

# **PG Science PO PSO\_CO**

## **M.Sc. Biotechnology**

### ***Goals of M.Sc. Biotechnology Course***

- To inculcate scientific temperament and problem-solving skills in the field of Biotechnology among young graduates.
- To train graduates in developing research aptitude and encouraged them to share and resolve their scientific curiosity through scientific methods and critical and rational thinking.
- To train graduates in state of art laboratory skills so as to be able to perform proper experiments in the laboratory, communication skills so as to convey their ideas and innovation, and research skills to develop research aptitude.

### ***Objectives of M.Sc. Biotechnology Course***

- To develop the scientific temper, critical thinking, and communication skills in the field of Biotechnology
- To develop basic laboratory skills through individual hands-on training.
- To develop an understanding of the scientific foundation of Biotechnology and its application in the development of the Nation.
- To develop attitudes toward innovation and entrepreneurship in the field of Biotechnology.
- To develop disciplined, just and law-abiding citizen.

### ***Program Outcomes (POs) for Postgraduates Programme***

After completing the post-graduation studies in any subject belonging to science (Physics, Biochemistry and Biotechnology, Chemistry, Computer Science and Law), student will be able to

- PO1:** Apply the knowledge of the respective domain of knowledge and specialization to the solution of complex problems in professional, social and personal life.
- PO2:** Develop a multidisciplinary perspective and contribute to the knowledge capital of the world in general and the country in particular.
- PO3:** Acquire communication and presentation skills and become employable in the job market.
- PO4:** Develop sensitivity for social issues and become proactive citizens.
- PO5:** Examine and explain how the subject has influenced the progress in the other areas of science and technology useful in the betterment of life of common people and development of society.
- PO6:** Acquire high level skills in laboratory experimentation and inferring logical conclusions.
- PO7:** Participate in Project works, doing independent designing & execution of the research work.
- PO8:** Recognize the areas which need further research work and could take up an independent research project in a R & D organization or in any industrial organization.
- PO9:** Demonstrate in-depth knowledge both conceptual and applied pertaining to their core discipline.
- PO10:** Students become well-equipped to be placed in health care organizations, data science laboratories, environmental organizations, higher educational institutions, food or dairy and beverage industries, and pharmaceutical industries.



## ***Program-Specific Outcomes of M.Sc. Biotechnology***

On the completion of M.Sc. Biotechnology students must be able to

**PSO1 or PO11** Remember and understand complex phenomena in Life sciences and techniques in Biotechnology and apply this knowledge to understand the current scientific questions and find out the solution to complex scientific problems

**PSO2 or PO12** Exhibit their knowledge about recent development in the field of Biotechnology

**PSO3 or PO13** Be skillful to work in various sectors related to biotechnology like pharmaceutical industries etc.

**PSO4 or PO14** Be skillful in handling laboratory equipment and perform experiments in very controlled and systematic manner while taking care of instruments.

## ***Course Outcomes of M.Sc. Biotechnology***

M.Sc. Biotechnology is a 4-semester course conducted by Dr. Ambedkar College, Deekshabhoomi, Nagpur as per the syllabus provided by Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur. Each semester students have to take four theory papers, two Practicums based on four theory papers, and a Seminar. The fourth semester has a six-month Research Project Work. Third and Fourth Semester has Two Elective papers. Coursework is according to theory papers, practicums, and seminars conducted throughout the program.

### **M. Sc. BIOTECHNOLOGY Semester I**

#### **Paper – I (Code: 1T1) Cell Biology and Enzymology**

*Course outcome Students will be able to*

CO1. Remember and understand the structure and function cells, sub cellular organelles Cellular communication and Cell cycle.

CO2. Remember and understand the Basic concepts of Enzymology and Enzyme Kinetics.

CO3. Analyses the mathematical derivations in understanding enzyme kinetics and different transformation and its application.

CO4. Understand the concept of Enzyme Engineering and immobilization

#### **Paper – II (Code: 1T2) Molecular Biology**

*Course outcome Students will be able to*

CO1. Remember and understand the fundamental concepts of DNA Replication and repair and apply these concepts in Biotechnological.

