

As Per NEP 2020

University of Mumbai



Syllabus for Minor Vertical 2 (Scheme – I)

Faculty of Science

Board of Studies in Microbiology

Second Year Programme in Minor (Microbiology)

Semester

III & IV

Title of Paper

Sem.

Total Credits 4

I) Basic Concepts of Microbiology

III

2

II) Fundamental Techniques in Microbiology

Title of Paper

Credits

I) Microbial Growth and Cultivation

IV

2

II) Basic Techniques in Microbiology

From the Academic Year

2025-26

Sem. - III

Syllabus
B.Sc. (Second year)
(Sem.- III)

III) Title of Paper Basic Concepts of Microbiology

Sr. No.	Heading	Particulars
1	Description of the course : Including but Not limited to :	The Basic Concepts of Microbiology course introduces microorganisms' structure, classification, and functions. It includes the role of key biomolecules like proteins, carbohydrates, lipids, and nucleic acids. Students learn how microbes generate energy and carry out essential biochemical processes. The course also focuses on methods to control microorganisms, including sterilization, disinfection, and antibiotic use. Emphasis is placed on both physical and chemical control techniques. Practical sessions train students in culturing, staining, and identifying microbes. The course highlights the importance of microbes in health, industry, and the environment. It builds a strong foundation in Microbiology and Biochemistry. Students gain essential laboratory and analytical skills. This course is essential for preparing students for advanced studies in Microbiology and related fields.
2	Vertical :	Minor
3	Type :	Theory / Practical
4	Credit:	2 credits (1 credit = 15 Hours for Theory or 30 Hours of Practical work in a semester)
5	Hours Allotted :	30 Hours / 60 Hours
6	Marks Allotted:	50 Marks/100 Marks
7	Course Objectives: CO1. To introduce the learners to biomolecules. CO2. To narrate the types and functions of biomolecules CO3.To explain the role of biomolecules CO4.To give an overview of general terms used in the control of microorganisms. CO5 To study the importance of physical and chemical methods of microbial control. CO6 To understand factors affecting the effectiveness of antimicrobial agents. CO7 To acquire skills for evaluation of disinfectants	
8	Course Outcomes: On completion of this course learner will be able to: OC1.Recall different types of biomolecules and their role. OC2 Understand the Chemical foundations of life OC3 Apply the knowledge of structure of biomolecules to interpret their role. OC4 Differentiate between various types of physical and chemical methods of microbial control. OC5 Assess the physical and chemical methods of microbial control. OC6 Elaborate on the mechanism , advantages and disadvantages of chemical methods of microbial control	
9	Modules	

Course code	Minor Course	Credits 2 (30 L/hr)
Module 1	The Foundations of Biochemistry	15 Lectures
1.1	Chemical foundations: 1.1.1 Biomolecules are compounds of carbon with a variety of functional groups. 1.1.2 Macromolecules as the major constituents of cells. 1.1.3 Configuration and Conformation with definitions and suitable examples only. 1.1.4 Types of Stereoisomers and the importance of stereoisomerism in biology. 1.1.5 Types of bonds and their importance: Electrovalence, covalent, ester, phosphodiester, thioester, peptide, glycosidic	2
1.2	Water- Structure, properties in brief.	1
1.3	Carbohydrates: Definition, Classification, Biological role. Monosaccharides, Disaccharides (maltose, cellobiose, sucrose, lactose) and polysaccharide (starch, glycogen, peptidoglycan, cellulose)	3
1.4	Lipids: Fatty acids as basic components of lipids and their classification nomenclature, storage lipids and structural lipids. Types of lipids with general structure of each and mention examples.	2
1.5	Amino acids Peptides & proteins: General structure and features of amino acids (emphasis on amphoteric nature) Classification by R-groups Peptides and proteins- Definition and general features and examples with biological role. Primary, secondary, tertiary, quaternary structures of proteins- Brief outline.	4
1.6	Nucleotides and Nucleic acids: Nitrogenous bases- Purines , Pyrimidines Pentoses-Ribose, Deoxyribose, Nomenclature of Nucleosides and nucleotides glycosidic bond, polynucleotide chain to show bonding between nucleotides (Phosphodiester bonds). Basic structure of RNA and DNA.	3
Module 2	Control of Microorganisms	15 Lectures
2.1	Definition of general terms used in control of microorganisms Rate of microbial death Properties of an ideal disinfectant	1
2.2	Physical methods of microbial control	5

