

DEPARTMENT OF MICROBIOLOGY

Mrs. K. S. K. College, Beed.

Academic Year: 2026-2027

M.Sc. (NEP)

GENERAL MICROBIOLOGY AND DIVERSITY MIC-UD/MJ/500 T

Course Objectives

To understand the microbial biodiversity

TO acquaint with ecology

TO understand the morphology, physiology, and significance Of extremophilic microbes

Course Outcomes

After successful completion of this course, students will be able to:

Comprehend the biodiversity.

Familiarize with various ecological niche and microbial interactions.

Recognize the morphology, physiology, and significance of extremophilic microbes.

Bioenergetics and Enzymology MIC-UD/MJ/501 T

Course Objectives

To understand concepts of bioenergetics and metabolic pathways of microorganisms.

To study the metabolic pathways of industrially important fermentation product.

To know the properties, kinetics, and significance of microbial enzymes.

Course Outcomes

After successful completion of this course, students Will be able to:

Elucidate the bioenergetics and microbial metabolic pathways.

Cognizant about the metabolic pathways of industrially important fermentation product.
Demonstrate the properties, kinetics, and significance of microbial enzymes.

Techniques in Microbiology Credits 2 MIC-UD/MJ/502 T

Course Objectives

To study the principles, need and care of laboratory instruments.

To understand theory, principles of chromatographic, electrophoretic, and techniques Get detail applications of various instrument and techniques in microbial field.

Course Outcomes

After successful completion of this students Will able to:

Explain the principles, need and SOP Of laboratory instruments.

Pertain the theory, principles of chromatographic, electrophoretic, spectrophotometric and radioisotope techniques.

Demonstrate various instruments and techniques.

Basic Biostatistics MIC-UD/MJ/503 T

To understand various statistics terminologies and their significance in microbiology

To get familiar with various computation tools of biostatistics.

To know-how research methodology.

Course Outcomes

After successful completion of this course, students Will able to:

Apply the principles of statistics for designing microbiological statistical analysis, and interpretation of results.

Operate and solve exercise using computation statistics software.

Get acquainted with basic approach of research methodology.

MICROBIAL TAXONOMY (T) MIC-UD/DSE/504 T

Course Objectives

To understand microbial diversity and their significance in microbiology

To get familiar with various methods for identification and classification of bacteria and viruses

To acquaint with Bergey's Manual, molecular phylogenetic

Course Outcomes

After successful completion of this course, students Will be able to:

Explain the principles, need and significance of classification.

Use knowledge for identification of bacteria.

Use tools for phylogenetic analysis.

Research Methodology MIC-UD/RMJ505 T

Course Objectives:

To define research and describe the research and research methods.

To understand qualitative research and methods used to execute and validate qualitative research

To know how to apply the basic aspects of the research process in order to plan and execute a research project.

To provide insight into the that lead to the publishing of research.

To able to present, review and publish scientific articles.

Course Outcomes:

Students will able to –

1. understand and explain research process.
2. Do systematic literature survey, formulation of a research topic, study design, analysis and interpretation of data.
3. To design a research approach for a research issue of their choice.

4. Select a suitable analytical method for a specific research approach.
5. Demonstrate a good understanding of how to write a research report.
6. critically assess published quantitative research with regard to the statistical methods and approaches adopted.
7. Create a research document for implementation research project.

Virology, Bacteriology, Parasitology MIC-UD/MJ/550 T

Course Objectives

TO aware the virus, classification, and their significance

TO abreast about bacteriology and Parasitology

To understand the viral multiplication and pathogenic role of viruses, bacteria and parasites along with control of virus and newly emerging virus

Course Outcomes

After successful completion of this course, students will be able to:

Explicate the virus, classification, and their significance.

Comprehend the viral multiplication and pathogenic role of viruses, bacteria and parasites.

Understanding about diagnosis and control of virus, bacteria and parasite.

