

GANPAT UNIVERSITY								
FACULTY OF ENGINEERING & TECHNOLOGY								
Programme	Master of Technology				Branch/Spec.	Biomedical Engineering		
Semester	II				Version	1.0.0.0		
Effective from Academic Year		2018-19			Effective for the batch Admitted in		July 2018	
Subject code	3BM203	Subject Name			Advanced Biomaterials & Surface Engineering (Elective-I)			
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
Hours	3	-	-	-	3	Practical	-	-
Pre-requisites:								
<p>Learning Outcome: The educational objectives of the course are to educate students to attain the following:</p> <ul style="list-style-type: none"> • Develop the understanding of the bio-materials to the newly admitted biomedical students who do not have the background in this filed. • Students will understand the basics of reactions of body towards medical implants. • Course will enable the student to have understanding about selection of materials and various replacements for different bony parts • Content of this course will enable the student to select relevant instrument for characterising surface properties and engineering optimum surface of implants and medical devices. 								
Theory syllabus								
Unit	Content							Hrs.
	Introduction to the overview and importance of the course.							1
1	INTRODUCTION OF BIOMATERIALS: Types, Classification and properties of biomaterials, General requirements, Current goals of biomaterials field, Overview of advanced biomaterials.							4
2	PHYSIOLOGICAL DEFENCE MECHANISMS OF THE BODY AGAINST BIOMATERIALS: Inflammation and wound healing, Blood clotting system, Biocompatibility: Tissue response to implants- Body response to implants, Carcinogenicity, Wound healing and Foreign body response Failure mechanisms; corrosion of metallic implants, degradation of Implanted Materials – Polymers, ceramics.							9
3	NANO- MATERIALS: Nanoscale materials and their biomedical applications, Nanomaterial for bone, bladder, neural, cartilage, vascular applications.							6
4	IMPLANTS AND REPLACEMENTS: Cardiovascular grafts and stents: Vascular implants, heart valve implants, blood substitutes and catheter, oral implants, Artificial organs. Soft tissue replacement- Sutures, surgical tapes, skin implants.							8
5	TECHNIQUES FOR CHARACTERIZATION OF SURFACE PROPERTIES OF BIOMATERIALS: Electron Spectroscopy, Secondary Ion Mass Spectrometry (SIMS), Transmission Electron Microscope(TEM), Scanning Electron Microscope(SEM), Atomic Force Microscope (AFM), Raman and NMR spectroscopy, Surface Enhanced Raman Spectroscopy (SERS), High Resolution Electron Energy Loss Spectroscopy (HREELS).							8
6	SURFACE ENGINEERING OF MEDICAL DEVICES AND IMPLANTS: Risks of infection and antimicrobial surfaces, Introduction of Bacterial adhesion and biofilms on surfaces, Microbial biofilm composition, Steps in biofilm formation, Infections associated with biofilm, Advancements in biofilm research, Surface functionalization with eluting antibacterial agent: silver ions, Surface functionalization with polymer coating of medical devices, Heparin coating for improving blood biocompatibility.							9
Practical content: Term Work and Practical shall be based on the above syllabus.								
Text Books:								
1	Biomaterials: An Introduction by By Joon Park, R. S. Lakes, Edition : 3 rd							
2	Characterization of Biomaterials edited by Amit Bandyopadhyay, Susmita Bose							
Reference Books								
1	Nanomaterials for Medical Applications By Zoraida P. Aguilar							
2	Antimicrobial surface functionalization of plastic catheters by silver nanoparticles by David Roe, Balu Karandikar, etal. Journal of Antimicrobial Chemotherapy							
3	Heparin coatings for improving blood compatibility of medical devices by Roy Biran, DanielPond							
4	Bacterial adhesion and biofilms on surfaces by Trevor Roger Garrett							

Note:

Version 2.0.0.0 (First Digit= New syllabus/Revision in Full Syllabus, Second Digit=Revision in Teaching Scheme,Third Digit=Revision in Exam Scheme, Forth Digit= Content Revision)

L=Lecture, TU=Tutorial, P= Practical/Lab., TW= Term work, DT= Direct Teaching, Lab.= Laboratory work

CE= Continuous Evaluation, SEE= Semester End Examination