CO2. Remember and understand the fundamental concepts of Prokaryotic and Eukaryotic Transcription and apply these concepts in Biotechnological.

CO3. Remember and understand the concepts of, Genetic code and Protein Biosynthesis and apply these concepts in Biotechnological.

CO4. Remember and understand the regulation of gene expression in prokaryotes and eukaryotes and apply these concepts in Biotechnological.

### **Paper – III (Code: 1T3) Biomolecules**

*Course outcome Students will be able to*

- CO1. Remember and understand the Structure and Properties of Carbohydrates and recognize their importance in Biotechnological Products and processes
- CO2. Remember and understand the Structure and Properties of Lipids and recognize their importance in Biotechnological Products and processes
- CO3. Remember and understand the Structure and Properties of Proteins and recognize their importance in Biotechnological Products and processes
- CO4. Remember and understand the Structure and Properties of Nucleic acids and recognize their importance in Biotechnological Products and processes

### **Paper – IV (Code: 1T4) Biophysical Techniques**

*Course outcome Students will be able to*

- CO1. Remember and comprehend techniques and instrumentation involved in studying basic biological phenomena focusing on Spectrophotometry and evaluate its application in providing solutions to biotechnological problems.
- CO2. Remember and comprehend techniques and instrumentation involved in studying basic biological phenomena focusing on Chromatography and evaluate its application in providing solutions to biotechnological problems.
- CO3. Remember and comprehend techniques and instrumentation involved in studying basic biological phenomena focusing on Electrophoresis and Viscosity and evaluate its application in providing solutions to biotechnological problems.
- CO4. Remember and comprehend techniques and instrumentation involved in studying basic biological phenomena focusing on Centrifugation and radioactivity and evaluate its application in providing solutions to biotechnological problems.

### **LAB I (Code: 1P1) Cell Biology and Enzymology**

*Course outcome Students will be able to*

- CO1. Perform major experiments in cell biology and enzymology
- CO2. Work well and carefully in the laboratory environment and with instruments

### **LAB II (Code: 1P2) Macromolecules & Analytical Techniques**

*Course outcome Students will be able to*

- CO1. Perform major basic in biochemistry
- CO2. Perform basic techniques in understanding biomolecules and Biophysical techniques.

**M. Sc. BIOTECHNOLOGY**  
**Semester II**

**Paper – I (Code: 2T1) Microbiology**

*Course outcome Students will be able to*

- CO1. Appreciate the diversity of microorganisms and their application in biotechnology.
- CO2. Remember and understand basic concepts of Microbiology, Taxonomy, and Bacterial Genetic Systems.
- CO3. Understand the basic phenomenon of Microbial Physiology, especially regarding Nutrition and Growth.
- CO4. Comprehend the concept of chemotherapy and understand and evaluate the Drug resistance in Microbes.

**Paper – II (Code: 2T2) Immunology**

*Course outcome Students will be able to*

- CO1. Remember and understand fundamental concepts of Immunology.
- CO2. Understand the generation of immune responses
- CO3. Understand the concept of Vaccinology and its mechanism of action
- CO4. Develop understanding of clinical immunology essential for medical diagnosis.

**Paper – III (Code: 2T3) Fundamentals of Genetic Engineering**

*Course outcome Students will be able to*

- CO1. Infer tools and techniques used in Genetic Engineering
- CO2. Understand the concept of DNA insertion and ligation into genome
- CO3. Learn Genomic DNA library construction and various DNA sequencing techniques
- CO4. Remember and understand cloning vectors used in Genetic Engineering experiments.

