SEMESTER S7

BIOINFORMATICS

Course Code	**PECST743**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. To understand the fundamental concepts in Molecular Biology, Genomics, Proteomics and Modelling.
2. To introduce bio macromolecules such as genes and proteins, different biological databases, and tools and algorithms for biological data processing, analysis and interpretation, and the elements of the systems approach to Molecular Biology.

SYLLABUS

Module	Syllabus Description	Contact Hours
1	**Molecular Biology Primer (3 hours)** Genes, DNAs, RNAs, Proteins, Genomics, Sequencing techniques, Bioinformatics overview and scope **Sequence Alignment (6 hours)** Global and local sequence alignment-dynamic programming algorithms, edit distance, similarity, Needleman Wunsch Algorithm, Smith Waterman Algorithm	9
2	**Biological Databases and Data Formats (3 hours)** Genomic and Sequence Data Formats, GenBank, EMBL-Bank, and DDBJ, PROSITE, NCBI- Database Searching: BLAST, FASTA **Phylogenetics (6 hours)** Phylogenetic Tree basics and Construction Methods, UPGMA, Neighbour joining, Parsimonous trees, Additive trees, Bootstrapping	9
3	**Combinatorial Pattern Matching (9 hours)** Combinatorial Pattern Matching, Repeat finding, Keyword Trees, Suffix Trees, Heuristic similarity search algorithms, Approximate Pattern Matching	9

4	**R FOR BIOINFORMATICS** Variables, Data types, control flow constructs, String manipulation, Pattern Matching, arrays, lists and hashes, File handling, Programs to handle biological data and parse output files for interpretation, packages for sequence alignment, FASTA, BLAST (Bioconductor, msa, Biostrings etc.) **Indicative Laboratory/Microproject Tasks** Biological Databases, Sequence alignment: BLAST family of programs, FASTA, ClustalW for multiple sequence alignment, Phylogenetics software, Homology Modeling and Model evaluation, Related Programs in R.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
● 2 Questions from each module. ● Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	● Each question carries 9 marks. ● Two questions will be given from each module, out of which 1 question should be answered. ● Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the Basics of Bioinformatics	**K2**
CO2	Use various biological databases and apply sequence alignment techniques	**K3**
CO3	Use molecular phylogenetics to identify evolutionary relationships among various biological species	**K3**
CO4	Apply the concept of combinatorial pattern matching in bioinformatics	**K3**
CO5	Use R language and packages to solve bioinformatics problems	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	-	-	-	-	-	2
CO2	3	3	3	-	-	-	-	-	-	-	-	2
CO3	3	3	3	3	-	-	-	-	-	-	-	2
CO4	3	3	3	3	-	-	-	-	-	-	-	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	An Introduction to Bioinformatics Algorithms,	N. C. Jones and P. A. Pevzner,	MIT Press, 2004	1/e, 2004
2	Bioinformatics for Beginners: Genes, Genomes, Molecular Evolution, Databases and Analytical Tools	Supratim Choudhuri	Academic Press	1/e, 2014
3	R Programming for Bioinformatics	Robert Gentleman	CRC Press	1/e, 2009

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Bioinformatics	T. K. Attwood and D. J. Parry-Smith,	Pearson Education	1/e, 2003
2	Analysis of Biological Networks,	B. Junker and F. Schreiber,	Wiley Publishers	1/e, 2007
3	Heterogeneous Information Networks - Principles & Methodologies	Y. Sun and J. Han, Mining	Morgan & Claypool Publishers	1/e, 2012
4	Multilayer Social Networks,	M. E. Dickison et al,	Cambridge University Press	1/e, 2016

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/102/106/102106065/
2	https://onlinecourses.swayam2.ac.in/cec21_bt04/preview