Program Academic Information

Master of Technology

Medical Technology

2025-27

Table of Contents

Section 1: Program General Information

Program	**M.Tech Medical Technology**
Level	**Postgraduate**
Course Duration	**2 years (4 Semester)**

Section 2: Program Educational Objectives (PEOs)

Broad goals that address institutional and program mission statements and are responsive to the expressed interests of various groups of program stakeholders.

PEO-1:	Graduates will become innovators or entrepreneurs engaged in technology development, technology deployment, or engineering system implementation in the healthcare industry.
PEO-2:	Graduates will be able to enhance their skills in designing and developing various electronic or computer aided devices and software for applications in medical instrumentation, medical imaging, physiological measurement, medical signal processing, and product design.
PEO-3:	Graduates will be able to address challenges in medical industries or interrelated professions.
PEO-4:	Graduates will be able to exhibit leadership skills, make decisions with societal and ethical responsibilities, function and communicate effectively in multidisciplinary activities.
PEO-5:	Graduates will be able to pursue research career in internationally recognized centres.

Section 3: Program Outcomes

The program must then formulate a set of program outcomes (knowledge, skills, and attitudes the program graduates should have) that directly address the educational objectives and encompass certain specified outcomes.

1.	Ability to apply the knowledge of Science, Technology, Engineering and Mathematics to address healthcare problems.
2.	Ability to identify and analyze healthcare problems and formulate feasible technical solutions to improve the health and health care.
3.	Ability to design system components or processes that meet the specified needs with realistic constraints, including public health, safety, culture, society, ethics, sustainability and environment.
4.	Ability to use appropriate techniques, skills, resources and modern engineering and IT tools necessary for prediction, modeling and solving complex engineering activities with an understanding of the limitations.
5.	Develop problem solving ability to assess societal, health, safety, legal and cultural issues through engineering solutions.
6.	Ability to think critically to inspire sustainable development.
7.	Ability to have a thorough understanding of professional and ethical responsibility.
8.	Ability to perform within a diversified multidisciplinary team and exhibit leadership.
9.	Ability to engage in independent and life-long learning.

Program Specific Outcomes :

By the end of the program, students should be able to develop the following specific skills and accomplishments

PSO-1	Graduates will be proficient in applying emerging technologies to solve practical healthcare problems, working directly with industry partners to deploy solutions that enhance patient care, and improve diagnostic accuracy.
PSO-2	Graduates will be able to apply advanced engineering principles, coupled with industry best practices, to create innovative and regulatory-compliant

medical devices. They will be skilled in using industry-standard tools and technologies, ensuring readiness for roles in R&D, quality assurance, and product development in the medical technology sector.

Section 4: Program Benchmarking

Details of the international standards / subject benchmark statements referred and web link for the same.

International standards / benchmarks statements referred	URL
Tamperene University, Finland	https://www.tuni.fi/en/study-with-us/medical-physics-and-biomedical-instrumentation-biomedical-sciences-and-engineering
National Institute of Pharmaceutical Education and Research (NIPER)	https://niperguwahati.ac.in/syllabus/4_8.Syllabus_MD_NIPER-G.pdf
Sree Chitra Tirumala Institute for Medical Sciences and Technology, Trivandrum	https://www.sctimst.ac.in/About%20SCTIMST/Organisation/BioMedical%20Technology%20Wing/Department%20of%20Medical%20Devices%20Engineering/
School of Medical science and Technology (SMST), IIT Kharagpur	http://www.smst.iitkgp.ac.in/Smst/curriculum
Accreditation Board of Engineering & Technology (ABET)	http://www.abet.org/
CDIO™ Educational Framework	http://www.cdio.org/

Section 5: Program Structure

CL	Classroom Interaction	**TU**	Tutorials	**PR**	Practical
CC	Core Course	**FE**	Free Elective	**DE**	Specialization Sequence with Directed Electives

Semester - 01								Total Credits: 21
S. No	Course Code	Course Title	Course Type	Credits	Weekly Contact Hours			
					CL	TU	PR	Total
1.		Medical Signal Acquisition and Analysis	CC	4	2	1	2	5
2.		Medical instrumentation-I	CC	4	2	1	2	5
3.		Digital Design of Biomedical Products	DE	4	2	1	2	5
4.		Biomechanics ~~and Rehabilitation Engineering~~	CC	4	2	1	2	5
5.		Design Thinking for Medical Innovation	DE	3				
6.		Seminar and Technical Writing - I	CC	0	0	0	2	2
7.		Research Methodology and Medical Ethics	CC	2	1	1	0	2

*Bridge course in Biology (credit -0) can be offered for students having non-relevant backgrounds.

