



ANDHRA KESARI UNIVERSITY ::ONGOLE

Model Syllabus for Microbiology (Minor) in consonance with Curriculum framework

w.e.f. AY 2025-26

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
II	III	1	Basic Microbiology	3	3
			Basic Microbiology-Practical	2	1
	IV	2	Techniques In Microbiology	3	3
			Techniques in Microbiology-Practical	2	1
III	V	3	Basics of Microbial Genetics	3	3
			Basics of Microbial Genetics-Practical	2	1
		4	Agricultural and Environmental Microbiology	3	3
			Agricultural and Environmental Microbiology-Practical	2	1
	VI	5	Microbial Pathogenicity	3	3
			Microbial Pathogenicity-Practical	2	1
		6	Food and Industrial Microbiology	3	3
			Food and Industrial Microbiology-Practical	2	1

A. V. Chavva

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SEMESTER-III

COURSE 1: BASIC MICROBIOLOGY

Theory

Credits: 3

3 hrs/week

I. Learning Objectives:

1. To introduce the history, scope, and importance of microbiology.
2. To provide knowledge of microbial diversity, including bacteria, archaea, fungi, algae, protozoa, helminths, and viruses.
3. To explain microbial cell structures and their functional significance.
4. To describe microbial growth, nutrition, and environmental influences.
5. To establish a foundation for advanced microbiology courses.
- 6.

II. Course Outcomes: On completion of this course students will be able to:

1. Recall the history and contributions of pioneers in microbiology.
2. Differentiate between prokaryotic and eukaryotic microorganisms.
3. Explain structural and physiological features of microbial groups.
4. Classify microorganisms based on Bergey's Manual, morphology, and host specificity.
5. Interpret microbial growth patterns under varying nutritional and environmental conditions.

III. Syllabus of Theory:

Unit 1: Fundamentals of Microbiology

No. of hrs: 9

- 1.1 History and major contributions – Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Joseph Lister, Ignaz Semmelweis, Alexander Fleming, Ivanowsky, Beijerinck, Winogradsky.
- 1.2 Scope, branches, applications and importance of microbiology in health, agriculture, food, industry and environment.
- 1.3 Classification of microorganisms – Whittaker's Five Kingdoms, Carl Woese's Three Domains.
- 1.4 Origin of microbial life on Earth – Timeline of microbial evolution, Endosymbiosis theory (role of cyanobacteria), differences between prokaryotic and eukaryotic cells.

Unit 2: Microbial Diversity – Prokaryotes

No. of hrs: 9

- 2.1 General features of Bacteria and Archaea.
 - 2.2 Bacterial cell structure: cell wall, glycocalyx/capsule, flagella, pili, fimbriae, nucleoid, plasmids, ribosomes, cytoplasmic membrane, mesosomes, inclusion bodies, endospore.
 - 2.3 Gram-positive and Gram-negative bacteria – structural differences and significance.
 - 2.4 Bergey's Manual of Systematic Bacteriology – basic outline of bacterial classification.
- Economic importance of bacteria.



Unit 3: Microbial Diversity – Eukaryotes**No. of hrs: 9**

- 3.1 General features of fungi – morphology, reproduction, significance.
- 3.2 General features of Microalgae – classification, ecological roles, Photosynthetic pigments
- 3.3 General features of protozoa – Morphology, modes of nutrition, reproduction, parasitic protozoa overview.
- 3.4 Economic importance of Algae and Fungi.

Unit 4: Viruses and Other Acellular Agents**No. of hrs: 9**

- 4.1 General characteristics of viruses, bacteriophages, viroids, and prions.
- 4.2 Structure of typical viruses – bacterial, plant, animal viruses.
- 4.3 Host specificity and classification of viruses – plant viruses, animal viruses, bacteriophages.
- 4.4 Role of viruses as disease-causing agents and as useful tools in biotechnology (gene therapy vectors, vaccine development)

Unit 5: Bacterial Growth and Nutrition**No. of hrs: 9**

- 5.1 Nutritional requirements of bacteria:** macronutrients, micronutrients, growth factors; nutritional types (autotrophs, heterotrophs, phototrophs, chemotrophs).
- 5.2 Culture media:** defined, complex, selective, differential, enrichment, transport.
- 5.3 Bacterial growth curve:** phases (lag, log, stationary, death) and significance.
- 5.4 Factors affecting bacterial growth:** temperature, pH, osmotic pressure, oxygen requirement (aerobes, anaerobes, facultatives, microaerophiles).

IV. Co-curricular activities:

- 1. Seminars: Contributions of microbiologists, microbial diversity presentations.
- 2. Assignments: Charts on microbial cell structure, microbial growth curve.
- 3. Poster/Model Making: Prokaryotic vs. eukaryotic cells, virus structure.
- 4. Field Visit: Local water body/soil site for microbial awareness.
- 5. Quiz/Debate: “Are viruses living or non-living?”

IV. Reference Books:

- 1. Pelczar, Reid & Chan – Microbiology.
- 2. Prescott, Harley & Klein – Microbiology.
- 3. Madigan & Martinko – Brock Biology of Microorganisms.
- 4. Tortora, Funke & Case – Microbiology: An Introduction.
- 5. Cappuccino & Sherman – Microbiology: A Laboratory Manual.



SEMESTER-III

COURSE 1: BASIC MICROBIOLOGY

Practical

Credits: 1

2 hrs/week

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Demonstrate Good Laboratory Practices, biosafety procedures, and proper handling of the compound light microscope and its parts.
2. Perform microscopic observation and identification of microorganisms including bacteria, algae, fungi, protozoa, and interpret electron micrographs of viruses.
3. Operate essential microbiology laboratory equipment like autoclave, hot air oven, and laminar airflow chamber by following correct working principles and aseptic techniques.

