Vitthalbhai Patel & Rajratna P. T. Patel Science College
(Autonomous)
(Reaccredited with 'A' Grade by NAAC (CGPA 3.13)
Affiliated to SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
Syllabus effective from the Academic Year 2024-2025

(Bachelor of Science) (Undergraduate)
B. Sc. (UG) Semester-I

Course Code	**US01MAMI01**	Title of the Course	**INTRODUCTION TO MICROBIOLOGY**
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	To make students familiar with: • