



# **RAICHUR UNIVERSITY, RAICHUR**

**Under Graduate Curriculum for Degree of  
Bachelor of Science (B.Sc) in**

**Microbiology  
(I & VI Semester)**

**As per Revised NEP 2024  
With Effect from the Academic year from  
2024-25 and onwards**

**Raichur University Raichur**  
**B.Sc. Microbiology**

**Programme Specific Outcomes (PSO):**

**On completion of the 03 years Degree in Microbiology students will be able to:**

- Demonstrate, solve and understand the major concepts in all the disciplines of --.
- Understand practical skills so that they can understand and assess risks and work safely and competently in the laboratory.
- To apply standard methodology to the solutions of problems in Microbiology
- Provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes.
- Develop in students the ability to adapt and apply methodology to the solution of unfamiliar types of problems.
- Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of Microbiology.
- To build confidence in the candidate to be able to work on his own in industry and institution of higher education.
- To develop an independent and responsible work ethics.
- Exploring the microbial world and analyzing the specific benefits and challenges.
- Applying the knowledge acquired to undertake studies and identify specific remedial
- Measures for the challenges in health, agriculture, and food sectors.
- Thorough knowledge and application of good laboratory and good manufacturing
- Practices in microbial quality control.
- Understanding biochemical and physiological aspects of microbes and developing
- broader perspective to identify innovative solutions for present and future challenges posed by microbes.
- Understanding and application of microbial principles in forensic and working, knowledge about
- Clinical microbiology. Enhance and demonstrate analytical skills and apply basic computational and
- Statistical techniques in the field of microbiology

**B.Sc. Semester-I**  
**Discipline Specific Course (DSC)-**  
**Course Title:- Basic Microbiology and Techniques**  
**Course Code:C1MCB1T1**

**Course Outcomes (COs): At the end of the course students will be able to:**

- CO1: Students will get the knowledge of Microbiology, historical Background of Microbiology, where they learn about Contribution and discoveries of different scientist of Microbiology field
- CO2: Students will get Knowledge about the general characters and types of classification of Microorganisms, Viz-Bacteria, Fungi, algae, protozoa and virus Comprehend evolutionary importance and economic significance of microorganisms
- CO3: Understanding the microbiological techniques, cultivation and detection of microorganisms.
- CO4: Learning and practicing professional skills in handling microbes. Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.

Unit	<b>Title: Basic Microbiology and Techniques - C1MCB1T1 (Credits: Theory-4, Practicals-2)</b>
Unit I	<p><b>History and Scope of microbiology</b>            Over view of origin of life. Theory of Endosymbiosis. Concept of Abiogenesis and biogenesis. Branches and significance of Microbiology, Contributions of Scientists in the field of microbiology - Antony van Leeuwenhoek, Francesco Redi, John Needham, Lazzaro Spallanzani Louis Pasteur, Robert Koch Edward Jenner, Joseph Lister, Alexander Fleming, Iwanowsky, Ananda Chakraborty etc.. Scope and applications of Microbiology as Modern Science. Glimpse of carrier opportunities in Microbiology.</p> <p><b>Microscopy</b>            Principles of Microscopy - Resolving power. Refraction and Detraction Numerical Aperture, Working distance magnification and Chromatic aberrations. Principle and Applications of Microscopes –Compound, Dark field, Stereo microscope, Phase contrast microscope, Fluorescent microscope, Electron microscope - Scanning and Transmission electron microscope.</p>
Unit II	<p><b>Stains and Staining technique</b>            Principles and types of stains – Principles of Stains and dyes. Preparation of smears and fixation. Simple staining (Positive and Negative), Differential staining (Grams staining and Acid - Fast staining) Structural staining (Cell wall, Capsule, Flagella and Endospore staining)</p> <p><b>Sterilization Techniques</b>            A)Physical Methods and their mode of action              i) Heat: a) Dry heat - Hot air oven.                      b) Incineration.                      c) Moist heat - Autoclave.                      d) Tantalization (Fractional sterilization)              ii) Filtration methods - Types of filters, Inorganic (Seitz, Chamberland, sintered glass, candle and asbestos filter) and organic filters (HEPA and Membrane filters),              iii) Radiations Methods - UV radiation, Y-rays and cathode rays.            B) Chemical methods:</p>

	<p>a) Definition of terms - disinfectants, antiseptics. Sanitizers, Microbicides - bactericides, virucide, Fungicide and Sporicide. Micro-biostatic – bacteriostatic and fungistatic agents.</p> <p>b) Use and mode of action - Alcohols, aldehydes, halogens, phenols, heavy metals. Detergents: Quaternary ammonium compounds.</p>
Unit III	<p><b>General Characteristics of Microorganisms</b></p> <p>General characteristics of major groups of micro-organisms - Algae, Protozoa. Fungi, Bacteria (Based on Bergey's manual of systematic Bacteriology).. General characteristics of viruses, classification of viruses – RNA viruses and DNA viruses. Viroids and Prions</p> <p><b>Microbial Taxonomy and Diversity</b></p> <p>Principles and types of classification- Haeckel's Three Kingdom system, Whittaker's Five kingdoms classifications – Monera, Protista, Fungi, Plantae and Animalia. Methods of microbial classification by Classical, Biochemical, numerical and molecular base. Comparison of the 3 domains Classification: Archaea, Bacteria and Eukarya Distribution and significance of microorganisms in air, water and soil.</p>
Unit IV	<p><b>Culturing of microorganisms</b></p> <p>Culture media – Natural, Synthetic and Semi-synthetic - solid, liquid and semi solid media. Special media-Basal media, Selective, transport, differential, enrichment media. Methods of isolation of bacteria, fungi - serial dilution, pour plate, spread plate and streak plate techniques.</p> <p>Cultivation of Anaerobic bacteria - Anaerobic jar and chamber method.</p> <p>Maintenance of Pure Cultures, Culture Collection Centres</p> <p><b>Instruments</b></p> <p>Working principles and applications of Instruments: Centrifuge, pH meter, Incubator (BOD and Bacterial), Autoclave, Hot air oven, Laminar air flow, Colorimeter and Spectrophotometer. Chromatography- Working principles of Paper, Thin layer, Column and Ion-Exchange Chromatography</p>

