



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

B. Sc. Microbiology Program Objectives and Outcomes

Program Objectives:

- To enrich students with knowledge and understanding of the different disciplines of Microbiology such as medical Microbiology B, immunology, biochemistry, fermentation technology, environmental Microbiology, genetics, agricultural and food Microbiology, Waste management.
- To make students learn advanced fields of microbiology such as Nanobiotechnology and Marine microbiology.
- To introduce the concepts of application and research in Microbiology and inculcate sense of scientific responsibilities.
- To help students build-up a progressive and successful career in Microbiology.
- To take a step ahead for the holistic development of students through activities like lectures from eminent personalities, Visits and various competitions.
- It makes the student's competent enough to use Microbiology knowledge and skills to analyze problems involving microbes and undertake remedial measures.
- In addition, students are to be trained to use this knowledge in day-today applications and get a glimpse of research.
- The students graduating in B.Sc. Microbiology degree must have thorough understanding the fundamentals of Microbiology as applicable to wide ranging contexts.
- They should have the appropriate skills of Microbiology so as to perform their duties as microbiologists.
- They must be able to analyze the problems related to Microbiology and come up with most suitable solutions.
- As Microbiology is an interdisciplinary subject the students might have to take inputs from other areas of expertise. So the students must develop the spirit of team work.

Program Specific Objectives:

The B.Sc. Microbiology Program will enable the students;

PSOB-1. To learn basic concepts of amazing world of Microorganisms, Techniques in Microbiology, basics of Bacteriology, Cultivation and growth of Micro-organisms.

PSOB-2. To understand concepts of Medical Microbiology, Immunology, Bacterial Physiology, Fermentation Technology, Bacterial Genetics, Air, Water and Soil Microbiology.

PSOB-3. To strengthen the fundamentals of various fields of Microbiology. PSOB-4. To develop scientific aptitude and motivate students to take up higher studies like MSc microbiology and Research.

PSOB-5. To realize and appreciate the applicability of knowledge and Interdisciplinary approach in everyday life.

Program Specific Outcomes:

After successful completion of B.Sc. Microbiology Course, student will have:

PSOC-1. Understanding of Basic Concepts and Advanced knowledge of theory and practical courses in Microbiology.

PSOC-2. Subject knowledge to solve issues like bioremediation, Waste management and diagnostics.

PSOC-3. Competency in laboratory safety and in routine and specialized microbiological laboratory skills.

PSOC-4. Motivation to involve in research activities, including accurately reporting observations and analysis.



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F.Y.B.Sc. Microbiology (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Amazing World of Microbiology
Course Code	21SBMB111
Semester	I
No. of Credits	2

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To enrich students' knowledge and train them in pure Microbial Sciences
2.	To present to the students the historical developments in microbiology.
3.	To inculcate sense of Scientific Responsibilities & Social Awareness
4.	To familiarize students with Microbial Diversity
5.	To introduce the basic concepts of classification and taxonomy of micro-organisms.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be acquainted with the different areas of Microbiology
2.	Students will become aware about the role of Microbiologist in various fields of science.
3.	Students will understand the Significance of Micro-organisms in Day-to-Day Life

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	Scope, Applications and Role of Microbiologist in various fields	21
	Spontaneous Generation theory and Discovery of Microorganisms	1
	Experiments by Redi, Pasteur and Tyndall	3
	Robert Hooke and Cell Theory	1
	1. Medical Microbiology-	3
	i. Louis Pasteur : Germ Theory of disease	
	ii. Robert Koch and Koch's Postulates, Rivers' postulates	
	iii. Joseph Lister, antisepsis and chemical disinfection	
	2. Chemotherapy -	2
	i. Paul Ehrlich : magic bullets	
	ii. Discovery of Antibiotics: Alexander Fleming, Waksman	
	3. Vaccination-	2
	i. Edward Jenner :Concept of vaccine	
	ii. Definition and types of vaccine	
	4. Virology-	3
	i. Dimitri Iwanowski: Discovery of viruses	
	ii. Discovery of Bacteriophages	
	iii. Applications of Bacteriophages	
	5. Agricultural Microbiology-	3
	i. Martinus Beijerinck and Sergei N. Winogradsky	
	ii. Bio-control agents – concept and applications	
	iii. Bio-inoculants- Types and applications	
	6. Industrial Microbiology-	3
	i. Louis Pasteur – Fermentation	
	ii. Microbes in Industry	
	iii. Probiotics and fermented foods	
Unit II	Microbial Diversity	15
	1. Algae	2
	2. Fungi (Molds and Yeasts)	2
	3. Protozoa	2

4. Bacteria	2
5. Viruses, viroids and Prions	2
6. Archaeobacteria	2
7. Principles of Classification of bacteria (Bergey's) and viruses (ICTV)	3

