

**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI,
HYDERABAD CAMPUS
SECOND SEMESTER 2021-
2022 COURSE HANDOUT
(PART II)**

Date: 15/01/2022

In addition to part I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course NO. : Bio F242

Course Title : Introduction to Bioinformatics

Instructor-in-Charge: SHUVADEEP MAITY (L), VAISHALI KUMAR (T)

1. Scope and objective of the Course:

Introduction to genomic & Proteomics, Human Genome and other sequencing projects, Biological databases and data mining, sequence similarity search and sequence alignment, Protein structure predication and structure analysis, use of software package in Bioinformatics. This course designed to impart the beginner with the fundamentals, which would enable understanding of the intricacies and vast scope of Bioinformatics. A sampling of the different areas required for understanding of this upcoming field will be provided along with *in silico* exercises to familiarize individuals with different program packages.

2. Text Book : “Introduction to Bioinformatics” Arthur M. Lesk; Oxford University Press (2009) (TB)

3. Reference Books:1. “Instant Notes in MOLECULAR BIOLOGY” P.C. Turner, A.G. McLennan, A.D. Bates & M.R.H. White, Viva Books Private Ltd, New Delhi. (RB1)

2. “Bioinformatics Genome and sequence Analysis” by David W Mount, CSHL Press, 2003 (RB2)

4.Course Plan:

| Lecture No. | Learning Objectives | Topics to be covered | Chapter in Textbook |
|-------------|--|--|--------------------------------------|
| 1. | Introduction | What is Bioinformatics, Scope | Lecture Notes |
| 2-6 | Overview of molecular biology & genetics | Nucleic acid; Structure & function | Sec C- RB1 |
| | | Protein Structure & function | Sec B- RB1 |
| | | Central dogma of life – Replication/Transcription/Translation | Secs E/K/Q- RB1 |
| | | Genetic code, Codon bias | Sec P- RB1 |
| 7-13. | General overview of different techniques to generate biomolecular information and analysis | DNA sequencing, RNA sequencing, PCR, NMR, X-ray crystallography, Micro array, Programming language for bioinformatics (R,Perl) | Class Notes |
| 14. | Information Networks | WWW, TCP/IP, HTTP, URLs | Chap.2 TB |
| 15-16 | Collection and storage of sequences | Data repositories (Genomics & proteomics), Submission of sequences to the databank, Computer storage of sequences, Web resources in Bioinformatics | Chap-2,3,4,5 (TB) Class notes |

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|--------|---------------------------------|--|--------------------------|
| 17-18 | Information Resources | Biological databases | Chap.4 TB Class notes |
| | | Primary databases | Chap.3 TB |
| | | Secondary databases | Chap.8 TB |
| 19-25 | Sequence Analysis and alignment | Definition of sequence alignment, Method of sequence analysis, Dot-matrix, dynamic programming algorithms for sequence alignment, use of scoring matrix and gap penalties, significance of sequence alignment, Multiple sequence alignment, statistical methods for aiding alignment, Markov models, Hidden Markov models, position-specific scoring matrices. | Chap. 3 and Chap. 4 RB2 |
| 26-29 | Phylogenetic analysis | Tree building and evaluation methods | Chap. 4 TB |
| 30-38 | Next generation sequencing | RNAseq and its variants, Quality control experimental, Transcriptome assembly, data processing, differential expression analysis | Class Notes |
| 39- 41 | Analysis Packages | Commercial databases and software | Chap. 3 & 10 TB |
| 42 | Bioinformatics Programming | Introduction of different scripting language, Demo with R languages | Class notes |

5. Evaluation scheme:

| EC No. | Evaluation Component | Duration | Weightage % | Date, Time & Venue | Nature of Component |
|--|---|----------|-----------------------------------|-----------------------------|---|
| 1 | 4 Announced Quizzes* (Continuous evaluation) | Variable | 35% (70M =15M+20M+ 15M+20M) | To be announced | OB [#] (50%) and Closed book (50%) |
| 2 | Mid-Sem | 90 Min. | 30% (60M) | 12/03 11.00am to 12.30pm | OB |
| 3 | Comprehensive | 2 Hrs. | 35% (70M) | 11/05 AN | Closed Book |
| *Quizzes will be conducted during lecture hours; two before the mid-semester and two after. Out of 4 quizzes 2 open books and 2 closed books. # OB- Open Book Only prescribed textbook/Reference book(s), slides and hand written notes (in a binding format, No loose pages) are permitted | | | | | |

6. Consultation Hour: To be announced in the class.

7. Notices: Notices will be displayed via CMS.

8. Make up Policy: Make up will be given on genuine grounds as determined by the IC.

9. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge
Bio F242