardiology techniques, electrophysiology studies, and peri-procedural echocardiography. • Integrate patient data, imaging, and hemodynamic parameters to support accurate diagnosis, therapeutic decisions, and procedural planning. • Exhibit professional and ethical clinical practice by ensuring patient safety, maintaining sterile technique, and adhering to institutional and accreditation protocols

Students will gain additional skills in echocardiography, quality assurance and recent advancements. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist and cardiologist. **(Total-270 hrs.)**

SECOND YEAR

M.Sc. Cardiac Care Technology

SEMESTER-IV

Code No.	Core Subjects
Discipline Specific Core Theory	
MCCT 117 T	Cardiac Catheterization: Advanced
MCCT 118 T	Pediatric and Congenital Cardiology
Discipline Specific Core Practical	
MCCT 119 CP	MCCT Directed Clinical Education-IV
MCCT 114	Research Project/ Dissertation

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester IV**
Name of the Course	**Cardiac Cathterization: Advanced**
Course Code	**MCCT 117 T**

Teaching Objective	• To provide an in-depth understanding of advanced diagnostic and interventional cardiac catheterisation techniques. • To develop the ability to interpret hemodynamic data and correlate it with clinical conditions. • To train students in assisting complex coronary, structural, and congenital heart interventions. • To inculcate critical thinking in recognizing and managing complications during cardiac catheterisation. • To prepare students for safe, evidence-based, and ethical practice in the cardiac catheterisation laboratory.
Course Outcomes	• Demonstrate advanced knowledge of hemodynamics, coronary angiography, structural heart evaluations, and apply theoretical concepts to clinical practice in the cath lab. • Perform and assist in complex diagnostic and interventional cardiac catheterisation procedures, applying appropriate techniques for coronary, structural, and peripheral interventions. • Analyze hemodynamic data, angiographic findings, and physiological assessments (FFR/iFR) to support accurate diagnosis, clinical decision-making, and patient management in collaboration with the cardiac team. • Adhere to standards of radiation safety, infection control, and quality assurance while managing complications effectively and demonstrating ethical and professional responsibility in the cath lab.

Sr. No.	Details	No. of Hrs.
1.	**Fundamentals and Hemodynamics:** • Evolution and current scope of cardiac catheterisation • Indications and contraindications • Vascular access techniques and closure devices • Hemodynamic waveforms: RA, RV, PA, PCWP, LV, AO • Oxygen saturation studies, Fick principle & thermodilution • Hemodynamics in valvular heart disease, cardiomyopathies, and shock	5
2.	**Coronary Angiography and Physiological Assessment:** • Coronary anatomy, anomalies, dominance patterns • Techniques of selective coronary angiography • Quantitative coronary angiography • Physiological assessment: Fractional flow reserve (FFR), Instantaneous wave-free ratio (iFR)	5
3.	**Interventional Cardiology Procedures:** • Percutaneous coronary intervention (PCI): balloon angioplasty, DES • Adjunctive techniques: Rotablation, IVL, laser, thrombectomy • Bifurcation PCI strategies • Structural interventions: TAVR, TMVR, LAAC, ASD/VSD/PDA closure	10

4.	**Complications & Emergency Management:** • Coronary dissection, perforation, no-reflow • Vascular access complications: hematoma, pseudoaneurysm, AV fistula • Arrhythmias during catheterisation • Contrast-induced nephropathy, anaphylaxis • Cardiac tamponade and emergency pericardiocentesis • Cath lab crash protocols	5
5.	**Quality, Safety & Innovations:** • Radiation safety, ALARA principle, dosimetry • Infection control and sterility protocols • Cath lab accreditation standards (AHA/ACC/ESC, NABH) • Quality assurance, outcomes assessment • Future perspectives: bioresorbable scaffolds, next-gen structural devices	5
Total		**30 hrs**

Recommended Learning Resources:

Recommended textbooks:

1. Grossman's Cardiac Catheterization, Angiography and Intervention
2. Sandy Watson: Invasive Cardiology: Manual for Cath Lab Personnel
3. Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester IV**
Name of the Course	**Pediatric and Congenital Cardiology**
Course Code	**MCCT 118 T**

Teaching Objective	• To provide comprehensive knowledge of paediatric and congenital cardiovascular anatomy, physiology, and pathology. • To train students in performing and assisting advanced diagnostic cardiac catheterisation in neonates, infants, and children. • To develop skills in hemodynamic analysis, shunt quantification, and vascular resistance calculations in congenital heart disease. • To familiarize students with interventional procedures for congenital and paediatric cardiac conditions, including device closures, balloon valvuloplasty, and stenting. • To prepare students for the safe management of complications, pharmacological therapy, and post-procedure care in paediatric cath labs.
Course Outcomes	• Demonstrate comprehensive knowledge of paediatric and congenital cardiovascular anatomy, physiology, and common heart defects. • Perform and interpret diagnostic cardiac catheterisation, hemodynamic measurements, shunt calculations, and angiography in children. • Assist in interventional procedures including balloon valvuloplasty, device closure of ASD/VSD/PDA, stenting, and hybrid procedures in paediatric patients • Identify, manage, and prevent complications in congenital cardiology practice.

