Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NPHD504	BIOPHYSICS	3	0	0	3

Prerequisite: Mathematical Physics, Electrodynamics, Statistical Mechanics, Thermodynamics, Optics and Spectroscopy.

Course Objective

This course introduces the basic concepts of biophysics, which is a multidisciplinary field that combines physics and mathematics to understand the physical and chemical processes occur in living organisms.

Learning Outcomes

After completion of the course, students will:

- Understand the impact of physics in solving the biological problems.
- Learn how to address the next generation biological challenges by utilizing physical instrumentation and methodologies.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Introduction and Basic concepts**: Notion of biophysics, Explanation with examples, Cell: structure, function, division; Tissue: structure, function; Intra and extracellular components.	07	This unit will cover the motivation for studying biophysics. Also will describe the structure and functions of cell, tissue and cellular components.
2	**Thermodynamics**: Entropy; Enthalpy – Hess law; Laws of thermodynamics; Free energy; Chemical potential; Redox potential; Bioenergetics.	05	Here, students will learn about the thermodynamic concepts applied in biological systems.
3	**Biomolecules and their interactions**: Micro and macromolecules; Structure and dynamics of protein, nucleic acid, carbohydrate, phospholipid, biological membrane; drug; bio-compatible nanoparticles; functionalization; Intra- and inter-molecular forces and interactions; Computational biophysics.	10	In this unit students will be familiar with several biological molecules and their interactions.
4	**Membrane biophysics**: Structure of biomembrane; Lock and key model; Fluid mosaic model; protein, drug and nanoparticle interactions with cell membrane.	05	Here students will learn about the physics of biomembranes.
5	**Experimental methods in biophysics:** ***Radiation biophysics***: Light-matter interaction in biophysics; X-rays; X-ray scattering: reflectometry, diffraction, small angle X-ray scattering.	05	In this unit students will gather knowledge on various Radiation Biophysics tools used for characterization of biophysical systems for understanding the physics of life.
6	(b) ***Spectroscopy***: Ultraviolet & visible spectroscopy-Beer Lamberts law; Infrared spectroscopy; Raman spectra; Circular Dichroism; Fluorescence spectroscopy.	05	In this unit students will gather knowledge on various Spectroscopy tools used for characterization of biophysical systems for understanding the physics of life.
7	***(c) Microscopy***: Atomic force microscopy; Brewster's angle microscopy; Scanning and tunnelling electron microscope; Optical microscope; Imaging techniques: Ultrasonography, Magnetic resonance imaging (MRI).	05	In this unit students will gather knowledge on various Microscopy tools used for characterization of biophysical systems for understanding the physics of life.
Total		**42**	

Text Books:

1. Biophysics, V. Pattabhi & N. Gautham, 2002, Kluwer Academic Publishers.
2. Biophysics: An introduction, R. Glazer, 2012, Springer-Verlag Berlin Heidelberg.
3. Molecular and Cellular Biophysics, Meyer B Jackson, 2006, Cambridge

Reference Books:

1. Intermolecular and surface forces, J. Israelachvilli, 2011, Elsevier.
2. Biophysics: An introduction, Rodney M. J. Cotterill, 2002, Wiley.
3. Biophysics, Ed. W. Hoppe, 1983, Springer-Verlag.
4. Basic Biophysics for Biologist by M. Daniel, 2011, Agrobios, India.
5. Essentials of Biophysics, P Narayanan, 2005, New Age International.