

Programme	BS-Biotechnology	Course Code	BT. 404	Credit Hours	3
Course Title	NanoBiotechnology				
Course Introduction					
<p>This course provides an introduction to the field of NanoBiotechnology, designed for undergraduate students majoring in Biochemistry and Biotechnology. The curriculum covers the fundamental principles of nanotechnology and its applications in biotechnology. Students will learn about the synthesis and characterization of nanomaterials, their interactions with biological systems, and their applications in medicine, agriculture, and environmental science.</p>					
Learning Outcomes					
<p>On the completion of the course, the students will:</p> <ul style="list-style-type: none"> • Describe the principles of nanotechnology in biotechnology. • Explain the methods for the synthesis and characterization of nanomaterials. • Discuss the impact of Nano biotechnology on various fields. 					
Course Content					
Theory Unit					
<ul style="list-style-type: none"> • Introduction and overview of Nanobiotechnology • Importance of nanomaterials, Basics of Nanomaterials, Types of Nanomaterials, Synthesis Methods • Characterization Techniques, Microscopy Techniques, Electron Microscopy (SEM/TEM/AFM), Spectroscopy Techniques, UV-Vis Spectroscopy, Zeta sizer/DLS • Nanoparticles, Functionalization and Applications, Types and mode of action • Nanowires, Nanorods and other nanomaterials, Magnetic Nanoparticles • Carbon Fullerenes and Nanotubes, Non Carbon nanotubes and Fullerenes like materials • Nanobiotechnology in Medicine, Drug Delivery Systems, Nanocarriers, Diagnostic Applications • Nanosensors • Imaging Techniques • Nanobiotechnology in Agriculture, Nano-fertilizers, Nano-pesticides • Food Safety and Quality, Nanotechnology in Food Packaging, Detection of Contaminants • Environmental Nanobiotechnology, Nanomaterials for Water Treatment, Air Purification, Soil Remediation, Nanomaterials for Soil Cleanup, Case Studies • Toxicology of Nanomaterials, Biological Interactions, Toxicity Assessment • Safety and Regulation, Regulatory Frameworks, Safety Guidelines • Nanotechnology in Biotechnology • Nanobiocatalysts, Enzyme Immobilization • Bio-imaging, Fluorescent Nanoparticles • Quantum Dots • Nanomaterials in Tissue Engineering, Scaffolds and Biomaterials, Tissue Regeneration 					

- Nanotechnology in Regenerative Medicine, Stem Cells and Nanomaterials, Clinical Applications
- Nanomaterials for Cancer Diagnosis, Synthesis and Mechanism of action, Biological applications, Nanomaterials for Cancer Treatment, Synthesis and Mechanism of action, Biological applications
- Nanotechnology in Bioelectronics, Biosensors and Biochips, Nanowire Transistors
- Nanomaterials for Gene Delivery, Vectors and Carriers, Applications in Gene Therapy
- Nanomaterials for Antibacterial Applications, Mechanisms of Action, Synthesis of Antibacterial Nanomaterials
- Applications in Healthcare, Wound Healing, Medical Devices
- Nanotechnology in Personal Care Products, Cosmetics and Sunscreens, Safety and Regulation, Consumer Products, Household Items, Market trends
- Future Directions in Nanobiotechnology, Emerging Technologies, Innovations and Trends
- Ethical and Social Issues, Ethical Considerations, Societal Impact

Textbooks and Reading Material

Textbooks.

- Christof M. Niemeyer and Chad A. Mirkin (2022) *Nanobiotechnology: Concepts, Applications and Perspective 2nd Edition*, Press.
- Mikhail Y. Berezin (2020) *Nanotechnology for Biomedical Imaging and Diagnostics: From Nanoparticle Design to Clinical Applications 1st Edition*.
- Pratima R. Solanki (2021) *Nanobiotechnology: Inorganic Nanomaterials vs Organic Nanomaterials 1st Edition*.

Teaching Learning Strategies

- Active Learning; Promoting student participation and interaction blended learning
- Experimental learning
- Formative assessment
- Inquiry based instructions
- Growth mindset

Assignments: Types and Number with Calendar

- Short assignment; Before mid term exam
- Long assignment; Before final term exam
- Class room participations; before and after midterm exam
- Quizzes; before and after midterm exam
- Poster presentations

Assessment			
Sr. No.	Elements	Weightage	Details
1	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.