

## IT-765 : Computational Biophysics : Credit 3

The objective of the course is to introduce the subject of Computational Biophysics using theoretical & computational methods to explain and unfold basic topics like physicochemical properties of macromolecules, primary organization of interactive macromolecules, structure function relationship evolving different cellular functions and growing towards the thermodynamics of cell. A part will be classroom teaching and other part will be working exercise with project assigned to the participants.

### Prerequisites and Restrictions:

Must complete the semester one and at least credited the course on "Computational Biology & Bioinformatics". Strong in Mathematics & Programming/Matlab/Python

Physical & chemical aspects in Biological systems at each level like, cellular, tissue organization, construction of parts & physiology of living system, Hierarchy in living system. Information, construction & Function, a self assemble system. (5)

Structure of Biomolecules, heterogeneous, disorderd & glass like molecules, Flexibility, plasticity and functional deformations, assembly in different levels, Protein, DNA, lipid & carbohydrate and how to understand these phenomena theoretically using different models. (10)

Interaction & modeling of different macro & small molecules, tools for learning macro modeling some of the important biological systems like, single molecule dynamics to Biochemical pathway dynamics, role of noise in fluctuation and biochemical reactions, proof reading & noise reduction in genetic systems. (10)

Sequence ensembles, Designing structures from sequence for function in proteins, membranes & DNA/RNA. States of cell, long duration in neural network and ion chaqnnels, neuronal dynamics. (10)

Entropy vs. Information flow, Optimization of Information, Gathering information and modeling different biological functions like Genetic switch, Chemotactic, Control of metabolism, Signalling systems etc. (10)

Teaching will be interactive and through project work & journal papers.

### Books to follow:

**Frauenfelder**, *Physics of Proteins*

**Bialek**, *Biophysics: Searching for Principles*

**Phillips**, *Physical Biology of the cell*