Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

(Autonomous)

Syllabus (CBCS) for F.Y.B.Sc. Microbiology
Semester II
(2022 Pattern)

w.e.f.

June 2022

Preamble:

Microbiology is a branch of science that studies “Life” taking an example ofmicroorganisms such asbacteria, protozoa, algae,fungi,viruses, etc. Thesestudies integrate cytology, physiology, ecology, genetics and molecular biology, evolution, taxonomy and systematics with a focus on microorganisms; in particular bacteria. The relevance and applications of these microorganisms tothe surrounding environment including human life and Mother Nature becomes part of this branch. Since inception of this branch of science, Microbiology has remained a field of actively research and ever expanding in all possible directions; broadly categorized as pure and applied science. Different branches of Pure Microbiology based on taxonomy are Bacteriology, Mycology, Protozoology and Parasitology, Phycology and Virology; with considerable overlap between these specific branches over each other and also with otherdisciplines of life sciences, like Biochemistry, Botany, Zoology, Cell Biology, Biotechnology, Nanotechnology, Bioinformatics, etc. Areas in the applied Microbial Sciences can be identified as: Medical, Pharmaceutical, Industrial (Fermentation, Pollution Control), Air, Water, Food and Dairy, Agriculture (Plant Pathology and Soil Microbiology), Veterinary, Environmental (Ecology, Geo microbiology); and the technological aspects of these areas. Knowledge of different aspects of Microbiology has become crucial and indispensable to everyone in the society. Study ofmicrobes has become anintegral partofeducation and human progress. Building a foundation and a sound knowledge-base of Microbiological principles among the future citizens of the country will lead to an educated, intellectual and scientifically advanced society. Microbiological tools have been extensively used to study different life processes and are cutting edge technologies. There is a continual demand formicrobiologists in the work force – education, industry and research. Careeropportunities for the graduate students are available in manufacturing industryand researchinstitutesattechnicallevel.

Eligibility:
First Year B.Sc.:

A. Higher Secondary School Certificate (10+2) or its equivalent Examinationwith English and Biology; and two of the science subjects such as Physics,Chemistry,Mathematics,Geography,Geology,etc.

OR

B. Diploma in Pharmacy Course of Board of Technical Education conducted by Government of Maharashtra or its equivalent.

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati
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SYLLABUS (CBCS) FOR F. Y. B. Sc. MICROBIOLOGY
(w.e.f. June 2022)

COURSE STRUCTURE FOR F.Y. B.Sc. MICROBIOLOGY (w.e.f. June 2022)

Sr. No.	Class	Semester	Code	Paper	PaperTitle	Credit
1	F.Y.B.Sc	I	USMB111	Theory	Introduction to Microbiology I	2
2	F.Y.B.Sc.	I	USMB112	Theory	Basic Techniques In Microbiology I	2
3	F.Y.B.Sc.	I	USMB113	Practical	Practical Course I	2
4	F.Y.B.Sc.	II	USMB121	Theory	Introduction to Microbiology II	2
5	F.Y.B.Sc.	II	USMB122	Theory	Basic Techniques in Microbiology II	2
6	F.Y.B.Sc.	II	USMB123	Practical	Practical Course II	2

SYLLABUS (CBCS) FOR F.Y.B.Sc. Microbiology

(w. e. from June, 2022)

Class : F.Y.B.Sc.
Semester : II
Course Type : Theory
Course Code : USMB121
Course Title : Introduction to Microbiology II
No. of Credits : 02
No. of Teaching Hours : 32

Course Objective:

1. To enrich the knowledge of undergraduate science faculty students about the basic terms used in biochemistry.
2. To allow students to understand the biochemical reactions going on in microorganisms.
3. To explain the various categories of macromolecules present in microorganisms.
4. To make students understand the chemical composition of different parts of bacterial cell.
5. To allow students to understand the general structure of bacterial cell.
6. To understand the functions of different parts of bacterial cell.
7. To enrich students' knowledge about bacterial cell inclusions and their functions.

Course Outcome:

CO1 The students will acquire a fundamental understanding of biochemistry.
CO2 The students will be aware of the basic concepts used in biochemistry field.
CO3 The students will be able to do the calculations related to preparation of molar and normal solutions.
CO4 The students will be able to distinguish the different parts of bacterial cell.
CO5 The students will be able to understand the chemical composition of various parts of bacterial cell.
CO6 Students shall earn information about major biomolecules present in the bacterial cell.
CO7 Students shall learn about the physiology of various components of bacterial cell.

