

DEPARTMENT OF MICROBIOLOGY PROGRAM OUTCOMES AND COURSE OUTCOMES


PROGRAM OUTCOMES:

1. Students of the B.Sc. Microbiology program will learn to use scientific logic as they explore a wide range of contemporary subjects spanning various aspects of basic microbiology such as Bacteriology, Virology, Biochemistry, Microbial Physiology, Immunology, Cell Biology, Molecular Biology, Genetics, Systems Biology, Immunology, and Molecular biology, in addition to becoming aware of the applied aspects of microbiology such as Industrial Microbiology, Food, and Dairy Microbiology, Environmental Microbiology, and Medical Microbiology to name just a few.
2. Students will appreciate the biological diversity of microbial forms and be able to describe/explain the processes used by microorganisms for their replication, survival, and interaction with their environment, hosts, and host populations. They will become aware of the important role microorganisms play in the maintenance of a clean and healthy environment. They will learn about the role of microorganisms in plant, animal, and human health and disease.
3. Students will gain knowledge of various biotechnological applications of microorganisms and will learn of industrially important substances produced by microorganisms. They will gain familiarity with the unique role of microbes in genetic modification technologies.
4. Students will become familiar with scientific methodology, hypothesis generation and testing, and design and execution of experiments. Students will develop the ability to think critically and to read and analyse scientific literature.
5. Students will acquire and demonstrate proficiency in good laboratory practices in a microbiological laboratory and be able to explain the theoretical basis and practical skills of the tools/technologies commonly used to study this field.
6. Students will develop proficiency in the quantitative skills necessary to analyse biological problems
7. Students will develop strong oral and written communication skills through the effective 2 presentations of experimental results as well as through seminars.
8. Graduates of the B.Sc. Microbiology program will be informed citizens who can understand and evaluate the impact of new research discoveries in the life sciences and will be able to pursue a wide range of careers, including biological and medical research in higher education institutions as well as careers in public and global health, scientific writing, environmental organizations, and food, pharmaceuticals, and biotechnology industries.

COURSE OUTCOMES:

PAPER I: Introductory Microbiology

- After completing the Paper, the student should be able to:
- Students will learn about the different fields in microbiology.
- Students will gain knowledge about the different types of microorganisms and their significance.


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- Students will study different techniques used in microbiology
- Students will gain knowledge about the different cell organelles of microorganisms and their detailed functions.
- Students will also study the growth and control of microbes as well as different bacteriological techniques involved in microbiology
- Students will learn about biomolecules by studying their structures and types.

PAPER II: Microbial Physiology and Biochemistry:

- This course enables the students to provide basic knowledge about catabolism, anabolism, regulation of metabolism, and pathway analysis. It also gives an understanding of how enzymes and metabolites in the living system work to produce energy and synthesize different biomolecules.
- Students will study the growth of different types of microorganisms based on various environmental factors.
- Students will gain knowledge about nutrient uptake and transport and the different metabolic pathways involved in their growth.
- Students will also learn about viruses and eukaryotic cell structures in detail.

PAPER III: Medical Microbiology and Basics of Immunology:

- After completing the Paper, the student should be able to:
- Demonstrate the basic knowledge of immunological processes at a cellular and molecular level
- Define central immunological principles and concepts
- Outline, compare and contrast the key mechanisms and cellular players of innate and adaptive immunity and how they relate
- Elucidate the genetic basis for immunological diversity and the generation of adaptive immune responses
- Outline key events and cellular players in antigen presentation, and how the nature of the antigen will shape resulting effector responses
- Identify the main mechanisms of inflammation
- Outline key events and cellular players governing mucosal immunity
- Understand the principles governing vaccination and the mechanisms of protection against infectious diseases
- Understand and explain the basis of immunological tolerance, autoimmunity, and transplantation
- Understand and explain the basis of allergy and allergic diseases

- Understand and explain the immune system in cancer; tumor immunology and principles of immunotherapy
- This course provides learning opportunities in the basic principles of medical microbiology and infectious disease. It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora. The biology of bacterial, viral, fungal, and parasitic pathogens and the diseases they cause are covered. Relevant clinical examples are provided. The course provides the conceptual basis for understanding pathogenic microorganisms and the mechanisms by which they cause disease in the human body. It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases.

PAPER IV: Molecular Biology and Microbial Genetics:

- To provide a comprehensive background of Salient features of Nucleic Acids and DNA models to the course learners.
- To impart a detailed understanding of key events of molecular biology comprising the mechanism of DNA Replication, Transcription, and Translation in Prokaryotes and Eukaryotes.
- To provide adequate knowledge about Post Transcriptional Modifications and Processing of Eukaryotic RNA to the course learners.
- To give a detailed explanation of Transcriptional Regulation with examples of the lac operon and tryptophan operon in prokaryotic as well as eukaryotic organisms along with the key concept of Gene Silencing to the course learners.
- To develop a comprehensive understanding of DNA Repair Mechanisms in the course learners.
- To provide a glimpse of the types of Regulatory RNAs by imparting adequate information about ribo-switches, RNA Interference, miRNA, and siRNA to the course learners.
- The course will also emphasize Post Transcriptional Modifications and Processing of Eukaryotic RNA covering the concepts of Split genes, Introns, Exons, Splicing Mechanisms, and RNA Editing.

PAPER V: Industrial and Food Microbiology:

Throughout the semester, students should be able to:

- To provide in-depth knowledge to students on different aspects of microbial growth and associated spoilage in foods.
- Demonstrate to students on principles, different preservation methods of food, and mode of action of various preservation methods on microbes.
- Acquaint students with types of fermentation processes and microbial production of industrial products.

- factors influencing their growth and survival.
- Illustrate the use of basic microbiological methods for the evaluation of the microbial load in the different food matrices.
- Able to compare various physical and chemical methods used in the control of microorganisms.
- Involved in the production of different industrial products from microorganisms in industries

PAPER VI: Environmental Microbiology

Throughout the semester, students should be able to:

Environmental microbiology is designed to introduce students to understand environmental concepts, principles, and the world of microorganisms from the point-view of interaction and reaction of microbial impacts and the role of microorganisms in the environment. Control and resolve environmental problems that affect our lives. Characterized the microorganisms and their activities exist in air, water, and soil environments in combination with factors that influence their activity and development.

Throughout the semester, students should be able to:

- Identify the main concepts of microbial ecology
- Discuss the applications and use of microbial power in the control of some environmental pollution and how it is applied to study and resolve environmental problems
- List the negative roles of microorganisms in the environment (Biodegradation of paints, - Biodegradation and concrete corrosion, Biodegradation and Metal corrosion)
- list the general characteristics of the different environments
- Discuss the effect of general characteristics of the different environments of its microflora.
- Explain the impacts of environmental factors on microbial activities.
Explain how microorganisms can survive, spread, adapt, and be resistant and tolerant in extreme environments.
- Summarize the microbe-microbe interaction, microbe-plant interaction, microbe-animal interaction
- Differentiate between biodegradation and biodeterioration
- Describe the biodegradation process.
- Apply the scientific methods in environmental microbiology e.g. collection, isolation, and investigation of microbial flora from various environments.
- List microorganisms in the air, water, soil, extreme environment, and man-made environment, its role and activities.
- Differentiate between the Ecosystems and Environments

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