

# Department of Biotechnology

## B.Sc. Part-I

### Semester – I

### Paper – I

**Course name:**Biochemistry

**Course objective:**To provide basic knowledge and understanding of the molecular machinery of living cells.

**Course outcome:**

1. Student will be able to understand fundamental biochemical principles such as structure and function of bio molecules.
2. Significance of water in stability of bio molecules.
3. Able to know basic laboratory procedure for identification of bio molecules.
4. Able to understand molecules involved in storage of information with evidences.
5. Students will come to know the complexity of life.
6. They will understand the building blocks of biotic components.

**Text Book:**

- Textbook of Biochemistry by J.L .Jain.

**Reference Book:**

- Cell and Molecular Biology, (3<sup>rd</sup> Edition) – G.Karp, Pub: Johnwiley& Sons Inc. NY .
- Principles of Biochemistry, (4<sup>th</sup> Edition)-Lehninger, Nelson & Cox. Pub: Macmillan.
- Biochemistry- D.Voet&J.G.Voet. Pub: John Willy & Sons.

# Department of Biotechnology

## B.Sc. Part-I

### Semester – I

### Paper – II

**Course name:** Microbiology

**Course objective:** Microorganisms are used as living industry in biotechnology therefore the course will provide basic knowledge of these organisms.

**Course outcome:**

1. They would know the fine structure of prokaryotic and eukaryotic microbial cell.
2. They would come to know the concept of sterilization for cultivation of microorganisms.
3. Become aware of common lab equipment.
4. Culture media for cultivation.
5. Physicochemical effect on growth of microorganisms.
6. They will understand that how harmful and useful is the microorganisms for us.

**Text Book:**

- A textbook of Microbiology by R.C. Dubey& D.K. Maheshwari.

**Reference Book:**

- Textbook of Biotechnology by R.C. Dubey.

**Department of Biotechnology**  
**B.Sc. Part-I**  
**Semester – I**  
**Paper – III**

**Course name:** Cell Biology

**Course objective:** Cells are unit of living organism. This course will provide knowledge to various cells, their receptors, signaling and communication.

**Course outcome:**

1. Students will understand the basic components of prokaryotic and eukaryotic cells.
2. They would learn the concept of microscope, Micrometry & Counting Chamber.
3. Structure and function of biological membrane.
4. How the signals are conveyed across the cell.
5. Mechanism of cellular communication.
6. Practical and theoretical aspect of cell visualization.

**Text Book:**

- Cell and Molecular Biology, (3<sup>rd</sup> Edition) – G.Karp, Pub: John Wiley & Sons Inc. NY .
- Cell and Molecular Biology by Agrawal & Verma.

**Reference Book:**

- Molecular Biology of the Cell, (4<sup>th</sup> Edition) - Bruce Albert, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts & Peter Walter, Pub: G.S. Garland Science Taylor & Francis Group NY 10001-2299.
- Cell and Molecular Biology, (8<sup>th</sup> Edition) – DeRobertis and DeRobertis, Pub: B.I. Publishers Pvt. Ltd. N.Delhi

# Department of Biotechnology

## B.Sc. Part I

### Semester – II

#### Paper – I

**Course name:** Introductory Enzymology

**Course objective:** Enzymes are biological catalyst. They are useful for human welfare. The course will make aware of basic nature of enzymes, mode of action & application .

**Course outcome:**

1. Students will be able to know fundamentals of enzymes.
2. Catalytic properties of enzymes.
3. Enzymes purification and isolation for research, medical and industrial purposes .
4. Immobilised enzyme as a better outcome for human welfare.
5. Enzymes and human health care.
6. Enzymes and food processing.

**Text Book:**

- Textbook of Biotechnology by B.D. Singh.

**Reference Book:**

- Enzymology & Enzyme Technique by S.M. Bhatt.

# Department of Biotechnology

## B.Sc. Part - I

### Semester – II

#### Paper – II

**Course name:** Biotechnology Tools and Techniques

**Course objective:** To make familiar with basic equipment, tools and techniques of biotechnology.

**Course outcome:** By the end of course students will understand the:

1. Principles and working operations of equipments & purification methodology of bio molecules isolation.
2. Aware to spectroscopic techniques to find analyte concentration and molecular structure.
3. Physical technique for imaging biological structures.
4. Practical implementation of techniques.
5. Radiochemical techniques and its safety measures.
6. Radioisotopes, Autoradiography & Biosensors.

