DEPARTMENT OF MICROBIOLOGY

FACULTY OF SCIENCE & HUMANATIES

Program Learning Outcomes (PLOs)

PLO 1: The students will be able to understand the biochemical pathways of synthesis and degradation of the molecules and the transport of different metabolites generated with application in industrial processes.

PLO 2: Students will be able to demonstrate a knowledge and understanding of: Genetic engineering principle in the development of novel microbial strains with an application in agriculture, bioremediation, vaccine development, gene therapy and disease detections.

PLO 3: Students will be able to work both independently or in groups on complex problems to apply the scientific knowledge to develop entrepreneurship abilities. They will be able to identify a research topic, planning and execution and are capable to present the results/findings in the scientific manner.

PLO 4: Confidence level is enhanced by arranging seminars where students give seminars on current research topics of the subject. Students are encouraged to think independently, plan research separately during dissertations, subject based quiz competition, instructions to address a research problem.

PLO 5: Students are encouraged to undergo summer training during vacations in their related fields. Students are also encouraged to participate in seminars, visit to research institutions is arranged where they get a chance to interact with the researchers.

Program Specific Outcomes (PSOs)

The student will able to,

PSO 1: Gain theoretical and practical insight about general microbiology, molecular biology and biochemical techniques, to gain scientific knowledge about the subject.

PSO 2: Have a career option in research, industries and academics pertaining to the field of microbiology and other allied life science subjects.

PSO 3: Basic knowledge about application of bacteria, fungi, protozoa and viruses in traditional (food, dairy, wine, antibiotics, fermentation, etc.) And biotechnological industries. Human health – includes pathogenic micro-organisms (bacterial, viral, protozoan and Fungal), therapeutics and pharmaceutical approach towards diseases, diagnostics, vaccine developments,

epidemiological characterization of diseases, gene therapy, etc.

PSO 4: Have an awareness to become conscious citizens with a sense of responsibility towards their surrounding and sustainable living.

MICROBIOLOGY

Course Code: 21MBM101 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type: THEORY

Prerequisite: None

COURSE LEARNING OUTCOMES: Students should be able to:

1. Identify major categories of microorganisms and analyse their classification, diversity, and omnipresence;
2. Identify and demonstrate structural, physiological, genetic similarities and differences of major categories of microorganisms;
3. Understand, how they cause different diseases and demonstrate how to control microbial growth;
4. Establish and evaluate interactions between microbes, hosts and environment.

CELL BIOLOGY

Course Code:21MBM102 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type: THEORY

Prerequisite: NONE

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Classify the cell.
2. Understand how a cell and cell organelles perform their functions.
3. Understand the mechanism of cellular talk and signal transduction.
4. Understand the underlying mechanism of cell division.

Microbial Biochemistry

Course Code: 21MSM103 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type:Theory

Prerequisite:

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. The student will be able to understand the structure, composition and function of protein, carbohydrate, lipids and nucleic.
2. The student will be able to understand the glycolysis, Kreb cycle, electron transport and photosynthesis.
3. The student will be able to understand the anabolism and catabolism of macromolecules.
4. The student will be able to understand the principles of thermodynamics and its application in living organisms.

BIOPHYSICS & INSTRUMENTATION TECHNOLOGY

Course Code: 21MBM104 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type:Theory

Prerequisite: NIL

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the various types of bonds stabilizing a protein and its separation based on molecular weight and isoelectric point;
2. Understand the principle and instrumentation of separation techniques of biomolecules;
3. Understand the various spectrophotometry techniques;
4. Understand the light microscopy and electron microscopy.

MOLECULAR BIOLOGY

Course Code:21MSM105 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type: Theory

Prerequisite: NIL

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the chemical structure of genetic material and molecular mechanism of inheritance;
2. Understand packaging of the vast genetic material in a cellular compartment;
3. Understand the mutagens and their role in mutation;

4. Understand the transcription and translation;
5. Understand the regulation of transcription and translation.

MICROBIOLOGY LAB

Course Code: 21MBM151 Continuous Evaluation: 60 Marks Credits: 2 End Semester Examination: 40 Marks L T P : 0 0 2 Course Type: Practical

Prerequisite: NIL

COURSE LEARNING OUTCOME:

1. Understand advancement of techniques for healthcare
2. Learn Aseptic techniques
3. Industrial production of desired chemicals;
4. AMR and MIC
5. Microbes uses in various industries

