GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Science
Level: Under Graduate
Branch Name: Honors/ Honors With Research (Biotechnology)
Course / Subject Code: BS03001041
Course / Subject Name: Nanotechnology

W.e.f. Academic Year:	2025-26
Semester:	3
Category of the Course:	Multidisciplinary Course

Prerequisite: Students should have prior knowledge of basic biotechnology concepts, chemistry, and molecular biology fundamentals.

Rationale: Nanotechnology and Nanobiotechnology are interdisciplinary fields that combine physics, chemistry, biology, and engineering to manipulate materials at the nanoscale. This course will provide an understanding of nanomaterials, their synthesis, applications, and implications in biotechnology.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	70	30	30	200

Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	Introduction to Nanotechnology- Definition, historical perspective, nanoscale materials, quantum mechanics basics, size-dependent properties, types of nanomaterials (nanotubes, nanoparticles, nanowires), and cellular nanostructures.	**10**	**25**
2	Synthesis and Characterization of Nanomaterials- Top-down and bottom-up approaches, physical, chemical, and biological synthesis of nanoparticles, characterization techniques (XRD, TEM, SEM, AFM, DLS, FT-IR).	**10**	**20**
3	Applications of Nanotechnology in Biotechnology-Use of nanotechnology in agriculture, food industry, water purification, environmental remediation, diagnostics, DNA and protein-based nanodevices.	**15**	**35**
4	Ethical, Safety, and Regulatory Aspects-Nanotoxicology, environmental impact, risk assessment, ethical concerns, regulatory	**5**	**15**

	guidelines for nanotechnology applications.		

Reference Books:

"Nanobiotechnology: Concepts, Applications and Perspectives" - Niemeyer & Mirkin.
"Introduction to Nanotechnology" - Charles P. Poole Jr. and Frank J. Owens.
"Nanotechnology in Biology and Medicine" - Tuan Vo-Dinh.
"Nanobiotechnology: Principles and Applications" - C. M. Niemeyer, C. A. Mirkin.
"Nanomedicine: Design and Applications of Magnetic Nanomaterials" - J. D. Adams.

Course Outcome:

After Completion of the Course, Student will able to:

Sr. No	Course Outcomes	RBT Level
1	Understand the fundamental concepts of nanotechnology and its applications in biotechnology.	RM,UN
2	Learn the methods of nanoparticle synthesis and characterization techniques.	RM,UN
3	Gain knowledge about the role of nanotechnology in healthcare, drug delivery, and diagnostics.	RM,UN
4	Evaluate ethical and regulatory issues in nanobiotechnology.	RM

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

List of Experiments:

1. Synthesis of silver nanoparticles using biological methods.
2. Synthesis of magnetic nanoparticles
3. Characterization of nanoparticles using UV-Vis spectroscopy.
4. SEM/TEM image analysis of synthesized nanoparticles.
5. Detection of biomolecules using nanobiosensors.
6. Antimicrobial activity of nanoparticles.
7. Functionalization of nanoparticles for targeted drug delivery.
8. Study of DNA-nanoparticle interactions.

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