Course title: Introduction to Nanobiotechnology			
Course code: BBP 115	**No. of credits:** 2	**L-T-P:** 22-08-0	**Learning hours:** 30
Pre-requisite course code and title (if any):			
Department: Department of Biotechnology			
Course coordinator: Dr. Shashi Bhushan Tripathi		**Course instructor :** Dr. Chandrani Nath	
Contact details: shashi.tripathi@terisas.ac.in			
Course type: Core		**Course offered in:** Semester 2	

Course description:

Nanotechnology is an interdisciplinary field and attracts students from various disciplines. This course provides basic overview of nanomaterials and their applications. This course begins with a review of various types of nanomaterials and an introduction to general terminologies. Subsequently the course covers synthesis methodologies, physical and chemical characterization of nanomaterials. Finally, case studies illustrating application of nanomaterials in diverse fields will be discussed.

Course objectives:

To understand the nature and properties of nanomaterials.

To provide scientific understanding of application of nanomaterials and nanotechnology in agriculture, health and environmental conservation.

Course contents

S.No	Topic	L	T	P
1.	**Introduction to nanomaterials;** • Various types of nanomaterials, Three-dimensional, two-dimensional, one-dimensional and zero-dimensional nanomaterials. • Carbon nanotubes, Graphene, Carbon dots, metal nanoparticles, metal oxide-based nanomaterials, semiconductor nanomaterials, quantum dots, hybrid nanoparticles, • Bio-nanomaterials, polymer nanoparticles, lipid nanoparticles etc. • Synthesis methodologies, Top down and bottom up approaches for nanomaterial synthesis.	4	2	0
2.	**Properties of nanomaterials** • Structural properties, chemical properties, surface functionalization, physical properties. • Characterization of nanomaterials by various analytical methods, optical characterization and spectroscopy such as FT-IR, UV-Vis, DLS, Zetapotential, structural characterization by X-Ray Diffraction, XPS and advanced microscopy (TEM, SEM, AFM) etc. •	4	4	0
3.	**Nanobiotechnology in healthcare;** • Role of nanobiotechnology in the area of infectious & non-infectious diseases • Nanopharmaceuticals • Diagnosis, sensors and biosensors • Delivery vehicles, biomedical applications of nanomaterials. Multimodal nanoparticles, targeted drug delivery, theranostics	8		

4.	**Nanobiotechnology for Agriculture:** Nanotechnology based tools to enhance agricultural productivity • Nanobased Agri and Food Products, food preservation and toxicity • Nanopesticides and Nanofertilizers • Nano-biostimulants and soil enhancers • Nano-enabled technologies and abiotic stress management • Nanobiotechnology for Crop improvement • Precision Delivery Systems • Diagnostics and sensing • Nanotechnology for environment: contamination detection and remediation	6	2	0
	Total	**22**	**8**	

Evaluation criteria:
Minor exam 1 and Minor exam 2: 20% weightage to each
Major exam (end semester) : 50% weightage
Assignment : 10% weightage

Learning outcomes:
1. Familiarity with working principles, tools and techniques in the field of nanomaterials.
2. Understanding of the strengths, limitations and potential uses of nanomaterials.

Pedagogical Approach:
1. Classroom lectures and discussions.
2. Case studies and examples from original research articles.

Materials:
Suggested readings:(*1–7*)

1. A. L. Rogach, *Semiconductor nanocrystal quantum dots synthesis, assembly, spectroscopy and applications* (Springer, Wien; London, 2008).
2. E. Gazit, *Plenty of room for biology at the bottom: an introduction to bionanotechnology* (Imperial College Press ; Distributed by World Scientific Pub. in the USA, London : Hackensack, NJ, 2007).
3. G. E. J. Poinern, *A laboratory course in nanoscience and nanotechnology* (CRC Press, Taylor & Francis Group, Boca Raton, 2015).
4. C. A. Mirkin, C. M. Niemeyer, Eds., *More concepts and applications* (Wiley-VCH, Weinheim, 2007), *Nanobiotechnology*.
5. A. K. Mishra, Ed., *Application of nanotechnology in water research* (Wiley, Scrivener Publishing, Hoboken, New Jersey, 2014).
6. K. R. Nill, *Glossary of biotechnology and nanobiotechnology terms* (Taylor & Francis, Boca Raton, 4th ed., 2006).
7. J. Kim, Ed., *Advances in nanotechnology and the environment* (Pan Stanford, Singapore, 2012).
8. P. N. Prasad. Nanophotonics (Wiley, New York, 2003).

Websites

Journals

Other readings

Additional information (if any): None

Student responsibilities:

1. Study of course materials as specified by the instructor
2. Timely submission of given class assignment

Course reviewed by:

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