Credit No	Topic	Lectures
I	**Unit 1:Basic biochemistry for Microbiology** a) Atoms, elements, ions and molecules b) Mole, Molarity, Normality, Isotopes, Avogadro's number c) Covalent and non-covalent (ionic, hydrogen, van der Waals, hydrophobic, hydrophilic) bonding in biomolecules d) Biochemical reactions-Metabolism and enzymes e) Concepts of pH, acid, base and buffers	**6**
	Unit 2 : Structure and functions of Biomolecules a) Carbohydrates (Monosaccharide-Aldoses & Ketoses, disaccharides, Oligosaccharides and polysaccharides	**10**

	b) Lipids (Triglycerides, phospholipids, oils and sterol) c) Proteins (Structural levels, Haemoglobin and Immunoglobulin) d) Nucleicacids (DNA and RNA) e) Conjugated biomolecules	
II	**Unit1:Bacterial Cytology** Structure, chemical composition and functions of the following: a) Flagella (Gram-positive and Gram-negative) and types of motility (spirochetal and gliding) b) Fimbriae and Pili c) Capsule (Slime layer and glycocalyx) d) Cell wall (Gram-positive and Gram-negative) e) Cell membrane f) Endospore (sporulation cycle) g) Ribosomes (23S, 5S, 16S, 30S, 50S) h) Chromosomal & extra-chromosomal material i) Cell inclusions: (Gasvesicles, carboxysomes, PHB granules, metachromatic granules, Megnatosomes, starch granules, sulfur granules and glycogen bodies)	**2** **1** **1** **2** **1** **1** **2** **2** **4**

References:

1. TortoraG.J.,FunkeB.R.,CaseC.L.(2006).Microbiology:An Introduction. 8th Edition.Pearson Education Inc
2. SalleA.J.(1971)FundamentalPrinciplesofBacteriology.7thEdition.TataMac Graw Hill Publishing Co.
3. StanierR.Y.,AdelbergE.A.andIngrahamJ.L.(1987) General Microbiology, 5th Edition. Macmillan Press Ltd.
4. Prescott,Lancing.M.,John,P.HarleyandDonald,A.Klein(2006) Microbiology 6thEdition, McGraw Hill Higher Education.
5. M.H.Gajbhiye,S.J.Sathe,S.R.PharandeandR.J.Marathe(2015)Introductiont o Microbiology, 3rd Edition. Career publication.
6. MichaelJPelczar,JR.E.C.S.Chan,NoelR.Krieg.(1993)Microbiology,5thEdi tion, Tata MacGraw Hill Press.
7. Nelson D.L.and CoxM.M.(2002) Lehninger's Principles of Biochemistry, Mac MillanWorthPub. Co. NewDelhi.
8. MadiganM.T., MartinkoJ.M. (2006). Brock'sBiologyof Microorganisms. 11th Edition.Pearson Education Inc.

9. Mount,D.W.(2001)Bioinformatics:SequenceandGenomeanalysis.ColdSpri ng Harbor Laboratory Press, New York.
10. Mahendra Rai and Nelson Duran(2011) Metal Nanoparticles inMicrobiology, Springer Verlag Berlin Heidelberg

Mapping of course outcomes and programme outcomes:

Weightage: 1=weak or low relation, 2= Moderate or partial relation, 3= Strong or direct relation

	Programme Outcomes(POs)								
Course outcome (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2			3				3
CO2	3	3		2	3	3			
CO3	3	3		3	3	3			
CO4	3								2
CO5	3								
CO6	3	2						2	
CO7	3							3	

Justification for the mapping

PO1 **Disciplinary Knowledge:**

CO1:The basics ofbiochemistryshall belearnedby thestudents.
CO2: The students shall learn about the basic concepts used in the biochemistry area.
CO3: The students shall gain knowledge about the molarity and normality of thesolutions.
CO4: Students shall learn about the different components of a typical bacterial cell.
CO5:The students shall learn knowledge about the different chemicals presentin different components of a bacterial cell.
CO6:The students shall learn information about the molecules presentin biological cell.
CO7:The students shall gain knowledge about the functions of different components Of bacterial cells.

PO2 **Critical Thinking and Problem Solving:**

CO1: The students shall be aware of the basic terms and units used in chemistry.
CO2:The students will be able to do the basic calculations used in the analysis.
CO3:The students will be able to understand the preparation of solutions with different concentrations.
CO6:The students shall know about the quantitative relationships of different Macromolecules present in bacterial cells.

PO4 **Research-related skills and Scientific temper:**

CO2:The students will be able to do the calculations and perform relevant experiments.

