M. C. E. Society's
Abeda Inamdar Senior College
Of Arts, Science and Commerce, Camp, Pune- 1
(Autonomous) Affiliated to Savitribai Phule Pune University
NAAC accredited 'A' Grade

F.Y.B.Sc NEP Pattern

Microbiology Syllabus to be implemented from 2026-27

Semester I

Course Code	Title of the paper
26SBMB11MM	Exploring Microorganisms
26SBMB12MM	Handling Microorganisms
26SBMB13MM	General Microbiology-I
26SBMB11VS	Basic techniques in Microbiology

Course/ Paper Title	Exploring Microorganisms
Course Code	26SBMB11MM
Semester	I
No. of Credits	2

Course Objectives:

Sr. No.	Objectives
1.	To enrich students' knowledge about the scope and applications of Microbiology.
2.	To present to the students the historical developments in Microbiology.
3.	To familiarize students with Microbial Diversity and Principles of Taxonomy.

Course Specific Learning Outcome:

Sr. No.	Expected Learning Outcome
CO1	Students will be able to describe the evolution of microbiology and the key early scientific discoveries related to the field.
CO2	Students will be able to explain the diversification of microbiology and its applications in medicine, agriculture, industry, and environmental sciences.
CO3	Students will be able to understand the scientific contributions of major scientists in the field of microbiology.
CO4	Students will be able to demonstrate the diversity of the microbial world and distinguish the characteristics of different groups of microorganisms.
CO5	Students will be able to classify organisms according to the six-kingdom classification system.

Syllabus

Unit. No	Title of Unit and Contents	No. of Lectures
Unit I	**Scope, Applications and Role of Microbiologist in the field of:**	**(15)**
	1.Biogenesis V/s Abiogenesis- **a)** Redi's and Pasteur's Experiment **b)** Robert Hooke and Cell theory	2
	2. Medical Microbiology- a)Louis Pasteur : Germ Theory of disease b) Robert Koch and Koch's Postulates, Rivers' postulates c) Joseph Lister, antisepsis and chemical disinfection d) Concept of Normal flora and pathogens	3
	3. Chemotherapy – a) Paul Ehrlich : magic bullets b) Discovery of Antibiotics: Alexander Fleming, Waksman	2
	4. Vaccination- a) Edward Jenner :Concept of vaccine b) Definition and types of vaccine	2
	5. Virology- a) Dimitri Iwanowsky: Discovery of viruses b) Discovery and Applications of Bacteriophages	2 2
	6. Agricultural Microbiology- a) Martinus Beijerinck and Sergei N. Winogradsky b) Concept and application of Bioinoculants and Biocontrol agents	
	7.Industrial Microbiology- a) Discovery of Anaerobic Life – Fermentation b) Microbes in Industry c) Probiotics and fermented foods	2

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Unit II	**Microbial Diversity:** **1.Whittaker system of five kingdom classification** **2.Morphological characters and Importance of:** • Algae • Fungi (Molds and Yeasts) • Protozoa • Bacteria • Viruses, viroid and Prions • Archaebacteria • Actinomycetes **3. Principles of Classification of bacteria(Bergey's Manual)** **4. Principles of Classification of viruses (ICTV)**	**(15)** 1 2 2 2 2 2 1 1 1 1

Recommended Books:

1. Daniel Lim, Microbiology, 2nd Edition; McGraw-Hill Publication
2. Ingraham J. L. and Ingraham C.A. (2004). Introduction to Microbiology. 3nd Edition. Thomson Brooks / Cole
3. Michael J Pelczar, JR. E.C.S. Chan, Noel R. Krieg. (1993) Microbiology, 5th Edition, Tata McGraw Hill Press.
4. Prescott L.M., Harley J.P., and Klein D.A. (2005). Microbiology, 6th Edition. McGraw Hill Companies Inc.
5. Willey J. M., Sherwood L. M. and Woolverton C. J. (2013) Prescott's Microbiology, 8th Edition, McGraw-Hill Higher Education
6. Salle A.J. (1971) Fundamental Principles of Bacteriology. 7th Edition. Tata McGraw Hill Publishing Co
7. Stanier R.Y., Adelberg E.A. and Ingraham J.L. (1987) General Microbiology, 5th Edition. Macmillan Press Ltd.
8. Tortora G.J., Funke B.R., Case C.L. (2006). Microbiology: An Introduction. 8th Edition. Pearson Education Inc

Course/ Paper Title	Handling Microorganisms
Course Code	26SBMB12MM
Semester	I
No. of Credits	2

Course Objectives:

Sr. No.	Objectives
1.	To enrich students' knowledge and train them in handling Microorganisms
2.	To make them learn different types of Microscopy and staining techniques
3.	To introduce the concept of Sterilization and Disinfection

Course Specific Learning Outcome:
On completion of the course, the students will be able to:

Sr. No.	Expected Learning Outcome
CO1	Students will be able to discuss the history and discovery of different types of microscopes.
CO2	Students will be able to diagrammatically explain and compare the principles, working, and applications of various microscopic techniques.
CO3	Students will be able to understand the significance of physical agents (heat, radiation, filtration) in sterilization.
CO4	Students will be able to validate sterilization efficiency of instruments using biological and chemical indicators.
CO5	Students will be able to specify the mode of action and applications of different disinfectants.