BIOCHEMISTRY LAB

Course Code: 21MBM153 Continuous Evaluation: 60 Marks Credits: 2 End Semester Examination: 40 Marks L T P : 0 0 2 Course Type: Practical

Prerequisite: NIL

COURSE LEARNING OUTCOME:

1. Understand the principles of various fields of chemistry and biology (organic chemistry, analytical chemistry, biochemistry, genetics, metabolism, and molecular biology);

2. Students will be able to make different solutions & reagents of different molarity, molality & normality according to experiment need;
3. Students can be able to analyze organic compounds quantitatively & Qualitatively;
4. Develop as independent thinkers who are responsible for their own learning.

MOLECULAR BIOLOGY LAB

Course Code:21MBM155 Continuous Evaluation: 60 Marks
Credits: 1 End Semester Examination: 40 Marks L T P : 0 0 2 Course Type: Practical

Prerequisite: Biology at graduation

LAB LEARNING OUTCOMES (CLOs):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Isolate DNA and protein from prokaryotic and eukaryotic cell;
2. Handle the instruments like centrifuge, trans-illuminator, incubator, gel electrophoresis, PCR;
3. Understand the chemistry behind each experiment;
4. Work independently regarding the experiments conducted.

ANIMAL BIOTECHNOLOGY

Course Code: 21MPE101 Continuous Evaluation: 40 Marks
Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type:THEORY

Prerequisite: NIL

COURSE LEARNING OUTCOMES (CLOs):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Explain the principles of animal tissue culture technique.
2. Identify & compare the traditional and novel methods of animal breeding.
3. Appreciate the genetic tools used in animal improvement.
4. Identify and assess the various animal disease models.
5. Appreciate the applications of transgenic animals.

PLANT BIOTECHNOLOGY

Course Code: 21MPE102 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P :3 0 0 Course Type: THEORY

Prerequisite: NIL

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Describe the historical background & principles of plant tissue culture.
2. Describe the fundamentals of plant tissue culture technique.
3. Appreciate the production and uses of plant secondary metabolites.
4. Compare and contrast various techniques for creating transgenics.
5. Recognize the applications of transgenic plants.

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: 21MPB103 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 Course Type:Theory

Prerequisite: NIL

COURSE LEARNING OUTCOMES (CLO)

1. Examine the global environmental challenges.
2. Compare and contrast various alternative non-fuel energy sources.
3. Describe the various waste water treatment process and solid waste treatment process. 4. Discuss the various approaches to bioremediation.
5. Recognize the importance of Environment Impact Assessment.

ENVIRONMENTAL MICROBIOLOGY

Course Code: 21MSM204 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 Course Type:Theory

Prerequisite: NIL

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the basic concepts of environment and role of microorganisms in ecosystem management.
2. Understand the impact of air, water and soil pollution and its measurement. 3. Understand the role of microorganisms in wastewater management and bioremediation.
4. Understand the importance of microorganisms in generating energy and bioleaching. 5. Understand the effect of environmental pollutants on health and the importance of biomonitoring.

GENOMICS & PROTEOMICS

Course Code: 21MBM201 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type: Theory

Prerequisite: Knowledge of basic biology

COURSE LEARNING OUTCOME:

Students should be able to acquire

1. Knowledge and understanding of fundamentals of genomics and

proteomics, transcriptomics and metabolomics.

2. Information of the structure and functions of the genomes together with the computational approaches to analyse the genomes &proteome;
3. Understanding of the gene expression and functional genomics;
4. Understanding the applications in various applied areas of biology.

MICROBIAL TECHNOLOGY

Course Code: 21MSM202 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type:Theory

Prerequisite: Elementary knowledge of molecular biology

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. •Learn Industrial Microbiology
2. •Understand the global environmental problems.
3. •Understand the various ways in which microbes benefit human beings and the environment.
4. •Apply the knowledge of various techniques in developing technology for sustainable development.

BIOINFORMATICS & COMPUTATIONAL BIOLOGY

Course Code: 21MBM203 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type: Theory

Prerequisite: Knowledge of biology and basic programming (10+2)

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Develop an understanding of basic theory of these computational tools.
2. Gain working knowledge of these computational tools and methods
3. Appreciate their relevance for investigating specific contemporary biological questions;
4. Understanding the applications in various applied areas of biology.