II. Laboratory/Field exercises:

1. Microbiology Laboratory: Basic Rules and Requirements
2. Laboratory equipment: Working principles of Autoclave, Hot air oven, Laminar airflow chamber.
3. Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air.
4. Study of fungal morphology using Lactophenol cotton blue.
5. Study of algal morphology using wet mount.
6. Enumeration of Bacteriophages by Plaque Assay
7. Effect of Environmental temperature on Bacterial Growth.



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SEMESTER-IV

COURSE 2: TECHNIQUES IN MICROBIOLOGY

Theory

Credits: 3

3 hrs/week

I. Learning Objectives:

1. Learn principles and use of microscopes and basic staining methods.
2. Understand preparation of media and isolation of pure cultures.
3. Learn methods to estimate microbial numbers and assess growth.
4. Understand physical and chemical sterilization methods and their applications.
5. Learn biosafety levels, PPE usage, and safe handling of biohazardous materials.

II. Course Outcomes: On completion of this course students will be able to:

1. Identify microbial morphology, arrangements, and structures using different stains and microscopes.
2. Demonstrate isolation of microbes and maintain pure cultures effectively.
3. Quantify microbial populations and monitor growth patterns.
4. Sterilize media, glassware, instruments, and workspaces effectively.
5. Apply good laboratory practices to prevent contamination and ensure safety.

III. Syllabus of Theory:

Unit 1: Microscopy and Staining Techniques

No. of hrs: 9

- 1.1 Principles and applications of light microscopy, phase-contrast, and fluorescence microscopy
- 1.2 Electron microscopy: SEM and TEM, sample preparation, and applications
- 1.3 Staining methods: Simple, differential, and special staining (Gram, Acid-fast, Capsule, Endospore)

Unit 2: Culture and Isolation Techniques

No. of hrs: 9

- 2.1 Media preparation: Types of media: selective, differential, and enrichment media
- 2.2 Isolation techniques: Streak plate, spread plate, pour plate
- 2.3 Pure culture maintenance: Sub-culturing and preservation methods.

Unit 3: Quantitative and Qualitative Microbial Analysis

No. of hrs: 9

- 3.1 Microbial enumeration: Serial dilution, standard plate count, most probable number (MPN)
- 3.2 Microscopic counts: Direct counts using counting chambers with vital staining
- 3.3 Assessment of microbial growth: Turbidity measurement, spectrophotometry, and dry Weight



Unit 4: Sterilization Techniques

No. of hrs: 9

- 4.1 Physical methods: Autoclaving, dry heat, filtration, and radiation techniques
- 4.2 Chemical methods: Alcohols, phenolics, aldehydes, quaternary ammonium compounds
- 4.3 Sterilization: Sterilization of Media, glassware, instruments, and workspace

Unit 5: Biosafety and Handling Biohazardous Materials

No. of hrs: 9

- 5.1 Laboratory biosafety levels (BSL-1 to BSL-3) and PPE
- 5.2 Handling, transport, and disposal of biohazardous materials
- 5.3 Good microbiological and laboratory practices

IV. Co-curricular activities:

- 1. Hands-on session for students to explore different microscopes (light, phase-contrast, fluorescence) and practice staining techniques.
- 2. Organize a mini-competition on serial dilution, colony counting, and turbidity measurement to reinforce quantitative techniques.
- 3. Simulation activity where students demonstrate proper use of personal protective equipment, handling of biohazardous materials, and sterilization practices.

IV. Reference Books:

- 1. Appl, M. (1999). *Microbiology of Extreme Soils*. Springer.
- 2. Atlas, R. M. (2010). *Handbook of Microbiological Media* (4th ed.). CRC Press.
- 3. Cappuccino, J. G., & Sherman, N. (2014). *Microbiology: A Laboratory Manual* (10th ed.). Pearson Education.
- 4. Frazier, W. C., & Westhoff, D. C. (2014). *Food Microbiology* (5th ed.). McGraw-Hill Education.
- 5. Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. (2009). *Microbiology: Concepts and Applications* (6th ed.). McGraw-Hill Education.
- 6. Prescott, L. M., Harley, J. P., & Klein, D. A. (2005). *Microbiology* (6th ed.). McGraw-Hill Education.
- 7. Tortora, G. J., Funke, B. R., & Case, C. L. (2020). *Microbiology: An Introduction* (13th ed.). Pearson Education.
- 8. Willey, J. M., Sherwood, L. M., & Woolverton, C. J. (2017). *Prescott's Microbiology* (10th ed.). McGraw-Hill Education.

SEMESTER-IV

COURSE 2: TECHNIQUES IN MICROBIOLOGY

Practical

Credits: 1

2 hrs/week

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Perform basic staining and microscopic techniques to study microorganisms.
2. Handle culture media and isolate pure microbial cultures using aseptic methods.
3. Estimate bacterial population using quantitative methods and follow laboratory biosafety practices.

II. Laboratory/Field exercises:

1. Compound Light microscope: Parts, handling and observation of the cultures.
2. Simple Staining Technique.
3. Gram Staining Technique.
4. Observation of electron microphotographs of viruses (Lambda, T4, TMV, HIV, SARS CoV-2, Polio).
5. Demonstration of biosafety cabinet usage.
6. Sterilization of Glassware using Hot Air Oven.
7. Preparation and Sterilization of Media using Autoclave.
8. Aseptic transfer of microbial cultures using loop and pipette.
9. Isolation of pure culture of bacteria by streak plate, pour plate and spread plate method.
10. Determination of bacterial count using standard plate count method.
11. Determination of bacterial count using turbidity (spectrophotometric) method.

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