	a. Dry & moist heat – mechanisms, instruments used and their operations b. Electromagnetic radiations – Ionizing radiations, mechanisms c. Bacteria proof filters	
2.3	Chemical methods of microbial control - mechanism & advantages & disadvantages applications. a. Phenolics and Alcohols b. Heavy metals and their compounds c. Halogens d. Detergents	6
2.4	Gaseous sterilising agents- formaldehyde, ethylene oxide, hydrogen peroxide	1
2.5	Disinfection of surfaces and spillages Disinfection of biosafety cabinets Disinfection of rooms	2
10	Text Books: 1. Principles of Biochemistry 5th Edition Lehninger 2. Microbiology TMH 5th Edition by Michael J.Pelczar Jr., E.C.S. Chan ,Noel R. Krieg	
11	Reference Books: 1. Prescott ,Harley.Klein-Microbiology, 5th & 6th edition, International edition 2002 & 2006, McGraw Hill. 2. Michael T.Madigan & J.M.Martin,Brock ,Biology of Microorganisms 11th Ed. International edition ,2006, Pearson Prentice Hall.	

12	Internal Continuous Assessment: 40%	External, Semester End Examination 60% Individual Passing in Internal and External Examination																								
13	Continuous Evaluation through: Quizzes, Class Tests, presentation, project, role play, creative writing, assignment etc.(at least 3)	As per paper pattern*																								
	Paper Pattern for 30 marks : 30 Marks per paper Semester End Theory Examination: Duration - These examinations shall be of one hour duration																									
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	Minor Course Practical Fundamental Techniques in Microbiology	2 Credits (60 L/hr)
1.	Microbiology lab tour- Safety, Common glassware, equipments and instruments	3
2.	Qualitative tests of carbohydrates - Molisch	3
3.	Qualitative tests of Proteins- Biuret.	3
4.	Qualitative tests of Amino acids- Ninhydrin.	3
5.	Qualitative tests of DNA- DPA	3
6.	Qualitative tests of RNA - Orcinol.	3
7	Solubility test of lipids in different solvents	3
8.	Working of Colorimeter, Autoclave , Hot air oven	6
9.	Determination of lambda max- copper sulfate and Potassium permanganate	5
10.	Verification of Beer and Lambert's law - copper sulfate	5
14.	Aseptic transfer techniques (broth, butt, slant, plate)	5
15.	Effect of Triphenylamine dyes using disc diffusion	5
17.	Effect of Antibiotics by disc diffusion	5
18.	Study of Oligodynamic effect of heavy metals	4
19.	Effect of disinfectants used in the lab (Swabbing of surfaces)	4

Internal Continuous Assessment: 40%	External, Semester End Examination 60% Individual Passing in Internal and External Examination
Continuous Evaluation through: Minor experiment /Viva/ Assignment/ objective question test (15 Marks), Overall performance (5 Marks) = 20 Marks	As per the pattern given below* 2 hours each day (2 days)
*Pattern of the end-semester practical examination Experiments (15 marks Major + 5 marks Viva/Spots + 5 marks Quiz and 5 Marks for Journal = 30 Marks)	

Sem. - IV

Syllabus
B.Sc. (Second year)
(Sem.- IV)

