Department of Food Sciences
University of the Punjab, Lahore
Course Outline

Programme	B.Sc. (Hons.) Food Science & Technology	**Course Code**	BIOT-302	**Credit Hours**	3(2-1)
Course Title	**Introductory Bioinformatics**				

Course Introduction

This course is designed to provide a foundational understanding of the tools and techniques used in the analysis of biological data. Students will explore key concepts such as DNA sequence analysis, protein structure prediction, and genomic data interpretation. This course will equip students with the knowledge and practical experience to navigate the rapidly growing field of bioinformatics.

Learning Outcomes

On the completion of the course, the students will:

· Gain a solid understanding of the basic principles and concepts of bioinformatics, including sequence alignment, database searching, and data visualization.

· Develop proficiency in using bioinformatics tools and software for analyzing and interpreting biological data, such as sequence alignment tools, genome browsers, and protein modeling software.

· Learn to apply bioinformatics methods to real-world biological research questions, enhancing your ability to conduct independent research and contribute to interdisciplinary projects.

	Course Content	Assignments/Readings
Week 1	**Unit-I** 1.1 Introduction to Bioinformatics	
	1.2 Biological Information	
Week 2	**Unit-II** 2.1 Introduction to Molecular Biology	
	2.2Nucleic Acid Databases	
Week 3	**Unit -III** 3.1 Introduction to Protein Structure and Function	
	3.2 Protein Databases	
Week 4	**Unit IV** 4.1 Sequence Alignment Algorithms	
	4.2 Pairwise sequence Alignment tools	

Week 5	**Unit V** 5.1 Multiple Sequence Alignments: Clustal Omega, MUSCLE	
	5.2 Phylogenetic Analysis introduction and Tree Building Methods	
Week 6	**Unit VI**	
	6.1 Primer Designing	
	6.2 Primer Designing	
Week 7	**Unit VII** 7.1 Introduction to Gene Prediction	
	7.2 Functional Annotation of Genes	
Week 8	**Unit VIII** 8.1 Introduction to Microarrays and RNA-Seq	
	8.2 Differential Gene Expression Analysis	
Week 9	**Unit IX** 9.1 Introduction to Protein-Protein Interactions	
	9.2 Protein Interaction Networks	
Week 10	**Unit X** 10.1 Introduction to Systems Biology	
	10.2 Integration of Biological Data	
Week 11	**Unit XI** 11.1 Introduction to Next-Generation Sequencing (NGS) Technologies	
	11.2 RNA-Seq and Applications (Transcriptome Analysis)	
Week 12	**Unit XII** 12.1 Introduction to Genome Variation: SNPs, Indels, CNVs	
	12.2 Applications of Genome Variation Analysis (GWAS)	
Week 13	**Unit XIII** 13.1 Introduction to Cheminformatics: Molecules and Chemical Databases (PubChem)	
	13.2 Drug Discovery and Design using Bioinformatics	

Week 14	**Unit XIV** 14.1 Bioinformatics Tools and Resources for Biomedical Research	
	14.2 Introduction to Bioethics and Data Sharing in Bioinformatics	
Week 15	**Unit XV** 15.1 Introduction to Bio-python and Programming for Bioinformatics	
	15.2 Applications of Python Scripting in Bioinformatics	
Week 16	**Unit XVI** 16.1 Course Review: Applications of Bioinformatics in Different Fields	
	16.2 Future Directions in Bioinformatics	
PRACTICAL		
Week 1	Introduction to NCBI Databases (GenBank, PubMed) Sequence Retrieval using BLAST	
Week 2	Introduction to Sequence Alignment Tools (CLUSTAL Omega, BLAST)	
Week 3	Building Phylogenetic Trees using Multiple Sequence Alignments	
Week 4	Exploring Gene Prediction Tools (GeneScan) Introduction to Functional Annotation Databases (GO, KEGG)	
Week 5	Introduction to Microarray Data Analysis Tools	
Week 6	Introduction to Protein Structure Visualization Tools (PyMOL) Exploring Protein Interaction Databases (STRING)	
Week 7	NGS Data Analysis: Introduction to RNA-Seq Analysis Tools	
Week 8	Genome Variation Analysis: Exploring SNP Databases (dbSNP)	
Week 9	Introduction to Cheminformatics Databases (PubChem)	

	Exploring Drug Discovery Tools	
Week 10	Introduction to Bio-python Scripting (Basics)	
Week 11	Automating Sequence Analysis Tasks with Bio-python Scripts	
Week 12	Bioinformatics Project: Design and Problem Selection	
Week 13	Physio-chemical Analysis of Proteins	
Week 14	Protein Structure Formation using different Insilico Tools	
Week 15	Bioinformatics Project: Data Analysis, Interpretation, and Report Writing	
Week 16	Bioinformatics Project Presentations and Course Evaluation	

Textbooks and Reading Material

1. Claverie, J.M. & Notredame C. (2003) Bioinformatics for Dummies. Wiley Editor.

2. Letovsky, S.I. (1999). Bioinformatics. Kluwer Academic Publishers.

3. Baldi, P. & Brunak, S. (1998) Bioinformatics. The MIT Press.

4. Setubal, J. & Meidanis, J. 1996 Introduction to Computational Molecular Biology. PWS Publishing Co., Boston.

5. Lesk, A.M. (2002) Introduction to Bioinformatics. Oxford University Press.

6. Rastogi, S.C., Mendiratta, N. & Rastogi, P. (2004) Bioinformatics: Concepts, Skills & Applications. CBS Publishers & Distributors, New Delhi.

7. Jae, K.L. (2002). Statistical Bioinformatics, John Wiley & Sons Inc.

8. Krawetz, A. & Womble, D. (2002). Introduction to Bioinformatics. (A Theoretical and Practical Approach). Humana Press.

Teaching Learning Strategies

1. Lecture and Presentation
2. Practical Sessions
3. Case Studies and Realworld Applications
4. Group Projects and Collaborative Learning
5. Interactive Discussions and Q&A Sessions

Assignment: Types and Number with Calendar

1. Assignments
2. Quiz
3. Presentations
4. Class participation/attendance

Assessment

Sr. No.	Elements	Weight age	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination 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.