IMMUNOLOGY & IMMUNOTHERAPY

Course Code: 21MBM205 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type: Theory

Prerequisite: NIL

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Demonstrate the basic knowledge of immunological processes at a cellular and molecular level 2. Outline key events and cellular players in antigen presentation, and how the nature of the antigen will shape resulting effector responses
3. Understand the principles governing vaccination and the mechanisms of protection against infectious diseases
4. Understand and explain the basis of immunological tolerance, autoimmUnity and transplantation
5. Understand and explain the basis of allergy and allergic diseases.
6. Understand and explain the immune system in cancer; tumor immunology and principles of immunotherapy

MICROBIAL TECHNOLOGY LAB

Course Code:21MSM252 Continuous Evaluation: 60 Marks Credits: 2 End Semester Examination: 40 Marks L T P : 0 0 4 Course Type:Practical

Prerequisite: NIL

COURSE LEARNING OUTCOMES (CLO)

1. Appreciate the impact of microbial processes in food , water and soil.
2. Develop critical thinking skills required for food /environment quality control.

IMMUNOLOGY LAB

Course Code: 21MBM255 Continuous Evaluation: 60 Marks
Credits: 1 End Semester Examination: 40 Marks L T P : 0 0 2 Course Type: Practical

Prerequisite: NIL

COURSE LEARNING OUTCOMES (CLO)

After performing immunological experiments student must learn

1. Detection antigen in the given patient sample

2. Detection of antibodies in the given specimen
3. Detection antigen antibody complexes
4. Diagnosis of antigens & antibodies in serum
5. Detection of hormones, drugs & vitamins at very low concentration

COMPUTATIONAL BIOLOGY LAB

Course Code:21MBM253 Continuous Evaluation: 60 Marks Credits: 1 End Semester Examination: 40 Marks L T P : 0 0 2 Course Type: Core

Prerequisite: Knowledge of biology and basic programming (10+2)

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of practical course, students would be able to:

1. To use and develop bioinformatics programs for comparing & analyzing biological sequence data to identify probable function.
2. Gain working knowledge of these computational tools and methods
3. To understand the methodologies used for database searching, and determining the accuracies of database search.
4. Analysis and development of models for better interpretation of biological data to extract knowledge.

DRUG DESIGNING & PHARMACOGENOMICS

Course Code: 21MPE201 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 Course Type:THEORY

Prerequisite: NIL

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Explain the basic concepts of drug discovery and development
2. Describe drug receptor interaction.
3. Discuss molecular modelling and virtual screening
4. Explain the role of genomics in drug discovery
5. Discuss drug delivery methods and regulations

ENZYMOLOGY

Course Code: 21MPE202 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type: Theory

Prerequisite: NIL

COURSE LEARNING OUTCOMES
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Describe and use the equations of enzyme kinetics.
2. Explain the principles of enzyme inhibition.
3. Explain the mechanisms of enzyme catalysis.
4. Know the enzyme technology and application of enzymes.

VIROLOGY

Course Code:21MPE203 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type: Theory

Prerequisite: NIL

COURSE LEARNING OUTCOMES
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Describe and review the elements of the viral life cycle.
2. Explain viral replication strategies; and compare and contrast replication mechanisms used by viruses relevant for human disease.
3. Describe viral strategies to evade host immune and cellular factors.
4. Understand virus pathogenesis, and methods used for laboratory diagnosis of viral infections

DOWNSTREAM PROCESSING & FERMENTATION TECHNOLOGY

Course Code: 21MBM301 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type: Theory

Prerequisite: NIL

COURSE LEARNING OUTCOMES:
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Learn Bioprocess engineering.
2. Understand how biology and engineering are interconnected.
3. Understand industrial production of chemicals.
4. Types of fermentation process; and applications.

BIOSTATISTICS

Course Code: 21MBM302 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type: Theory

Prerequisite: Nil

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Gain broad understanding of biostatistics.
2. Appreciate their relevance for investigating specific contemporary biological questions.
3. Develop their own work flows using biostatistics concept to solve biological problems.
4. Apply Recognize importance and value of mathematical and statistical thinking, training, and approach to problem solving, on a diverse variety of disciplines.

