DEPARTMENT OF MICROBIOLOGY (ug)

PROGRAM OUTCOME:

1. Students develop the skill to think independently, plan research and execute it in different fields of Microbiology especially the environment sustainability, entrepreneurship and become job providers; can excel in academics, consultancy, industry and pollution control boards, industry as well as policy makers. Can make impactful contributions in the field for the development of nation as a whole.
2. Students learn to integrate science with society for the overall development of the nation. Are charged with the concepts to take up higher studies, set up small scale industries, and develop confidence to take up challenging tasks of research in the field of Microbiology.
3. Students learn to integrate science with day to day life, nutrition, quality control and laws governing the food safety. Can become independent researchers and make impactful contributions to the field of Food Microbiology. Can take up the jobs of Quality control in various organisations besides research and academics. Instead of becoming job seekers, they are trained to become job providers. Can play an important role in the nutritional safety of the nation for a healthy nation.
4. Students learn to integrate science with society for the overall development of the nation. Are equipped to train manpower, think independently, honesty in research and community service quality inculcated in them will help them in taking up higher studies, set up small scale industries, and develop confidence to take up challenging tasks of research in the field of Microbiology.

COURSE OUTCOMES

Semester-1

1. INTRODUCTION TO CLASSICAL BIOLOGY

1. Learn the principles of classification and preservation of biodiversity
2. Understand the plant anatomical, physiological and reproductive processes.
3. Knowledge on animal classification, physiology, embryonic development and their economic importance.
4. Outline the cell components, cell processes like cell division, heredity and molecular processes.
5. Comprehend the chemical principles in shaping and driving the macromolecules and life Processes.

Semester-1

2. INTRODUCTION TO APPLIED BIOLOGY

1. Learn the history, ultrastructure, diversity and importance of microorganisms.
2. Understand the structure and functions of macromolecules.
3. Knowledge on biotechnology principles and its applications in food and medicine.
4. Outline the techniques, tools and their uses in diagnosis and therapy.
5. Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

Semester -2

3. INTRODUCTION TO MICROBIOLOGY

1. Understand the historical significance of microbiology and the contributions of key scientists.
2. Recognize the classification of microorganisms and their place in the living world.
3. Comprehend the scope and applications of microbiology, including the origin of microbial life and the distinction between eukaryotic and prokaryotic cells.
4. Describe the characteristics of bacteria, archaea, fungi, algae, and protozoa.
5. Describe viruses, including their nature, composition, and diversity in structure.
6. Develop practical skills in aseptic techniques, growth media

Semester -2

4. BACTERIOLOGY AND VIROLOGY

1. Understand the concept of prokaryotic diversity and taxonomy.
2. Identify and describe the salient features of various bacterial groups
3. Comprehend the discovery, nature, and definition of viruses.
4. Describe the replication processes of specific viruses
5. Comprehend the concept of oncogenic viruses, and role of viruses in the ecosystem.

Semester-3

5: EUKARYOTIC MICROORGANISMS

1. Understand the characteristics, classification, and reproductive mechanisms of fungi, algae, and protozoa.
2. Recognize the importance of fungi in biotechnology, including their roles in food production, medicine, and agriculture.
3. Comprehend the significance of algae in various industries, the environment, and as a source of food.
4. Identify pathogenic protozoa and understand their impact on human health and the environment

Semester-3

6: BIOMOLECULES AND ENZYMOLOGY

1. Understand the classification and properties of carbohydrates, including monosaccharides, disaccharides, polysaccharides, and sugar derivatives.
2. Gain knowledge of lipids and fatty acids, including their classification, structures, functions, and their role in cell signaling and metabolism.
3. Comprehend the structure and functions of amino acids and proteins, including their primary, secondary, tertiary, and quaternary structures.

