

BIOTECHNOLOGY (878)

Aims:

1. To enable candidates to acquire the knowledge and develop an understanding of how materials are provided by biological agents to provide goods and services.
2. To appreciate the role played by biotechnology in improving health care for human beings.
3. To understand the interdisciplinary nature of this subject.
4. To create awareness about the appreciation of biological processes to industries.
5. To develop the ability to appreciate biological phenomenon in nature and the contribution of biotechnology to human welfare.
6. To develop scientific attitude towards biological phenomenon.

CLASS XI

There will be two papers in the subject:

Paper I: Theory: 3 hours ... 70 marks

Paper II: Practical: 3 hours ... 20 marks
Project Work ... 7 marks
Practical File ... 3marks

PAPER I –THEORY- 70 Marks

There will be **one** paper of **three** hours duration divided into **two** parts.

Part 1 (20 marks) will consist of compulsory short answer questions, testing knowledge, application and skills relating to elementary/fundamental aspects of the entire syllabus.

Part 2 (50 marks) will consist of **eight** questions out of which the candidates will be required to answer **five** questions. Each question in this part shall carry 10 marks.

1. Introduction to Biotechnology

- (a) Historical background and the future of Biotechnology: definition and a brief introduction of the traditional techniques which are now covered under the heading Biotechnology. Different ways in which traditional principles of Biotechnology are being used for the betterment of mankind.
- (b) Basic concepts of Biochemical technology: What does biochemical technology mean? An understanding of various principles and

statistical methods involved in research under the umbrella of biotechnology.

- (c) Scope and importance of biotechnology: different branches of biotechnology and different regulatory, social, ethical and legal issues that a biotechnologist comes across while doing the work.

2. Cell Biology

- (a) Cell, basic unit of life: justification of cell as a basic unit of life. A brief note on the cell components with special reference to nucleus and its components. Various cytological techniques used in counting and identifying the cell and chromosomes.
- (b) Cell Division and cell cycle: necessity for a cell to divide. Types of cell division and various other activities of cell such as biochemical transformations.
- (c) Errors in cell division: what happens if the cell does not divide normally? An understanding of different numerical and structural abnormalities which can be detected with the help of a microscope.

3. Growth and Development in Living beings

- (a) Multicellularity among plants and animals: an understanding of unicellular and multi-cellular organisms. Concept of histology. An account of various types of tissues, organs and organ systems in both plants and animals.

- (b) Animal and plant development: development of a complete organism from zygotic cell in both plants and animals. An understanding of defence strategies in all types of living organisms.
- (c) Biodiversity and evolution of populations: an understanding of biodiversity in both plants and animals and the concept of population. A brief account of ethnology with respect to Indian population and its importance.

4. Genetics

- (a) Laws of Inheritance: how can one establish if a trait/disease is genetic or environmental? An account of Mendel's experiments. Different types of genetic inheritance and various complicating factors in genetic research.
- (b) Gene Mapping: mapping of genes on chromosomes using linkage analysis. An understanding of mutations and Cancer genetics.
- (c) Genes in populations: how do genes behave in populations from generation to generation? Various ways of studying population genetics.

PAPER II

PRACTICAL WORK – 20 marks.

Candidates are required to complete the following experiments.

1. Preparation of Buffers.
2. Colour reactions of Carbohydrates.
3. Colour reaction for proteins.
4. Study of various stages of Mitosis and Meiosis.
5. Preparation of karyotypes.
6. Determination of blood groups.
7. Constructing of pedigrees showing different types of inheritance.
8. Usage of pH meter.

PROJECT WORK AND PRACTICAL FILE

– 10 Marks

Project Work – 7 Marks

Candidates are to creatively execute **one** project/assignment on any aspect of Biotechnology. Teachers may assign or students may choose any one project of their choice. The report should be kept simple, but neat and elegant. No extra credit shall be given for type-written material/decorative cover, etc.

Practical File – 3 Marks

Teachers are required to assess students on the basis of the practical file maintained by them during the academic year.

CLASS XII

There will be two papers in the subject.

Paper I: Theory: 3 hours ... 70 marks

Paper II: Practical: 3 hours ... 20 marks

Project Work ... 7 marks

Practical File ... 3marks

PAPER I –THEORY- 70 Marks

There will be **one** paper of **three** hours duration divided into **two** parts.

Part 1 (20 marks) will consist of compulsory short answer questions, testing knowledge, application and skills relating to elementary/fundamental aspects of the entire syllabus.

