

**Department of Microbiology
Kakatiya University
Warangal-506 009 (TS)**

Vision:

To provide knowledge and skills in microbiology that will empower the learners through awareness of the significance of microorganisms in the plant, animal, human health, environment, industry, and general human welfare through a problem-based and skill-oriented curriculum.

Mission:

- It shall develop competently, committed, and compassionate leaders with the advanced knowledge, skills, and attitudes required to manage changes in the field.
- It shall endeavor to continuously acquire, upgrade, and disseminate knowledge, creating and developing skills of highly adaptable employees capable of working in both laboratory and managerial roles.
- It shall encourage students to go beyond the classroom and learn about basic research and applications.

Programme Outcomes (POs):

- PO1: Apply theoretical knowledge to develop critical thinking and practical understanding in the field of microbiology to find solutions to human welfare.
- PO2: Acquire, retain and apply technical concepts and knowledge relevant to different fields of microbiology.
- PO3: Obtain knowledge on the role of microbes in human disease, development of novel diagnostic methods, and immune response to microbial infection.
- PO4: Gain hands-on experience with laboratory equipment that could enrich them to perform high throughput research on microorganisms and execute the research methodology required in the food, dairy, and pharmaceutical industries.
- PO5: Communicate scientific concepts, experimental results, and analytical discussions clearly and concisely, both verbal and written.
- PO6: Opt for higher studies in national level institutes and overseas, jobs in various sectors, and entrepreneurship abilities in the field of microbiology (consultancy, training centres, and diagnostic centres).
- PO7: Acquire the ability to work efficiently with a team to accomplish a common goal.
- PO8: Understand the potential and impact of microbiological innovations in reducing environmental pollution, health sector, and agriculture.

Programme Specific Outcomes (PSOs):

- PSO1: Get sufficient knowledge on principles and applications of microbiology, which will be applied in various sectors such as research and development, laboratories of

microbial product-based industries (production of antibiotics, industrially important enzymes, and dairy products).

PSO2: Students can apply their knowledge in competitive exams such as CSIR-UGC NET, SET, GATE, ICMR-JRF, and other national levels exams, as well as in executing research projects.

Course outcomes (COs):

Semester I

General Microbiology

CO1: Know the history and development of microbiology contributions of various scientists.

CO2: To gain knowledge on principles of microbial diversity, phylogeny, and taxonomy.

CO3: To learn the general characters and reproductive methods of algae, fungi, and protozoa.

CO4: To understand microbial growth and the environmental effect on microbial growth.

CO5: To learn a metagenomic approach to explore microbial diversity.

Virology

CO1: Acquire knowledge about the structure and classification of viruses.

CO2: Understand the methods of cultivating plant viruses, animal viruses, and bacteriophages.

CO3: Understand the replication pattern of bacteriophages and plant and animal viruses.

CO4: Learn about viral vaccines, interferons, and antiviral drugs.

CO5: Acquire knowledge of different of viral organisms and their importance in agriculture, environment, and health.

Biological Chemistry

CO1: Understand the structure of carbohydrates and physicochemical properties from monosaccharides to polysaccharides.

CO2: Understand the structure and classification of amino acids, the design of proteins and types of proteins, understanding of protein purification methods, etc.

CO3: Acquire knowledge about the classification, structures, importance, and functions of lipids.

CO4: Understand the difference between the properties and functions of nucleic acids and their chemical composition.

CO5: Understand the types of vitamins and their crucial role in metabolism. Learn about the structures and functions of porphyrins.

Cell Biology and Enzymology

CO1: Understanding of energy sources and synthesis of energy, cell signaling, and communication systems.

CO2: Acquire knowledge about cell division, cancer-causing agents, and cancer biology.

CO3: To know the importance of enzymes and their role in different biological pathways.

CO4: Acquire knowledge about the industrial production and applications of enzymes.

CO5: Understanding the application of various enzymes as biosensors.

Semester II

Microbial Physiology and Metabolism

CO1: Acquire the knowledge on nutritional diversity and nutrient uptake in microorganisms, their physiology, and economic importance

CO2: Understand the mechanism of phototropism, diversity of phototrophs photochemistry, and modes of CO₂ fixation

CO3: Understand the metabolism of carbohydrates and the interrelation between different metabolism pathways.

CO4: To know the concepts of aerobic and anaerobic respiration and energy gaining, primary and secondary metabolisms, and biotransformations.

CO5: Understand the synthesis and catabolism of various lipids and amino acids. Importance of and breakdown of purine and pyrimidine nucleotides

Molecular Biology

CO1: Acquire knowledge about DNA replication, damage, and repair mechanisms in prokaryotes and eukaryotes.

CO2: Understanding of transcription mechanism and role of different enzymes in transcription.

CO3: To know the importance of translation, protein targeting, folding, and sorting.

CO4: Acquire knowledge on the factors affecting the regulation of gene expression.