Sr. No.	Details	No. of Hrs.
1.	**Fundamentals of Paediatric & Congenital Cardiology:** • Embryology and developmental anatomy of the heart • Normal fetal and neonatal circulation • Classification of congenital heart disease (cyanotic vs. acyanotic) • Indications and contraindications of paediatric cardiac catheterisation	5
2	**Congenital Heart Diseases:** Atrial Septal Defect (ASD), Ventricular Septal Defect (VSD), Patent Ductus Arteriosus (PDA). Coactation of aorta (CoA),Tetralogy of Fallot (TOF),Transposition of great arteries (TGA),Eisenmenger syndrome.	5
3	**Diagnostic Cardiac Catheterisation in Children:** • Vascular access techniques in neonates, infants, and small children • Pressure recordings: RA, RV, PA, LV, AO, systemic & pulmonary veins • Oximetry runs and shunt quantification (Qp/Qs calculations) • Pre- and post-operative catheterisation in congenital heart disease	5
4	**Interventions in Paediatric & Congenital Cardiology** • Device closure of septal defects: ASD, VSD, PDA • Coarctation of the aorta – diagnosis, balloon angioplasty, stenting • Transposition of Great Arteries (TGA) – balloon atrial septostomy	10

	• Balloon valvuloplasty: pulmonary, aortic, mitral	
5	**Complications & Post-Cath Care:** • Hemodynamic instability in neonates and infants • Vascular complications in small children • Arrhythmias during diagnostic or interventional procedures • Contrast safety and nephropathy in children • Post-procedure monitoring and ICU management	5
Total		**30 hrs**

Core References

1. *Grossman's Cardiac Catheterization, Angiography and Intervention* (comprehensive for congenital cath & hemodynamics)
2. *Braunwald's Heart Disease* (pathophysiology, management, surgical & interventional perspectives)
3. *Invasive Cardiology: Manual for Cath Lab Personnel* – Sandy Watson (practical & procedural approach for paediatric cath labs)

Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester IV**
Name of the Course	**MCCT Directed Clinical Education – IV**
Course Code	**MCCT 119 CP**

Course Outcome	• Apply theoretical knowledge of cardiac catheterisation, pediatric, and congenital cardiology to real-world clinical settings through supervised training and case-based learning. • Demonstrate competency in assisting diagnostic and interventional catheterisation procedures in adults and children, including evaluation of congenital heart diseases and shunt assessments. • Interpret hemodynamic data, angiographic findings, and clinical presentations in pediatric and congenital cases to contribute effectively to diagnostic and therapeutic decision-making. • Exhibit effective teamwork, communication skills, adherence to safety standards, and ethical responsibility while engaging in direct patient care in the cath lab and pediatric cardiology units.

Students will gain additional skills in cardiac adult and pediatric interventional procedures Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. and cardiologist. **(Total-225 hrs.)**

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Name of the Program	**M.Sc. Cardiac Care Technology**
Semester	**Semester IV**
Name of the Course	**RESEARCH PROJECT / DISSERTATION**
Course Code	**MCCT 114**

Course Outcome	• Design and execute a research study in cardiac sciences by applying appropriate experimental or clinical methodologies. • Collect, manage, and analyze research data using suitable biostatistical tools, ensuring validity and reliability of results. • Present and defend research findings effectively through dissertation writing, viva-voce, and scientific presentations, while upholding ethical and professional standards.

The Dissertation work will begin from 3rdSemester and will continue through the 4thSemester. (330 hrs)

1. Dissertation/Project work should be carried out as an individual Dissertation and actual bench work.
2. The students will carry independent project work under the supervision of the staff of Department on an advanced topic assigned to him/her. In house projects are encouraged. Students may be allowed to carry out the project work in other Departmental laboratories /Research institutes /Industries as per the availability of Infrastructure.
3. Co guides from the other institutions may be allowed.
4. The Dissertation/Project work will begin from 3rd Semester, and will continue through the 4th Semester.
5. The Dissertation/Project report (also work book shall be presented at the time of presentation and viva voce) will be submitted at the end of the 4th Semester and evaluated.
6. Five copies of the project report shall be submitted to the Director, SBS.
7. For the conduct of the End Semester Examination and evaluation of Dissertation/Project work the University will appoint External Examiners.
8. Since the dissertation is by research, Dissertation/Project work carries a total of 250 marks and evaluation will be carried out by both internal and external evaluators.
9. The student has to defend his/her Dissertation/Project Work in a seminar which will be evaluated by a internal and external experts appointed by the University.
10. The assignment of marks for Project/Dissertation is as follows:
    Part I-
    Topic Selection, Review of Literature, Novelty of works-50 marks
    Part-II-
    a. Continuous Internal Assessment, Novelty, Overall Lab Work Culture - 100 Marks
    b. Dissertation/Project work book: 50 Marks
    c. Viva-Voce: 50 Marks

