Course Title:	**Bioinformatics**
Course Code:	**BSTA-403**
Semester:	**VII**
Credit Hours:	**03**

Learning Outcomes

By the end of this course, students will be able to:

1. understand the basic principles and concepts in exploring sequence storage, retrieval and analysis.
2. develop understanding of gene and protein at structural level using computational tools.
3. demonstrate the ability to apply skills in a professional environment via an industrial or academic internship.

Course Outline

Unit – I

1.1 Basic Concepts of Bio Informatics
Cell, Molecule, Gene, Chromosom, DNA, RNA, Protein, Connection DNA-RNA-Protein, Protein structures, Protein functions.

1.2 Bio-Chemical Properties
Bio-chemical properties of Amino Acids, Motif, Domain, Protein Families, Evolution, Similarity, Homology.

1.1 Optimal Search
Means-Ends Analysis, Problem Reduction, Goal Tree, DepthFSearch, BreadthFSearch, BestFSearch, Optimal Search, Branch and Bound, Dynamic Programming Principle, (Minimax-procedure, Alpha-Beta pruning).

Unit – II

1.1 Scoring System and Alignment
PAM-Matrices (Dayhoff), BLOSUM (Henikoff and Henikoff), Scoring Systems based on Amino Acid Classifications. Cost (measure) of Multiple Alignment, Dynamic Programming, Progressive Alignment (CLUSTAL), Use of Local Multiple Alignment.

1.2 Positions of DNA Sequence
Methods for finding Relative Positions of DNA Sequences on a Chromosome. (Small and Large scale). Construction using Character States, Construction using Distance Matrices.

Unit – III

1.1 Statistical Significance

Statistical significance, Dot matrix methods, Dynamic programming (MPSearch), FASTA, BLAST, Search with profiles. The PROSITE-database, Sequence Driven Methods, Pattern Driven Methods.

1.2 RNA Structure Prediction
Introduction to the RNA Secondary Structure Prediction and Protein Folding problems.

- **Teaching-learning Strategies:**

Class Lecture method, which includes seminars, discussions, assignments and projects. (Audio-visual tools are used where necessary)

- **Assignments-Types and Number with calendar:**

According to the choice of respective teacher.

- **Assessment and Examinations:**

According to the University's Semester Rules.

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	It takes place at the mid-point of the semester.
2.	Formative Assessment	25%	It is continuous assessment. It includes: Classroom participation, attendance, assignments, and presentations, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

Textbook:

1. Lesk, A. (2019). *Introduction to bioinformatics*. Oxford university press.

Suggested Readings:

1. Bult, C. J. (1998). *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins*. *Science*, *282*(5389), 635-636.
2. Gibas, C., Jambeck, P., & Fenton, J. (2001). *Developing bioinformatics computer skills*. " O'Reilly Media, Inc.".
3. Gu, J., & Bourne, P. E. (Eds.). (2009). *Structural bioinformatics* (Vol. 44). John Wiley &

Sons.
4. Krane, D. E. (2002). *Fundamental concepts of bioinformatics*. Pearson Education India.
5. Su, C. (2006). Bioinformatics: *A Practical Guide to the Analysis of Genes & Proteins, (third editon)*. Edited by Andreas D. Baxevanis and BF Francis Ouellette New York: John Wiley & Sons.