#### **Text Book:**

- Textbook of Biotechnology by R.C. Dubey.

#### **Reference Book:**

- Tools & Techniques of Biotechnology by Mousmi Debnath.

# Department of Biotechnology

## B.Sc. Part-I

### Semester – II

### Paper – III

**Course name:**Genetics

**Course objective:**The objective of this course is to learn the basic principles of inheritance at molecular level and molecular analysis of gene and gene product.

#### **Course outcome:**

1. Students will be able to understand the basic mechanism of mendelian inheritance.
2. They will have introductory knowledge of various processes in bacterial recombination.
3. They will have a knowledge of virus genetics.
4. They would know about mutation and its practical application.
5. Student will be aware of techniques used for molecular analysis of gene.
6. They will understand the role of genetic mechanism in evolution.
7. They will understand the role of genetics technology in industries related to biotechnology and research purpose.

#### **Text Book:**

- Textbook of Biotechnology by R.C. Dubey.
- Cell and Molecular Biology by P.S. Verma and Agrawal

#### **Reference Book:**

- Principles of Genetics – Gardner et al.
- Principles of genetics, (3<sup>rd</sup>Edition )-Snustad& Simmons.
- Textbook of Microbiology by R.C. Dubey.

# Department of Biotechnology

## B.Sc. Part-II

### Semester – III

#### Paper – I

**Course name:** Molecular Biology

**Course objective:** The objective of this course is to study biological systems at the molecular level.

**Course outcome:**

1. Students will understand the molecular mechanism by which genetic material replicates both in eukaryotes and prokaryotes.
2. Molecular mechanism by which DNA controls characteristics of organisms.
3. Understanding of gene expression and gene regulation.
4. Interaction of nucleic acid and proteins at molecular level.
5. Make aware of experimental approaches used in molecular biology such as DNA isolation, electrophoresis.
6. To provide fundamentals of life.

**Text Book:**

- Molecular Biology by New State.

**Reference Book:**

- Cell and Molecular Biology, (3<sup>rd</sup> Edition) – G.Karp, Pub: Johnwiley& Sons Inc. NY .
- Molecular Biology by P.K. Gupta.

# Department of Biotechnology

## B.Sc. Part-II

### Semester – III

#### Paper – II

**Course name:** Introductory Immunology

**Course objective:** The students will be able to learn the cellular and molecular basis of immune responsiveness.

**Course outcome:**

1. The students will be able to know the role of immune system in maintainance health.
2. Cellular and molecular pathway of innate and acquired immunity.
3. They must understand the mechanism of immunity.
4. Discrimination between self and non-self.
5. Making aware to simple immunological techniques for the diagnosis of disease and estimations.
6. Cells and organs of the immune system.

**Text Book:**

- Immunology by Kuby.

**Reference Book:**

- Textbook of Biotechnology by B.D. Singh.
- Immunology by S.C. Lal& S. Kumar.



# Department of Biotechnology

## B.Sc. Part-II

### Semester – III

### Paper – III

**Course name:**Plant Tissue Culture

**Course objective:**The course seeks to provide basic principles of plant tissue culture, its application and hands on experience for laboratory work.

#### **Course outcome:**

1. At the end of course students would be able to disinfect and place into culture suitable explants.
2. They will be able to make culture medium from reagent grade chemicals.
3. Students will know the in-vitro method of farming.
4. They will learn the role of biotechnology in manipulation of plant breeding at laboratory level.
5. They may have preliminary knowledge about Germ Plant storage Techniques.
6. They will be aware of secondary metabolites as a outcome of Plant Tissue Culture in any human welfare.

#### **Text Book:**

- Textbook of Biotechnology by B.D. Singh.

#### **Reference Book:**

- An Introduction To Plant Tissue Culture: M.K. Razdan.
- Plant Tissue Culture By H.D. Kumar.

# Department of Biotechnology

## B.Sc. Part-II

### Semester – IV

#### Paper – I

**Course name:** Applied Immunology

**Course objective:** The aim of the course is to provide students the opportunity to enhance their knowledge about immunology at molecular level in defence and application of immunological principles in producing diagnostic tests.

#### **Course outcome:**

On satisfying the requirements of this course students will have the knowledge to:

1. Explain how the specific immune system responds to non – self .
2. Immunization programme .
3. Cell mediated effector response to evade non-self.
4. Apply diagnostic, laboratory techniques for the diagnosis of immunological diseases
5. Interpret experimental data in research in immunology.
6. Read the literature critically to assimilate views on new finding.

