Subject Code: 02BT0533

Subject Name: Nano-Biotechnology (Elective)

M. Sc. Semester – III

Objective: To provide the fundamental to application based knowledge for the advancement in the area of nano-biotechnology.

Credits Earned: 4 Credits

Course Outcomes: After completion of this course:

1. Student will understand the basics of Physics and Chemistry that leads to the fundamental concept of Nanosciences.
2. Student will understand and analyze the behaviour, characteristics of nanoparticles and phenomenon arises due to these.
3. Student will be able to understand and analyze the synthesis of nanoparticles, their application and learn various instrumental techniques for the study of nano-particles/structures/materials study.
4. Students will be able to apply their knowledge for the application and evaluation of various nanoparticles in specific and broad domain of Science.

Pre-requisite of course: Basic knowledge of physical chemistry and molecular biology

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Practicals/ TW	
4	0	0	4	50	30	20	0	0	100

Contents:

Unit	Topics	Teaching Hours
I	**Nano-Biotechnology Basics I** Introduction, History, Nanoparticles (NPs), Nanostructures, Nanomaterials, Bohr's atomic model, Jellium model, Super atom, Lattice Structure, Geometric structure, Magic Number, Electronic Structure of Nanomaterials, Measurements in nano dimensions, metallic nanoparticles and nanomaterials, Non-metallic NPS	15
II	**Nano-Biotechnology Basics II** Carbon Nanostructures, Characteristics dependent upon shape, size and different physical and chemical parameters, Synthesis of nanoparticles, nucleation and growth, Surface Plasmon Resonance (SPR) and Surface Enhanced Raman Spectroscopy (SERS)	15
III	**Nano-Biotechnology Applications I** Self-Assembly of nanoparticles, Nanocapsules, Nanopolymers, Nanocatalysts, Plasmonics, Nanobiosensors, Plasmonic ELISA, Plasmonic Nanosensors, Surface Plasmon Resonance Imaging (SPRI), Nanofabrication – Bottom up and Top down	15
IV	**Nano-Biotechnology Applications II** Application of nanosensors and nanocatalysts in diagnostics and treatment, nanoparticles and nanopolymers as drug carrier, Delivery of nanoparticles and nanopolymers, Fate of Nanoparticles inside organism and cell, Nano-biomedical Engineering, Nanodevices for biosensors, Metallic and Non-metallic nanoparticles in Microbiology – synthesis, interaction and applications, DNA Nanotechnology, Nanoparticles in agriculture and environment, Ethics in Nano-Biotechnology	15

References:

1. Introduction to Nanotechnology, (2007). Wiley India Pvt. Limited.
2. Alarcon, E. I., M. Griffith and K. I. Udekwu (2015). Silver Nanoparticle Applications: In the Fabrication and Design of Medical and Biosensing Devices, Springer International Publishing.
3. Bennett-Woods, D. (2008). Nanotechnology: Ethics and Society, CRC Press.
4. Bondì, M. L. B. and C. B. E. Amore (2015). Frontiers in Nanomedicine, Bentham Science Publishers.
5. Brown, T. A. (2016). Gene Cloning and DNA Analysis: An Introduction, Wiley.
6. Crowther, J. R. (2010). The ELISA Guidebook: Second Edition, Humana Press.
7. Fan, C. (2013). DNA Nanotechnology: From Structure to Function, Springer Berlin Heidelberg.
8. Prasad, R. (2017). Fungal Nanotechnology: Applications in Agriculture, Industry, and Medicine, Springer International Publishing.
9. Rai, M. and N. Duran (2011). Metal Nanoparticles in Microbiology, Springer Berlin Heidelberg.
10. Sambrook, J., E. F. Fritsch and T. Maniatis (1989). Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory.

11. Sambrook, J. and D. W. Russell (2001). Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory Press.
12. Schasfoort, R. B. M. (2017). Handbook of Surface Plasmon Resonance: 2nd Edition, Royal Society of Chemistry.
13. Zuccheri, G. and B. Samorì (2016). DNA Nanotechnology: Methods and Protocols, Humana Press.

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

Instructional Method:

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, etc.

b. The internal evaluation will be done on the basis of continuous evaluation of students in the class-room in the form of attendance, assignments, verbal interactions etc.

c. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.