Microbial Physiology MIC-UD/MJ/551 T

Course Objectives

To acquaint various life process like photosynthesis, respiration and fermentation, anaerobic respiration, and bacterial sporulation.

To understand bacterial membrane transport.

To understand the concept of chemolithotrophy and nitrogen metabolism.

Course Outcomes

After successful completion of this course, students Will be able to:

Understand various life process like photosynthesis, respiration and fermentation, anaerobic respiration, and bacterial sporulation.

Elucidate bacterial membrane transport.

Discuss the concept of chemolithotrophy and nitrogen metabolism.

FOOD MICROBIOLOGY MIC-UD/MJ/552 T

Course Objectives

To understand concepts in fermentation microbiology.

To complement the students with the knowledge of microbiology of food preservation and spoilage

To acquaint the students with food preservation methods

Outcomes

After successful completion of this course, students Will be able to:

Know the concepts related to popular food products, its microbiology and spoilage.

Understand fermented food products, food spoilage and contamination.

Understand various methods for food preservation.

Applied and Industrial Microbiology MIC-UD/M. J/553 T

Course Objectives

To understand concepts in milk microbiology.

To complement the students with the basic knowledge of microbiology.

To acquaint the students with food preservation techniques

Outcomes

After successful completion of this course, students will be able to:

Know the concepts related to milk products, milk examination and spoilage.

Comprehend knowledge regarding fermented food products, food spoilage and infection.

Understand diverse strategies for food preservation.

A) Pharmaceutical Microbiology (T) MIC-UD/DSE/554 T

Course Objectives

To develop practical skills involved in interpretation of microbiological materials and data

To promote development of entrepreneurship and build up professionals in Pharmaceutical Analysis, and work

To understand quality assurance validation

Course Outcomes

After successful completion of this course, students are expected to:

Conversant in practical skills involved in interpretation of microbiological materials and data

Explain the development of entrepreneurship and build up professionals in pharmaceutical Analysis, and work

Aware about quality validation

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Program Outcomes (PO)

On completion of program students will be able to

1. Acquire ability to apply the process of science by formulating hypotheses and design experiments based on the scientific method.
2. Analyse and interpret results from a variety of microbiological experiments
3. Use quantitative reasoning by using mathematical calculations to solve problems in microbiology.
4. Communicate and collaborate with other disciplines effectively

5. Identify credible scientific sources to interpret and evaluate the evidences
6. Understand the relationship between science and society by recognizing and discussing logical, scientific and ethical issues in microbiology.
7. Exhibit ability to pursue careers in the industry and applied research where microbial systems are increasingly employed.

Program specific outcomes (PSO)

On completion of program students will be specifically able to

1. Prepare and view specimens for examination using light microscopy
2. Apply techniques to isolate, identify and maintain microorganisms.
3. Enumerate microorganisms from various samples
4. Independently handle microbiological equipment and methods.
5. Exercise Safe microbiology practices.
6. Plan, design, execute experiments and interpret, document and present findings.

MICROBIAL GENETICS MIC/UD/MJ/600T

Course Objectives:

1. **Fundamentals of Microbial Genetics:** To provide students with a solid foundation in the principles and concepts of microbial genetics.
2. **Microbial Genome Organization:** To teach students about the structure, function, and organization of microbial genomes, including plasmids and bacteriophages.
3. **Genetic Variation and Mutation:** To explore the mechanisms of genetic variation and mutation in microorganisms.
4. **Regulation of Gene Expression:** To provide an understanding of how gene expression is regulated in microorganisms.

Course Outcomes:

1. **Understanding Microbial Genetics Principles:** Students will demonstrate a comprehensive understanding of the basic principles and concepts of microbial genetics.
2. **Knowledge of Genome Organization:** Students will be able to describe the structure, function, and organization of microbial genomes, including the roles of plasmids and bacteriophages.
3. **Insight into Genetic Variation:** Students will understand the mechanisms that drive genetic variation and mutation in microorganisms.
4. **Regulation of Gene Expression:** Students will have a clear understanding of the regulatory mechanisms controlling gene expression in microorganisms.