### Recommended books:

1. Dubey, R. C., & Maheshwari, D. K. (2020). *Textbook of Microbiology* (2nd ed.). S Chand and Company Limited.
2. Alcamo, E. (2019). *Fundamentals of Microbiology* (10th ed.). Jones & Bartlett Learning.
3. Gunasekaran, P. (2018). *Laboratory Manual in Microbiology* (2nd ed.). New Age International Ltd.
4. Madigan, M. T., Martinko, J. M., & Bender, K. S. (2021). *Brock Biology of Microorganisms* (15th ed.). Pearson.
5. Nelson, D. L., & Cox, M. M. (2021). *Lehninger Principles of Biochemistry* (8th ed.). W.H. Freeman.
6. Powar, C. B., & Dagainwala, H. F. (2015). *Microbiology* (Vol. 1 & 2, 4th ed.). Himalaya Publishing House.
7. Salle, A. J. (2019). *Fundamental Principles of Bacteriology* (10th ed.). Tata McGraw Hill.
8. Srivastava, S., & Srivastava, P. S. (2017). *Understanding Bacteria* (2nd ed.). Springer.
9. Stanier, R. Y., Ingraham, J. L., Wheelis, M. L., & Painter, P. R. (2019). *General Microbiology* (6th ed.). Prentice Hall.
10. Sullia, S. B., & Shantaram, S. (2015). *General Microbiology* (3rd ed.). Oxford & IBH Publishing Co.
11. Sundara Rajan, R. (2018). *Tools and Techniques of Microbiology* (2nd ed.). Anmol Publications.
12. Tortora, G. J., Funke, B. R., & Case, C. L. (2021). *Microbiology: An Introduction* (13th ed.). Pearson Education.
13. Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. (2020). *Microbiology* (7th ed.). Tata McGraw Hill.
14. Madigan, M. T., Martinko, J. M., Bender, K. S., Buckley, D. H., Stahl, D. A., & Brock, T. (2021). *Brock Biology of Microorganisms* (15th ed.). Pearson.
15. Willey, J., Sandman, K., & Wood, D. (2020). *Prescott's Microbiology* (12th ed.). McGraw-Hill Education.

**B.Sc. Semester-I**  
**Discipline Specific Course (DSC)**  
**Practical: Basic Microbiology and Techniques**

**Course Title:1.2 – Basic Microbiology and Techniques**

**Course Code: C1MCB1P1**

**Course Outcomes (COs): At the end of the course, students will be able to:**

CO1: All the Practical will add on to professional skills in handling microbes and instruments.

CO2: Thorough knowledge and application of SOP and GLP will help students to be expertise in microbial quality control area.

CO3: Students will learn through knowledge Culturing and Staining technique will help in identification of microbes.

CO4: Students will learn the motility, micrometry and chromatographic techniques.

**List of the Experiments, each will have 4hrs / Week (Minimum 12 experiments)**

1. General safety rules and regulations followed in Microbial Sample, Hazards Chemicals, and Glassware at Microbiology laboratory.
2. Study of Structure and working principles of Light microscope and their maintenance.
3. Demonstrations of working Principles and SOP of laboratory instruments: Autoclave, hot air oven, incubator, Laminar Air Flow, Centrifuge, pH Meter, Colorimeter and tools – Inoculation loop, Petri dish Drigalsky spreader and Micro Pipettes
4. Isolation of microorganisms from air by settle plate method.
5. Isolation of microbes from water and soil by serial dilution.
6. Study of Morphological characters of microbial isolates.
7. Simple staining techniques – Positive and Negative staining technique
8. Differential staining technique Gram's and Acid-Fast staining and structural staining.
9. Fungal staining technique and Structural staining technique of bacteria – Capsule and Endospores.
10. Study of the Protozoa, Fungi Algae and Cyanobacteria by preparing temporary mounts.
11. Study of Bacterial Motility by Hanging drop method.
12. Measurement of microbes by Micrometry.
13. Counting of yeast cells and fungal spores by Haemocytometer.
14. Demonstration of Chromatographic techniques (Paper Chromatography).

**Books recommended:**

1. Aneja, K. R. (2021). *Experiments in Microbiology, Plant Pathology, Tissue Culture, and Mushroom Cultivation* (6th ed.). New Age International.
2. Benson, H. J. (2020). *Microbiological Applications* (14th ed.). McGraw Hill.
3. Colwell, R. R. (2012). *Microbial Diversity* (2nd ed.). Academic Press.
4. Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. (2020). *Microbiology* (7th ed.). Tata McGraw Hill.
5. Sullia, S. B., & Shantaram, S. (2015). *General Microbiology* (3rd ed.). Oxford & IBH Publishing Co.
6. Sundara Rajan, R. (2018). *Tools and Techniques of Microbiology* (2nd ed.). Anmol Publications.
7. Stanier, R. Y., Ingraham, J. L., Wheelis, M. L., & Painter, P. R. (2019). *General Microbiology* (6th ed.). Prentice Hall of India.