Semester - 02								Total Credits: 24
S. No	Course Code	Course Title	Course Type	Credits	Weekly Contact Hours			
					CL	TU	PR	Total
1		Medical Instrumentation-II	CC	4	2	1	2	5
2		Biomaterials and Artificial Organs	DE	4	3	1	0	4
3		Physiological Modeling and Computation	DE	4	2	1	2	5
4		Medical Image Processing	CC	4	2	1	2	5
5		Entrepreneurship and IPR	DE	2	2	0	0	2
6		Biomedical Device Quality and Regulatory standards	FE	4	3	1	0	4
		Healthcare Data Analytics and Visualization			3	1	0	4
7		~~BioMEMS~~ Biosensors and Systems			3	1	0	4
8		Seminar and Technical Writing - II	CC	0	0	0	2	2
9		Industrial Internship - I	CC	2	0	0	0	0

Semester - 03								Total Credits: 21
S. No	Course Code	Course Title	Course Type	Credits	Weekly Contact Hours			
					CL	TU	PR	Total
1		Bio Additive Manufacturing	DE	4				
2		Assistive Technology and Medical Robotics	CC	4	2	1	2	5
3		IoMT and Wearable Devices	DE	4	2	1	2	5
4		Research Project-I	CC	5	0	0	0	0
5		XR in Healthcare	FE	4	2	1	2	5
		Deep Learning in Medical Technology			2	1	2	5
		AI in healthcare			2	1	2	5

Semester - 04								Total Credits: 18
S. No	Course Code	Course Title	Course Type	Credits	Weekly Contact Hours			
					CL	TU	PR	Total
1		Research Project-II	CC	15	0	0	0	0
2		Industrial Internship - II	CC	3	0	0	0	0

Total Program Course Distribution		
Course Category	**Credits**	**Courses**
CC: Core Courses	48	11
DE: Specialization Sequence with Directed Electives	24	07
FE: Free Electives	08	02

Total Program Credit Distribution			
SN	**Year**	**Semester**	**Credits Assigned**
1	First	I	22
2		II	24
3	Second	III	21
4		IV	18
	Total Semester	**4**	**85**

Section 6: Core Sequence

Sequence of courses attaining a particular curriculum outcome or a sequence of courses attaining a particular specialization. Courses sequences could be more than 3 also. Courses to be mentioned in a sequential manner.

Sequence I	Sequence II	Sequence III	Sequence IV	Sequence V
Medical Devices	**Biomedical and Organ Engineering**	**Medical Data Analysis**	**Medical System Application**	**Biomedical Research**
Medical instrumentation-I	Tissue Engineering	Medical Signal Acquisition and Analysis	Digital Design of Biomedical Products	Research Methodology and Medical Ethics
Medical Instrumentation-II	Artificial Organs and Biomaterials	Physiological Modeling and Computation	Assistive Technology and Medical Robotics	Biomedical Device Quality and Regulatory standards
IOMT and Wearable Devices	Biomechanics ~~and Rehabilitation Engineering~~	Medical Image Processing	Bio additive Manufacturing	Entrepreneurship and IPR
Biosensors and Systems		Deep learning in medical Technology		Research Project-I/II
		XR in Healthcare		Industrial Internship – I/II
		Healthcare Data Analytics and Visualization		Seminar and Technical Writing
				Quality Control and Standards for Biomedical Devices

Specialization Sequence
1. Medical Devices
2. Biomedical and Organ Engineering
3. Medical Data Analysis
4. Medical System Application
5. Biomedical Research

Curriculum Implementation through C-D-I-O Initiative

The CDIO™ INITIATIVE is an innovative educational framework for producing the next generation of engineers. The framework provides students with an education stressing engineering fundamentals set in the context of Conceiving — Designing — Implementing — Operating (CDIO) real-world systems and products. Throughout the world, CDIO Initiative collaborators have adopted CDIO as the framework of their curricular planning and outcome-based assessment [1].

[1] http://www.cdio.org

In this curriculum, the topics in each course have been classified under one or more of C-D-I-O to provide an understanding to the students and faculties about the scope of learning. The CDIO approach addresses the needs of students, faculty and industry by collecting and formalizing the knowledge, skills and attributes that student's desire and that industry leaders expect graduating engineers to have.

