Jawaharlal Nehru University

School Of Life Sciences
New Delhi

LS 562
Course title: BIOPHYSICAL CHEMISTRY METHODS AND APPLICATIONS
Credit: 02
Course Co-ordinator: Sneha Sudha Komath

This course has been designed to introduce perspectives of physical chemistry in the study of macromolecules for students of Life Sciences at the Masters level. The course seeks to review basic concepts from all four traditional branches of physical chemistry (thermodynamics, kinetics, quantum chemistry and spectroscopy and statistical mechanics) besides familiarizing students with some typical applications of physical chemistry to biological systems. Where ever possible, examples from recent scientific literature will be used to illustrate various principles.

Topics	**No. of Lectures (32)**
Some Basic Concepts:	
Thermodynamic state, state functions, path functions and thermodynamic systems. Feasibility, spontaneity and thermodynamic stability of natural processes. Entropy and hydrophobic effect.	2
Thermodynamics of solutions. Solutions of macromolecules. Molecular weights of macromolecules.	3
Statistical weights and partition functions. The Boltzmann distribution. Random walk.	2
Rates and rate equations of chemical reactions. Standard states, steady states. Activation energies, equilibrium constants. Rapid reactions and transient kinetics.	3
Waves, particles and quanta. Electromagnetic spectrum and transition energies. Quantum mechanical postulates and central concepts in spectroscopy.	5
Phenomena, Methods, Techniques:	
Protein folding and stability; cooperativity in protein folding.	1
van't Hoff analysis versus calorimetry (DSC and ITC).	2
Transport and diffusion; sedimentation and electrophoresis.	1
Thermodynamic equilibria.	1
Binding isotherms; single and multiple equilibria in binding of small ligands to macromolecules. Scatchard plots.	2
Relaxation processes, stopped-flow and temperature jump techniques.	1
Absorption, circular dichroism spectroscopy of biomolecules.	3
Fluorescence spectroscopy and microscopy (including anisotropy, TRES, FRET, FRAP, REES, FCS)	6

Selected bibliography:

1) Physical Chemistry by P. W. Atkins
2) Physical Biochemistry by K. E. Van Holde, W. Curtis Johnson and P. Shing Ho
3) Biophysical Chemistry by C. R. Cantor and P. R. Schimmel

Other relevant readings will be suggested during the course.