GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3163903
SUBJECT NAME: BIO-NANOTECHNOLOGY AND MEDICINE

6th SEMESTER

Type of course: Material Science, Chemistry, Biotechnology and Nanotechnology

Prerequisite: Fundamental of Chemistry, Synthesis of Nano materials, Physics of Nano materials

Rationale: The purpose of this course is to provide a review of timely concepts in the rapidly emerging field of Nano medicine. It reviews how Nano medicine is redefining clinical research in areas such as diagnostic imaging agents and drug delivery.

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	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	**INTRODUCTION** 1.2 Historical Background 1.3 First-Generation Biomaterials (1950s–1960s) 1.3.1 General Characteristics 1.3.2 Naturally Occurring Biomaterials 1.3.3 Metals and Alloys 1.3.3.1 Pure Metals 1.3.3.2 Alloys 1.3.3.3 Shape-Memory Alloys (SMAs) 1.3.4 Ceramics 1.3.5 Polymers 1.3.6 Composites 1.4 Second-Generation Biomaterials (1970s–2000) 1.4.1 General Characteristics 1.4.2 Biodegradable Polymers 1.4.3 Hydrogels 1.4.4 Bioactive and Biodegradable Ceramics 1.5 Third-Generation Biomaterials (2000–Present) 1.5.1 Biomaterials in Tissue Engineering 1.5.2 Micro/Nanotechnology and Biomaterials 1.5.2.1 Microfabrication and Microtechnology 1.5.2.2 Nanofabrication and Nanotechnology	**10**	**20%**
2	NANO MEDICINE	**10**	**20%**

	2.1Introduction 2.2Basics of Nanobiotechnology in Relation to Nanomedicine 2.3Relation of Nanobiotechnology to Nanomedicine 2.4Landmarksinthe Evolution of Nanomedicine 2.5Classification of Nanobiotechnologies 2.6Micro- and Nanoelectromechanical Systems 2.7BioMEMS 2.8Microarrays and Nanoarrays 2.9Protein Nanoarrays 2.10Microfluidics and Nanofluidics 2.11Nanotechnology on a Chip		
3	**MAGNETIC NANOPARTICLES AS DRUGCARRIERS** 3.1Introduction 3.2Definitions 3.3Propertiesofmagneticmaterials in the vicinity of Nano medicine 3.4Nanoparticles 3.5MagneticNanoparticles 3.6Ironoxidebasedmagneticnanoparticles 3.7Cobaltbasedmagneticnanoparticles 3.8Ironbasedmagneticparticles 3.9Encapsulatedmagneticnanoparticles 3.10Biocompatibilityissue soft magnetic nanoparticles	**10**	**20%**
4	**APPLICATIONOFMAGNETICNANOPARTICLESASDRUGCARRIERS** 4.1Magnetichyperthermia 4.2Magneticchemotherap y 4.3Othermagnetictreatment approaches 4.4Magneticgenetransfer	**10**	**20%**
5	**NANOPARTICLE-BASED DRUG DELIVERY** 5.1Gold Nanoparticles as Drug Carriers 5.2Calcium Phosphate Nanoparticles 5.3Ceramic Nanoparticles 5.4Nanocrystalline Silver 5.5NanoCrystal Technology 5.6Nanoparticles Bound Together in Spherical Shapes 5.7Encapsulating Water-Insoluble Drugs in Nanoparticles 5.8Trojan Nanoparticles	**8**	**20%**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
Remembrance R Level	**Understanding U Level**	**Application A Level**	**Analyze N Level**	**Evaluate E Level**
30	35	35	-	-

Legends: R: Remembrance; U: Understanding; A: Application 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

TEXT BOOKS AND REFERENCES

EDITOR

1. The Handbook of Nanomedicine Kewal K. Jain MD ISBN: 978-1-60327-318-3 e-ISBN: 978-1-60327-319-0 Library of Congress Control Number: 2007940762 ,2008 Humana Press, a part of Springer Science+Business Media, LLC.
2. Nano Particulates As Drugcarriers , Vladimirptorchilin ,NortheasternUniversity,USA ,ImperialCollegePress (WorldScientificPublishingCo.Pte.Ltd.)
3. Nanoparticle Technology for Drug Delivery edited by Ram B. Gupta Auburn University,Auburn, Alabama Uday B. Kompella University of Nebraska Medical Center Omaha, Nebraska New York London, Published in 2006 byTaylor & Francis Group
4. Nanoscale Technology in Biological Systems, Edited by Ralph S. Greco, Fritz B. Prinz ,R. Lane Smith,CRC PRESS,Boca Raton London New York Washington, D.C. Copyright © 2005 by Taylor & Francis

Course Outcome:

1. Comprehend the principles behind nanomedicine

2. Describe broad understanding of concepts and applications of nanomedicine

3. Describe the concepts of Nano medicine to a focused clinical area of their choice

4. Impart the knowledge to apply these nano drug delivery systems for the diagnosis and therapy.

List of Open Source Software/learning website:

https://en.wikipedia.org/wiki/Nanomedicine

http://www.nanotechproject.org/inventories/medicine/

http://www.nanomedjournal.com/