References:

- Daniel Lim Microbiology, 2nd Edition McGraw-Hill Publication
- Ingraham J. L. and Ingraham C.A. Introduction to Microbiology, 3rd Edition, Thomson Brooks / Cole
- Michael J Pelczar, JR. E.C.S. Chan, Noel R. Krieg. (1993) Microbiology, 5th Edition, Tata Mac Graw Hill Press.
- Prescott L.M., Harley J.P., and Klein D.A. Microbiology, 6th Edition MacGraw Hill Companies Inc.
- Stanier R.Y., Adelberg E.A. and Ingraham J.L. (1987) General Microbiology, 5th Edition. Macmillan Press Ltd
- D H Bergey; John G Holt Bergey's manual of determinative Bacteriology, 9th Edition. Baltimore: Williams & Wilkins, 1994.



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F.Y.B.Sc Microbiology
2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Techniques in Microbiology
Course Code	21SBMB112
Semester	I
No. of Credits	2

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To enrich students' knowledge and train them in Microbial Techniques
2.	To make them learn different types of Microscopy
3.	To introduce the concept of Sterilization and disinfectant

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be acquainted with the different types of Microscopes
2.	Students will learn to observe micro-organisms and their organelles
3.	Students will understand the importance of sterility in Microbiology

	i. Chemical agents and their mode of action - Aldehydes, Halogens, Quaternary ammonium compounds, Phenol and phenolic compounds, ii. Heavy metals, Alcohol, Dyes, Detergents and Ethyleneoxide. iii. Characteristics of an ideal disinfectant iv. Checking of efficiency of disinfectant - Phenol Coefficient (Rideal-Walker method)	 1 2
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References:

- Salle A.J. (1971) Fundamental Principles of Bacteriology 7th Edition. Tata MacGraw Hill Publishing Co.
- Tortora G.J., Funke B.R., Case C.L. (2006). Microbiology: An Introduction. 8th Edition. Pearson Education Inc.
- Wilson K. and Walker J.M. (2005) Principles and Techniques of Biochemistry and Molecular Biology. 6th Edition Cambridge University Press.
- Hans G. Schlegel (1993) General Microbiology, 8th Edition, Cambridge University Press
- Michael J Pelczar, JR. E.C.S. Chan, Noel R. Krieg. (1993) Microbiology, 5th Edition, Tata Mac Graw Hill Press.



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F.Y.B.Sc. Microbiology

2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	General Microbiology-I
Course Code	21SBMB113
Semester	I
No. of Credits	1.5

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To make students aware about the conduct in microbiology laboratory
2.	To make them familiar with glassware, equipment and instruments (including microscope) in Microbiology laboratory
3.	To teach them basic techniques required to isolate, cultivate and observe the micro-organisms

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will learn the handling and maintenance of various instruments and equipment
2.	Students will learn to isolate and cultivate the micro-organisms
3.	Students will be acquainted with the methods used for observation of the micro-organisms using various staining techniques and their motility patterns

Syllabus

Expt. No.	Topics	No. of Practicals
1	Safety measures(BSL1, BSL2, BSL3 and BSL4) and Good Laboratory Practices in microbiology laboratory, Concept of virulence, pathogenicity and transmission of microorganisms	1
2	To study the principle, operation, precautions and application of common microbiology laboratory instruments: i. Incubator ii. Hot air oven iii. Autoclave iv. Colorimeter v. Laminar air flow hood vi. Clinical centrifuge vii. pH Meter Concept of cleaning, calibration and validation of instruments	1
3	Construction (mechanical and optical), working and care of bright field microscope	1
4	Permanent slide observation: Algae, Fungi and Protozoa	1
5	Wet mount slide preparation and its observation for: Bacteria, Algae, Fungi and Protozoa	1
6	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	1

	xi. Durham's tube xii. Cragie's tube xiii. Inoculating needles: Wire loop & stab needles	
7	Learning basic techniques in Microbiology: i. Wrapping of glassware ii. Cotton plugging iii. Cleaning and washing of glassware iv. Biological waste disposal	1
8	Media preparation: i. Preparation of simple laboratory nutrient media: a. Nutrient broth b. Nutrient agar c. MacConkey's agar ii. Checking sterilization efficiency of autoclave using a biological indicator (<i>B. stearothermophilus</i>)	1
9	Basic staining techniques: i. Monochrome staining ii. Negative staining iii. Gram staining of bacteria	3
10	Observation of motility in bacteria using: i. Microscopic technique: Hanging drop method ii. Culture techniques: Swarming growth and Cragie's tube method	2
11	Method of Isolation of bacteria : Streak plate technique (Recording of colony and cultural characteristics)	1
	TOTAL	14

References:

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



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Semester II

F.Y.B.Sc Microbiology

(CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Bacteriology
Course Code	21SBMB121
Semester	II
No. of Credits	2

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To enlighten the students with the basic concepts of Bacteriology.
2.	To familiarize students with the ultra-structure of bacterial cell.
3.	To introduce the concepts of bio-molecules.
4.	To comprehend the organization of a bacterial cell.
5.	To relate structure and functions of bio-molecules in a bacterial cell.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be conversant with the structure of bacterial cell.
2.	Students will acquire basic knowledge of bio-chemistry.
3.	The students will Develop understanding about structure-function relationship in bio-molecules.



