## II SEMESTER
## COURSE 3: - INTRODUCTION TO MICROBIOLOGY

credits -_3

**Course Outcomes**:

On successful completion of the course, the students will be able to

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 preparation, isolation methods, and the identification of bacteria and fungi.

**Unit - 1**: **History of Microbiology** **No. of Hours: 10**

1. Discovery of Microscope and microbial world by Anton von Leeuwenhoek; Aseptic techniques with reference to Charak Samhita, Sushruta Samhita and Ignaz Philipp Semmelweis
2. Golden era of Microbiology- Refutation of abiogenesis; Germ theory of Disease; Discovery of vaccination; Discovery of penicillin
3. Major contributions of Scientists: Edward Jenner, Louis Pasteur, Robert Koch, Joseph Lister, Ivanowsky, Martinus Beijerinck and Sergei Winogradsky

**Unit - 2: Place of Microorganisms in the living world** **No. of Hours:10**

1. Haeckel's three Kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese
2. Definition and scope of Microbiology; Applications of Microbiology; Diverse groups of Microorganisms
3. Origin of microbial life on earth- Timeline, Miller's Experiment, endosymbiosis (cyanobacteria), distinguishing features of eukaryotic and prokaryotic cell

**Unit - 3: Prokaryotic microorganisms and Viruses** **No. of Hours:10**

1. General characteristics of Bacteria (Morphology, metabolic diversity and reproduction)
2. General characteristics of Archaea differentiating them from Bacteria
3. General characteristics of viruses (Nature, composition, size, host specificity, diversity in structure)

**Unit - 4: Eukaryotic microorganisms** **No. of Hours: 10**

1. Fungi - Habitat, nutrition, vegetative structure and modes of reproduction;
2. Algae- Habitat, thallus organization, photosynthetic pigments, storage forms of food, reproduction.
3. Protozoa–Habitat, cell structure, nutrition, locomotion, excretion, reproduction, encystment.

**Unit - 5: Growing Microbes in Lab: Five I's** **No. of Hours:05**

1. Inoculation-Aseptic methods of introducing inoculum to growth media; Composition of basic growth media, solid and liquid
2. Incubation and Isolation- Ambient temperature for growth of microorganisms; Concept of Pure culture, mixed culture and contaminated culture
3. Inspection and Identification - Observation of colour, size and shape of colonies; Wet mount and simple staining of bacteria and fungi

**III. Skill Outcomes:**

1. Implement safety protocols, handling hazardous materials, and practicing personal protective measures.
2. Identify microscope parts, adjusting focus and diaphragm, and accurately observing and documenting microscopic images.
3. Prepare smears, identifying different microorganisms, and interpreting microscopic characteristics.
4. Analyze electron micrographs, identifying virus types, and describing their morphology and size.
5. Operate Autoclave, Hot Air Oven, and Laminar Air Flow Chamber for sterilization and decontamination purposes.

**II SEMESTER**

**COURSE 3: - INTRODUCTION TO MICROBIOLOGY**

credits -_1

1. Good Laboratory Practices and Biosafety
2. Compound Light microscope -Parts and its handling
3. Microscopic observation of bacteria, Algae and Fungi and protozoa
4. Observation of electron micrographs of viruses (Lambda, T4, TMV, HIV, SARS CoV-2, Polio)
5. Laboratory equipment -Working principles of Autoclave, Hot air oven, Laminar airflow chamber

## IV. References:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5th Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi.
2. ·Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand, New Delhi. Edition), Himalaya Publishing House, Mumbai.
3. Prescott, M.J., Harley, J.P. and Klein, D.A. (2012). Microbiology. 5th Edition, WCB McGraw Hill, New York.
4. Reddy, S.M. and Reddy, S.R. (1998). Microbiology Practical Manual, 3 rd Edition, Sri Padmavathi Publications, Hyderabad.
5. Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi.
6. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed.,Prentice Hall of India Pvt. Ltd., New Delhi.
7. Jaya Babu (2006). Practical Manual on Microbial Metabolisms and General Microbiology. Kalyani Publishers, New Delhi.
8. Gopal Reddy et al., Laboratory Experiments in Microbiology

## V. Co-Curricular Activities:

1. Establish a Microbiology Club where students can come together to discuss and explore various topics related to microbiology.
2. Organizing microbiology-themed events like microbiologyday 3

Poster presentations, oral presentations, and Q&A sessions.

4. Field Trips to Microbiology-related Sites

5. Establish a Microbiology Journal Club where students can review and discuss scientific articles related to microbiology.