BIOETHICS, IPR & BIOSAFETY

Course Code:21MSM303 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type:Theory

Prerequisite: NIL

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will gain awareness about Intellectual Property Rights (IPRs) to take measure for the protecting their ideas
2. Students will be able to devise business strategies by taking account of IPRs
3. Students will acquire adequate knowledge in the use of genetically modified organisms and its effect on human health
4. Students will gain more insights into the regulatory affairs.

ADVANCED STRUCTURAL BIOLOGY

Course Code:21MPE103 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type: Theory

Prerequisite: Knowledge of basic biology

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Learn the fundamentals of protein structure, and physical interactions.
2. Learn about various methods and experimental approaches that reflect the state-of-the art in protein research and are commonly used;
3. Understand various applications of protein structure;
4. The course will provide students with a learning experience that will make protein structure exciting, interesting, and accessible to them, as well as applicable to their future careers.

MICROBIAL GENETICS

Course Code:21MSM207 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type:Theory

Prerequisite:

COURSE LEARNING OUTCOMES
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. The student will be able to explain the processes behind mutations and other genetic changes.
2. The student will be able identify and distinguish genetic regulatory mechanisms at different levels.
3. The student will be able solve theoretical and practical problems in genetic analysis particularly concerning genetic mapping and strain construction.

Downstream Processing Lab

Code: 21MBM351 Continuous Evaluation: 60 Marks
Credits: 2 End Semester Practical Examination: 40 Marks L T P : 0 0 4

Prerequisite: NIL	

LAB LEARNING OUTCOMES (CLO):
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Learn Bioprocess engineering;
2. Understand how biology and engineering are interconnected;
3. Industrial production of chemicals;
4. Types of fermentation process.

Applied Microbiology Lab

Code: 21MSM354 Continuous Evaluation: 60 Marks
Credits: 2 End Semester Practical Examination: 40 Marks L T P : 0 0 4

Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO):
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Learn various methods for their isolation, detection and identification of microorganisms in food and employ in industries;
2. Get equipped with a theoretical and practical understanding of industrial microbiology;
3. Appreciate how microbiology is applied in manufacture of industrial products;
4. Understand the rationale in medium formulation & design for microbial fermentation, sterilization of medium.

Research Methodology

Course Code:21MBM357 Continuous Evaluation: 40 Marks

Credits: 1 End Semester Examination: 60 Marks L T P : 1 0 0 Course Type:Theory

Prerequisite:

COURSE LEARNING OUTCOMES
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Demonstrate the ability to choose methods appropriate to research aims and objectives.
2. Understand the limitations of particular research methods. Develop skills in qualitative and quantitative data analysis and presentation.
3. Develop advanced critical thinking skills.

FOOD MICROBIOLOGY & NUTRITION SCIENCE

Course Code: 21MPM301
Continuous Evaluation: 40 Marks
Credits: 3 End Semester Examination: 60 Marks L T P : 3 Course Type:THEORY

Prerequisite: NIL

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Appreciate the role of microbes in food spoilage.
2. Identify & assess food preservation methods.
3. Restate the relationship between food and nutrition.
4. Explain role of microbes in nutraceuticals and fermented foods.
5. Appreciate food safety and quality management.

COURSE LEARNING OUTCOMES
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the industrially useful microorganism and its application for development of useful products.

AI & ML IN BIOLOGICAL SCIENCES

Course Code: 21MPE303 Continuous Evaluation: 40 Marks Credits: 3 End Semester Examination: 60 Marks L T P : 3 0 0 Course Type:Theory

Prerequisite:

COURSE LEARNING OUTCOMES:
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Use the bioinformatics and computational tools for study and research;
2. Develop an understanding of basic theory of these computational tools;
3. Gain working knowledge of these computational tools and methods;
4. Understanding the applications in various applied areas of biology.

NUTRITIONAL IMMUNOLOGY

Course Code: 22MPE304 Continuous Evaluation: 40 Marks

Credits: 3	End Semester Examination: 60 Marks

L T P : 3 0 0 Course Type: Theory

Prerequisite: NIL

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Outline and integrate factors that determine microbial growth, survival, and death in foods & can explain methods for detection and enumeration.
2. Know the different methods of food preservation, basics of sanitation, and food safety.
3. Know role of gut microbiota in immune system development
4. Know the importance of microorganisms for development of food products and microbes that benefit host health.
5. Students will be aware of probiotics, prebiotics, their role in immunomodulation & prevention of diseases.