SEMESTER-VII

BTC DSC 401T
NANOBIOTECHNOLOGY AND BIOENGINEERING

Contact Hours: 45
Full Marks = 100 [ESE (70) CCA (30)]

Course Objective: *The course aims to provide students with a comprehensive understanding of nanobiotechnology and bioengineering, emphasizing the application of nanotechnology within biological contexts and the development of innovative biotechnological solutions. The course is designed to equip the students with the fundamental principles of nanotechnology and its relevance in biology and medicine, comprehend the unique properties of nanoparticles and their wide-ranging applications in biotechnology, evaluate various techniques for nanomaterial synthesis and their interactions with biological systems, and address ethical and safety concerns associated with nanobiotechnology.*

UNIT 1 *(9 Lectures)*

Introduction to Nanobiotechnology: principles of nanotechnology and its relevance to biology and medicine; properties of nanoparticles and their applications in biotechnology; nanomaterial synthesis techniques and their biological interactions.

UNIT 2 *(8 Lectures)*

Nanoparticles in Drug Delivery: use of nanoparticles as drug carriers for targeted therapy; nanoparticle-drug interactions and controlled release systems; challenges and opportunities in nanomedicine.

UNIT 3 *(9 Lectures)*

Nanoscale Biosensors: design and functioning of nanoscale biosensors for biomolecule detection; types of biosensors (optical, electrochemical, and surface plasmon resonance-based sensors); applications of biosensors in healthcare and diagnostics.

UNIT 4 *(9 Lectures)*

Tissue Engineering and Regenerative Medicine: principles of tissue engineering and regenerative medicine; nanomaterials in tissue scaffolds and organ-on-a-chip devices; potential of bioengineered tissues for transplantation and disease modeling.

UNIT 5 *(10 Lectures)*

Emerging Trends and Future Applications: emerging trends in nanobiotechnology, such as nanotherapeutics, nanotoxicology, and nano-based imaging; challenges and regulatory aspects of nanobiotechnology; future prospects and ethical considerations of nanobiotechnology.

Course Outcome: *Upon completion of this course, students should be able to describe the fundamental principles of nanobiotechnology and its applications in biomedicine. They can evaluate the role of nanomaterials in drug delivery and their impact on healthcare. Students will be able to analyze the functioning and potential applications of nanoscale biosensors, and well as learn the principles of tissue engineering and regenerative medicine.*

SUGGESTED READING

1. Niemeyer, C. M., & Mirkin, C. A. (2004). Nanobiotechnology: Concepts, Applications, and Perspectives. Oxford University Press.
2. Vo-Dinh, T. (Ed.). (2017). Nanotechnology in Biology and Medicine: Methods, Devices, and Applications. Wiley-Blackwell.
3. Lanza, R., Langer, R., & Vacanti, J. (2014). Principles of Tissue Engineering. Academic Press.
4. Prasad, P. N. (2012). Introduction to Nanomedicine and Nanobioengineering. Germany: Wiley.
5. Lee, Y., Moon, J. (2020). Introduction to Bionanotechnology. Germany: Springer Nature Singapore.