CO3:The students shall be able to prepare the solutions of different concentrations

Used to perform several biological experiments.

PO5 **Trans-disciplinary knowledge:**

CO1:The students shall learn basic concepts in chemistry subject.

CO2:The students shall learn about the subject of biochemistry.

CO3:The students shall get the knowledge of inorganic chemistry.

PO6 **Personal and professional competence:**

CO2: The students will be able to learn the skills needed to work in laboratories of industrial sectors.

CO3: This knowledge shall grant confidence in students while working in groups.

PO8 **Environment and Sustainability:**

CO6: The knowledge of acidic and basic solutions shall help students understand the effect of chemical wastes on the environment.

CO7: Understanding the role of microbes in different environmental sectors shall help students understand the functions of different components of a bacterial cell.

PO9 **Self-directed and Life-long learning:**

CO1: For the better understanding of the biochemistry subject in the future, understanding the basic concepts of chemistry is needed for the students.

CO4: To make their future understanding of the subject better, the students shall gain knowledge about the basic chemicals present in bacterial cell.

SYLLABUS (CBCS) FOR F.Y.B.Sc. Microbiology
(w. e. from June, 2022)

Class	**: F.Y.B.Sc.**
Semester	**: II**
Course Type	**: Practical**
Course Name	**: Basic Techniques in Microbiology-II**
Course Code	**: USMB122**
No. of Credits	**: 02**
No. of Lectures	**: 32**

Course Objectives

1. Introduce students to the fundamental principles and methodologies employed in microbiology, emphasizing techniques for isolating, preserving, and cultivating microorganisms.
2. Provide students with knowledge regarding the nutritional requirements and classification of microorganisms based on their nutritional characteristics.
3. Familiarize students with various culture media types and their applications in microbiological research.
4. Enable students to comprehend the principles and procedures essential for isolating microbial growth.
5. Introduce students to diverse culture preservation techniques employed in microbiology.
6. Equip students with knowledge about microbial growth processes.
7. Enhance students' understanding of methods used for microbial enumeration.
8. Familiarize students with the factors influencing bacterial growth.
9. Enable students to grasp the concepts of synchronous and diauxic growth cultures.

Course Outcomes :

CO1	Gain an understanding of the principles and applications of various types of media, along with their components
CO2	Acquire knowledge about diverse isolation techniques employed in the field of microbiology.
CO3	Demonstrate comprehension of the applications and limitations associated with various preservation techniques in microbiological research
CO4	Explain the significance of isolation techniques in upholding aseptic laboratory conditions and preventing contamination
CO5	Acquire knowledge of techniques utilized for the enumeration of bacterial cells
CO6	Develop proficiency in performing isolation and preservation methods in microbiological practices.
CO7	Attain knowledge about the different phases of bacterial growth.
CO8	Apply acquired techniques to analyze and interpret experimental data within the realm of microbiology

Credit No	Topic	Lectures
I	**Cultivation of Microorganisms** **Unit 1:** Nutritional requirements: a) Nutritional classification of microorganisms b) Common ingredients of media c) Types of media **Unit 2:** Methods of Cultivation of : a) Photosynthetic Bacteria b) Chemoautotrophic Bacteria c) Extremophiles **Unit 3 :** Isolation and Preservation a) Isolation of bacteria by - i. Streak Plate Method ii. Spread Plate Method iii. Pour Plate Method b) Preservation techniques - i. Agar Slant Method ii. Soil & Grain Culture Method iii. Saline Suspension Method iv. Freezing Method v. Lyophilization c) Culture collection centers and their role	**4** **4** **4** **4**
II	**Bacterial Growth** **Unit 1 : Phases of bacterial Growth curve** Definition of : i. Generation ii. Generation time iii. Growth rate and iv. Specific growth rate **Unit 2 : Methods for the Enumeration of Bacteria:** a) Microscopic Methods i. Direct Microscopic Count ii. Counting cells by Neubauer chamber b) Plate counts c) Estimation of Biomass d) Turbidimetric methods **Unit 3:** a) Factors affecting bacterial growth: i. pH ii. Temperature	**4** **7** **5**

	iii. Solute Concentration iv. Heavy metals b) Diauxic growth, Synchronous culture c) Continuous cultivation-Chemostat and Turbidostat	

References:

1. TortoraG.J.,FunkeB.R.,CaseC.L.(2006).Microbiology:An Introduction. 8th Edition.Pearson Education Inc
2. SalleA.J.(1971)FundamentalPrinciplesofBacteriology.7thEdition.TataMac Graw Hill Publishing Co.
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Course outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3				2			3	3
CO2	2					3		2	2
CO3	3	3		3		2		2	2
CO4		3				1		1	1
CO5	2	2		3					3
CO6	2				1	3		3	2
CO7	3				3				
CO8		3		3	2	3			2

Justification for the mapping

PO1 Disciplinary Knowledge:

CO1. Attain knowledge about various nutrient elements, types of media, and their applications.