List of Textbooks and Reference Books	
Course name	**Textbooks/ Reference Books/ Study Materials**
Medical instrumentation-I Medical Instrumentation-II IOMT and Wearable Devices	▪ Introduction to Biomedical Engineering" by John Enderle and Joseph Bronzino ▪ Medical instrumentation by John G webster ▪ Biomedical instrumentation by RS Khandpur ▪ Introduction to Biomedical Equipment Technology by Joseph J. Carr and John M Brown ▪ IOMT by Dr.Ruby Dwivedi ▪ Biomedical Instrumentation and Measurements by Leslie Cromwell, Fred J Weibell, Erich A Pfeiffer
Quality Control and standards for Biomedical Devices	▪ Total Quality Management by J. E. Rose, Kogan Page Ltd., 1993 ▪ The Practise of clinical Engineering, Cesar A. Cacere & Albert Zana,Academic Press, Newyork, 1997 ▪ The Essence of Total Quality Management, John Bank, Prentice Hall of India, 1993 ▪ Clinical Engineering, Principles & Practices, Webster J.G and Albert M.Cook, Prentice Hall Inc., Engle wood cliffs, New Jersey, 1979
Biomechanics and Rehabilitation Engineering	▪ Biomechanics: "Mechanical Properties of Living Tissues" by Y C Fung, Springer, 2 nd edition, 1993 ▪ Basic biomechanics by Susan.J. Hall, Tata Mcgraw hill, 4 th edition, 2004 ▪ Biomechanics- Principles and Applications by D. J. Schneck and J. D. Bronzino, CRC Press, 2 nd Edition, 2000. ▪ An Introduction to Rehabilitation Engineering by Rory A Cooper, Hisaichi Ohnabe, Douglas A Hodson,CRC Press, First edition, 2006
Artificial Organs and Biomaterials	▪ Biomaterials by Ratner ▪ Biomaterials by sujata v bhat ▪ Artificial organs by Nadey S Hakim ▪ Biomaterials science and Tissue Engineering by prof.Bikramjit Basu
Medical Signal Acquisition and Analysis	▪ Biomedical Signal Processing: Principles and Techniques by D.C.Reddy, 2nd editio, Tata McGraw-Hill, New Delhi, 2005.

	▪ Biomedical signal processing by Rangaraj.M.Rangayyan, 1st edition, IEEE press, 2002 ▪ Biomedical Engineering Handbook by Joseph.D.Bronzino, 3rd edition CRC,Press, 2005 ▪ Digital Signal Processing, Algorithms and Applications by John G, Proakis and Dimitris Manolakis G,PHI of India Ltd., New Delhi, fourth Edition ▪ Digital Signal Processing by Sanjit.K, Mitra, Tata McGraw-Hill, New Delhi, fourth edition 2011. ▪ Biomedical digital signal processing by tompkins ▪ Signals and systems in biomedical engineering: signal processing and physiological systems modeling. By suresh devashyam
Physiological Modeling and Computation	▪ Physiological Control Systems by Michael C.K. Khoo, Analysis, Simulation and Estimation, 2012, 1st Edition, Prentice Hall of India ▪ Dynamic Systems Biology Modeling and Simulation by Joseph DiStefano, 1st Edition, Academic Press, Massachusetts ▪ Application of Control Theory to Physiological Systems by H. Thomas Milhorn, 2010, 1st Edition, Saunders (W.B.) Co Ltd., Philadelphia. ▪ Control system Engineering by Norman
Medical Image Processing	▪ Digital image processing by Gonzalez and woods ▪ Principal of medical imaging by kirk shung ▪ Fundamentals of Digital Image Processing by Anil K Jain, Pearson Education. ▪ Fundamentals of Digital image processing by Dr. Sanjay Sharma,sk kataria& sons
Deep Learning in Medical Technology	▪ Deep learning for medical image analysis by Elsvier ▪ Computational methods for deep learning By: Yan, Wei Qi ▪ Introduction to Deep Learning in Medical Image Analysis by ▪ Ms. S. Purnima,Dr. M.S Jeyalakshmi
Digital Design of Biomedical Products	▪ Engineering Drawing -Geometrical Drawings by S.K. Kataria

	▪ Engineering Graphics by K.R. Mohan ▪ Fundamental of Engineering Drawing & Graphics Technology,French, Thomas E.,Vierck, C. J. and Foster,R. J ▪ Engineering Drawing: Plane and Solid Geometry by Bhatt N.D.Panchal V.M
Assistive Technology and Medical robotics	▪ Robotic assistive Technology: Principles and practices by pedro and albert, CRC press ▪ A handbook of assistive technology for people with visual disability by Suraj Singh, Century publication, New Delhi.
Bio Additive Manufacturing	▪ Additive Manufacturing Technologies by Ian Gibson, David Rosan, Brent Stucker,Springer, 2010 ▪ Rapid Prototyping: Principles and Applications Chua C.K.,Leong K.F., and Lim C.S.Second Edition, World scientific Publishers, 2003 ▪ Andreas Gebhardt, Understanding additive manufacturing: rapid prototyping, rapid tooling ,rapid manufacturing, Hanser Publishers, 2011.
Research Methodology	▪ Research Methodology for Engineers by R ganeshan ▪ Research Methodology and IPR by Mayura Yewale, Technical Publications
Medical Device and Regulatory Affairs	▪ “Regulatory Affairs for Biomaterials and Medical Devices” edited by Stephen F. Amato and Robert M. Ezzell Jr. ▪ “Medical Device Innovation Handbook” Paperback , by William Durfee (Author), Paul Iaizzo, 2014 ▪ “Combination Products: Regulatory Challenges and Successful Product Development" edited by Smita Gopalaswamy and Siddhartha Ghosh
Medical Ethics and IPR	▪ Biomedical Ethics Perspectives in the Indian Context Vol.1-2022" by ICMR, Jaypee publisher