

## Approval: 8<sup>th</sup> Senate meeting

**Course Name:** Nanobiotechnology

**Course Number:** BY505

**Credit:** 3-0-0-3

**Prerequisites:** - IC 136 - Understanding Biotechnology & its Applications OR Consent of Faculty member

**Students intended for:** 3<sup>rd</sup> and 4<sup>th</sup> year UG and PG

**Elective or Compulsory:** Elective

**Semester:** Odd/Even

**Course Preamble:** The aim of this course is to give an introduction to different nanomaterials and their sensing and biomedical applications. The fundamental concepts of the unique properties of nanomaterials compared to those of bulk materials will be discussed in details. Since nanotechnology allures students from different backgrounds, the course will enable them to understand the nano-bio interface and how nanotechnology can be useful in several biotechnological applications. The course will essentially serve as a platform to interlink students from non-biology background at all levels.

### Course outline:

#### Module 1 [15 Lectures]

Introduction: Definition of nanotechnology, small-strange and useful, why go nano – unique properties of nanomaterials, history of nanotechnology, present and future of nanotechnology, Nano + Light, Engineering optical properties, Band gaps, exciton, quantum confinement, Different kinds of nanomaterials- Metal and semiconductor nanoparticles; Polymeric nanoparticles; Molecular nanoparticles, Forces at the nanoscale, The Nano-Bio interface.

#### Module 2 [15 Lectures]

Nanobiosensing: Definition of sensors, different elements of sensor, introduction to nanobiosensing, Different types of biosensors, surface plasmon resonance based biosensor, electrochemical and potentiometric based biosensor, motion, temperature, chemical, light and pressure sensitive biosensors, Applications of biosensors in molecule analysis; food safety, environmental and biomedical monitoring and detection of biological weapons, Lab on chip devices for sensing and detection.

#### Module 3 [12 Lectures]

Nanomedicine: Nanoparticle within a biological environment, Nanoparticle dynamics in biological media, nanoparticles for therapy- drug delivery, gene delivery, protein delivery, photothermal and photodynamic therapy, uptake and toxicology of nanomaterials, Nanomaterials for tissue engineering and prosthetics. Nanoparticles based bioimaging.

**Text & Reference Books:**

1. Nanotechnology: An Introduction, by Jeremy Ramsden, 2011, *Elsevier Publishers*.
2. Nanobiotechnology: Concepts, Applications and Perspectives, edited by C.M. Niemeyer and C. A. Mirkin, 2012, Wiley-VCH Verlag GmbH & Co.
3. Nanomedicine, edited by Huw Summers, 2013, *Elsevier Publishers*.
4. Nano-Bio-Sensing, edited by Sandro Carrara, 2011, Springer Publishers
5. Additionally, other latest research articles related to the topic will be discussed.