CO5: Understanding the role of different molecules in various biological systems.

Immunology

CO1: Learn about the structure and functions of lymphoid organs and the immune system.

CO2: Understand the principles of antigen-antibody interactions *in vitro* and *in vivo*.

CO3: Understand immunopathology (autoimmune diseases, hypersensitivity reactions)

CO4: Acquire knowledge of tumor immunology and tissue and organ transplantation.

CO5: To understand complement systems and pathways, and Hybridoma technology.

Biophysical Techniques and Instrumentation

CO1: Understanding the preparation of buffers and gaining knowledge about different types of microscopes.

CO2: Acquire knowledge about different analytical techniques like centrifugation and chromatographic techniques.

CO3: To know the importance of different electrophoretic and radiation biology techniques and their applications.

CO4: Acquire knowledge about spectroscopic techniques and their applications.

CO5: Understanding the role of different biophysical techniques and their applications in various biological systems.

Semester III

Microbial genetics and Genetic engineering

- CO1: Gain knowledge about recombination and its models. The concept of gene mapping, the importance of plasmids, and transposable elements.
- CO2: Acquire knowledge about the mutation, mutagens, and their types. Importance of mutation screening methods.
- CO3: Gain knowledge of recombinant technology and gene libraries.
- CO4: Understand the mechanism of polymerase chain reaction and types of PCR and their importance.
- CO5: Understand the concept and strategies of gene therapy and its prospects.

Bioinformatics and Computational methods

- CO1: Acquire knowledge about the genomic tools and evolution of organisms.
- CO2: Understanding various biological data management and data access and processing.
- CO3: To know the importance of collecting, analyzing, and interpreting biological data using different statistical methods.
- CO4: Acquire knowledge about different statistical methods and their applications in biology.
- CO5: Understanding the different bioinformatic tools and biostatistical methods and their applications.

Bioprocess Technology

- CO1: Understanding of growth and preservation of industrially important microbes.
- CO2: Acquire knowledge about different fermentation techniques.
- CO3: Understanding the cost effect and recovery of industrially important microbial products.
- CO4: Acquire knowledge about the industrial production of various microbial metabolites.
- CO5: Understanding the role of different microbes and their uses in various industries.

Agricultural Microbiology

- CO1: Acquire knowledge about the soil structures and soil microbes and their interactions with plants in soil fertilization.
- CO2: Understanding the pathogenesis and interaction between pathogens and plants.
- CO3: Acquire knowledge about plant pathogens and their symptoms in various crop plants.
- CO4: Understanding different methods applied in disease control and post-harvest conditions and their control measures.
- CO5: To learn plant pathogens, their interaction, and control methods.

Semester IV

Environmental Microbiology

- CO1: Understand the study of diversity, structure, activities, and evolution of microbes. In short, it focuses on all the interactions of the microbes with the environment.

- CO2: Acquire the knowledge of biodiversity and various elements involved in this concept.
- CO3: Understand the concept and principles of soil microbiology, decomposition of organic matter, and concept of microbial leaching and biomining.
- CO4: Acquire knowledge of water purification methods and pollution control biotechnology.
- CO5: To gain knowledge on atmosphere and airborne microbes, the importance of air sampling methods, air quality, and air sanitation.

Medical Microbiology

- CO1: Application of various fields of medical microbiology.
- CO2: Understand the pathogenesis, epidemiology, and lab diagnostic procedure of bacterial infections.
- CO3: To know the pathogenesis of different types of viral infections.
- CO4: Acquire knowledge about the life cycle and pathogenesis of protozoan diseases.
- CO5: Knowledge of different diagnostic procedures (morphological, serological, and molecular levels).

Microbial Technology

- CO1: Understanding the involvement of different microbes in food spoilage.
- CO2: To know about different types of microbial foods.
- CO3: Acquire knowledge about the production of microbial foods and enzymes.
- CO4: To know about the industrial production of value-added products.
- CO5: Understanding the role of different microbes in spoilage and production of valuable foods and compounds.

Pharmaceutical Microbiology

- CO1: Understanding of growth and preservation of pharmaceutically essential microbes.
- CO2: Acquire knowledge about different types of antibiotics and cosmetics.
- CO3: To know about chemotherapy, mode of action of drugs, and screening methods.
- CO4: Acquire knowledge regarding the assays to identify multidrug-resistant microbes.
- CO5: Understanding pharmaceutically important microbes and their applications.

Ph.D. Programme in Microbiology:

Programme outcome:

The Research Scholars will be able to identify and recognize the root cause of societal problems and their importance in designing scientific experiments to mitigate and solve societal problems with ethical research and scientific temperament. The Research Scholar will become good academicians with sound scientific knowledge and rational thinking. In the end, Research Scholars will be awarded a Ph.D. degree, and they will be more suitable for higher education and industry needs.