

Core theory course (Interdisciplinary)

CPH-603: BIOPHYSICS

UNIT-I

Separation Techniques:

Introduction, Chromatography, Column chromatography, Thin layer chromatography, Paper chromatography, Adsorption chromatography, Partition chromatography, Gas liquid chromatography (GLC) , Ion exchange chromatography, Molecular exclusion chromatography, Affinity chromatography

Electrophoresis: Moving boundary electrophoresis, Zone electrophoresis, Low voltage electrophoresis, High voltage electrophoresis, Gel electrophoresis, Sodium dodecyl sulphate poly acrylamide gel electrophoresis (SDS-PAGE), Iso electric focusing, Continuous flow electrophoresis.

Physico-Chemical Techniques to Study Biomolecules:

Introduction, Hydration of Macromolecules, Role of Friction, Diffusion, Sedimentation, The Ultracentrifuge, Viscosity, Rotational Diffusion: Flow birefringence measurements, Electric birefringence, Light Scattering, Small Angle X-ray Scattering.

UNIT-II

Spectroscopy:

Introduction, Ultraviolet/Visible Spectroscopy, Circular Dichroism (CD) and Optical Rotatory Dispersion (ORD), Fluorescence Spectroscopy, Infrared Spectroscopy, Raman Spectroscopy, Electron Spin Resonance.

Light Microscopy:

Introduction , Elementary Geometrical Optics, The Limits of Resolution, Different Types of Microscopy, Bright field microscopy, Dark field microscopy, Phase contrast microscopy, Fluorescence microscopy, Polarising microscopy.

UNIT-III

Electron Microscopy:

Introduction, Electron Optics, The Transmission Electron Microscope (TEM) The Scanning Electron Microscope (SEM), Preparation of the Specimen for Electron Microscopy, Image Reconstruction, Electron Diffraction, The Tunnelling Electron Microscope, Atomic Force Microscope.

NMR Spectroscopy:

Introduction, Basic Principles of NMR, NMR Theory and Experiment, Classical Description of NMR, NMR Parameters, Chemical shift Intensity, Line width, Relaxation parameters, Spin-spin coupling, The Nuclear Overhauser Effect, NMR Applications in Chemistry Chemical shift, Spin-spin coupling, ¹³C NMR , NMR Applications in Biochemistry and Biophysics, Concentration measurement

125 /S.8Y.38.2 pCHontfiottramtiaotnion 1o2f5biomolecules, Two-Dimensional NMR, Determination of macromolecular structure, NMR in Medicine.

UNIT-IV

Biomechanics:

Striated Muscles , Contractile proteins, Mechanical Properties of Muscles, Contraction mechanism, Biomechanics of the Cardiovascular System , Blood pressure, Electrical activity during the heartbeat, Electrocardiography.

Neurobiophysics:

Introduction, The Nervous System, Synapse, Membrane potential, Voltage Clamp, Resting potential, Action potential, TMheevchisaunailsmresc-elTpthoer 21E8ye , Electrical activity and visual generator potentials, Optical defects of the eye, Neural aspects of vision, Visual communications, bioluminescence, Physical Aspects of Hearing, The Ear, Elementary acoustics, Theories of hearing, Signal Transduction, Mode of transport, Signal transduction in the cell.

References:

- (1) Biophysics by Vasantha Pattabhi and N. Gautham, Narosa Pub.
- (2) Introduction to Biophysics by Pranabkumar Banerjee, S.Chand.