#### **Text Book:**

- Immunology by Kuby.

#### **Reference Book:**

- Textbook of Biotechnology by B.D. Singh.
- Immunology by S.C. Lal& S. Kumar.

# Department of Biotechnology

## B.Sc. Part-II

### Semester – IV

#### Paper – II

**Course name:** Animal Cell & Tissue Culture

**Course objective:** This course objective is to familiarize students with sterile techniques for maintenance of cell in culture, cell lines and application of animal cell culture.

**Course outcome:**

1. The students will be able to understand aseptic techniques and physicochemical requirement of animal cell culture.
2. They will be able to prepare culture media from analytical grade reagents aseptically.
3. They will have preliminary knowledge for isolation of cells and their disaggregation.
4. Maintenance of culture.
5. Cell lines used in pharmaceuticals and biotechnological researches.
6. Application of cell culture in medical field.

**Text Book:**

- Animal Cell Culture Concepts and Applications by S.M.bhatt.
- Biotechnology by P.K. Gupta.

**Reference Book:**

- Textbook of Animal Cell Culture by Freshney.

# Department of Biotechnology

## B.Sc. Part-II

### Semester – IV

#### Paper – III

**Course name:** Genetic Engineering

**Course objective:** The purpose of this course is to make the students familiar with the foundation of modern biotechnology and principles of recombinant DNA technology.

**Course outcome:** By the end of the course students will be able to-

1. Understand the tools & techniques of recombinant DNA technology.
2. Different cloning vectors.
3. The method of introducing cloning vectors (Transfection).
4. Provide examples of current application of biotechnology and advances in medical science.
5. Powerful technique like PCR.
6. They will be able to design an experiment according to research protocol.

#### **Text Book:**

- Gene Cloning & DNA Analysis by T.A. Brown.
- Textbook of Biotechnology by B.D. Singh.

#### **Reference Book:**

- Molecular Biotechnology & Genetic engineering by P.K. Gupta.

# Department of Biotechnology

## B.Sc. Part-III

### Semester – V

#### Paper – I

**Course name:** Plant Biotechnology

**Course objective:** The objective of the course is give students knowledge about modern plant biotechnology process, including breeding of healthy plants, plants with improved characteristics.

**Course outcome:**

1. Students will learn concepts, principles and process in plant biotechnology.
2. They will learn the techniques of gene transfer in plants.
3. Introductory knowledge about expression of induced gene and gene silencing.
4. Become aware of transgenic plants with improved characteristics.
5. They would learn the role of biotechnology in modern farming.
6. Become aware to ongoing research in the field of plant biotechnology.

**Text Book:**

- Textbook of Biotechnology by B.D. Singh.

**Reference Book:**

- Plant biotechnology by P.K. Gupta.

# Department of Biotechnology

## B.Sc. Part-III

### Semester – V

#### Paper – II

**Course name:** Animal Biotechnology

**Course objective:** The goal is to make the students familiar to biotechnological methods to produce improved animals which can serve as bio reactors for human welfare, research model and solution to the infertility issues in human.

**Course outcome:**

At the end of the course students would know the technique of:

1. Making transgenic animals and its application in human welfare.
2. Use of transgenic animal in industry and value added food production.
3. Methods to produce genetically superior farm animals.
4. In vitro fertilization to solve the problem of childless couples.
5. Ethical issues of artificial breeding programs.

**Text Book:**

- Textbook of Biotechnology by B.D. Singh.
- Biotechnology by P.K. Gupta.

**Reference Book:**

- Animal Biotechnology by Rangh.

# Department of Biotechnology

## B.Sc. Part III

### Semester – V

#### Paper – III

**Course name:** Environmental Biotechnology

**Course objective:** The objective of the course is to make the students aware of present environment by conservation of resources, utilization of microbial processes in Waste and Water Management.

**Course outcome:**

1. By the end of the course students will know how to conserve natural resources.
2. They will seek knowledge about in-situ and ex-situ way of bioremediation to keep environment clean.
3. They become aware of the significance of microorganism in waste water treatment.
4. Students will be aware of activated sludge process to keep the environment clean.
5. They will learn a process for minimum and treated waste expulsion in industry.
6. They became aware of use of biodegradable needs in life to have sustainable environment.

**Text Book:**

- Textbook of biotechnology by B.D. Singh.

**Reference Book:**

- Environmental Biotechnology by SVS Rana.
- Environmental Biotechnology by S.K. Agrawal.

