Course: Computational Biology and Bioinformatics

1. Faculty: FLSB
2. Course Code: LSB 620
3. Course Title: Computational Biology and Bioinformatics
4. Number of Credits: Three
5. Course objective: Students will get theoretical and experiment foundations for Computational Biology and Bioinformatics. The course will also provide an introduction to the analysis of protein structure, DNA sequences, and gene expression. Through practical exercises, the course aims to give students basic competence in the use of various bioinformatical tools.
6. Minimum prerequisites for taking this course, if any: Bachelor's degree in life sciences or any allied sciences.

7. Course structure with units, if applicable:

a) Module I: Phylogenetic prediction

Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.

b) Module II: Predictive methods using DNA sequences

Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification.

c) Module III: Predictive methods using protein sequences

Protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification;

d) Module IV: Structure databases

PDB and MMDB, structure file formats, visualizing structural information, advance structure modeling, Internal and external co-ordinate system, cartesian and cylindrical polar co-ordinate system, Potential energy calculations using semiempirical potential energy function, Electrostatic energy surface generation, three dimensional structure using dynamic programming methods, Molecular mechanics and dynamics, Docking of Molecules, Molecular Design, structure similarity searching; structure prediction in proteins. Sequence alignment theory and applications

e) Module V: Network Biology

Reconstruction pathways, network using cytoscape. Network feature and analysis.

8. Reading suggestions:

• Bioinformatics: Sequence, Structure and Databanks: A Practical Approach (The Practical Approach Series, 236), Des Higgins (Editor), Willie Taylor. I st edition, October 2000, Oxford University Press. ISBN: 978-0199637904.

• Bioinformatics: Sequence and Genome Analysis, David W. Mount. 2nd edition, June 2004, Cold spring harbor laboratory press. ISBN: 978-0879697129

• Introduction to Bioinformatics, Teresa Attwood, David Parry-Smith, 1st edition, May 2001, Pearson Education. ISBN: 978-8178085074

• Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Second Edition, Andreas D. Baxevanis, B. F. Francis Ouellette. 3nd edition, October 2004, A John Wiley & Sons, Inc., Publication. ISBN: 978-0471478782.

"Bioinformatics for Dummies" [John Wiley and Sons; ISBN 07645169651.

"Developing Bioinfonnutics Skills" , Cynthia Gibas and Per Jambeck's, ISBN 1565926641.

9. Evaluation:

Mid-semester Written Examination 40% Marks

End-semester Written Examination 40% Marks

Quiz / Assignment/Presentation (oral / poster)/other 20% Marks