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	2025-26	Effective for the Batch admitted in	July 2022
CourseCode	2BM7107	Course Name	Prosthetics & Orthotics Engineering

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 Human Anatomy, Physiology, and Biomechanics.

Course Outcomes

On successful completion of the course, the students will be able to:

CO1	**Demonstrate** a clear understanding of prosthetics & rehabilitation engineering and its industrial applications, focusing on the design principles and classification of prosthetic and orthotic devices.
CO2	**Analyze** the working principles, advancements, and challenges of cardiac and advanced prosthetic devices, emphasizing biocompatibility and IoT integration.
CO3	**Evaluate** the advanced design aspects of upper and lower limb prosthetics and orthotics, incorporating customization techniques like 3D printing and additive manufacturing.
CO4	**Apply** knowledge of sensory and mobility prosthetics to design and implement solutions that enhance sensory-motor feedback and mobility through neural integration and robotics.
CO5	**Develop** innovative rehabilitation technologies using brain-computer interfaces, AI, and wearable devices, ensuring compliance with ethical considerations and regulatory standards.

Theory Syllabus

Unit	Content	Hrs.
1	FUNDAMENTALS OF PROSTHETICS AND ORTHOTICS: Introduction to Rehabilitation Engineering and its industrial applications, Basics of Prosthetics and Orthotics: Design principles, need, and classification, Overview of Orthotic and Prosthetic Devices: Current trends, advancements, and challenges in the field, Emerging technologies: Artificial intelligence, machine learning applications in Prosthetics and Orthotics.	7
2	CARDIAC AND ADVANCED PROSTHETIC DEVICES: Advanced Cardiac Assist Devices: Artificial hearts, ventricular assist devices, heart-lung machines, Innovative designs and challenges in cardiac prosthetics, Smart prosthetic devices: Integration with biosensors and IoT for real-time monitoring, Biocompatible materials for enhanced durability and function.	10
3	UPPER AND LOWER LIMB PROSTHETICS AND ORTHOTICS: Advanced design aspects for upper limb prostheses: Myoelectric hands, dynamic splints, and externally powered devices; lower limb prostheses: Dynamic response feet, advanced knee and ankle components, and energy-storing designs; Applications of 3D printing and additive manufacturing for customization; pediatric prosthetics and orthotics: Design considerations and materials.	10
4	SENSORY AND MOBILITY PROSTHETICS: Sensory Prosthetic Devices: Visual augmentation, cochlear implants, and auditory substitution; Mobility Solutions: Ergonomics and structure of wheelchairs, powered wheelchairs, and exoskeletons; robotic prosthetics for mobility enhancement and rehabilitation; neural integration with prosthetics for sensory-motor feedback.	10

5	EMERGING TRENDS AND APPLICATIONS IN REHABILITATION ENGINEERING: Brain-computer interfaces and neuroprosthetics, Computer-aided design and engineering for precision in prosthetic development, Wearable devices for rehabilitation: Smart orthotic devices and FES systems, Role of AI and machine learning in rehabilitation monitoring, Ethical considerations and regulatory standards in prosthetic manufacturing.	8
Practical Content		
Term Work and Practical shall be based on the above syllabus.		
Text Books		
1	Prosthetics and Orthotics By: Donald G. Shurr et al.2e Pub.: Prentice Hal	
2	Rehabilitation Engineering By Robinson C.J, Pub.: CRC Press	
3	Handbook of Biomedical Engineering, second edition – Volume II by Bronzino Joseph D., CRC press,2010	
Reference Books		
1	Rehabilitation Technology By Ballabio E. et al, Pub.: I.O.S Press	
2	Orthotics and Prosthetics in Rehabilitation by Michelle M. Lusardi, Caroline C. Nielsen, Pub.: Saunders Elsevier	
ICT/MOOCs Reference		
1	https://nptel.ac.in/courses/112/106/112106248/	
2	https://www.youtube.com/watch?v=QcNrMBl3pWQ	

Mapping of CO with PO and PSO:

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