राष्ट्रीय प्रौद्योगिकी संस्थान पटना / NATIONAL INSTITUE OF TECHNOLOGY PATNA
संगणक विज्ञान एंव अभियांत्रिकी विभाग / DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
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No:- Date:

CSXX1922: Biomedical Engineering **L-T-P-Cr: 3-0-0-3**

Pre-requisites: Fundamental knowledge of biological concepts and computer science.

Objectives:

- To understand fundamental concepts of cellular and molecular biology.
- To learn fundamental principles in material science in biomedical engineering.
- To learn fundamental concepts of nanotechnology for various biomedical applications.
- To understand the impact of drug design development in biomedical applications
- To learn various medical imaging techniques.

At the end of the course, a student should:

Sl. No	Outcome	Mapping to POs
1.	Understand fundamentals concepts of Molecular Biology	PO1, PO2
2.	Able to understand the utility and applications of biomaterials	PO3, PO4, PO9
3.	Understand the development of nanotechnology in therapeutic applications	PO1, PO2
4.	Understand various stages of drug design	PO2, PO4
5.	Able to understand methods of medical imaging	PO12, PO3, PO4, PO5

UNIT I: Molecular Biology **Lectures: 12**

Structure and Functions of Nucleic Acids, Chemical structure of DNA and RNA, Watson-Crick model, DNA replication, repair and recombination, Structure and function of RNA polymerases. Transcription factors and machinery in Prokaryotes, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, Protein synthesis and processing Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, Machine learning approaches in medical systems.

UNIT II: Biomaterials **Lectures: 08**

Introduction to Materials in Medicine, Classification of materials. Fundamentals of biomaterials science. Evolution of biomaterials. Physico-chemical properties of biomaterials: mechanical, Natural polymers in synthesis of biomaterials, Interactions between biomaterials and tissues. Surface interactions. Biocompatibility, Cells, Tissue organization. Structure, morphology and properties. Cell-matrix interactions. Stem cell engineering

UNIT III: Nanobiotechnology **Lectures: 08**

Introduction to Nanotechnology, Classification of Nanoscale materials, Transmission Electron Microscopy (TEM) and Scanning Electron Microscope (SEM), Various synthesis methods of nanoscale materials, Top down and Bottom-up approach, Nano-sensors for detection of biomolecule. Antibacterial and Anti-cancer activity of NPs, Drug targeting, drug delivery

UNIT IV: Computer Aided Drug Designing **Lectures: 08**

Basic pharmacodynamics and pharmacokinetics, Strategies for drug designing and drug development, Structure Based Drug Designing (SBDD), Ligand Based, Drug Designing (LBD)

UNIT V: Biomedical Imaging **Lectures: 06**

Ultrasound Imaging, X-ray imaging, MRI imaging, Nuclear imaging, ECG, EEG

Text/Reference Books

1. Freifelder D (2012). Molecular Biology
2. Berg JM, Tymoczko JL, Gatto GJ and Stryer L (2015) Biochemistry
3. Lanza RP, Langer R, Vacanti JP, Principles of Tissue Engineering, Academic Press,
4. Palsson B and Bhatia SN, Tissue Engineering
5. Biomaterials Science: An Introduction to Materials in Medicine - Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, second sedition
6. A Textbook of Nanoscience and Nanotechnology by Prof. T Pradeep
7. Drug Design: Structure and ligand-based approaches: Kenneth M.Merz, Dagmar Ringe, CharlesH.Reynolds.
8. The Essential Physics of Medical Imaging, Bushberg, Lippincott, Williams and Wikins