Bot.Sp-09 COMPUTATIONAL BIOLOGY Credit Hours: 3 (2+1)

THEORY:

Introduction of the Course

The course contains methods and software tools related to the interdisciplinary field of biology, computer (database) sciences, mathematics and statistics. It comprises techniques about how to derive desired information out of large biological databases mainly stored in online repositories. The course helps in analysis and interpretation of biological data mainly through *in silico* (simulatory) means in response to certain biological queries.

Course Objectives:

The course is designed:

1. To make students well versed on the latest digital application of data sciences in biology for reaching out to solution of a bioinformatics problem over short span of time.
2. To make students learned about novel methods and tools to provide better understanding of biological systems.
3. To familiarize with computational tools related to biological systems.
4. To be able to conduct, analyze and interpret large dataset related to biological sciences.

Contents:

1. Introduction to computational biology and bioinformatics

1.1 Introduction to data and databases
1.2 Internet databases and resources
1.2 Databases – access, retrieval and submission

2. Genome databases (GDB) and software

2.1 Introduction to genome databases and software
2.2 Public repository of data on human genes, clones, STSs, polymorphisms and maps
2.3 Genomic database
2.4 GenBank – NIH genetic sequence database

3. Interpretation of Genomic Data

3.1 Sequence Similarity and sequence alignment
3.2 Software tools for pairwise and multiple sequence alignment
3.3 Phylogenetic analysis

4. Use of software related to structure of macromolecules

4.1 Software related to proteins, DNA, etc.
4.2 Introduction and use of FiberApp
4.3 Introduction and use of RasMol and OpenRasMol

PRACTICALS:

1. Purpose and use of major bioinformatics software
2. Practical demo of use of Database Search, NCBI BLAST
3. Practical demo of use of Pairwise sequence alignment
4. Practical demo of Multiple sequence alignment (Clustal W)
5. Performing phylogenetic analysis
6. Performing interpretation of Genomic Data
7. Use of different software for analysis of biomolecules etc.

Teaching Learning Strategies:

1. Lectures
2. Visits to different biotechnology laboratories
3. Laboratory work
4. Assignments / Seminars Workshops

Learning Outcomes:

1. The students would know about latest developments in the online databases related to biological sciences.

2. The students would be able to use the online database search engines for its application in biological sciences.

3. The students would have hands on practice on how to use major software related to computational biology.

4. The students would have essential skillset related to research in genetics, molecular biology and other relevant disciplines of biology.

Assessment Strategies:

1. **Lecture-based quiz (both objective and subjective)**
2. **Brief and detailed assignments**
3. **Class tests**
4. **Group activities**

Recommended Readings:

1. Buffalo, V. (2015). Bioinformatics Data Skills: Reproducible and Robust Research with Open Source Tools 1st Edition. O'Reilly Media, Inc. ISBN-13: 978-1449367374.
2. Edwards, D., Stajich, J.E. and Hansen, D. (2009) Bioinformatics Tools and Application. Springer Link Publishers. ISBN: 0387927379.
3. Information Resources Management Association, USA (Eds.). Bioinformatics: Concepts, Methodologies, Tools, and Applications (3 Volumes). IGI Global Publishers. ISBN13: 9781466636040.
4. Kelley, S.T., Didulo. D. (2018). Computational Biology: A Hypertextbook. Willey Publishers. ISBN: 978-1-683-67002-5.

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