GANPAT UNIVERSITY									
FACULTY OF ENGINEERING & TECHNOLOGY									
Programme	Bachelor of Technology					Branch/Spec.	Biomedical Engineering		
Semester	VII					Version	1.0.0.0		
Effective from the Academic Year			2025-2026			Effective for the Batch admitted in			July 2022
Course Code	2BM71PE04		Course Name			Elective-IV: Robotics in Medical Applications			
Teaching Scheme						Examination Scheme (Marks)			
(Per week)	Lecture (DT)		Practical (Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	-	1	-	4	Theory	40	60	100
Hours	3	-	2	-	5	Practical	30	20	50

Pre-requisites
Basic knowledge of Mathematics & Engineering Mechanics, Dynamic System, and MATLAB.

Course Outcomes	
On successful completion of the course, the students will be able to:	
CO1	Understand the basic concepts of kinematics, dynamics, and control relevant to medical robotics
CO2	Use robotic systems with mathematical models for problem-solving
CO3	Analyse robotic sensing and motion planning concepts applied to healthcare.
CO4	Design and propose innovative robotic solutions for complex medical applications, considering safety and performance.
CO5	Evaluate the integration of medical imaging, rehabilitation systems, and robotic-assisted surgical procedures for enhanced healthcare.

Theory Syllabus		
Unit	Content	Hrs.
1	INTRODUCTION TO ROBOTICS AND MEDICAL APPLICATIONS: Definition, origin, and generations of robots, Types of robots and structures of medical robots, Basics of motion control concepts and joint kinematics, Artificial intelligence, and machine learning applications in Prosthetics and Orthotics.	9
2	KINEMATICS AND DYNAMICS: Position and orientation representation, Forward and inverse kinematics, Spatial vector notation, and dynamic modeling of rigid body systems.	9
3	SENSOR AND MOTION PLANNING: Motion planning, sampling-based approaches, and adaptive control. Sensors: force, tactile, inertial, sonar, visual servicing, and performance optimization.	9
4	MOBILE AND DISTRIBUTED ROBOTICS: Motion control of wheeled mobile robots and obstacle avoidance, Non-holonomic mobile robots, and distributed robot systems, Applications of tension and compression sensors.	9
5	MEDICAL ROBOTICS AND AUTOMATION: Medical imaging modalities and their compatibility with robotics, Applications: advanced imaging, rehabilitation, therapy, and robotic-assisted surgeries. Safety measures in medical robotics.	9

Practical Content
Term Work and Practical shall be based on the above syllabus.

Text Books	
1	Brunosciliano, OussamaKhatib, “Springer Handbook of Robotics”, springer verlag berlin Heidelberg, First Edition.

2	John J. Craig, 'Introduction to Robotics: Mechanics and Control', 3rd edition Pearson.
Reference Books	
1	R. K. Mittal, I. J. Nagrath, 'Robotics and Control', Tata McGraw Hill Education.
2	Robert J. Schilling, 'Fundamentals of Robotics Analysis & Control', PHI.
3	Fu. K.S, Gonzalez, R.C., Lee, C.S.G, "Robotics, control, sensing, Vision and Intelligence", McGraw Hill International, First edition.
ICT/MOOCs Reference	
1	https://www.youtube.com/watch?v=KY8-WjpvRdk
2	https://www.youtube.com/watch?v=7RKnr6XXPps
3	https://swayam.gov.in/nd1_noc19_me74/preview
4	http://www.nptelvideos.in/2012/12/robotics.html

Mapping of CO with PO and PSO:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	0	3	2	0	0	1	0	1	0	0	1	3	1	0
CO2	2	2	0	2	1	0	0	0	1	0	2	1	2	2	1
CO3	3	1	1	0	3	2	0	1	0	0	0	2	1	3	3
CO4	2	1	2	0	2	0	0	2	0	0	2	1	2	1	0
CO5	3	2	3	2	3	3	1	1	1	1	1	3	2	2	2