GANPAT UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

Programme	Bachelor of Technology	Branch/Spec.	Biomedical Engineering
Semester	IV	Version	2.0.0.1
Effective from Academic Year	2023-24	Effective for the Batch admitted in	July 2022
Course Code	2BM4105	Course Name	Biomaterials & Implants

Teaching Scheme						Examination Scheme (Marks)			
(Per week)	Lecture (DT)		Practical (Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	-	-	-	3	Theory	40	60	100
Hours	3	-	-	-	3	Practical	-	-	-

Pre-requisites

Basic knowledge of human biological systems.

Course Outcomes

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

CO1	Students can **define** and **classify** various biomaterials and describe their properties of different biomaterials.
CO2	To **understand** biocompatibility and **identify** the interactions of different biomaterials with human body
CO3	Students will be able to **Suggest** the type of material for different medical applications.
CO4	Decide the testing procedure for specific biomaterial/implant and **evaluate** the response of biomaterial/Implant to Human body

Theory Syllabus

Unit	Content	Hrs.
1	INTRODUCTION OF BIOMATERIAL AND TYPES: Definition and classification of bio-materials, Engineering material and biomaterials and its properties- physical, mechanical, thermal, chemical, Viscoelasticity, Process, Body response toimplants, Types- Ceramic, Polymer and Metals.	7
2	APPLICATION OF METALS AND CERAMICS AS BIOMATERIALS: Stainless steel, Titanium and titanium alloys, Cobalt based alloys, Nitinol. Dental metals- Gold, Nickel, Corrosion of the metals, Ceramics- Introduction to biomedical usages, Bio-active glass, High density alumina, Calcium Phosphate, Ceramics- Porous materials, Biological interactions, Drug delivery from ceramics.	8
3	POLYMERS AND COMPOSITE BIOMATERIAL**:** Polymerization, Polyethylene, Prosthodontic polymers, Clinical study of soft polymers, Bio erodible polymers, Bioactive polymers, Hydrogels Composite Biomaterials: Introduction, Dental filling Composites & cement, Porous Composites, Fibrous & Particulate composites.	7
4	CARDIAC, OPTHALMIC, ORTHOPEDIC AND DENTAL IMPLANTS: Vascular grafts, Heart valves, Cardiac assisting devices, Stent, Implantable pacemaker, Contact lenses-Soft and hard lenses, Disposable lenses, Intra ocular lenses (IOLS), Viscoelastic solutions, Vitreous implants, Eye shields, Drainage tubes in Glaucoma, Acrylic adhesives, General manufacturing process of cardiac and ophthalmic implant. Temporary fixation devices, Fracture healing, Repair of the ligaments, Joint replacements, Total HIP replacement, Total knee replacements, Bone regeneration with resorbable material, Dental Implant modalities-Dentures, Sub-periosteal, Endosteal- Blade type, Root form, Packaging and preparation of dental implants, General manufacturing process of orthopaedic and dental implant.	10

5	RESPONSE OF BIOMATERIAL WITH INTERACTION TO HUMAN BODY Blood-Biomaterial Interactions, Biomaterials-Tissue Interactions, Tissue response to Implants, Inflammation, Wound Healing, Foreign Body Response, Infection and Tumorigenesis of Biomaterial	6
6	BIOCOMPATIBILTY AND STERILIZATION: Methods for testing and evaluating biocompatibility- In vitro testing, In Vivo Testing, Hemo compatibility, Osteo compatibility, Tissue reaction to external materials, Treatment of materials for biocompatibility, Biodegradable materials and their applications, Sterilization process- ETO, Gamma radiation, Autoclaving, Effects of sterilization.	7

Text Books	
1	Sujata V. Bhatt, Biomaterials Second Edition, Narosa Publishing House, 2005.
2	Joon B. Park Joseph D. Bronzino, Biomaterials - Principles and Applications – CRC Press, 2003
Reference Books	
1	Fredrick H. Silver Chapman and Hall, Biomaterials Medical Devices and Tissue Engineering, London J.V. Park, Biomaterials Science and Engineering, Plenum Press, New York
2	Buddy D. Ratner, Allan S. Hoffman, Frederick j. Schoen, Jack E. Lemons, Biomaterials Science-An introduction to materials in medicine
3	C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani, Introduction to Biomaterials: Basic Theory with Engineering Applications
ICT/MOOCs Reference	
1	https://nptel.ac.in/courses/102106057/
2	https://nptel.ac.in/courses/113108071/

Mapping of CO with PO and PSO:

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