MOLECULAR IMMUNOLOGY MIC/UD/MJ/601T

Course Objectives for Molecular Immunology

1. **Fundamental Concepts:** To provide students with a thorough understanding of the basic principles of immunology, including the molecular and cellular components of the immune system.
2. **Immune System Mechanisms and Signal Transduction:** To explore the mechanisms of immune recognition, response, and regulation at the molecular level and To introduce students to the signaling pathways involved in immune cell activation and regulation
3. **Molecular Techniques:** To familiarize students with the molecular techniques and methodologies used in immunology research, including flow cytometry, ELISA, and PCR.
4. **Immune Disorders:** To provide insights into the molecular basis of immune disorders.
5. **Vaccines and Immunotherapy:** To discuss the development and application of vaccines and immunotherapies based on molecular immunology principles.

Course Outcomes for Molecular Immunology

1. **Comprehensive Knowledge:** Students will demonstrate a comprehensive understanding of the fundamental concepts and principles of molecular immunology.

2. **Signal Transduction Pathways:** Students will be able to describe the key signaling pathways involved in immune cell activation and regulation.
3. **Proficiency in Molecular Techniques:** Students will gain proficiency in using molecular techniques commonly employed in immunology research and be able to interpret the results.
4. **Understanding Immune Disorders:** Students will be able to identify and explain the molecular basis of various immune disorders and their clinical implications.
5. **Application of Immunology Principles:** Students will be knowledgeable about the development and application of vaccines and immunotherapies, understanding their molecular underpinnings.

BIOPROCESS ENGINEERING AND TECHNOLOGY MIC/UD/MJ/602 T

Course Objectives:

1. **Fundamental Principles:** To provide students with a solid understanding of the fundamental principles of bioprocess engineering, including the basics of biological systems and chemical engineering principles.
2. **Bioreactor Design and Operation:** To teach students about the design, operation, and optimization of bioreactors and other bioprocess equipment.
3. **Downstream Processing:** To introduce the principles and techniques involved in the recovery and purification of bioproducts.
4. **Bioprocess Control and Monitoring:** To provide knowledge on the various control and monitoring techniques used to ensure efficient and stable bioprocess operations.
5. **Scale-up and Scale-down:** To discuss the principles and challenges involved in scaling up and scaling down bioprocesses from laboratory to industrial scale.

Course Outcomes:

1. **Understanding of Bioprocess Principles:** Students will demonstrate a comprehensive understanding of the fundamental principles of bioprocess engineering and technology.

2. **Proficiency in Bioreactor Design:** Students will be able to design, operate, and optimize bioreactors and other bioprocess equipment for various applications.
3. **Downstream Processing Skills:** Students will gain proficiency in the principles and techniques of downstream processing for the recovery and purification of bioproducts.
4. **Bioprocess Control and Monitoring:** Students will be able to implement and utilize various control and monitoring techniques to ensure efficient and stable bioprocess operations.
5. **Scale-up and Scale-down Proficiency:** Students will understand the principles and challenges of scaling up and scaling down bioprocesses, and be able to apply these principles in practical scenarios.

ENVIRONMENTAL MICROBIAL TECHNOLOGY MIC/UD/MJ/603T

Course Objective:

The course objective is to learn the principles of an environment, the interaction of organisms with the environment and other organisms. Role of microorganisms in control of environmental damage.

Course Outcomes:

The student after completion of the course will be able to:

1. Get acquainted with the environment, ecosystems and natural habitats.
2. Understand how organisms interact among themselves and with other organisms and various environmental factors.
3. Understand the important role microbes play in an ecosystem and its significance.
4. Get in-depth knowledge of different types of solid-liquid waste and their management.
5. Get familiar with pollution problems and technologies to overcome the problems.