## II SEMESTER

## COURSE 4: - BACTERIOLOGY AND VIROLOGY

credits -_3

**I. Learning Outcomes:**

On successful completion of the course, the students will be able to

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.

**Unit -1: Bacterial Taxonomy and Ultrastructure No. ofHours: 9**

1. Introduction to prokaryotic diversity and taxonomy. Types of classification-Numerical and Phylogenetic
2. Introduction to Bergy's manual of Systematic Bacteriology
3. Non-Culturables and Metagenomics

4.Ultrastructure of a Bacterial Cell-Invariable components -cell wall, Structure and/Functions of cell membrane, cytoplasm, nucleoid; Variable components- plasmid, inclusion bodies, flagella (structure and arrangement), pili, capsule, endospore.

**Unit - 2: Type studies of Bacteria and Archae No. of Hours:9**

1. Salient features of:

*a)* Photosynthetic bacteria - Purple bacteria, Green bacteria and *Anabaena*

*b)* Gliding bacteria - Myxobacteria and Cytophaga group

*c)* Filamentous -Actinomycetes

*d)* Spore forming bacteria - Bacillus and Clostridia

*e)* Miscellaneous - Mycoplasma, Rickettsia, Chlamydia

2. Salient features of Fermentative bacteria, Sulphur bacteria, Nitrogen fixing bacteria
3. Salient features of Extremophiles- Methanogens and halobacteria.

**Unit - 3: General Properties and Classification of Viruses No. of Hours:9**

1. Discovery of viruses, Nature and definition of viruses, general properties
2. Heirarchy of ICTV nomenclature
3. Outline of Baltimore system of classification.
4. Cultivation of Viruses, Virus Purification and Assay.

**Unit - 4: Replication of Viruses** **No. ofHours:9**

1. General features of Viral Replication
2. Replication of T4, lambda, TMV , HIV
3. Replication of Polio, Influenza, Adeno Viruses

**Unit - 5: Pathogenic and other Viruse** **No. ofHours:**9

1. Defective Viruses- viroids, virusoids, satellite viruses and Prions.
2. Emergence of Viral Pathogens, Introduction to Oncogenic viruses, Concept of Oncogenes and Protooncogenes
3. Role of viruses in Ecosystems; Applications in Biotechnology

**III. Skill Outcomes:**

On successful completion of the course, the students will be able to

1. Develop practical skills in the isolation, identification, and cultivation of bacteria.
2. Acquire knowledge about the preparation of growth media and study host-pathogen interactions.
3. Gain the ability to examine the bacteria through microscopy.
4. Demonstrate proficiency in isolating bacteria from natural environment

## II SEMESTER

## COURSE 4: - BACTERIOLOGY AND VIROLOGY

credits -1

1. Study of bacteria by colony observation and staining-simple, gram
2. Observation of motility and capsule
3. Isolation of bacteria using Winogradsky column and observation
4. Study of viruses (Bacteriophage, TMV and HIV) using micrographs
5. Isolation and enumeration of bacteriophages (PFU) from water/sewage sample using double agar layer technique.
6. Studying isolation and propagation of animal viruses by chick embryo technique.
7. Study of cytopathic effects of viruses using photographs.
8. Perform local lesion technique for assaying plant viruses.

**References:**

1. Prescott, M.J.,Harley,J.P.andKlein,D.A.Microbiology. 5th Edition WCB Mc GrawHill, New York, (2002).
2. Tortora, G.J., Funke ,B.R. and Case, C.L. Microbiology : An Introduction. Pearson Education, Singapore, (2004).
3. Alcomo,I.E.Fundamentals of Microbiology. VIEdition, JonesandBartlettPublishers.Sudbury.Massachusetts, (2001).
4. BlackJ.G.Microbiology-Principlesand Explorations.JohnWiley&SonsInc.NewYork, (2002).
5. Tom Besty,D.C Jim Koegh.Microbiology Demystified McGRAW-HILL.
6. Christopher Burrell Colin Howard Frederick Murphy. Fenner and White's Medical Virology 5th Edition. Academic Press

**Co-Curricular Activities:**

1. Invite guest speakers, to provide insights into the latest advancements and emerging trends in bacteriology and virology.

2. Conduct laboratory workshops that allow students to gain hands-on experience in bacterial culture techniques

3. Case Study Competitions: Organize case study competitions where students can work in teams to analyze and solve hypothetical cases related to bacteriology and virology

4. Arrange field trips to microbiology research facilities, such as government labs, industrial settings, or healthcare institutions