ES 71 GENERAL MICROBIOLOGY Cr. 3(2+1)

Course Objectives:

The objectives of the course are:-

1. Toenable the students to work with microorganisms
2. Tounderstand the basic techniques of sterilization, culturing and isolation
3. Todetermine different characteristics of the microorganisms

Course Learning Outcomes:

Upon successful completion of the course, the student will be able to:

1. **ATTAIN**the fundamental knowledge regardingmicroorganisms
2. **COMPREHEND** the basic concepts of microbial diversity
3. **GRASP**the microbiological techniques and use them efficiently
4. **EXPLORE**the microbial diversity androle of microorganisms
5. **VALIDATE**practical skills in the design and execution of experiments
6. **APPLY** the scientific method of investigation and hypothesis testing

Course Outline:

1. **The beginnings of Microbiology**
   - Discovery of the microbial world
   - Discovery of the role of microorganisms in transformation of organic matter, in the causation of diseases, development of pure culture methods
   - The scope of microbiology
   - Microbial evolution, systematics and taxonomy
   - Characterization and identification of microorganisms
   - Nomenclature and Bergey's manual
2. **Viruses**
   - Bacteriophages and phages of other protists
   - Replication of bacteriophages
   - Viruses of animals and plants
   - History, structure and composition
   - Classification and cultivation of animal viruses
   - Effects of virus infection on cells
   - Cancer and viruses
3. **Morphology and fine structure of bacteria**

- Size, shape and arrangement of bacterial cells
- Flagella and motility, Pili, Capsules, sheaths, Prosthecae and stalks
- Structure and chemical composition of cell wall
- Cytoplasmic membrane
- Protoplasts, spheroplasts, the cytoplasm, nuclear material

4. Cultivation of bacteria

- Nutritional requirements and nutritional types of bacteria
- Physical conditions required for growth
- Bacteriological media
- Choice of media and conditions of incubation

5. Reproduction and growth of bacteria

- Modes of cell division
- New cell formation, Normal growth cycle of bacteria, synchronous growth, Continuous culture
- Quantitative measurement of bacterial growth, Direct microscopic count, Electronic enumeration of cell numbers, the plate count method, Membrane-filter count, Turbidimetric method
- Determination of nitrogen content and dry weight of cells
- The selection of a procedure to measure growth and importance of measurement of growth

6. Pure cultures and cultural characteristics

- Natural microbial populations, Selective methods, Chemical methods, Physical methods, Biological methods, Selection in nature
- Pure cultures, Methods of isolating pure cultures, Maintenance and preservation of pure cultures, Culture collections
- Cultural characteristics; Colony characteristics, Characteristics of broth cultures

7. Eukaryotic microorganisms

- Algae: Biological and economic importance of algae
- Characteristics of algae; Lichens. Fungi: Importance of fungi
- Morphology; Physiology and reproduction, Cultivation of fungi
- Economic importance of protozoa

8. Prokaryotic diversity

- Purple and green bacteria, cyanobacteria, prochlorophytes, chemolithotrophs, methanotrophs and methylotrophs, sulfate and sulfur-reducing bacteria, homoacetogenic bacteria
- Budding and appendaged bacteria, spirilla, spirochetes, Gliding bacteria, Sheathed bacteria, Pseudomonads, Free living aerobic nitrogen fixing bacteria, Acetic acid bacteria, Zymomonous and chromobacterium, Vibrio, Facultatively aerobic Gram-negative rods, Neisseria and other Gram-negative cocci, Rickettsias, Chlamydias, Gram-positive cocci, Lactic acid bacteria, Endospore forming Gram- positive rods and cocci, Mycoplasmas, High GC Gram-positive bacteria
- Actinomycetes, Coryneform bacteria, propionic acid bacteria, Mycobacterium, Filamentous Actinomycetes
- Archaea, Extremely Halophilic archaea, Methane producing archaea, Methanogens, Hyperthermophilic archaea, Thermoplasma

Practical:

1. Preparation of culture media
2. Pure culturing and cultivation of microbes
3. Simple, Gram, endospore, capsular, flagellar and acid fast staining of different genera of bacteria/Vital staining and microscopic observations of protozoa
4. Isolation of bacteriophages

Text and Reference Books:

1. Microbiology: An Introduction, 12th ed. (2018) by Gerard J. Tortora, Berdell R. Funke, Christine L. Case.
2. Prescott's Microbiology,10th ed. (2017) by Joanne Willey, Linda Sherwood and Christopher

J. Woolverton.
3. Laboratory Experiments in Microbiology, 11th ed. (2015) by Ted R. Johnson and Christine L. Case.
4. Brock Biology of Microorganisms, 14th ed. (2014) by Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley, David A. Stahl and Thomas Brock.
5. Alcamo's Fundamentals of Microbiology, 9th ed.(2012) by Jeffrey C Pommerville.
6. Bergey's Manual of Systematic Bacteriology(2012).
7. Microbiology Principles and Explorations (2001) by Jacquelyn, G.G.