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.

CLASS- XI (2020-21)

COURSE STRUCTURE

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

Time: 3 hrs.
Max. Marks 70+30
Unit-I Biotechnology: An overview

Chapter 1: Biotechnology: An Overview
Historical Perspectives, Technology and Applications of Biotechnology, Global market and Biotech Products.

Unit-II Molecules of Life

Chapter 1: Biomolecules: Building Blocks

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

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.

Unit IV: Cells and Organisms

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 Mark
## CLASS XII (2020-21)
### COURSE- STRUCTURE- (THEORY)

<table>
<thead>
<tr>
<th>Units</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit V</td>
<td>40</td>
</tr>
<tr>
<td>Protein and Gene Manipulation</td>
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</tr>
<tr>
<td>Unit VI</td>
<td>30</td>
</tr>
<tr>
<td>Cell Culture and Genetic Manipulation</td>
<td></td>
</tr>
<tr>
<td>Practicals</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

**One Paper**

Max. Marks 70+30

Time: 3 hrs.

Total Marks: 70

**Unit-V Protein and Gene Manipulation**

40 Marks

**Chapter-1: Recombinant DNA Technology**

Introduction, Tool of DNA technology, Making of 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.

PRACTICAL 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
Max. Marks 30

Time: 3 Hours

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

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Two experiments</td>
<td>6+6 (only one computer based practical)</td>
</tr>
<tr>
<td></td>
<td>Practical record</td>
<td>04</td>
</tr>
<tr>
<td></td>
<td>Viva on Practical</td>
<td>04</td>
</tr>
<tr>
<td>B</td>
<td>Project work</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Write up</td>
<td>05</td>
</tr>
<tr>
<td></td>
<td>Viva on project</td>
<td>05</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>30</td>
</tr>
</tbody>
</table>

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

Assessment Areas (Theory) 2020-21
Class XII
Biotechnology (045)

Time : 3 hrs. Maximum Marks: 70 Marks

<table>
<thead>
<tr>
<th>Competencies</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>Demonstrate Knowledge and Understanding</td>
<td>50%</td>
</tr>
<tr>
<td>Application of Knowledge / Concepts</td>
<td>30%</td>
</tr>
<tr>
<td>Analyse, Evaluate and Create</td>
<td>20%</td>
</tr>
</tbody>
</table>

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.

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.