Syllabus: **Handling Microorganisms**

Unit. No	Title of Unit and Contents	No. of Lectures
Unit I	**Microscopy:** **1.Discovery Of Microscope :** Micrographia of Anton von Leeuwenhoek and Robert Hooke **2.Bright field microscopy:** i. Structure, working of and ray diagram of a compound light microscope; concepts of magnification, numerical aperture and resolving power. ii.Types, ray diagram and functions of – condensers, eyepieces and objectives iii.Concept of aberrations in lenses - spherical, chromatic, comma and astigmatism **B.Principle,working and ray diagram of** i. Fluorescence Microscope ii. Electron Microscopy – TEM, SEM **3.Staining Techniques:** i. Definition of Stain; Types of stains (Basic and Acidic), ii. Properties and role of Fixative, Mordant, Decolouriser and Accentuator iii.Monochrome staining and Negative (Relief)staining iv. Differential staining - Gram staining and Acid-fast staining	**(15)** 1 3 2 2 3 4
Unit II	**Sterilization and Disinfection** **1. Sterilization** **i.** Physical Agents - Heat, Radiation, Filtration ii. Checking of efficiency of sterilization (Dry and Moist) – Biological and Chemical Indicators 2.**Disinfection:** i. Chemical agents and their mode of action- • Aldehydes	**(15)** 5 2 8

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	• Halogens • Quaternary ammonium compounds • Phenol and phenolic compounds • Heavy metal • Alcohol • Dyes • Detergents • Ethylene oxide. ii. Characteristics of an ideal disinfectant iii. Checking of efficiency of disinfectant - Phenol Coefficient (Rideal–Walker method)	

Reference Books:

1. Daniel Lim, Microbiology, 2nd Edition; McGraw-Hill Publication
2. Michael J Pelczar, JR. E.C.S. Chan, Noel R. Krieg. (1993) Microbiology, 5th Edition, Tata McGraw Hill Press.
3. Prescott L.M., Harley J.P., and Klein D.A. (2005). Microbiology, 6th Edition. McGraw Hill Companies Inc.
4. Salle A.J. (1971) Fundamental Principles of Bacteriology. 7th Edition. Tata McGraw Hill Publishing Co
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6. Tortora G.J., Funke B.R., Case C.L. (2006). Microbiology: An Introduction. 8th Edition. Pearson Education Inc

F.Y.B.Sc. Sem I (NEP – Autonomy 2026 Pattern)

Course Title	**General Microbiology-I**
Course Code: 26SBMB13MM	**No. of Credits: 2**
Course Type: MM (Major Mandatory)	**Total Teaching Hours: 60**

Course Objectives	
1.	To make students aware about the conduct in the Microbiology laboratory and use of a Microscope.
2.	To enable them to understand various microscopic techniques required to observe the live micro-organisms. Handling of a microscope will be taught to them.
3.	To teach them basic techniques required to grow, isolate, cultivate and study microorganisms. To enable students to be aware about the cultural techniques of motility.
4.	To familiarise students about the significance of skin flora and personal hygiene techniques. Study of various sterilisation techniques.

Course Outcome	
CO 1	Students will be able to **study**, **handle** and maintain a microscope. They will also learn basic microscopic techniques of microscopic observation for live micro-organisms (Bacteria, fungi, protozoa) like Wet mount, Hanging drop technique for motility. They will be able to **describe** microorganisms as well as **draw** them. Basic care of a Microscope will be taught hands on.
CO 2	Students will be able to learn **understand** and **review** basic principle, procedure and perform the most important differential staining in microbiology for bacterial characterisation- Gram staining. They will learn to focussing techniques using 100 X objective using oil. They will also be able to **compare** as well as **differentiate** between bacteria based on this staining technique.
CO 3	Students will learn practically to prepare microbiological media (Minimum 3 different media) as well as **illustrate** the sterilization techniques. Efficacy of sterilisation will also be assessed and **applied** by them using a biological indicator.
CO 4	Students will learn and practice basic Isolation, cultivation techniques and study recording of colony characteristics of different bacteria. They will be able to **compare, correlate** and **analyse** various techniques of isolation.
CO 5	Students will learn and **assess** the importance of personal Hygiene in day to day life practically cultivating skin flora from their own hands. In this way they will be able to **validate** their own findings.
CO 6	Students will be acquainted with the Cultural motility techniques like Swarming growth and Cragie's tube method. They will be able to **explain** and also understand significance of sterilisation/disinfection using a term to **demonstrate** –The Phenol co-efficient.

