

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 of 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 (2016-17)

One Paper

Time: 3 hrs.
Max. Marks 70+30

Units		No. of Periods	Marks
Unit-I	Biotechnology: An overview	20	5
Unit-II	Molecules of Life	50	20
Unit-III	Genetics and Molecular Biology	50	20
Unit-IV	Cells and Organisms	60	25
	Practical	60	30
	Total	240	100

**CLASS XI
(Theory)**

One Paper

Time : 3 hrs
Total Marks: 70 180 Periods

Unit-I Biotechnology: An overview **5 Marks 20 Periods**

Chapter 1: Biotechnology : An overview

Historical Perspectives, Technology and Applications of Biotechnology, Global market and Biotech Products, Public Perception of Biotechnology, Biotechnology in India and Global Trends

Unit-II Molecules of Life **20 Marks 50 Periods**

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, Sphingosine, Glycerol and Cholesterol, Building blocks of Nucleic Acids - Nucleotides, Biochemical Transformations

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 50 Periods**

Chapter 1: Concepts of Genetics

Historical Perspective, Multiple Alleles, Linkage and Crossing Over, Genetic Mapping, Gene Interaction, Sex-Linked Inheritance, Extranuclear Inheritance, Quantitative Inheritance, Genes at the Population Level

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, Regulation of Gene Expression, Mutations, DNA Repair, Human Genetic Disorders, Genome Organization

Unit-IV Cells and Organisms **25 Marks 60 Periods**

Chapter 1: The Basic Unit of Life

Cell Structure and Components, Tissues and Organs, Stem Cells, Biodiversity, Organization of life

Chapter 2: Cell Growth and Development

Cell Division, Cell Cycle, Cell Communication, Nutrition, Gaseous Exchange, Internal Transport, Maintaining the Internal Environment, Reproduction, *In Vitro* Fertilization, Animal and Plant Development, Immune Response in Animals, Programmed Cell Death, Defense Mechanisms in Plants

PRACTICALS

60 Periods

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

1. Preparation of buffers and pH determination
2. Isolation of milk protein (Casein)
3. Estimation of protein by biuret method
4. Assaying the enzyme acid phosphate
5. Estimation of blood glucose by enzymatic method (GOD/POD)
6. Isolation of bacterial plasmid DNA.
7. Isolation of genomic DNA
8. Estimation of DNA
9. Detection of DNA by gel electrophoresis
10. Cell counting
11. Study of various stages of mitosis and calculation of mitotic index
12. Preparation of karyotyping

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

BIOTECHNOLOGY (CODE - 045)**QUESTION PAPER DESIGN****CLASS - XI (2016-17)**

Time 3 Hours

Max. Marks: 70

S. No.	Typology of Questions	Very Short Answer (VSA) (1 mark)	Short Answer-I (SA-I) (2 marks)	Short Answer-II (SA-II) (3 marks)	Long Answer (L.A.) (5 marks)	Total Marks	% Weightage
01	Knowledge Based	2	2	2	--	12	17%
02	Conceptual Understanding	--	1	3	1	16	23%
03	Application Based and Inferential type	1	2	3	--	14	20%
04	Reasoning Based	2	2	1	1	14	20%
05	Skill Based	1	1	2	1	14	20%
	Total	6	8	11	3	70	100%

Total No. of questions = 28

1. No chapter wise weightage. Care to be taken to cover all the chapters.
2. The above template is only a sample. Suitable internal variations may be made for generating similar templates keeping the overall weightage to different form of questions and typology of questions same.

CLASS XII (2016-17)
(THEORY)
COURSE STRUCTURE

One Paper

Max. Marks 70+30

Time: 3 hrs.

Units		No. of Periods	Marks
Unit-V	Protein and Gene Manipulation	100	40
Unit-VI	Cell Culture and Genetic Manipulation	80	30
	Practical	60	30
Total		240	100

One paper

Time: 3 hrs.

Total Marks: 70 180 Periods

Unit-V Protein and Gene Manipulation

40 Marks 100 Periods

Chapter-1: Recombinant DNA Technology

Introduction, Tool of rDNA technology, Making rDNA, Introduction of recombinant DNA into host cells, Identification of Recombinants, Polymerase Chain Reaction (PCR), Hybridization Techniques, DNA Library, DNA Sequencing, Site-directed Mutagenesis

Chapter-2: Protein Structure and Engineering

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 (Protein Engineering)

Chapter-3: Genomics and Bioinformatics

Introduction, Genome Sequencing Projects, Gene prediction and counting, Genome Similarity, SNPs and comparative Genomics, Functional Genomics, Proteomics, History of Bioinformatics, Sequences and nomenclature, Information Sources, Analysis using Bioinformatics tools

Unit-VI Cell Culture and Genetic Manipulation

30 Marks 80 Periods

Chapter-1: Microbial Culture and Applications

Introduction, Microbial Nutrition and 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, Biosafety issues in Microbial Technology

Chapter-2: Plant Cell Culture and Applications

Applications

Introduction, Cell and Tissue Culture Techniques, Applications of Cell and Tissue Culture, Gene Transfer Methods in Plants, Transgenic Plants with Beneficial Traits, Biosafety in plant genetic of Transgenic Plants

Chapter-3: Animal Cell Culture and Applications

Introduction, Animal Cell Culture Techniques, Characterisation of Cell lines, Methods of Gene Delivery into Cells, Scale-up of Animal Culture Process, Applications of Animal Cell Culture, Stem Cell Technology, Tissue Engineering

PRACTICALS

30 Marks 60 Periods

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

List of Experiments

1. Restriction digestion of plasmid DNA and its analysis by gel electrophoresis
2. Bacterial transformation using any plasmid
3. Sterilization techniques
4. Preparation of bacterial growth medium
5. Isolation of bacteria from curd and staining of bacteria
6. Determination of bacterial growth curve
7. Cell viability assay
8. Data retrieval and data base search using internet site NCBI
9. Download a DNA and protein sequence from internet, analyse it and comment on it
10. Reading of DNA sequencing gel to arrive at the sequence
11. 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

Prescribed Books:

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

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BIOTECHNOLOGY (CODE - 045)
QUESTION PAPER DESIGN
CLASS XII (2016-17)

Time 3 Hours

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