

GUJARAT TECHNOLOGICAL UNIVERSITY

BIOTECHNOLOGY (04) NANO-BIOTECHNOLOGY SUBJECT CODE: 2160409 B.E. 6th Semester

Type of course: B.E. (Biotechnology)

Prerequisite: Basic Concepts of Biological processes and Computational tools

Rationale: It is one of the advanced subjects of Biotechnology. It involves the use and applications of various computational tools & software in the field of biotechnology.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		ESE (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	2	0	5	70	20	10	30	0	20	150

Course Contents:

Sr. No.	Topics	Teaching Hours	Module Weightage
1	UNIT I: Introduction, History & Applications 1) Various definitions and Concept of Nano-biotechnology & Historical background. 2) Fundamental sciences and broad areas of Nano-biotechnology. 3) Various applications of Nano-biotechnology 4) Cell – Nanostructure interactions	9	18.75%
2	Unit II: Protein-based Nanostructures, Nanobio-machines & Signalling 1) Overview, chemistry and structure, Genetics & Secondary cell-wall polymers 2) Self-assembly in suspension, Re-crystallization at solid supports, Formation of regularly arranged Nano-particles 3) Cell as Nanobio-machine, link between the signaling pathways & molecular movements as well as neuron function 4) Concepts in nanobio-machines for information processing and communications	9	18.75%
3.	UNIT III: Microbial Nanoparticle Production 1) Overview and concept of microbial nano-particle production 2) Methods of microbial nano-particle production 3) Applications of microbial nano-particles 4) Bacteriorhodopsin and its potential in technical applications – overview, structure, photoelectric applications, photochromic applications and applications in energy	10	20.83%

	conversion		
4.	Unit IV: DNA-Protein Nanostructures 1) Overview and introduction 2) Oligonucleotide-Enzyme conjugates 3) DNA conjugates of binding proteins 4) Non-covalent DNA-Streptavidin conjugates 5) DNA-Protein conjugates in microarray technology	10	20.83%
5.	Unit V: Biomaterials & Bio-electronics 1) Biomaterials- types, properties and applications 2) Biomaterial nano-particle systems for bio-electronic & bio-sensing applications 3) Biomaterial-based Nano-circuitry 4) Protein-based Nano-circuitry 5) DNA as functional template for Nano-circuitry	10	20.83%

Suggested Specification table with Marks (Theory):

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
12	12	22	16	08	0

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) Nanobiotechnology: Concepts, Applications and Perspectives, Christof M. Niemeyer (Editor), Chad A. Mirkin (Editor) , Wiley Publishers, April 2004.
- 2) Nanotechnology: A Gentle Introduction to Next Big Idea, Mark Ratner and Daniel Ratner, Low Price edition, Third Impression, Pearson Education
- 3) Nanotechnology, William Illsey Atkinson, JAICO Publishing House, Second Impression-2008.
- 4) Bio molecular computation for Bio nanotechnology, Liu and Shimohara, Artech House-London, 2007

Course Outcome:

After learning the course, the students should be able to:

- Develop a fundamental understanding of basic concepts of nano-biotechnology and its uses in the field of life sciences.
- Evaluate applications of various concepts & techniques of nano-biotechnology to facilitate biotechnological advancement and innovations.

List of Tutorials:

- 1) Requirements to become Nanobiotechnology student
- 2) Evolution of nanobiotechnology
- 3) Unusual chemical and physical properties of nano-structures
- 4) Nano-biosensors and concept of Lab-on-a-chip
- 5) Nanopore sensors for DNA detection
- 6) Biological nanopores
- 7) Platforms for sensing disease agents (Cancer, Alzheimer's Disease etc)

- 8) Scope of research in the field of Nanobiotechnology
- 9) Recent developments in the field of Nanobiotechnology
- 10) Career as a Nanobiotechnologist
- 11) Role of nanobiotechnology in drug discovery

List of Open Source Software/learning website:

Students can refer to video lectures available on the websites including NPTEL. Students can refer to the CDs which are available with some reference books. Students can develop their own flowsheets for demonstration of various molecular biology techniques.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.