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26SBMB13MM GENERAL MICROBIOLOGY-I

Expt. No.	Topics	No. of Practicals
I	**STUDY OF MICROSCOPE AND MICROSCOPIC TECHNIQUES**	**5**
	1. Construction (mechanical and optical), working and care of bright field microscope.	1
	2. Study of fresh water microorganisms by Wet mount.	1
	3. Study of fungi (*Rhizopus/ Penicillium / Aspergillus*) from natural samples and its microscopic observation using lacto-phenol cotton blue staining.	1
	4. Differential staining-Gram staining technique for bacteria.	1
	5. Observation of motility in bacteria using: Microscopic technique: Hanging drop method.	1
II	**STUDY OF BACTERIOLOGICAL MEDIA AND CULTIVATION TECHNIQUES.**	**10**
	1. Media preparation: Preparation of simple laboratory nutrient media and its sterilisation a. Nutrient broth b. Nutrient agar c. MacConkey's media	2
	2. Checking the sterilisation efficiency of an autoclave	1
	3.Checking sterilization efficiency of autoclave using a biological indicator (*B. stearothermophilus*)	1
	4. Isolation of bacteria using Streak plate technique (Continuous and 4-Quadrant method) and recording cultural and colony characteristics	2
	5. Study of Skin flora and importance of personal Hygiene in day to day life	1
	6. Study of bacterial motility by cultural techniques: a. Swarming growth b. Cragie's tube method	2
III	Study of sterilisation & disinfection: Demonstration of Phenol co-efficient	1
	TOTAL	**15**

Syllabus passed in BOS Microbiology and Biotechnology meeting held on 24th Jan 2026

References

1. Microbiology: A Laboratory Manual - Book by James G. Cappuccino and Natalie Sherman.
2. Practical microbiology: Professor Dr. R. C. Dubey and Dr. D. K. Maheshwari, S. Chand Publishing, 2002
3. Practical Handbook of Microbiology: 2nd Edition, Edited by Emanuel Goldman and Lorrence H. Green, CRC Press

F.Y.B.Sc. Sem I (NEP – Autonomy 2026 Pattern)

Course Title	**Basic techniques in Microbiology**
Course Code: 26SBMB11VS	**No. of Credits:2**
Course Type: VSC (Major)	**Total Teaching Hours:60**

Course Objectives	
1.	To enable students to understand and apply safety measures, biosafety levels (BSL1–BSL4), biohazard symbols, and good laboratory practices in microbiology laboratories.
2.	To familiarize students with the principles, operation, precautions, and applications of common microbiology laboratory instruments and glassware.
3.	To help students develop the skills to perform basic microbiological techniques, including aseptic transfer, staining methods, handling of glassware, and proper disposal of biological waste.

Course Outcome	
CO 1	Students will be able to explain and apply laboratory safety measures, biosafety levels, biohazard symbols, and GLP in Microbiology.
CO 2	Students will be able to demonstrate and perform the correct use of common Microbiology laboratory instruments and glassware.
CO 3	Students will be able to perform and practice basic Microbiology laboratory techniques including aseptic transfer and glassware handling.
CO 4	Students will be able to measure and analyze yeast cell size using micrometry techniques.
CO 5	Students will be able to apply and interpret staining methods and biological waste disposal techniques.

26SBMB11VS Basic techniques in Microbiology

Expt. No.	Topics	No. of Practicals
1	Safety measures (BSL1, BSL2, BSL3 and BSL4) and Good Laboratory Practices in Microbiology laboratory Signs and Symbols used in Microbiology laboratory	2
2	Aseptic transfer techniques	1
3	**S**taining techniques: Monochrome staining	1
4	**S**taining techniques: Negative staining	1
5	**To study the principle, operation, precautions and applications of common Microbiology laboratory instruments:** a. Incubator b. Hot air oven c. Autoclave d. Colorimeter e. Laminar air flow hood f. Clinical centrifuge g. Analytical balance h. Distillation unit i. Spectrophotometer j. Water bath	6
6	**I. Introduction and use of common laboratory glassware:** i. Test tubes ii. Culture tubes iii.Suspension tubes iv. Screw Capped tubes v. Petri plates vi. Pipettes: Mohr, Serological & Micropipettes vii. Pasteur pipettes viii. Erlenmeyer flask ix .Volumetric flask x. Glass spreader xi. Durham's tube xii. Cragie's tube Inoculating needles: Wire loop, stab needle **II. Learning basic techniques in Microbiology:** a. Wrapping of glassware b. Cotton plugging c. Cleaning and washing of glassware	2
7	Biological Waste Disposal	1
8	Measuring the yeast cell size by micrometry	1
	TOTAL	**15**

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References:

1. Microbiology: A Laboratory Manual - Book by James G. Cappuccino and Natalie Sherman.
2. Practical Microbiology: Professor Dr. R. C. Dubey and Dr. D. K. Maheshwari, S. Chand Publishing, 2002
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