4. Learn about the structure and functions of nucleic acids, including DNA and RNA, as well as the concept of base composition and nucleic acid- protein interactions. They will also be introduced to the role of vitamins in metabolism.
5. Understand the structure of enzymes, enzyme classification, and mechanisms of action. They will also learn about the factors influencing enzyme activity and various types of enzyme inhibition

Semester-3

7. MICROBIAL AND ANALYTICAL TECHNIQUES

1. Understand the principles and applications of microscopy techniques, including bright field microscopy and electron microscopy (SEM and TEM), as well as staining techniques.
2. Know various sterilization and disinfection techniques, including physical methods (dry heat, moist heat, filtration, radiation) and chemical methods (disinfectants, alcohols, aldehydes, fumigants, phenols, halogens, heavy metals).
3. Perform pure culture isolation, maintenance and preservation of cultures, cultivation of anaerobic bacteria, and accessing viable non- culturable bacteria **(VNBC).**
4. Understand the principles and applications of spectrophotometry and chromatography techniques, including UV-visible spectrophotometry, colorimetry, turbidometry, paper chromatography, and column chromatography.
5. Gain knowledge of centrifugation principles and applications, electrophoretic techniques (agarose and SDS polyacrylamide gel), and the principles and applications of radioisotopes

Semester-3

8. CELL BIOLOGY AND GENETICS

1. Understand cell theory, cell organelles, the cell cycle, and the role of the cytoskeleton.
2. Students will comprehend the structure and functions of the cell membrane, nuclear envelope, and nucleolus, as well as gain basic knowledge of cancer development.
3. Learn about protein sorting, intracellular signal transduction pathways, programmed cell death, stem cells, and specialized chromosomes.
4. Gain knowledge of Mendelian genetics, including mono-hybrid and dihybrid crosses, inheritance patterns, and allele frequencies.
5. Understand the concepts of linkage, crossing over, the Hardy- Weinberg Law, natural selection, genetic drift, and the mechanisms of sex determination and inheritance.

Semester- 4

9. MOLECULAR BIOLOGY AND MICROBIAL GENETICS

1. Understand the nature of genetic material, its organization in prokaryotes and eukaryotes, and the role of DNA and RNA.
2. Explain the process of DNA replication in prokaryotes and the involvement of enzymes and

factors.

3. Recognize the characteristics, types, and applications of extra chromosomal genetic elements such as plasmids and transposons.
4. Differentiate between classical and modem concepts of genes, understand gene structure, and the process of transcription.
5. Comprehend the genetic code, translation process, and regulation of gene expression in bacteria.
6. Define and classify mutations, understand their molecular basis, and gain knowledge of DNA repair mechanisms.
7. Familiarize with genetic recombination in bacteria, including conjugation, transformation, and transduction processes.

Semester- 4

10. MICROBIAL PHYSIOLOGY AND METABOLISM

1. Understand the nutritional requirements of microorganisms and the different methods of nutrient uptake. They will also gain knowledge of different nutritional groups and types of growth media used for microbial cultivation.
2. Comprehend microbial growth, including the definition of growth, generation time, and the different phases of growth. They will also learn about factors influencing microbial growth and methods for measuring it.
3. Gain knowledge of thermodynamics in biological systems, including concepts of free energy, enthalpy, and entropy. They will also learn about ATP structure and properties, oxidation-reduction reactions, and carbohydrate breakdown pathways.
4. Understand microbial respiration, including aerobic and anaerobic respiration, chemoautotrophy, and fermentative modes.
5. Differentiate the processes of oxygenic and anoxygenic photosynthesis

Semester- 4

11: r DNA TECHNOLOGY, BIOINFORMATICS AND BIOSTATISTICS

1. Learn the principles and techniques of genetic engineering, including g restriction endonucleases, and DNA transformation.
2. Understand the use of vectors and the basics of polymerase chain reacti also explore the applications of genetic engineering in industry, agr medicine.
3. Gain knowledge of blotting techniques, DNA labeling, DNA sequenc basics of intellectual property rights.
4. Learn about bioinformatic resources, sequence databases, sequence align use of biostatistics in data analysis.
5. Develop skills in measuring central tendency and dispersion, understand types of data, and utilizing biostatistical software for analysis and data process.

