

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 Fundamentals of Biochemical Engineering Biotechnology and Society	10
Unit II	Biomolecules Building Blocks of Biomolecules-Structure and dynamics Structure and function of Macromolecules	20

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.

LIST OF EXPERIMENTS

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 viability assay (using Evans blue stain)
9. Cell counting (using Haemocytometer)
10. Determination of blood groups.
11. Isolation of genomic DNA.
12. Detection of DNA by gel electrophoresis.
13. Estimation of DNA.
14. Isolation of milk protein (casein)
15. Estimation of protein by Biuret method.
16. Assaying the enzyme acid phosphate.

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)**

Time : 3 Hours

One paper

Total Marks : 70

Unit V : Protein and Gene Manipulation

Marks 40

Chapter 1 : Protein Structure and Engineering

15

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

Introduction

Tools of rDNA Technology

Making Recombinant DNA

DNA Library

Introduction of Recombinant DNA into host cells

Identification of recombinants

Polymerase Chain Reaction (PCR)

DNA Probes

Hybridization Techniques

DNA Sequencing

Site-directed mutagenesis

Chapter III : Genomics and Bioinformatics

10

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	Marks 30
Chapter I :	Microbial Culture and Applications	10
	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	10
	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
	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 (XII)

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

5. Multiplication of tobacco by nodal bub culture
6. Data retrival and data base search using internet site NCBI
7. Download a DNA and protein sequence from internet, analyse and comment on it.
8. Determination of N-terminal of a protein
9. Ion-exchange chromatography for proteins.
10. Production and estimation of ethanol from micobial culture.
11. Reading of a DNA sequencing gel and arrive at the sequence.
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.	One experiment	:	07
	Practical record	:	04
	Viva on Practicals	:	04
B.	Project work	:	
	Write up	:	10
	Viva	:	05
Total			30

Recommended Books :

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