Part 2 (50 marks) will consist of **eight** questions out of which the candidates will be required to answer **five** questions. Each question in this part shall carry 10 marks.

1. Molecular Biology

- (a) Biomolecules: introduction to biomolecules-definition and types. Carbohydrates, proteins, lipids, vitamins and enzymes – their structure and properties.
- (b) Nucleic acids: an understanding of nucleic acids, their importance in biotechnological work, biochemical structure and capacity to replicate.
- (c) Protein Synthesis: synthesis of different RNAs, and the complete mechanism of polypeptide chain formation. Different metabolic diseases which occur due to a change in the DNA structure.

2. Genetic Engineering

- (a) Innovations in Biotechnology: select examples of products already available, produced by using modern biotechnological tools.
- (b) Introduction to gene cloning: concept of cloning and vectors. Various vectors used for recombinant DNA.
- (c) Biochemical techniques: classification of techniques based on various factors.

- (d) Gene analysis techniques: various techniques involved in any work in recombinant DNA technology.

3. Cell Culture Technology

- (a) Introduction and techniques: basic understanding of cell culture technology and its significance in biotechnology. Different materials and methods used in this technology.
- (b) Cell culture and cellular totipotency: types of cell culture and the concept of cellular totipotency.
- (c) Germplasm conservation: definition and significance of germplasm conservation and various methods involved in it.
- (d) Applications of cell culture technology: different fields in which cell culture technology is used and the ways it is used.

4. Bio-informatics

- (a) Introduction: an introduction to computers, both hardware and software aspects. Global biological databases.
- (a) Genomics: basic understanding of genome, types of genome, criteria for selecting an organism for sequencing. Various theoretical aspects of searching genes using the computer.
- (b) Proteomics: definition and introduction.

PAPER II – PRACTICAL WORK – 20 marks

Candidates are required to complete the following experiments.

1. Sterilization techniques.
2. Preparation of buffers.
3. Preparation of culture media.
4. Growth of bacteria in culture.
5. Isolation of proteins.
6. Determination of blood groups.
7. Salivary amylase activity on starch.
8. Separation of plant pigments by chromatography.

9. Identification of Plasmid DNA and Genomic (chromosomal) DNA bands in the gels (by photographs only).
10. Estimation of DNA either by colourimeter or spectrophotometer.

PROJECT WORK AND PRACTICAL FILE

– 10 Marks

Project Work – 7 Marks

The Project work is to be assessed by a Visiting Examiner appointed locally and approved by the Council.

Candidates are to creatively execute **one** project/assignment on an aspect of Biotechnology. Teachers may assign or students may choose any one project of their choice. The report should be kept simple, but neat and elegant. No extra credit shall be given for type-written material/decorative cover, etc.

A list of suggested projects is as follows:

1. Effluent analysis.
2. To study the technological details of malt preparation.
3. To study the technological details of the brewing industry.
4. To study the organisation of a fermentor.
5. To analyse technologically, the process of drug development, drug designing and drug targeting.
6. To study the technological details of vaccine development.
7. Diagnosis of diseases by modern techniques like ELISA, RIA and Antibody targeting.
8. DNA finger-printing.
9. DNA foot-printing.
10. To work out the microbiological contaminants in food and food products.
11. Isolation of microbes from air, water and soil.
12. Identification methods of microbes (various staining techniques and biochemical reactions).

Practical File – 3 Marks

The Visiting Examiner is required to assess students on the basis of the practical file maintained by them during the academic year.

List of Equipment for Biotechnology practicals for Classes XI & XII

1. Table-top Centrifuge
2. Vortex - Mixer
3. Thermostatic water-bath shaker
4. Spectrophotometer (UV visible range)
5. Refrigerator
6. Deep freezer
7. Vacuum evaporator/concentrator
8. pH meter
9. Air-dry oven
10. Autoclave (Vertical)
11. Sterilisation chamber
12. Desiccators
13. Micro-filtration unit
14. Chromatography columns
15. UV Chamber (inoculation chamber)
16. TLC Plates
17. DNA gel photographs showing plasmid and chromosomal DNA bands
18. Colourimeter
19. Magnetic stirrer with hot plate
20. Laminar flow cabinet (Vertical)
21. Weighing Balance (Electrical)
22. Hot plate
23. Binocular Microscope
24. Haemocytometer
25. Colony counter
26. Antiserum
27. Antibodies
28. Micropipettes
29. Microcentrifuge