AGRICULTURAL MICROBIOLOGY MIC/UD/DSE/604 B T

Course Objectives for Agricultural Microbiology

1. **Introduction to Microbial Biofertilizers and Biopesticides:** To provide students with a thorough understanding of the principles, concepts, and types of microbial biofertilizers and biopesticides.
2. **Microbial Interactions with Plants:** To explore the beneficial interactions between microorganisms and plants, including mechanisms of nutrient uptake and pest resistance.
3. **Production and Formulation:** To teach students the methods of producing and formulating microbial biofertilizers and biopesticides for agricultural use.
4. **Application Techniques:** To familiarize students with the various application techniques and best practices for using microbial biofertilizers and biopesticides in different crops and environments.

Course Outcomes for Course Outcomes for Agricultural Microbiology

1. **Understanding of Biofertilizers and Biopesticides:** Students will demonstrate a comprehensive understanding of the principles, types, and roles of microbial biofertilizers and biopesticides in agriculture.
2. **Knowledge of Plant-Microbe Interactions:** Students will be able to explain the beneficial interactions between microorganisms and plants, including how these interactions enhance nutrient uptake and pest resistance.
3. **Proficiency in Production and Formulation:** Students will gain practical skills in the production and formulation of microbial biofertilizers and biopesticides, including culture techniques and formulation strategies.
4. **Application Skills:** Students will be proficient in the application techniques of microbial biofertilizers and biopesticides, understanding how to apply them effectively in different agricultural settings.

RECOMBINANT DNA TECHNOLOGY MIC/UD/MJ/650T

Course Objectives for Recombinant DNA Technology

1. **Fundamentals of Genetic Engineering:** To introduce students to the basic principles and concepts of genetic engineering and recombinant DNA technology.
2. **Molecular Biology Techniques:** To familiarize students with essential molecular biology techniques, including DNA extraction, cloning, and transformation.
3. **Gene Manipulation:** To provide knowledge on gene manipulation methods, including restriction digestion, ligation, and polymerase chain reaction (PCR).
4. **Vector Design and Selection:** To teach students about the design, selection, and application of vectors used in recombinant DNA technology.
5. **Applications of Recombinant DNA Technology:** To discuss various applications of recombinant DNA technology in medicine, agriculture, and industry.

Course Outcomes for Recombinant DNA Technology

1. **Understanding of Genetic Engineering Principles:** Students will demonstrate a solid understanding of the basic principles and concepts of genetic engineering and recombinant DNA technology.
2. **Proficiency in Molecular Biology Techniques:** Students will gain proficiency in essential molecular biology techniques, including DNA extraction, cloning, and transformation.
3. **Gene Manipulation Skills:** Students will be able to perform gene manipulation techniques such as restriction digestion, ligation, and PCR.
4. **Vector Utilization:** Students will understand the design, selection, and application of vectors used in recombinant DNA technology.
5. **Application Awareness:** Students will be knowledgeable about the various applications of recombinant DNA technology in different fields such as medicine, agriculture, and industry.

FERMENTATION TECHNOLOGY MIC/UD/MJ/651T

Course Objectives for Fermentation Technology

1. **Fundamentals of Fermentation:** To provide students with a comprehensive understanding of the basic principles of fermentation processes, including microbial growth, metabolism, and the biochemical pathways involved.
2. **Types of Fermentation:** To familiarize students with different types of fermentation processes, including batch, fed-batch, and continuous fermentation, and their respective advantages and applications.
3. **Product Recovery and Purification:** To educate students on the methods of downstream processing, including product recovery, purification, and quality control of fermentation products.
4. **Industrial Applications:** To expose students to the industrial applications of fermentation technology in various sectors such as pharmaceuticals, food and beverages, biofuels, and waste treatment.

