

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
Syllabus of B.Sc.(Honors & Honors with Research) as per NEP-2020
Faculty of Life Sciences
Effective from June 2026
Subject: Biotechnology
SEMESTER-8

SUMMARY OF THE SYLLABUS

Sr. No.	Category of Course	Course Title	Course Level	Credit	Teaching Hours	Internal Marks	External Marks	Practical Internal Marks	Practical External Marks	Total Marks
1	MINOR-8	Foundations of Bioinformatics (<i>Theory</i>)	6.0	3	45	25	50	-	-	75
2	MINOR-8	Foundations of Bioinformatics (<i>Practical</i>)	6.0	1	30	-	-	25	-	25

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Course Level	UG (6.0)	Internal Marks	25
Programme	B.Sc. Microbiology	External Marks	50
Semester	VIII	Practical Internal	25
Category of Course	MINOR-8	Practical External	-
Course Credit	4 (3T+1P)	Prac. External Exam Duration	-
Teaching Hours	75 (45T+30P)	Total	100
Course Code	MINBTT801	Exam Duration	2 hrs.
Course Title	Foundations of Bioinformatics (Theory)		

Course Objectives:

The objectives of this course are:

1. To provide an integrated understanding of the theoretical and practical aspects of bioinformatics.
2. To introduce computational approaches used for the analysis of biological data.
3. To develop skills in gene and protein sequence analysis using bioinformatics tools and databases.
4. To understand the organization, retrieval, and interpretation of biological information from various databases.
5. To apply bioinformatics techniques for studying genes, proteins, molecular evolution, and disease-associated biomolecules.

Course Learning Outcomes (COs)

Upon successful completion of this course, students will be able to:

1. Demonstrate a clear understanding of fundamental concepts, principles, and applications of bioinformatics.
2. Analyze gene and protein sequences using appropriate bioinformatics tools and software.
3. Retrieve, interpret, and utilize information from major biological databases.
4. Perform comprehensive analyses of genes and proteins, including sequence alignment and functional annotation.
5. Compare biological sequences and identify similarities, variations, evolutionary relationships, and functional significance.

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Course Contents

Unit No.	Syllabi	Teaching Hours
1	Introduction to Bioinformatics - Overview of Bioinformatics: Definition, Scope, Branches and Applications - History and development of Bioinformatics - Overview of Genome Projects and Human Genome Project - Major Bioinformatics Resources: NCBI, EBI, SIB, ExPASy, JCVI, Sanger Institute, KEGG, NIH and NIG	10
2	Biological Databases - Nature, organization and types of biological databases - Nucleic acid sequence databases: GenBank, ENA and DDBJ - Protein databases: UniProt, InterPro, RCSB-PDB and MMDB - Structural Classification of Proteins: SCOP and CATH - Database searching and information retrieval	11
3	Sequence Alignment and Visualization - Introduction to biological sequences, alignments and Dynamic Programming - Global and Local sequence alignment - Multiple sequence alignment (ClustalW Algorithm) - Pairwise sequence alignment using BLAST and FASTA algorithms - Sequence visualization and interpretation	12
4	Phylogenetic Analysis and Genome Annotation - Introduction to phylogenetic analysis and its applications - Types of phylogenetic trees• Methods of phylogenetic tree construction - Genome annotation and gene prediction - Functional annotation of genes and proteins - Applications of phylogenetic analysis in evolutionary studies	12

Suggested Reading:

1. Attwood and Parry-Smith (1999) Introduction to Bioinformatics by Harlow, Essex, England : Longman
2. Baxevanis and Ouellette (1998) Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. John Wiley & Sons, Inc.

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3. C.W. Sensen (2002) Essentials of Genomics and Bioinformatics. WILEY-VCH Verlag GmbH 53
4. Mount (2004) Bioinformatics: Sequence and Genome Analysis. 2nd edition Cold Spring Harbor Laboratory Press.
5. Lesk (2002). Introduction to Bioinformatics. 5th edition. Oxford University Press
6. Rastogi, Mendiratta and Rastogi (2004). Bioinformatics: Concepts, Skills & Applications. CBS Publishers & Distributors
7. Old & primrose (2006) Principle of Gene Manipulation, 7th edition Blackwell Pub.
8. Brown (2020) Gene Cloning DNA analysis, 8th edition Wiley -Blackwell Pub.
9. Karp (2004) Cell& Molecular Biology: concepts & Experiments.4th Edition.
10. Watson, Baker, Bell, Gann, Levine, Losick (2017). Molecular Biology of the Genes. 7th edition. Pearson Publication.

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Suggested Practical Course:

Sr. No.	Practical	Teaching Hours
1	Retrieval of nucleotide sequences from public databases: GenBank, ENA, and DDBJ .	30
2	Retrieval and analysis of protein sequences from the UniProt database.	
3	Protein sequence analysis and functional annotation using InterPro .	
4	Similarity searching of nucleotide and protein sequences using BLAST and FASTA algorithms.	
5	Pairwise and Multiple Sequence Alignment (MSA) of biological sequences using ClustalW and related tools.	
6	Retrieval of protein three-dimensional (3D) structures from RCSB-PDB and visualization using RasMol .	
7	Measurement and analysis of bond lengths, bond angles, and torsion angles in protein structures using RasMol .	

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1. Attwood and Parry-Smith (1999) Introduction to Bioinformatics by Harlow, Essex, England : Longman
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**Theory Paper Style:
(Major and Minor)**

Time: 2 Hours

Total Marks: 50

Instructions:

1. Illustrate your answer with neat and labelled diagrams.
2. Figure to the right side indicates full marks of questions.

EXTERNAL ASSESSMENT BY UNIVERSITY			
Que. No.	Particulars	Unit	Marks
Que. 1	(1)	Unit 1	05
	(2)		05
	Or		
	(1)		05
	(2)		05
Que. 2	(1)	Unit 2	05
	(2)		05
	Or		
	(1)		05
	(2)		05
Que. 3	(1)	Unit 3	05
	(2)		05
	Or		
	(1)		05
	(2)		05
Que. 4	(1)	Unit 4	05
	(2)		05
	Or		
	(1)		05
	(2)		05
Que. 5	(1)	Unit 1 & 2	05
	(2)		05
	Or		
	(1)	Unit 3 & 4	05
	(2)		05
Total			50

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INTERNAL EVALUATION SCHEME (MAJOR)			
INTERNAL ASSESSMENT			
No.	Particulars	Marks	Weightage
1	Internal Test	50	25
2	Assignment		10
3	Field visit report/ class presentation		10
4	Attendance		05
	Total		50

INTERNAL EVALUATION SCHEME (MINOR)			
INTERNAL ASSESSMENT			
No.	Particulars	Marks	Weightage
1	Internal Practical	50	25
2	Internal Test		10
3	Field visit report/ class presentation		10
4	Attendance		05
	Total		50

INTERNAL EVALUATION SCHEME		
INTERNAL ASSESSMENT		
No.	Particulars	Weightage
1	Practical Performance	40
2	Viva	10
	Total	50

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Paper Style:

INTERNAL EVALUATION SCHEME		
INTERNAL ASSESSMENT PRACTICAL		
No.	Particulars	Weightage
1	Perform any Four practical from the given list of exercises as per the instruction of the examiner.	40
2	Viva	10
Total		50

ASSESSMENT BY UNIVERSITY		
Que. No.	Particulars	Marks
EXTERNAL EXAMINER		
1	Perform any Three or Four practical from the given list of exercises as per the instruction of the examiner	40
2	Viva-voce	10
Total		50