BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
HYDERABAD CAMPUS
Second SEMESTER 2022-2023
COURSE HANDOUT (PART II)

Date: 06/01/2023

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 mm**
Instructor-in-Charge **: SHUVADEEP MAITY**
Instructors **: Shuvadeep Maity, Nisith Gupta, Ali Akbar Shoukat Safdari**

1. Scope and objective of the Course:
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.
The course will let you learn about biological databases and data mining using different online sources, sequence similarity search and sequence alignment, protein structure predication and structure analysis, use of software package in Bioinformatics. It will also introduce you to new area of "omics" biology like genomic & proteomics, human Genome and other sequencing projects and their impact in understanding complex biology.

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)
3. BIOINFORMATICS AND MOLECULAR EVOLUTION Paul G. Higgs and Teresa K. Attwood Black Well Publishing (2005) (RB3)

4.Course Plan:

Lecture No.	Learning Objectives	Topics to be covered	Reference Chap./Sec. (Book)
1	Introduction	What is Bioinformatics, Scope	Lecture Notes
2-5	Overview of molecular biology & genetics	Nucleic acid; Structure & function	Sec C- RB1 Chap 2 RB3
		Protein Structure & function	Sec B- RB1 Chap 2 RB3
		Central dogma of life – Replication/Transcription/Translation	Secs E/K/Q- RB1 Chap 2 RB3
		Genetic code, Codon bias	Sec P- RB1
6-11	General overview of different techniques to generate biomolecular information and analysis	PCR, NMR, X-ray crystallography, DNA sequencing, RNA sequencing, Micro array,	Class Notes
12-13	Informatics and information Networks	WWW, TCP/IP, HTTP, URLs Programming language for bioinformatics (R, Perl), Learning the basics programming language	Chap.2 TB

14-15	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) RB Chap 5 Class notes
16-17	Information Resources	Biological databases	Chap.4 TB RB Chap 5 Class notes
		Primary databases	Chap.3 TB Class notes
		Secondary databases	Chap.8 TB Class notes
18-25	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, Pairwise sequence alignment –The problem, Pairwise sequence alignment –Dynamic programming methods, the effect of scoring parameters on the alignment, Multiple sequence alignment, Searching sequence databases: Similarity searching tools	Chap. 3 and Chap. 4 RB2 Chap 8 RB6
26-27	Phylogenetic analysis	Tree building and evaluation methods, The PAM model of protein sequence, Evolution, PAM distances, Log-odds scoring matrices for amino acids Understanding phylogenetic trees, Choosing sequences, Distance matrices and clustering methods, Calculation of distances in the neighbor-joining method, Bootstrapping	Chap. 4 TB Chap9 RB3
28-31	Next generation sequencing	RNAseq and its variants, Quality control experimental, Transcriptome assembly, data processing, differential expression analysis	Class Notes
32-34	Analysis Packages	Commercial databases and software for omics	Chap. 3 & 10 TB
35-36	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	Announced/surprised Quizzes/presentation* (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)	To be announced	OB (15%)

					Closed Book (15%)
	Comprehensive	2 Hrs.	35% (70M)	To be announced	Closed Book
3					
*Quizzes will be conducted during lecture/tutorial hours; Two before the mid-semester and two after. Out of 4 quizzes/presentations 2 open books and 2 closed books. # OB- Open Book Only prescribed textbook/Reference book(s), slides and handwritten notes 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 is indispensable for the course. Any violation to that may attract strict penalty**. Students' attendance in class required for better understanding of the course.**

Instructor-in-charge
Bio F242