

**BIOTECHNOLOGY**  
**Subject Code - 045**  
**Class XI-XII (2025-26)**

An unprecedented growth of human knowledge in the field of Biological Sciences coupled with equally significant developments in the field of technology have brought significant changes into existing social and economic systems. The emerging field of Biotechnology is likely to further enhance the applications of Science and Technology for human welfare. Modern Biotechnology processes encompass a wide range of new products such as antibiotics, vaccines, monoclonal antibodies and many more. Furthermore, developments in recombinant DNA technology have yielded numerous new useful products in the fields of healthcare and agriculture. The present syllabus takes care of all these aspects. Due emphasis has been laid on familiarizing the learners with the fundamental concepts, basic techniques and their applications. It is expected that the knowledge gained through the study of different topics and the skills acquired through the prescribed practical work will make the learners competent to meet the challenges of academic as well as professional courses after studying the subject at senior secondary stage.

**Objectives**

The broad objectives of teaching Biotechnology at senior secondary level are to:

- help the learners know and understand basic facts and concepts of the subject at elementary stage.
- expose the students to different basic processes and basic techniques used in Biotechnology.
- familiarize the learners to understand the relationship of the subject to health, nutrition, environment, agriculture and industry, etc.
- develop conceptual competence in the learners so as to cope up with professional courses in future career.
- acquaint students with different applications of Biotechnology in everyday life.
- develop an interest in students to study Biotechnology as a discipline.

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**COURSE STRUCTURE**

**Time: 3 hours**

**Max. Marks: 70+30**

<b>Units</b>		<b>Marks</b>
Unit- I	Biotechnology: An overview	5
Unit-II	Molecules of Life	20
Unit-III	Genetics and Molecular Biology	20
Unit-IV	Cells and Organisms	25
	Practical	30
	<b>Total</b>	<b>100</b>

**Theory**

**Time: 3 hours**

**Max. Marks: 70**

**Unit-I Biotechnology: An overview**

**5 Marks**

**Chapter 1: Biotechnology: An Overview**

Historical Perspectives, Technology and Applications of Biotechnology, Global market and Biotech Products.

**Unit-II Molecules of Life**

**20 Marks**

**Chapter 1: Biomolecules: Building Blocks**

Building Blocks of Carbohydrates - Sugars and their Derivatives, Building Blocks of Proteins - Amino Acids, Building Blocks of Lipids- Simple Fatty Acids, Glycerol and Cholesterol, Building Blocks of Nucleic Acids – Nucleotides.

**Chapter 2: Macromolecules: Structure & Function**

Carbohydrates - The Energy Givers, Proteins - The Performers, Enzymes -The Catalysts, Lipids and Biomembranes - The Barriers, Nucleic Acids - The Managers

**Unit-III Genetics and Molecular Biology**

**20 Marks**

**Chapter 1: Concepts of Genetics**

Historical Perspective, Multiple Alleles, Linkage and Crossing Over, Genetic Mapping.

**Chapter 2: Genes and Genomes: Structure and Function**

Discovery of DNA as Genetic Material, DNA Replication, Fine Structure of the Genes, From Gene to Protein, Transcription – The Basic Process, Genetic Code, Translation, Mutations, Human Genetic Disorders.

**Chapter 1: The Basic Unit of Life**

Cell Structure and Components, Organization of Life

**Chapter 2: Cell Growth and Development**

Cell Division, Cell Cycle, Cell Communication, Nutrition, Reproduction, Immune Response in Animals.

**PRACTICALS**

**Note: Every student is required to do the following experiments during the academic session.**

1. Preparation of buffers and pH determination
2. Sterilization techniques
3. Preparation of bacterial growth medium
4. Cell counting
5. Sugar Estimation using Di Nitro Salicylic Acid test (DNS test)
6. Assay for amylase enzyme
7. Protein estimation by biuret method

**Scheme of Evaluation**

**Time: 3 Hours**

**Max. Marks 30**

**The scheme of evaluation at the end of session will be as under:**

Two experiments	:	20 Marks
Viva on experiments	:	5 Marks
Practical record	:	5 Marks