Title of Paper Microbial growth and Cultivation

Sr. No.	Heading	Particulars
1	Description of the course : Including but Not limited to :	The Cultivation and Growth of Microorganisms course teaches the principles and techniques for growing microbes in the lab. It covers microbial nutritional needs and the use of various media types for cultivation and inoculation techniques. The course explains microbial growth phases and factors affecting growth, such as temperature, pH, and oxygen. Hands-on training includes measuring growth through turbidity and direct microscopic counts. Emphasis is placed on aseptic techniques and contamination control. Students use selective and differential media to isolate specific microbes. The course connects theory with lab practice for understanding microbial behavior. It builds essential skills for clinical, industrial, and research microbiology. Overall, it lays a strong foundation for advanced microbiological work
2	Vertical :	Minor
3	Type :	Theory / Practical
4	Credit:	2 credits (1 credit = 15 Hours for Theory or 30 Hours of Practical work in a semester)
5	Hours Allotted :	30 Hours
6	Marks Allotted:	50 Marks/100 Marks
7	Course Objectives: CO1. To apply the knowledge to cultivate and enumerate microorganisms CO2. To differentiate between various groups of microorganisms based on their nutritional types and characteristics. CO3. To explain the significance of different cultivation methods CO4. To describe the preservation methods of microorganisms. CO5 To gain knowledge about techniques used in the measurement of growth. CO6. To discuss the influence of environmental factors on growth.	

8	Course Outcomes: On completion of this course, the learner will be able to: OC1. Enlist the cultivation methods for different microorganisms OC2. Comprehend experiments to study the effect of environmental factors influencing growth. OC3. Discuss the nutritional types of microorganisms OC4. Apply the cultivation methods based on the types of microorganisms OC5. Analyze various methods used in the measurement of growth
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Course code	Minor Course	Credits 2 (30 L/hr)
Module 1	Cultivation of Microorganisms	15 Lectures
1.1	Nutritional requirements – Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulfur and growth factors.	3
1.2	Nutritional types of microorganisms	1
1.3	Types of Culture media 1.3.1 Synthetic and Complex- Allen /Chu/ M9 and Nutrient broth 1.3.2 Differential - MacConkey's agar 1.3.3 Enriched - SIBA 1.3.4 Selective- Salt mannitol agar 1.3.5 Enrichment - Ashby's mannitol broth	7
1.4	Isolation of microorganisms and pure culture Techniques.	2
1.5	Preservation of microorganisms (Periodic transfer, soil stock)	2
Module 2	Microbial Growth	15 Lectures
2.1	Definition of growth, Phases of growth	3
2.2	Measurement of growth 2.2.1 Direct microscopic count 2.2.2 Viable count 2.2.3 Turbidity measurements	7
2.3	Influence of environmental factors on growth- Temperature, pH, Solute concentration, Oxygen availability.	5
10	Text Books: 1. Microbiology TMH 5th Edition by Michael J.Pelczar Jr., E.C.S. Chan ,Noel R. Krieg 2. Prescott ,Harley.Klein-Microbiology, 5th & 6th edition, International edition 2002 & 2006, McGraw Hill.	
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Title of Paper :Basic Techniques in Microbiology

	Minor Course practicals Basic Techniques in Microbiology	2 Credits (60 L/hr)
1.	Media preparation and sterilization (Nutrient broth and agar, Sabouraud's broth and agar)	4
2.	Preparation of butts, slants and plates	4
3.	Staining - monochrome, gram staining	6
4.	Monitoring of surfaces, swabbing of wall, floor, handles, mobiles, etc.	4
5.	Inoculation of media (Isolation,spot, broth, slants and butts)	8
6.	Principles and application of types of media i. General purpose media (Nutrient agar- <i>Escherichia coli</i> , <i>Bacillus subtilis</i> ,one pigment producer) ii. Differential and Selective (MacConkey's agar, Salt mannitol agar)	8
7.	Concepts and techniques of Preservation of cultures i. Periodic transfer ii Soil stock	4
8.	Total count by Direct microscopic method using Haemocytometer/ Petroff Hausser/ Neubauer chamber	6
9.	Enumeration of bacteria using standard Brown's opacity tubes/Nephelometer tubes	4
10.	Effect of pH on growth	4
11.	Effect of temperature on growth	4
12.	Effect of salt concentration on growth	4

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Sd/-
Sign of BoS
Coordinator
Dr. Aparna Dubhashi
BoS in Microbiology

Sd/-
Sign of the
Offg. Associate Dean
Dr. Madhav R. Rajwade
Faculty of Science &
Technology

Sd/-
Sign of the Offg. Dean
Prof. Shivram S. Garje
Faculty of Science &
Technology