



GUJARAT TECHNOLOGICAL UNIVERSITY
Integrated Master of Science (Biotechnology)

Semester: 3

Subject Name: Nano Technology

Subject Code: 1320404

Teaching and Examination Scheme:

| Teaching Scheme | | | Credits | Examination Marks | | | | Total Marks |
|-----------------|---|---|---------|-------------------|--------------|---------|-----------------|-------------|
| L | T | P | | C | Theory Marks | | Practical Marks | |
| | | | ESE (E) | | PA (M) | ESE (V) | PA (I) | |
| 4 | 0 | 0 | 4 | 70 | 30 | 0 | 0 | 100 |

Prerequisite:

Students should have the basic knowledge of biology, physics and chemistry. They must aware about the different characteristic properties of the chemicals and biomolecules.

Rationale:

This course provides deep insight knowledge of Nanotechnology and to produces expert that would have sufficient knowledge and expertise to solve the major and urgent problems by using nanotechnology. This course will demonstrate the applications of analytical techniques in examining nanostructures/ particles as well as illustrate the scope of biomacromolecules in nanotechnology. This course will also be beneficial for inferring the importance of risk assessment in the usage of nanostructures/particles in various applications

Course Content:

| Unit No. | Content | No. of Hours | Weightage (%) |
|----------|--|--------------|---------------|
| 1 | Introduction to Nanotechnology History and development of nanobiotechnology; Structure-property relationships. | 6 | 10 |
| 2 | Biologically important nanomaterials Self-assembly as in proteins, lipids, and nucleic acids; Polymeric nanoparticles; Inorganic nanoparticles- quantum dots, silica-based nanostructures; metallic nanoparticles like silver and gold; nanotubes, nanowires, and nanofibers. | 12 | 20 |
| 3 | Synthesis and characterization of nanomaterials Physical, Chemical, and Biological means of synthesis; Biomimetic approaches of production: case studies- ferritins, silica in diatoms, FeNPs in magnetosomes; Merits and demerits of bio-based approaches. Optical techniques like UV-Vis and fluorescence spectroscopy; FTIR spectroscopy; electron microscopy (TEM and SEM); Atomic Force Microscopy, dynamic light scattering, zeta potential measurement, XRD (with emphasis on how these techniques to aid in characterizing nanoparticles). | 15 | 25 |



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| 4 | Application of nanotechnology Strategies for chemical and biological functionalization; Applications in tissue engineering & regenerative medicine. Nanoparticles as a reporter: metallic nanoparticles and quantum dots in rapid diagnostics tools; FRET and Molecular Beacons; SPR and SERS-based imaging. | 15 | 25 |
| 5 | Biosafety and Potential risks associated with nanomaterial Routes of exposure; Fate of nanoparticles- short and long term; Cellular interaction; environmental safety; Risk assessment and regulatory mechanisms. | 12 | 20 |
| Total Hours: | | 60 | |

Textbook:

1. Bhushan B (2010) Handbook of Nanotechnology, Springer-Verlag, Berlin, Heidelberg, Germany
2. B.S. Murty, P. Shankar, Baldev Raj, B B Rath, James Murday (2013) Textbook of Nanoscience and Nanotechnology

Reference Books:

1. Xie Y (2012) The Nanobiotechnology Handbook CRC Press
2. Eddy G and Poinern J (2014) A Laboratory Course in Nanoscience and Nanotechnology by CRC Press Authors, book

Course Outcomes:

| No. | Course Outcomes | RBT Level* |
|-----|--|----------------|
| 1 | Demonstrate the applications of analytical techniques in examining nanostructures/ particles | UN, RM, AN, AP |
| 2 | Explain the potential of nanobiotechnology in consumer applications and diagnostics | UN, RM, AN, AP |
| 3 | Illustrate the scope of biomacromolecules in nanotechnology | UN, RM, AN, AP |

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

List of Laboratory/Learning Resources Required

1. <https://nptel.ac.in/courses/118102003>
2. https://onlinecourses.nptel.ac.in/noc19_mm21/preview