Semester-5

12 A IMMUNOLOGY AND MEDICAL MICROBIOLOGY

1. Describe the key concepts in Immunology and how the immune system is able to discriminate self vs. non-self
2. Explain how the innate and adaptive immune systems work together to generate an effective immune response against a specific pathogen.
3. Explain how the immune system is able to respond to so many diverse antigens.
4. To understand the importance of pathogenic microorganisms in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract etc
5. To understand and able to correlate disease symptoms with causative agent, isolate and identify pathogens

Semester-5

12 B PHARMACEUTICAL MICROBIOLOGY

1. Explain the principles of biosafety cabinets and biological waste management
2. Explain the methods of detection of microorganisms in phamaceuticals.
3. Explain the molecular methods of detection of pathogens for quality control
4. Design/select specific media for identification of microbes in pharmaceutical products
5. Practice safety principles

Semester-5

13 A APPLIED MICROBIOLOGY

1. Identify the areas of entrepreneurship, and assess the scope for establishment.
2. Explain production of fermentation products and economics
3. Explain the production method of biofertilisers and mushrooms
4. Explain the process of baking and brewing
5. Prepare DPR and understand patenting

Semester-5

13 B DIAGNOSTIC MICROBIOLOGY

1. To differentiate and explain various methods of staining and media preparation.
2. Explain the principle and application of serological and molecular methods of diagnosis
3. Safeguard oneself and community from antibiotic misuse.
4. Analyse the incidence, distribution and determinants of diseases.
5. To execute the methods of prevention of various infectious diseases

Semester-5

14 A INDUSTRIAL MICROBIOLOGY

1. Recognize various industrially important microorganisms
2. Identify the methods of screening of required microorganisms
3. Identify the appropriate methods of fermentation to be adapted for productions
4. Discuss the basic concepts in industrial microbiology, industrially important microbes and metabolites
5. Explain the components of upstream and downstream bioprocessing

Semester-5

14 B: AGRICULTURAL MICROBIOLOGY

1. Soil Microbiology: Study soil as a microbial habitat, diversity of microorganisms, and their interactions.
2. Host Pathogen Interaction: Understand microbial pathogenicity, virulence factors, and plant defense mechanisms.
3. Control of Plant Diseases: Learn principles and practices for managing plant diseases, including regulatory, cultural, chemical, and biological methods.
4. Specific Plant Diseases: Study important plant diseases caused by fungi, bacteria, viruses, and viroids, focusing on their etiology, symptoms, epidemiology, and control.
5. Biofertilization, Phyto stimulation, Bioinsecticides: Explore plant growth promoting bacteria, biofertilizers, mycorrhizae, and their role in enhancing plant growth. Learn about bioinsecticides and their advantages over synthetic pesticides.

Semester-5

15 A: FOOD AND DAIRY MICROBIOLOGY

1. Understand the factors influencing microbial growth, contamination in foods, and sources of microbial contamination.
2. Gain knowledge of Microflora of milk, microbial contamination of raw milk and butter, and spoilage of various food types.
3. Use dairy starter cultures in fermented dairy products, other fermented foods, and probiotics.
4. Differentiate Foodbome diseases, intoxications, and infections
5. To adopt food sanitation, control measures, Follow HACCP; Carry out tests to detect pathogens in foods

Semester-5

15 B: ENVIRONMENTAL MICROBIOLOGY

1. Explore ecosystems (terrestrial, aquatic, atmospheric) and microflora in soil, water, atmosphere, human/animal bodies.
2. Learn about mutualism, synergism, commensalism, competition, parasitism, predation in microbes. Study plant-microbe and animal-microbe interactions.
3. Understand microbial involvement in carbon, nitrogen, phosphorus, and sulphur cycles, including organic degradation and nutrient processes.
4. Study solid waste disposal (composting, landfill), liquid waste treatment (sewage).