

10. Biotechnology (Code No. 045)

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

Course Structure

Class XI

(Theory)

One Paper (Three Hours)

70 Marks

Unit I Introduction to Biotechnology

10

Fundamentals of Biochemical Engineering
Biotechnology and Society

Unit II Biomolecules

20

Building Blocks of Biomolecules-Structure and dynamics
Structure and function of Macromolecules.
Biochemical Techniques

Unit III Cell and Development **20**

The basic unit of life
Cell Growth and development
Cellular Techniques

Unit IV Genetics and Molecular Biology **20**

Principles of Genetics
Genome Function
Genetical Techniques

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 (Wet and Dry Sterilization, Chemical sterilization and Ultrafiltration).
3. Media preparation (Solid and Liquid LB medium)
4. Isolation of bacteria from curd and staining of bacteria.
5. Determination of bacterial growth curve.
6. Study of various stages of mitosis and calculation of mitotic index.
7. Preparation of Karyotype.
8. Cell counting (using Haemocytometer)
9. Isolation of genomic DNA.
10. Detection of DNA by gel electrophoresis.
11. Isolation of milk protein (casein)
12. Estimation of protein by Biuret method.
13. Assaying the enzyme acid phosphatase.

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

**CLASS XII
(THEORY)**

One paper

Time: 3Hours

Total Marks : 70

Unit V: Protein and Gene Manipulation

Marks 40

Chapter I: Protein Structure and Engineering

15 Marks

Introduction to the world of Proteins
3-D Shape of Proteins
Structure Function relationship in Proteins
Purification of Proteins
Characterization of Proteins
Protein based products
Designing Proteins
Proteomics

Chapter II: Recombinant DNA Technology

15 Marks

Introduction
Tools of rDNA Technology
Making Recombinant DNA
DNA Library
Introduction of Recombinant DNA into host cells
Identification of recombinants
Polymerase Chains Reaction (PCR)
DNA Probes
Hybridization Techniques
DNA Sequencing
Site-directed mutagenesis

Chapter III: Genomics and Bioinformatics

10 Marks

Introduction
Genome Sequencing Projects
Gene Prediction and counting
Genome similarity, SNP's and comparative genomics
Functional Genomics
History of Bioinformatics
Sequences and Nomenclature
Information Sources
Analysis using Bioinformatics tools.

Unit VI : Cell Culture Technology

30 Marks

Chapter I: Microbial Culture and Applications

Introduction
Microbial Culture Techniques
Measurement and Kinetics of microbial Growth
Scale up of microbial process
Isolation of microbial products
Strain isolation and Improvement
Applications of microbial culture technology
Bioethics in microbial technology

Chapter II: Plant Cell Culture and Applications

Introduction
Cell and Tissue Culture Techniques
Applications of Cell and Tissue Culture
Gene Transfer Methods in Plants
Transgenic Plants with Beneficial Traits
Diagnostics in Agriculture and Molecular Breeding
Bioethics in Plant Genetic Engineering

Chapter III: Animal Cell Culture and Applications

10 Marks

Introduction
Animal Cell Culture Techniques
Characterisation of Cell Lines
Scale-up of Animal Culture Process
Applications of Animal Cell Culture
Stem Cell Technology
Bioethics of Genetic Engineering in Animals

Practicals

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

List of Experiments

1. Isolation of bacterial plasmid DNA and its detection by gel electrophoresis
2. Restriction digestion of plasmid DNA and its analysis by gel electrophoresis
3. Bacterial transformation using any plasmid
4. Data retrieval and data base search using internet site NCBI
5. Download a DNA and protein sequence from internet, analyse and comment on it.
6. Cell viability assay (using Evans blue Stain)
7. Determination of blood groups.
8. Estimation of DNA
9. Ion-exchange chromatography for proteins.
10. Reading of a DNA sequencing gel and arrive at the sequence.
11. Estimation of blood glucose by enzymatic method (GOD/POD)
12. 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 Practicals	:	04
B.	Project work	:	
	Write up	:	05
	Viva on project	:	05

Total 30

Recommended Books:

1. **A Textbook of Biotechnology**-Class XI: published by CBSE, New Delhi.
2. **A Laboratory Manual of Biotechnology**-Class XI: published by CBSE, New Delhi.
3. **A Textbook of Biotechnology**-Class XII: published by CBSE, New Delhi
4. **A Laboratory Manual of Biotechnology**-Class XII: published by CBSE, New Delhi.