Nirma University
Institute of Technology, School of Technology
M. Tech. Computer Science and Engineering (Data Science)
Semester – II

L	T	P	C
2	0	2	3

Course Code	3CS42D203
Course Name	Bioinformatics

Course Learning Outcomes (CLOs):

At the end of the course, students will be able to

1. comprehend the intersection of life and information sciences, gene expression, and database queries
2. explain how to locate and extract data from key bioinformatics databases and resources
3. apply the knowledge of the basic principles and concepts of biology, computer science and mathematics in an integrated way

Syllabus:

Teaching Hours

Unit I **6**

Introduction And Biological Databases: Central dogma of molecular biology, Concept of DNA, RNA, Protein and metabolic pathway**,** NCBI, EBI, Biological databases: Requirements and challenges, Example of different biological databases – sequence, structure, function, micro-array, pathway

Unit II **5**

Sequence alignment : Pairwise Sequence Alignment, Database Similarity Searching, Multiple Sequence Alignment, Heuristic searches, Whole genome comparison, Profiles and Hidden Markov Models, Protein Motifs and Domain Prediction

Unit III **3**

Gene And Promoter Prediction: Gene Prediction, Promoter and Regulatory Element Prediction, Operon, Gene, splices site

Unit IV **6**

Molecular Phylogenetics: Phylogenetics Basics, Phylogenetic Tree Construction Methods and Programs, maximum Parsimony, distance Matrix and maximum likelihood methods. Concepts of adaptive evolution.

Unit V **7**

Structural Bioinformatics and Graph theory: Protein Structure Basics, Protein Structure Visualization, Comparison, and classification, Protein Secondary Structure Prediction, Protein Tertiary Structure Prediction, RNA Structure Prediction**,** Biochemical Pathway, Protein-protein interaction network, Regulatory network and their analysis.

Unit VI **3**

Genomics And Proteomics: Genome Mapping, Assembly, and Comparison, Functional Genomics, Proteomics

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

Suggested Readings^:

1. Jin Xiong, Essential Bioinformatics, Cambridge University Press
2. FrédéricDardel, François Képès, Bioinformatics: Genomics and Post-Genomics, John Wiley & Sons, Ltd
3. Teresa Attwood, Introduction to Bioinformatics, Pearson Education
4. Darbeshwar Roy, Bioinformatics, Narosa
5. David Mount, Bioinformatics, Cold Spring Harbor Laboratory Press
6. R. Durbin, S.R. Eddy, A. Krogh and G. Mitchison, Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic acids, Cambridge University Press

L=Lecture, T=Tutorial, P=Practical, C=Credit

^this is not an exhaustive list