

M.Tech. in Clinical Engineering

**A collaborative effort by
Indian Institute of Technology Madras (IITM)
Sree Chitra Tirunal Inst. for Medical Sciences & Tech., Trivandrum (SCTIMST)
and Christian Medical College, Vellore (CMC)**

Introduction

In a typical hospital, which delivers modern medical care, an extensive use of variety of equipment and technologies is involved. It is essential that the equipment be efficiently and safely managed by well trained engineers. ‘Clinical Engineering’ is a specialty of ‘Biomedical Engineering’ and is defined by American College of Clinical Engineers as “A professional who supports and advances patient care by applying engineering and managerial skills to healthcare technology.”

Thus, the primary role of a clinical engineer is to carry out activities related to equipment management such as review of equipment specifications before purchase, installation and testing of new equipment, routine safety testing as well as preventive and break down maintenance and many other related activities. Furthermore, since clinical engineers are directly placed in the clinical environment, they get to know the technological problems faced in clinical situations, and hence can also have an important role in initiating the development of new medical technologies and evaluating them

Objective

The aim of this program is to train engineers to manage and ensure the safe and effective use of technology in hospitals and health care delivery points.

Duration: Two-and-a-half years

Curriculum for M. Tech. in Clinical Engineering

Orientation programme (3 to 4 weeks in July)

Venue	Course Name
SCTIMST/CMC	Introduction & Preliminary Clinical Attachment

The following aspects will be covered in this orientation programme.

- Introduction to hospitals and medical devices, visit to the hospital and BMT Wing, and visit to medical device industries. The purpose of these activities would be to make students realize the importance and relevance the course.
- The faculty from the three organisations will also meet in SCTIMST/CMC to interact with the new students, to review the courses and their contents, discuss possible modifications and plan joint research programs. Also relevant introductory sessions on Biomaterials and Medical Device Technology will be given to appropriately orient the students for effective study.

I semester (starting in August)

Venue	Course No.	Course Name	L	T	P	C
IITM	BT 672	Biomaterials	2	1	0	3
IITM	BT 654	Molecular and Cell Biology	3	0	0	3
IITM	MS 526	Management Information Systems	2	0	0	2
IITM	MS 657	Maintenance Management	2	0	0	2
IITM	AM 501	Biomechanics	2	1	0	3
IITM	ID 602	Introduction to Research	2	0	0	2
		TOTAL				16

II semester (starting in January)

Venue	Course No.	Course Name	L	T	P	C
CMC		Functional Anatomy and Physiology	4	0	0	4
CMC		Transducers and Instrumentation for Physiological Measurements	2	0	3	3
CMC/IITM		Biomedical Imaging Systems	2	0	3	3
CMC		Functional Anatomy and Physiology Lab	0	0	6	2
CMC		Elective 1	3	0	0	3
CMC		Clinical Attachment				4
		TOTAL				19

III semester (starting in August)

Venue	Course No.	Course Name	L	T	P	C
SCTIMST		Medical Device Technology	2	0	3	3
SCTIMST		Advanced Biomaterials	2	0	3	3
SCTIMST		Critical care Instrumentation and therapeutic equipment	2	0	3	3
SCTIMST		Internship				4
SCTIMST		Seminar in Medical technology	1			1
		TOTAL				14

IV semester (starting in January)

Venue	Course No.	Course Name	L	T	P	C
SCTIMST		Hospital Management Systems	2	0	3	3
SCTIMST		Quality Management in Healthcare	3	0	0	3
SCTIMST		Patient Safety and Risk Management in hospitals	3	0	0	3
SCTIMST		Elective 2	3	0	0	3
SCTIMST		Internship				4
		TOTAL				16

Summer and V semester (May – Nov)

Venue	Course No.	Course Name	L	T	P	C
SCTIMST/ CMC/IITM		Project				10
		TOTAL				10

Total Number of credits: **75**

Clinical Attachment at CMC (Semester II)

The purpose of this clinical attachment would be to

- Expose students to the clinical environment and to provide general awareness of routine activities of a hospital.
- Understand basic methods and logical processes used by clinicians to investigate and diagnose a clinical problem.
- Learn the language of clinicians and learn to interact with them effectively

- Undertake an exercise aimed at identifying 25 problems faced in a typical clinical environment and propose innovative/novel solutions to these problems.

One or more clinicians would be assigned to the students as mentors, who would meet them on a regular basis to discuss and analyse their experiences. The mentors would also carry out continuous assessment. The students would focus on identification of problems typical to clinical engineering practice such as equipment management, safety evaluation and preventive maintenance and come up with possible solutions. The evaluation will also be based on the 25 problems mentioned above and their innovative/novel solutions.

Internship in a Clinical Engineering Department at SCTIMST

This internship is intended to provide students with an opportunity to have direct exposure to day to day activities of the hospital and its Clinical Engineering Department. They will work in the department as if a regular employees and will be assigned various tasks. Assessment at the end of Internship would be by a professional interview. The candidate should be able to demonstrate that he/she has been able to acquire core competences and has enough hands-on experience to carry out various tasks as required by a clinical engineer.

MCE Project

The Project will be on the lines of the regular M.Tech. project at IIT Madras. Two faculty members will guide the project, one from IITM, and the other from SCTIMST or CMC.

List of electives currently suggested:

Venue	Course No.	Course Name	L	T	P	C
SCTIMST		Tissue Engineering and Regenerative Medicine	2	0	3	3
SCTIMST		Introduction to Epidemiology	2	0	3	3
SCTIMST		Advanced Polymer Science and Technology	2	0	3	3
SCTIMST		Analytical instrumentation and medical laboratory equipment	2	0	3	3
CMC		Introduction to Digital Signal and Image processing	2	0	3	3
CMC		Physiological Systems Modeling	2	0	3	3
CMC		Rehabilitation Engineering	2	0	3	3
IITM	BT 622	Introduction to Computational Neuroscience	2	1	0	3
IITM	AM 519	Haptics in Biomedical Engineering	3	0	0	3
IITM	BT 520	Principles of Neuroscience	3	0	0	3
IITM	BT 518	Biological Vision	3	0	0	3
IITM	BT 676	Drug Design and Medicinal Chemistry	3	0	0	3
IITM	BT 655	Medical Informatics and Bioinformatics	3	0	0	3
IITM	BT 673	Ergonomics	3	0	0	3
IITM		Bio-fluid Mechanics	2	1	0	3
IITM	MS 693	Management and Entrepreneurship	3	0	0	3
IITM	BT 653	Biostatistics	2	1	0	3
IITM	BT 652	Clinical Biochemistry	3	0	0	3