GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3170418
Semester –VII
Subject Name: Biomaterials

Type of course: Open Elective course

Prerequisite: Basic knowledge in Physics, chemistry and biology

Rationale:

1. Develop scientific perspective to look at natural phenomena or material and detailed understanding about it.
2. To be able to comprehend the use of biotechnology tools and various methods for synthesis and characterization of various biomaterials
3. Interface technologies like these will shape the future of many technologies like energy storage, food packaging, healthcare and accesories etc.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	Introduction to biomaterials: History, Bulk and surface properties, Functional biological materials : Gecko feet, Underwater adhesion: Abalone foot:, Cutting: sharp biological materials, Optical properties: chameleon, Bioinspired materials	6
2	Nano biomaterials: Biomimetic nanotechnology, protein-based nanostructures, Nano motors, bacterial (E. coli) and mammalian (Myosin family), DNA nanotechnology, nanostructures in cells study, microarray platforms, Nano printing of DNA, RNA, and proteins biochips applications in nano scale detection, lab-on-a-chip devices (LOC), Nanotechnology in Tissue Engineering & Organ Printing, plants and microbes as nanofactories	12
3	Biodegradable polymers , Biopolymers: Synthesis from a simple biological monomer (eg	6

	hyaluronate polymers); Dextrans (used in chromatography columns); Rubber llike materials produced by bacteria and fungi (Polyhydroxybutyrate PHB), Polycaprolactone(PCL); Production of a copolymer of PHB and PHV(polyhydrovaleric acid), Biodegradable polymers	
4	Synthesis of nanomaterials by Biological Methods, Characterization of Nanomaterials, Protein and Glyco Lipid Nanotechnology	6
5	**Biomaterials case studies:** Collagen , spider silk, underwater adhesives from mussel/barnacle proteins, Hydrogel, Carbon nanotubes and Its bio-applications	9

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
5	15	10	10	5	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Fundamentals and applications of nanomaterials by Guo Z and Tan L, Artech house (2009).
2. Biological Materials Science by Marc André Meyers, Po-Yu Chen (2014)
3. Nanobiotechnology by Balaji S, MJP Publishers (2010).
4. Nanobiotechnology: concepts, applications and perspectives by Niemeyer CM and Mirkin CA, Wiley-VCH (2004).
5. Introduction to Nanoscience by Lindsay SM, Oxford University Press (2010).
6. Ratledge C and Kristiansen B, Basic Biotechnology, Cambridge University Press, 2nd Edition, (2001)
7. Doi Y, Microbial Polyesters, VCH Weinheim, (1990)

Course Outcomes:
Students should be able to

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Sr. No.	CO statement	Marks % weightage
CO-1	Understand and explain the functionality behind various natural phenomenon and biomaterials.	36
CO-2	Analyse the applicability and synthesis of various nanobiomaterials.	32
CO-3	Evaluate the properties of various biodegradable polymers for various applications	16
CO-4	Understand the biosynthesis and characterization of various nanobiomaterials	16

List of Open Source Software/learning website:

1. Students can refer to video lectures available on the websites including NPTEL.
    a. https://nptel.ac.in/courses/102/107/102107058/
    b. https://nptel.ac.in/courses/118/106/118106019/
    c. https://nptel.ac.in/courses/118/107/118107015/
2. Students can perform experiments on Virtual Lab