# Department of Biotechnology

## B.Sc. Part-III

### Semester – V

#### Paper – IV

**Course name:** Agricultural Biotechnology

**Course objective:** The objective of the course is to make students familiar with classical and modern biotechnological ways to improve agriculture.

**Course outcome:**

1. By the end of course, students will learn about use of microorganism as bio fertilizer.
2. Isolation and cultivation of nitrogen fixing microorganism.
3. Role of phosphate solubilising microorganism and mycorrhizal symbiosis.
4. Bio control agent for increased productivity and integrated pest management.
5. Production of transgenic fish.
6. The students will have knowledge in agricultural biotechnology to render the local agricultural sector more productive.

**Text Book:**

- Textbook of Microbiology by R.C. Dubey & D.K. Maheshwari.

**Reference Book:**

- Textbook of Biotechnology B.D. Singh.



# Department of Biotechnology

## B.Sc. Part-III

### Semester – VI

#### Paper – I

**Course name:** Health Care Biotechnology

**Course objective:** The course aims to offer students the opportunity to learn basic concept about measurement and management of problems related to human health.

**Course outcome:**

After completing the course successfully the students will be able to know

1. Advance technology for the disease prevention and diagnosis.
2. Importance of forensic science in identification of medico-illegal disputes.
3. Application of recombinant products in human health care.
4. Types and mode of action of antibiotics used in disease prevention.
5. Students will be able to know medical laboratory techniques.
6. Role of biotechnology in medical field.

**Text Book:**

- Textbook of Biotechnology by B.D. Singh.

**Reference Book:**

- Medical Biotechnology by S.N. Jogdand.

# Department of Biotechnology

## B.Sc. Part-III

### Semester – VI

#### Paper – II

**Course name:** Bio Fuel Biotechnology

**Course objective:** The objective is to provide students with basic principles of biofuels and bioenergy system design.

**Course outcome:**

1. The students will identify bio fuels and bio energy sources.
2. They will learn the nature of biomass.
3. Students will learn different types of conventional fuels and its demerits.
4. Introductory knowledge about modern fuel and its substrate.
5. Become aware of bio fuel and biogas plant set up.
6. They can improve the quality of bio fuels and bio energy facilities.
7. Understand the market and economics of bio fuel and bio energy system.

**Text Book:**

- Environmental Biotechnology by S.K. Agrawal.

**Reference Book:**

- Textbook of Biotechnology by B.D. Singh.

# Department of Biotechnology

## B.Sc. Part-III

### Semester – VI

### Paper – III

**Course name:** Introductory Bioinformatics and Biostatistics

**Course objective:** The basic objective is to give students an introduction to the application of web internet and biological databases. Introductory knowledge of Biostatistics will help the students in designing studies and analyzing data from research problems.

#### **Course outcome:**

1. Students will be able to browse and surf web.
2. Knowledge and awareness of the basic principles and concepts of biology and computer science.
3. Basic knowledge of databanks, databases and how to extract information.
4. Sequence alignment to prepare evolutionary tree.
5. Basic concept to protein modeling and drug designing by docking.
6. Data analysis and computing research papers by statistical evaluation.

#### **Text Book:**

- Bioinformatics by Jin Xing.
- Fundamentals of Mathematical Statistics by Kapoor&Verma.

#### **Reference Book:**

- Bioinformatics and genetics by M.R. Barnes & Ian C. Gray.

# Department of Biotechnology

## B.Sc. Part-III

### Semester – VI

#### Paper – IV

**Course name:** Applied Microbiology

**Course objective:** The objective of the course is to provide students practical knowledge about microbial cultivation, media preparation, strain improvement for industrial process and role of microorganisms in human health and agriculture.

**Course outcome:**

1. Students will be able to learn aseptic pure culture techniques.
2. Students will be able to describe manipulation of microorganism to produce product of human welfare.
3. They will learn how the microorganism increases the soil fertility in agriculture.
4. Microorganisms can be used as bio control agents to protect plants.
5. To know how microorganisms play an integral role in plants as well as in human life.
6. Students will be able to describe how microorganisms are important for crop production & protection.

**Text Book:**

- Textbook of Microbiology by R.C. Dubey.

**Reference Book:**

- Biotechnology - A textbook of Industrial Microbiology (2<sup>nd</sup>Edn., 1989)- Crueger&Crueger.
- Microbial Biotechnology – Fundamental & Applied Microbiology – (1995) Glazier &Nikaido.