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Course/ Paper Title	Cultivation and Growth of Microorganisms
Course Code	21SBMB122
Semester	II
No. of Credits	2 (1 Unit equivalent to 1 Credit)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To enrich students' knowledge and train them in understanding requirements of microorganisms
2.	To make them learn different techniques to cultivate microorganisms
3.	To introduce the concept of bacterial growth and measurement of growth

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be acquainted with the microbial nutritional requirements
2.	Students will learn different techniques to cultivate micro-organisms
3.	Students will understand different phases of bacterial growth and its measurement

Syllabus

Sr.No	Topic	No. of Lectures
Credit I	Nourishing Microorganisms:	18
	1.Nourishing Microorganisms i.Nutritional requirements ii.Nutritional classification iii.Design and preparation of media: Common ingredients of media iv.Types of media v.Factors affecting bacterial growth {pH, Temperature, Solute Concentration (Salt and Sugar)} and Heavy metals vi.Concept of Enrichment, Pure Culture, Isolation of culture by streak plate, pour plate, spread plate vii.Maintenance of bacterial and fungal cultures using different techniques viii.Culture collection centres and their role	2 1 2 2 3 4 2 2
Credit II	Bacterial growth	18
	1.Bacterial growth i.Kinetics of bacterial growth (Exponential growth model) ii.Growth curve and Generation time iii.Diauxic growth iv.Measurement of bacterial growth- Methods of enumeration: a.Microscopic methods (Direct microscopic count, counting cells using improved Neubauer, Petroff-Hausser's chamber) b.Plate counts (Total viable count) c.Turbidometric methods d.Estimation of biomass (Dry mass, Packed cell volume) e.Chemical methods (Cell carbon and nitrogen estimation) v.Methods for cultivating photosynthetic, extremophilic and chemo- lithotrophic bacteria, anaerobic bacteria, algae, fungi, actinomycetes and viruses	2 2 2 2 5 5

References:

- Salle A.J. (1971) Fundamental Principles of Bacteriology 7th Edition. Tata MacGraw Hill Publishing Co.
- Tortora G.J., Funke B.R., Case C.L. (2006). Microbiology: An Introduction. 8th Edition. Pearson Education Inc.
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F.Y.B.Sc Microbiology
2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	General Microbiology-II
Course Code	21SBMB123
Semester	II
No. of Credits	1.5

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To make students learn the techniques for isolation and observation of fungi and various types of bacteria
2.	To make them aware about the techniques used to enumerate the bacteria present in different samples
3.	To teach them the effect of various parameters on the growth of bacteria

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will learn the cultivation of various types of organisms including skin microflora
2.	Students will understand the methods of bacterial enumeration from food, water or soil samples
3.	Students will be acquainted with the effects of various parameters including pH, salt concentration, temperature and heavy metal on bacterial growth

SBMB 123: Practical: General Microbiology-II

Expt. No.	Topics	No. of Practicals
1	Cultivation of photosynthetic, aerobic, anaerobic & chemolithotrophic organisms using Winogradsky's column, monitoring and observation of microorganisms after growth	1
2	Isolation of fungi from natural samples and observation by lactophenol cotton blue staining (<i>Rhizopus/Penicillium/Aspergillus</i>)	1
3	Special staining techniques: i. Endospore staining ii. Capsule staining	2
4	Enumeration of bacteria/yeast by microscopic technique: <i>Neubauer chamber</i> (Hemocytometer) method	1
5	Enumeration of bacteria from fermented food / soil / water by culture techniques: i. Spread plate method ii. Pour plate method	2
6	Study of normal flora of skin: i. Cultivating and observing different morphoforms of bacteria from skin ii. Study of effect of washing on skin with soap and disinfectant on its microflora	2
7	To study the effect of different parameters on growth of microorganism (bacteria): i. pH ii. Temperature iii. Sodium chloride concentration	2
8	Study of oligodynamic action of heavy metal	1
9	Preservation of cultures on slants, soil and on grain surfaces; revival of these cultures and lyophilized cultures	1
10	Checking of efficacy of chemical disinfectant: Phenol Coefficient by Rideal– Walker method	1

	TOTAL	14
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- Microbiology: A Laboratory Manual - Book by James G. Cappuccino and Natalie Sherman.
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