CO2. Acquire understanding of diverse isolation techniques employed in microbiology.

CO3. Gain knowledge pertaining to the preservation of microbial cultures.

CO5. Obtain basic knowledge about the enumeration of bacterial cells.

CO6. Develop knowledge and skills in performing isolation and preservation methods.

CO7. Acquire knowledge about the bacterial growth curve.

PO2 Critical Thinking and Problem Solving:

CO3. Demonstrate understanding of the applications and limitations of various preservation techniques in microbiological research.

CO4. Execute isolation techniques to maintain aseptic conditions and prevent contamination.

CO5. Acquire knowledge about techniques used for the enumeration of bacterial cells.

CO8. Apply, analyze, and interpret experimental data in the context of microbiology.

PO4 Research related Skills and Scientific Temper:

CO3. Demonstrate different preservation techniques across various fields of microbiology.

CO5. Gain knowledge about techniques used for the enumeration of bacterial cells.

CO8. Apply learned techniques to analyze and interpret experimental data in the context of microbiology.

PO5 Trans disciplinary Knowledge:

CO1. Attain knowledge about different nutrient elements, types of media, and their applications.

CO6. Develop knowledge and skills to perform isolation and preservation methods.

CO7. Acquire knowledge about bacterial growth.

CO8. Apply learned techniques to analyze and interpret experimental data in the field of microbiology.

PO6 Personal and Professional Competence:

CO2. Acquire knowledge of different isolation techniques used in microbiology.

CO3. Understand the applications and limitations of preservation techniques.

CO4. Explain how to cultivate microorganisms.

CO6. Gain basic knowledge about preservation methods.

CO8. Apply learned techniques to analyze and interpret experimental data in the context of microbiology.

PO8 Environment and Sustainability:

CO1. Understand the principles and uses of different types of media and their components.

CO2. Acquire knowledge of different isolation techniques used in microbiology.

CO3. Demonstrate understanding of the applications and limitations of different preservation techniques in microbiology research.

CO4. Explain the importance of isolation techniques in maintaining aseptic conditions and preventing contamination.

CO6. Gain knowledge about performing isolation and preservation methods.

PO9 Self directed and Life long Learning:

CO1. Understand the principles and uses of different types of media and their components.

CO2. Acquire knowledge of different isolation techniques used in microbiology.

CO3. Demonstrate an understanding of the applications and limitations of different preservation techniques in microbiology research.

CO4. Explain the importance of isolation techniques in maintaining aseptic conditions and preventing contamination.

CO5. Earn knowledge about techniques used for the enumeration of bacterial cells.

CO6. Gain knowledge about performing isolation and preservation methods.

CO8. Apply, analyze, and interpret experimental data in the context of microbiology.

SYLLABUS (CBCS) FOR F.Y.B.Sc. Microbiology
(w. e. from June, 2022)

Class	**: F.Y.B.Sc.**
Semester	**: II**
Course Type	**: Practical**
Course Name	**: Practical Course-II**
Course Code	**: USMB123**
No. of Credits	**: 02**
No. of Lectures	**:40**

Course Objectives

1. Improve students' understanding and proficiency with basic principles of microbiology.

2. Explain to students the significance of the different isolation techniques in aseptic research and diagnosis.

3. Give students actual, hands-on training in the fundamental microbiological procedures needed to cultivate microorganisms.

4. Introduce pupils to the methods required for aseptic culture procedures.

5. Educate pupils on how to recognize the structural traits of microbes.

6. Encourage students to become proficient in laboratory skills while putting a heavy emphasis on safety protocols.

7. Teach pupils how to maximize the conditions for microbial development.

8. Encourage children to enhance their critical thinking and problem-solving abilities.

Course Outcomes :

CO1	Familiarize students with the microbiology laboratory and standard practices employed in both research and diagnostic microbiology
CO2	Develop proficiency among students in the preparation of media, broth, and slants
CO3	Enable students to analyze, interpret, and describe the morphological features of microorganisms
CO4	Instill an understanding of the importance of aseptic transfer techniques among students
CO5	Equip students with the capability to perform special staining techniques for visualizing and differentiating structures within microorganisms
CO6	Provide knowledge about the significance and methods of calibration used in sterilization processes.
CO7	Enable students to optimize and analyze the impact of various factors influencing the growth of microorganisms
CO8	Cultivate expertise in students, allowing them to work directly in applied fields such as industry or institutions, eliminating the need for additional training

