BIOTECHNOLOGY

An unprecedented growth of human knowledge in the field of Biological Sciences coupled with equally significatn 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.

BIOTECHNOLOGY

THEORY

COURSE STRUCTURE

CLASS - XI

One Paper ***Time : 3 Hours*** ***70 Marks***

Unit	Contents	Marks
I	Introduction to Biotechnology	10
II.	Biomolecules	20
III.	Cell and Development	20
IV.	Genetics and Molecular Biology	20
	Total	**70**

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 Gowth 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. Sterlization techniques (Wet and Dry Sterlization, Chemical sterlization and Ultrafiltration)
3. Media preparation (Solid and Liquid LB medium)
4. Isolation of bacterial 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 protection (casein).
12. Estimation of protein by Biuret method.
13. 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

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DESIGN
QUESTION PAPER/UNIT TEST

Subject : BIOTECHNOLOGY
Unit/Paper : Theory
Class : XI
Time : 3 Hours
Full Marks : 70

I. WEIGHTAGE TO OBJECTIVES :

Objectives	K	U	A	S	Total
Percentage of Marks	35	45	15	05	100
Marks	25	31	10	04	70

II. WEIGHTAGE TO FORM OF QUESTIONS :

Forms of Questions	E	SA-I	SA-II	VSA	O	Total
No. of Questions	03	07	10	10	04	34
Marks Allotted	15	21	20	10	04	70
Estimated Time (in Minutes)	60	42	40	30	08	180

III. WEIGHTAGE TO CONTENT :

Unit	Contents	Marks
1.	Introduction to Biotechnology	10
2.	Biomolecules	20
3.	Cell and Development	20
4.	Genetics & Molecular Biology	20
	Total :	**70**

IV. SCHEME OF SECTIONS : Nil

V. SCHEME OF OPTIONS: Nil

VI. DIFFICULTY LEVEL :

Difficult : 15% marks
Average : 50% marks
Easy : 35% marks

Abbreviation : K (Knowledge), U (Understanding), A (Application), S (Skill), E (Essay Type), SA (Short Answer Type), VSA (Very Short Answer Type), O (Objective Type)

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BIOTECHNOLOGY
THEORY
COURSE STRUCTURE
CLASS - XII

One Paper ***Time : 3 Hours*** ***70 Marks***

Unit	Contents		Marks
I.	**Protein and Gene Manipulation**		
	Chapter I	Protein Structure and Engineering	15
	Chapter II	Recombinant DNA Technology	15
	Chapter III	Genomics and Bioinformatis	10
II.	**Cell Culture Technology**		
	Chapter I	Microbial Cultural and Application	10
	Chapter II	Plant Cell Culture and Application	10
	Chapter III	Animal Cell Culture and Application	10
		Total	**70**

Unit-I : Protien 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 DNA 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 Production and counting
Genome similarity, SNP's and comparative genomics
Functional Genomics
History of Bioinformatics
Sequences and Nomenclature
Information Sources
Analysis using Bioinformatics tools.

Unit-II : Cell Culture Technology **Marks 30**

Chapter I: Microbial Culture and Applications **10 Marks**

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 Marks**

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.

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 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.

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QUESTION PAPER/UNIT TEST

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Unit/Paper : Theory
Class : XII
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Marks Allotted	15	21	20	10	04	70
Estimated Time (in Minutes)	60	42	40	30	08	180

III. WEIGHTAGE TO CONTENT :

Units	Contents			Marks
1.	**Protein & Gene Manipulation**			
	i.	Protein Structure & Engineering	15	
	ii.	Recombinant DNA technology	15	40
	iii.	Genomic & Bioinformatics	10	
2.	**Cell culture Technology**			
	i.	Microbial Culture & Application	10	
	ii.	Plant Cell Culture & Application	10	30
	iii.	Animal Cell Culture & Application	10	
			Total :	**70**

IV. SCHEME OF SECTIONS : Nil

V. SCHEME OF OPTIONS: Nil

VI. DIFFICULTY LEVEL :

Difficult : 15% marks
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