Scheme of University Examination Theory for PG Program:

General structure / patterns for setting up question papers for Theory / Practical courses, their evaluation weightages for PG programs of MGMSBS are given in the following tables

Marks scheme for the University exam:

Final theory marks will be 100 marks (80 marks University Theory exam + 20 Marks Internal assessment).

Question		Marks distribution	Marks allotted per section	Marks
Sec: A	MCQ	10 x 1 M = 10	10	10
Sec: B	SAQ	3/4x 5 M = 15	15	35
Sec: B	LAQ	2/3 x 10 M = 10	20	
Sec: C	SAQ	3/4x 5 M = 15	15	35
Sec: C	LAQ	2/3x 10 M = 10	20	
Total				**80 Marks**

Practical exam pattern: Total 40 marks with following breakup:

Exercise	Description	Marks
Q No 1	Practical exercise - 1	1 x15=15 M
Q No 2	Station exercise	2x5M=10 M
Q No 3	VIVA	10 M
Q No 4	Journal	5M
Total		**40 Marks**

Practical to be conducted at respective departments and marks submitted jointly by the parent department to the university.

Breakup of theory IA calculation for 20 marks

Description	Marks
Internal exam (at department)	15 marks
Seminar	5 marks
Total	**20 Marks**

Breakup of practical IA calculation:

Description	Marks
Internal exam (at department)	10 marks
Viva	5 marks
Journal	5 marks
Total	**20 Marks**

Note –20 marks to be converted to 10 marks weightage for submission to the university.

Model Checklist for Evaluation of the Clinical Directed Posting (PG)

Name of the student: _____Date:_____
Program: _____
Semester: _____ Name of the internal faculty/Observer: _____
Name of the External Faculty/Observer:_____

Core Competencies	Marks allotted	Marks obtained
Students will begin to develop critical thinking abilities utilizing the allied health personnel roles of communicator and caregiver. Students will learn principles of professional allied health personnel practice and provide direct care to individuals within a medical surgical setting while recognizing the diverse uniqueness of individuals with health alterations.		
Clinical Teaching		
a. Demonstrate beginning competency in technical skills.	10	
Independent Work by Student guided by faculty		
a. Develop effective communication skills (verbally and through charting) with patients, team members, and family	2.5	
b. Identify intra and inter-professional team member roles and scopes of practice. Establish appropriate relationships with team members.	2.5	
Hands on practical work by students		
a. Protect confidentiality of electronic/manual health records data, information, and knowledge of technology in an ethical manner	05	
Independent work by student		
a. Demonstrate expected behaviors and complete tasks in a timely manner. Arrive to clinical experiences at assigned times. Maintain professional behavior and appearance.	05	
Log book	10	
Viva	10	
Attendance	05	
Total	**50 Marks**	

Sign of Internal Examiner:_____
Sign of External Examiner:_____

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Evaluation for Semester III – Dissertation (PG) (Internal Assessment)

Dissertation/Project Proposal : overall performance of the student	**Marks allotted**	**Marks Obtained**
Open mindedness/ Receptivity to feedback Integrates feedback	5 Marks	
Meets deadlines / Regularity in meeting / Consistency in communication	10 Marks	
Continuous Internal evaluation (CIE)		
Interest shown in selecting topic	5 marks	
Appropriate review	10 marks	
Discussion with guide and other faculty	10 marks	
Quality of protocol	5marks	
Preparation of proforma / log book / daily reports	5marks	
TOTAL	**Out of 50**	

Evaluation for Semester IV - Evaluation parameter (Dissertation / Project)

Evaluation parameter (Semester IV)	Continuous Internal Evaluation (CIE)	Semester End Evaluation (SEE)	
	Guide	Internal examiner	External examiner
Thesis preparation, Novelty, Overall Lab Work Culture	25	-	-
Dissertation/Project work book	25	25	25
Evaluation of thesis including Viva Voce	-	50	50
Total	50	75	75
Overall Total = 200			

MGM INSTITUTE OF HEALTH SCIENCES

(Deemed to be University u/s 3 of UGC Act, 1956)

Grade 'A' Accredited by NAAC

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