Credit No	Expt. No.	Topic	Hours
I	**1**	Cultivation of microorganisms: a) Preparation of simple laboratory media (solid and liquid) (Nutrient Broth & Agar, MacConkey's Broth & Agar & Potato Dextrose Broth & Agar)	**4**
	2	Isolation of bacteria by Streak plate technique & Observation of the growth of cultures and reporting of colony characteristics	**4**
	3-4	Enumeration of bacteria from fermented food / soil / water by: a) Spread plate method b) Pour plate method	**8**
	5	Aseptic transfer techniques (slant to slant, broth to broth, broth to agar and Agar to Agar)	**4**
II	**6**	Oligodynamic effect of heavy metals	**4**
	7	Checking sterilization efficiency of autoclave using a biological indicator	**4**
	8	Demonstration of checking the efficacy of chemical disinfectant: Phenol Coefficient by Rideal Walker method	**4**
	9	Study the effect of soap and disinfectant on skin microflora	**4**
	10	To study the effect of different parameters on growth of bacteria: pH, temperature &Salt concentration	**4**

References:

1. James G. Cappuccino and Natalie Sherman (2014) Microbiology: A Laboratory Manual, 10th Edition Pearson.
2. DavidT.Plummer(2010)An introduction to practical biochemistry: By Mc Graw -Hill
3. Dr.R.C.Dubey and Dr.D.K. Maheshwari-Practical Microbiology

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Course outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3				3	3		3	3
CO2		3				2			2
CO3		2		3		3			3
CO4	2	2		2					
CO5		3		3		3			3
CO6	3				3	2			2
CO7		2		3	2			3	
CO8		3		3		2			3

Justification for the mapping

PO1 Disciplinary Knowledge:

CO1. Familiarize students with the dos and don'ts in common practices used in research and diagnostic microbiology.

CO4. Enable students to proficiently execute aseptic transfer techniques.

CO6. Equip students with knowledge about calibration methods employed for sterilization.

PO2 Critical Thinking and Problem Solving:

CO2. Develop students' proficiency in the preparation of media, broth, and slants.

CO3. Empower students to analyze, interpret, and describe the morphological features of microorganisms.

CO4. Provide students with skills related to aseptic techniques.

CO5. Enable students to perform special staining techniques for visualizing and differentiating structures within microorganisms.

CO7. Equip students to optimize and analyze the effects of various factors influencing the growth of microorganisms.

CO8. Provide students with expertise to work directly in applied fields, industry, or institutions.

PO4 Research related Skills and Scientific Temper:

CO3. Enable students to perform basic research related steps for the cultivation and identification of microorganisms.

CO4. Provide students with skills related to aseptic techniques.

CO5. Empower students to perform special staining techniques for visualizing and differentiating structures within microorganisms.

CO7. Enable students to optimize the growth of microorganisms.

CO8. Provide students with expertise to work directly in applied fields (industry or institutions) without additional training.

PO5 Trans disciplinary Knowledge:

CO1. Introduce students to the microbiology laboratory and common practices used in research and diagnostic microbiology.

CO6. Provide students with knowledge and skills related to sterilization.

CO7. Enable students to optimize the growth of microorganisms.

PO6 Personal and Professional Competence:

CO1. Equip students with skills related to common practices in research and diagnostic microbiology.

CO2. Develop students' proficiency in preparing media, broth, and slants.

CO3. Enable students to analyze and interpret the classification of bacteria.

CO5. Provide students with skills in performing special staining techniques to observe structures within microorganisms.

CO6. Familiarize students with the significance and calibration methods used for sterilization.

CO8.Provide students with expertise to work directly in applied fields (industry or institutions) without additional training.

PO8 Environment and Sustainability:

CO1. Increase students' awareness of the dos and don'ts in common practices used in research and diagnostic microbiology.

CO7. Enable students to optimize and observe the effects of different factors affecting the growth of microorganisms.

PO9 Self directed and Life long Learning:

CO1. Equip students with skills related to common practices in research and diagnostic microbiology.

CO2. Provide students with proficiency in preparing media, broth, and slants.

CO3. Encourage students to apply learned knowledge in identifying microorganisms.

CO5. Develop students' skills in special staining techniques.

CO6. Familiarize students with the significance and calibration methods used for sterilization.

CO8. Provide students with expertise to work directly in applied fields (industry or institutions) without additional training.