Program Academic Information

Master of Technology

Medical Technology 2025-27

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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.

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

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.

Ability to apply the knowledge of Science, Technology, Engineering and

Mathematics to address healthcare problems.

Ability to identify and analyze healthcare problems and formulate feasible technical 2. solutions to improve health and health care. Ability to design system components or processes that meet the specified needs with realistic constraints, including public health, safety, culture, society, ethics, 3. sustainability and environment. Ability to use appropriate techniques, skills, resources and modern engineering and IT tools necessary for prediction, modeling and solving complex engineering 4. activities with an understanding of the limitations. Develop problem solving ability to assess issues in societal, health, safety, legal 5. and cultural through engineering solutions. Ability to think critically to inspire sustainable development. 6.

Ability to have a thorough understanding of professional and ethical responsibility.

Ability to perform within a diversified multidisciplinary team and exhibit leadership.

Program Specific Outcomes:

7.

8.

9.

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

Ability to engage in independent and life-long learning.

	Graduates will be proficient in applying emerging technologies to solve
	practical healthcare problems, working directly with industry partners to
PSO-1	deploy solutions that enhance patient care, and improve diagnostic accuracy.
	Graduates will be able to apply advanced engineering principles, coupled with
	industry best practices, to create innovative and regulatory-compliant medical
PSO-2	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	URL
statements referred	
	https://www.tuni.fi/en/study-with-us/medical-
Tamperene University, Finland	physics-and-biomedical-instrumentation-
	biomedical-sciences-and-engineering
National Institute of Pharmaceutical	https://niperguwahati.ac.in/syllabus/4_8.Syllabus_
Education and Research (NIPER)	MD_NIPER-G.pdf
	https://www.sctimst.ac.in/About%20SCTIMST/Orga
Sree Chitra Tirumala Institute for Medical	nisation/BioMedical%20Technology%20Wing/Dep
Sciences and Technology, Trivandrum	artment%20of%20Medical%20Devices%20Enginee
	ring/
School of Medical science and Technology	http://www.smst.iitkgp.ac.in/Smst/curriculum
(SMST), IIT Kharagpur	
Accreditation Board of Engineering &	http://www.abet.org/
Technology (ABET)	
CDIO™ Educational Framework	http://www.cdio.org/

Section 5: Program Structure							
CL	Classroom		Tutorials	PR	Practical		
O_	Interaction	TU	ratorialo		Tactical		
					Specialization		
СС	Core Course	FE	Free Elective	DE	Sequence with		
				DL	Directed		
					Electives		

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

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

Seme	Semester - 02 Total Credits: 24								
S. No	Course	ourse Course Title	Course	Cre	Weekly Contact Hours				
3. NO	Code	Course Title	Type	dits	CL	TU	P R	Total	
1		Medical Instrumentation-II	CC	4	2	1	2	5	
2		Biomechanics and Rehabilitation Engineering	CC	4	2	1	2	5	
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			3	1	0	4	
0		Healthcare Data Analytics and Visualization	FE	4	3	1	0	4	
7		BioMEMS			3	1	0	4	
8		Seminar and Technical Writing - II	CC	0	0	0	2	2	
9		Industrial Internship / Certification	CC	2	0	0	0	0	

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Seme	Semester - 03 Total Credits: 21							
S. No	Course Course Title	Course	Credits	Weekly Contact Hours				
	Code		Туре		CL	TU	PR	Total
1		Bio Additive Manufacturing	DE	4	2	1	2	5
2		Assistive Technology and Medical Robotics	СС	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
		XR in Healthcare			2	1	2	5
5		Deep Learning in Medical Technology	FE	4	2	1	2	5
		Al in healthcare			2	1	2	5

Semeste	Semester - 04							Total Credits: 18			
S. No	Course	se Course Course Credite		٧		ly Co lours	ntact				
3. NO	Code	Course Title	Туре	Credits	O L	T U	P R	Total			
1		Research Project-II	CC	15	0	0	0	0			
2		Industrial Internship / Certification	СС	3	0	0	0	0			

Total Program Course Distribution						
Course Category	Credits	Courses				
CC: Core Courses	51	13				
DE: Specialization Sequence with Directed Electives	25	07				
FE: Free Electives	08	02				

Total Program Credit Distribution						
SN	Year	Semester	Credits Assigned			
1	1 First –		21			
2	Filst	II	24			
3	Second -	III	21			
4	Second	IV	18			
	Total Semester	4	84			

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	Sequence	Sequence	Sequence	Sequence
I	II	III	IV	V
		Medical	Medical	Biomedica
Medical Devices	Biomedical and	Data	System	
	Organ Engineering	Analysis	Application	I Research
Medical instrumentation-l	Biomaterials and Artificial Organs	Medical Signal Acquisition and Analysis	Digital Design of Biomedical Products	Research Methodology and Medical Ethics
Medical Instrumentation-II	Biomechanics and Rehabilitation Engineering	Medical Image Processing	Assistive Technology and Medical Robotics	Entrepreneurs hip and IPR
IOMT and Wearable Devices	Physiological Modeling and Computation	Healthcare Data Analytics and Visualization	Bio additive Manufacturing	Biomedical Device Quality and regulatory standards
	BioMEMS	Deep learning in medical Technology	Design thinking for medical innovation	Research Project-I/II
		XR in Healthcare		Industrial Internship and certification
		Al in healthcare		Seminar and Technical Writing

Section 7: Specialization Sequence	
1. Medical Devices	
2. Biomedical and Organ Engineering	
3. Medical Data Analysis	
4. Medical System Application	
5. Biomedical Research	

Section 8: 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.

Section 9: List of Textbooks and Reference Books			
Course name	Textbooks/ Reference Books/ Study Materials		
Medical instrumentation-I Medical Instrumentation-II	 Introduction to Biomedical Engineering" by John Enderle and Joseph Bronzino 		
	Medical instrumentation by John G webster		
metamontation in	Biomedical instrumentation by RS Khandpur		
IOMT and Wearable Devices	 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 		
	 Molecular Biology of The Cell by Alberts et al, 5th edition 		
Tissue Engineering	 Fundamentals of Tissue Engineering and Regenerative Medicine by Meyer, U.; Meyer, Th.; Handschel, J.; Wiesmann, H.P 		
	 Tissue engineering by Robert s langer 		
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
Assistive Technology and Medical robotics	 N.D.Panchal V.M Robotic assistive Technology: Principles and practices by pedro and albert, CRC press
and Modical Topolics	 A handbook of assistive technology for people with visual disability by Suraj Singh, Century publication, New Delhi. Additive Manufacturing Technologies by Ian Gibson, David Rosan, Brent Stucker, Springer, 2010
Bio Additive Manufacturing	 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 laizzo, 2014 "Combination Products: Regulatory Challenges and Successful Product Development" edited by Smita
Medical Ethics and IPR	Gopalaswamy and Siddhartha Ghosh Biomedical Ethics Perspectives in the Indian Context Vol.1- 2022" by ICMR, Jaypee publisher