**Paper – IV (Code: 2T4) Applied Molecular Biology**

*Course outcome Students will be able to*

- CO1. Gain knowledge of Recombination and Genome Mapping and its application in Biotechnology
- CO2. Comprehend the concept of Antisense, Ribozymes, and Epigenetics and their application
- CO3. Understand methods to study cancer and genetic and viral causes of cancer
- CO4. Understand the concept of angiogenesis, metastasis, and cancer stem cells

**LAB I (Code: 2P1) Microbiology & Immunology**

*Course outcome Students will be able to*

- CO1. Acquire basic Microbiology laboratory skills like bacterial pure culture

isolation, microscopy, and biochemical analysis of microbes  
CO2. Understand experiments in Immunology

**LAB II (Code: 2P2) Genetic Engineering & Applied Molecular Biology**

*Course outcome Students will be able to*

CO1. Acquire laboratory skills involved in Genetic Engineering and Molecular Biology.

CO2. Understand the handling of laboratory instruments and chemicals involved in Genetic Engineering.

## **M. Sc. BIOTECHNOLOGY**

### **Semester III**

#### **Paper – I (Code: 3T1) Genetic Engineering & its applications**

*Course outcome Students will be able to*

- CO1 Understand the concepts of Transformation, Transfection, and PCR
- CO2 Understand Transformation technology in Plants
- CO3 Describe the expression of heterologous genes and the processing of recombinant proteins.
- CO4 Explain and illustrate techniques like Phage display and gene therapy

#### **Paper – II (Code: 3T2) Plant Biotechnology**

*Course outcome Students will be able to*

- CO1 Remember and understand the basic concept of Plant tissue culture and breeding
- CO2 Understand and Differentiate between different plant tissue culture techniques.
- CO3 Comprehend different techniques to produce better crops via applying the principles of biotechnology
- CO4 Understand concepts of Plant Metabolic Engineering

#### **Paper – III (Core Elective A) (Code: 3T3A) Industrial Biotechnology I**

*Course outcome Students will be able to*

- CO1 Remember and Understand the design and functioning of Basic Bioreactor
- CO2 Understand the design and functioning of different types of Bioreactors
- CO3 Understand the technique, kinetics, and reactors of Immobilization
- CO4 Understand and apply the downstream process in improving bioprocess economics

#### **Paper – III (Core Elective B) (Code: 3T3B) Environmental Biotechnology I**

*Course outcome Students will be able to*

- CO1 Remember and understand the basic principles of Environmental Science
- CO2 Understand the structure and functioning of ecosystem
- CO3 Understand the energy as bioresource and biofuel
- CO4 Understand the applications of biofertilizer and Integrated pest management.

#### **Paper – IV (Foundation Paper I) (Code: 3T4A) Introductory Biotechnology**

*This course is allowed for students of M.Sc. from subjects other than Biotechnology. Therefore the students in this course will be from field other than Biotechnology and will not have background of Biotechnology. Students will be able to*

- CO1 Comprehend the structure and function of macromolecules such as Proteins and Nucleic Acid and their arrangement in Cell
- CO2 Understand the concept of genes and enzymes

**Paper-IV: (Core Subject Centric I) (Code: 3T4B) Diagnostic Medical Biotechnology  
Molecular and Nanomolecular Diagnostics**

*Students who are not opting for foundation course in any other subject (other than Biotechnology) can opt for this course.*

*Course outcome Students will be able to*

CO1 Demonstrate an understanding of Host-pathogen interaction and basic clinical and molecular diagnostic techniques.

CO2 Understand the concept of genes involved in human diseases and the techniques involved in diagnosing them.

CO3 Understand the basic proteomic experiments and their application in disease diagnosis.

CO4 Understand the principles behind Nanomolecular diagnostics and Biosensors.

**LAB I (Code: 3P1) Genetic Engineering & Plant Biotechnology**

*Course outcome Students will be able to*

CO1 Skillfully perform basic experiments in Genetic engineering and plant Biotechnology