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**COURSE STRUCTURE**

**Time: 3 hours**

**Max. Marks: 70+30**

<b>Units</b>		<b>Marks</b>
<b>Unit V</b>	Protein and Gene Manipulation	40
<b>Unit VI</b>	Cell Culture and Genetic Manipulation	30
	<b>Practicals</b>	30
	<b>Total</b>	<b>100</b>

**Theory**

**Time: 3 hours.**

**Max. Marks: 70**

**Unit-V Protein and Gene Manipulation**

**40 Marks**

**Chapter-1: Recombinant DNA Technology**

Introduction, Tool of Recombinant DNA technology, making rDNA molecule, Introduction of recombinant DNA into host cells, Identification of recombinants, Polymerase Chain Reaction (PCR), DNA Sequencing.

**Chapter-2: Protein Structure and Engineering**

Introduction to the world of proteins, Structure-function Relationship in proteins, Characterization of proteins, Protein based products, Designing proteins (Protein Engineering)

**Chapter-3: Genomics, Proteomics and Bioinformatics**

Gene prediction and counting, Genome similarity, SNPs and Comparative genomics, Functional genomics, Proteomics, Information sources, Analysis using bioinformatics tools.

**Unit-VI Cell Culture and Genetic Manipulation**

**30 Marks**

**Chapter-1: Microbial Cell Culture and its Applications**

Introduction, Microbial nutrition and culture techniques, Measurement and kinetics of microbial growth, Isolation of microbial products, Strain isolation and improvement, Applications of microbial culture technology.

## **Chapter -2: Plant Cell Culture and Applications**

Introduction, Cell and tissue culture techniques, Applications of cell and tissue culture, Transgenic plants with beneficial traits, Biosafety of transgenic plants

## **Chapter-3: Animal Cell Culture and Applications**

Introduction, Animal cell culture techniques, Applications of animal cell culture, Stem cell technology.

## **PRACTICALS**

**30 Marks**

**Note: Every student will be required to do the following experiments during the academic session.**

1. Use of special equipment in biotechnology experiments
2. Isolation of bacterial plasmid DNA
3. Detection of DNA by gel electrophoresis
4. Estimation of DNA by UV spectroscopy
5. Isolation of bacteria from curd & staining of bacteria
6. Cell viability assay using Evan's blue dye exclusion method
7. Data retrieval and database search using internet site NCBI and download a DNA and protein sequence from internet, analyze it and comment on it
8. Reading of a DNA sequencing gel to arrive at the sequence
9. Project work

## Scheme of Evaluation

**Time: 3 hours**

**Max. Marks 30**

**The scheme of evaluation at the end of the session will be as under:**

A	Two experiments	6+6 (only one computer based practical)
	Practical record	04
	Viva on Practical	04
B	Project work	
	Write up	05
	Viva on project	05
	<b>Total</b>	<b>30</b>

**Note:** - More emphasis should be given on hands on work in projects.

### **Prescribed Books:**

1. **A Text Book of Biotechnology** - Class XI : Published by CBSE, New Delhi
2. **As reference- Biotechnology** - Class XI : Published by NCERT, New Delhi
3. **A Laboratory Manual of Biotechnology** - Class XI : Published by CBSE, New Delhi
4. **A Text Book of Biotechnology** - Class XII : Published by CBSE, New Delhi
5. **A Laboratory Manual of Biotechnology** - Class XII : Published by CBSE, New Delhi

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**Assessment Areas**

**Theory**

**Time: 3 hrs.**

**Max. Marks: 70 Marks**

Competencies	
Demonstrate, Knowledge and Understanding	50%
Application of Knowledge / Concepts	30%
Analyse, Evaluate and Create	20%

**Note:**

- Typology of questions: VSA including MCQs, Assertion – Reasoning type questions; SA; LA-I; LA-II; Source-based/ Case-based/ Passage-based/ Integrated assessment questions.
- An internal choice of approximately 33% would be provided.

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**Suggestive verbs for various competencies**

- **Demonstrate, Knowledge and Understanding**  
State, name, list, identify, define, suggest, describe, outline, summarize, etc.
  - **Application of Knowledge/Concepts**  
Calculate, illustrate, show, adapt, explain, distinguish, etc.
  - **Analyze, Evaluate and Create**  
Interpret, analyse, compare, contrast, examine, evaluate, discuss, construct, etc.
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