	Media.	
Learning Outcomes	Students should: • Gain ability to investigate, design and conduct experiments, analyze and interpret data, and apply laboratory skills to solve complete bioprocess technology problems. • Use acquired skills and knowledge in solving problems typical of bio-industry and research.	

Programme: M. Sc. Biotechnology

Course Code: GBO-184 **Title of the Course:** Lab VI- Bioinformatics

Number of Credits: 1

Effective from AY: 2019-2020

Prerequisites for the course:	No prerequisites required.	
Objective:	The aim is to provide practical training in bioinformatics and statistical methods including accessing major public sequence databases.	
Content:	**MODULE I** 1. Using NCBI and Uniprot web resources. 2. Introduction and use of various genome databases. 3. Sequence information resource: Using NCBI, EMBL, Genbank, Entrez, Swissprot/ TrEMBL, UniProt. 4. Similarity searches using tools like BLAST and interpretation of results. 5. Multiple sequence alignment using ClustalW.	24 hours

	6. Phylogenetic analysis of protein and nucleotide sequences. 7. Use of gene prediction methods (GRAIL/Genscan,/Glimmer). 8. Use of various primer designing and restriction site prediction tools. 9. Use of different protein structure prediction databases (PDB, SCOP, CATH). 10. Construction and study of protein structures using RASMOL/Deepview/PyMol. 11. Homology modelling of proteins. 12. Use of tools for mutation and analysis of the energy minimization of protein structures.	
Pedagogy:	lectures/ tutorials/assignments/self-study	
References/Readings	1. A.D. Baxevanis and B.F.F. Ouellette (Eds). (2002), *Bioinformatics: a Practical Guide* 2. *to the Analysis of Genes and Proteins*, John Wiley and Sons. 3. D.W. Mount, (2001), *Bioinformatics: Sequence and Genome Analysis*, Cold Spring 4. Harbor Laboratory Press. 5. Jones & Peuzner, (2004); *Introduction to Bioinformatics Algorithms*; Ane 6. Books, India. 7. Dov Stekel, (2003); *Microarray Bioinformatics*; Cambridge 8. Bioinformatics:concepts skills and applications (2004).S.C. Rastogi, N. Mendiratta and P. Rastogi. 9. Bioinformatics: A modern approach . (2005) V.R. Srinivas. 10. Essential Bioinformatics (2006). J. Xiong. 11. Statistical methods in Bioinformatics: An introduction. (2005). W. Even and G. Grant 12. Bioinformatics: A Practical Approach 2007 Shui Qing (Chapman & Hall/CRC Mathematical and Computational Biology)	
Learning Outcomes	On completion of this course, students should be able to: • describe contents and properties of important bioinformatics databases, perform text- and sequence-	

	based searches, analyse and discuss results in the light of molecular biology knowledge; • explain major steps in pairwise and multiple sequence alignment, explain its principles and execute pairwise sequence alignment by dynamic programming; • predict secondary and tertiary structures of protein sequences; • perform and analyse various statistical tools available to analyse the data.	

Programme: M. Sc. Biotechnology

Course Code: GBO-186 **Title of the Course:** Field Trip and Report

Number of Credits: 1

Effective from AY: 2019-2020

Programme: M. Sc. Biotechnology

Course Code: GBO-187 **Title of the Course:** IPR, Biosafety And Bioethics

Number of Credits: 2

Effective from AY: 2019-2020

Prerequisites for the course:	No prerequisites required.	
Objective:	To provide basic knowledge onintellectual property rights and theirimplications in biological research andproduct development; • To become familiar with India'sIPR Policy; • To learn biosafety and risk assessmentof products derived from biotechnology and regulation of such products; • To become familiar with ethical issuesin biological research. This coursewill focus on consequences	