Course Title: Advanced Computational Biology

Course Code CSE- 953

Course Objectives:

This course is beneficial for computational and experimental biologists to understand the principles of analyzing biological data, building models and testing hypotheses using computer science paradigms. This course is a survey of algorithms and mathematical methods in biological sequence analysis, protein structures and system biology. Sequence analysis topics include introduction to probability, hidden Markov models, gene prediction, sequence alignment, and identification of transcription-factor binding sites. Systems biology topics include gene regulatory networks, quantitative and qualitative modeling of gene regulatory networks.

Course Outcomes:

After completing this course student will be able to:

- Know about the properties of DNA, RNA, and proteins, the relationships among these molecules
- Know how to convert a biological question into a computational problem that can be solved using computers.
- Understand some basic and commonly used algorithms in bioinformatics
- Explain about various computational methods and tools used for protein secondary structure prediction and genome analysis
- Explain about various techniques used in genomics and proteomics

Course Contents:

Details of course contents are as follows: Introduction to DNA & Proteins, Intro. to Databases and biological Databases, String Matching Algo. for Sequence Alignment, Multiple Sequence Alignment, Phylogenies Trees, Protein Structure Prediction & Analysis, Protein-Protein Interactions, Molecular Docking, Molecular Dynamics, Gene Regulatory Networks, Modeling of Gene Regulatory Networks (GRN), Modeling GRN with Kinetic Logic, Modeling GRN with Ordinary Differential Equations, Modeling GRN with Piece-wise Linear Differential Equations, Signaling Transduction Pathways, Pathway Logic.

Recommended / Reference Books:

Baxevanis, A.D. and Ouellette (eds.) Bioinformatics. A Practical Guide to the Analysis of Genes and Proteins. (2004) Third Edition Rene Thomas and Richard D'Ari. Biological Feedback.