Course Outcomes for Fermentation Technology

1. **Understanding of Fermentation Principles:** Students will be able to explain the fundamental principles of microbial fermentation and the biochemical pathways involved.
2. **Proficiency in Fermentation Types:** Students will be able to distinguish between different types of fermentation processes and select the appropriate method for specific industrial applications.
3. **Downstream Processing Knowledge:** Students will gain knowledge in downstream processing techniques for the recovery and purification of fermentation products, ensuring product quality and compliance with industry standards.
4. **Application of Fermentation Technology:** Students will understand the wide range of industrial applications of fermentation technology and be able to apply this knowledge in real-world scenarios.

ENZYME TECHNOLOGY MIC/UD/DSE/652T

Course Objectives:

1. Fundamentals of Enzyme Technology:

- Understand the basic principles of enzyme structure, function, and kinetics.
- Learn about the role of enzymes in biological systems and industrial processes.

2. Enzyme Production and Purification:

- Gain knowledge of various methods used for the production and purification of enzymes.
- Understand the techniques for enzyme isolation, characterization, and assay.

3. Enzyme Catalysis and Mechanisms:

- Study the mechanisms of enzyme catalysis and the factors affecting enzyme activity.
- Learn about enzyme-substrate interactions and enzyme inhibition.

4. Applications of Enzymes:

- Explore the diverse applications of enzymes in industries such as pharmaceuticals, food and beverage, textiles, and biofuels.
- Understand the use of enzymes in medical diagnostics and therapy.

Course Outcomes:

1. Comprehensive Understanding of Enzyme Function:

- Ability to describe the structure and function of enzymes and explain the principles of enzyme kinetics.
- Proficiency in understanding the role of enzymes in metabolic pathways and industrial applications.

2. Proficiency in Enzyme Production and Purification:

- Skills to produce and purify enzymes using various biotechnological methods.
- Ability to perform enzyme assays and characterize enzyme activity.

3. Expertise in Enzyme Catalysis:

- Knowledge of enzyme catalysis mechanisms and factors affecting enzyme function.
- Ability to analyze enzyme kinetics data and understand enzyme inhibition.

4. Application of Enzymes in Industry:

- Understanding of how enzymes are used in various industrial processes.

- Capability to identify and solve problems related to enzyme applications in different industries.

BIOINFORMATICS, MICROBIAL GENOMICS AND PROTEOMICS

MIC/UD/DSE/654A T

Course objectives:

1. Understand the Fundamentals of Bioinformatics:

- Grasp basic principles of bioinformatics including the concepts of sequence alignment, database searching, and molecular evolution.
- Learn about various types of biological data and their sources.

2. Explore Genomics and Proteomics:

- Understand the principles of genomics and proteomics.
- Learn about genome sequencing technologies, proteomic techniques, and their applications.

3. Apply Bioinformatics to Real-World Problems:

- Understand the role of bioinformatics in areas such as personalized medicine, evolutionary biology, and biotechnology.
- Learn to apply bioinformatics techniques to solve biological and biomedical problems.

Course Outcomes:

1. Proficiency in Bioinformatics Tools:

- Ability to use bioinformatics software for sequence alignment, phylogenetic analysis, and structural biology.
- Competence in utilizing databases such as GenBank, EMBL, and PDB.

2. Expertise in Computational Methods:

- Capability to develop and implement algorithms for bioinformatics applications.
- Skill in statistical analysis and machine learning techniques applied to biological data.

3. Critical Thinking and Problem-Solving:

- Enhanced ability to apply bioinformatics knowledge to solve complex biological problems.
- Improved skills in interpreting and visualizing complex datasets.

4. Research and Practical Experience:

- Hands-on experience in conducting bioinformatics research projects.
- Development of skills necessary for academic and industrial research careers.

5. Preparedness for Advanced Studies and Careers:

- Readiness to pursue further studies or careers in bioinformatics, computational biology, or related fields.
- Strong foundation for contributing to interdisciplinary research and development in biotechnology, healthcare, and environmental science.