CO2 Handle sophisticated laboratory equipment and reagents

**LAB II (Core Elective A) (Code: 3P2) Industrial Biotechnology**

*Course outcome Students will be able to*

CO1 Skillfully perform basic experiment in Industrial Biotechnology

**LAB II (Core Elective B) (Code: 3P2) Environmental Biotechnology**

*Course outcome Students will be able to*

CO1 Skillfully perform basic experiment in Environmental Biotechnology



**M. Sc. BIOTECHNOLOGY Semester IV**  
**Paper – I (Code: 4T1) Animal Biotechnology**

*Course outcome Students will be able to*

- CO1 Remember and Understand the Fundamental Concepts of Animal Cell Culture techniques.
- CO2 Understand the principles of primary cell culture and measurement of cytotoxicity and viability
- CO3 Understand the concepts of scaling up, stem cells, and apoptosis related to cell culture
- CO4 Understand and envision the future Commercial aspects of Animal Cell culture

**Paper – II (Code: 4T2) Biostatistics, Bioinformatics, Ethics & Patenting**

*Course outcome Students will be able to*

- CO1 Understand the underlined concepts of Biostatistics and its application in the field of Biotechnology
- CO2 Understand the underlined concepts of Bioinformatics and its application in the field of Biotechnology
- CO3 Understand the underlined concepts of Ethics and its application in the field of Biotechnology
- CO4 Understand the underlined concepts of Patenting and its application in the field of Biotechnology

**Paper – III (Core Elective A) (Code: 4T3A) Industrial Biotechnology II**

*Course outcome Students will be able to*

- CO1 Remember and Understand the basic concept of bioprocess engineering
- CO2 Understand the Process optimization and control in Industrial Biotechnology
- CO3 Understand the basic principles of scale up and biosensors
- CO4 Evaluate the production of Primary and Secondary Metabolite

**Paper – III (Core Elective B) (Code: 4T3B) Environmental Biotechnology II Applied Environmental Biotechnology**

*Course outcome Students will be able to*

- CO1 Remember and Understand the advanced concept of Environmental Biotechnology and effects of xenobiotics in environment
- CO2 Evaluate the functioning of technology involved in Waste water treatment

#### **Paper – IV (Foundation Paper II) (Code: 4T4A) Basic rDNA Technology**

*This course is allowed for students of M.Sc. from subjects other than Biotechnology. Therefore the students in this course will be from field other than Biotechnology and will not have background of Biotechnology. Students will be able to*

CO1 Comprehend the basics of recombinant DNA Technology

CO2 Understand the concept of gene cloning

#### **Paper-IV: (Core Subject Centric II) (Code: 4T4B) Therapeutic Medical Biotechnology Molecular Therapeutics and Drug Discovery**

*Students who are not opting for foundation course in any other subject (other than Biotechnology) can opt for this course.*

*Course outcome Students will be able to*

CO1 Understand and evaluate the fundamentals of Therapeutic Medical Biotechnology

CO2 Understand the role of proteomics and other technology in drug discovery

CO3 Understand the concept of nanotechnology for drug discovery

CO4 Illustrate the process of Drug Discovery and Clinical research

#### **LAB I (Code: 4P1) Animal Biotechnology, Biostatistics, Bioinformatics, Ethics & Patenting And Industrial Biotechnology II or Environmental Biotechnology**

*Course outcome Students will be able to*

CO1 Skillfully perform the experiments involving the fundamentals of Biostatistics, Bioinformatics, Animal Cell culture techniques and experiments related to the elective paper opted by them

#### **Project (Code: 4PROJ1)**

*Every student is required to carry out a project work in semester IV. The project can be of following types. A) Experimental Project Work; OR B) Field Based Project Work; OR C) Review writing based Project Work.*

*Course outcome: Students will be able to*

CO1 Develop the critical thinking ability and communication skills.

CO2 Understand and apply the scientific method.

CO3 Develop the aptitude to work on a scientific problem and look for alternative solution.

CO4 Write their finding in a form of a thesis and defend it by presenting it in front of their teachers and examiners.

CO5 Experience and embrace the habit of ethical practice in performing experiments and communicating them

#### **Seminar (Code: 1S1, 2S1, 3S1 and 4S1)**

Class seminar are conducted every semester to develop communication skills of students. Students will be able to comprehend the current research and should be able to put forward major ideas in front of their colleagues and teachers. Students will be evaluated on the basis of their presentation and questions and answer session.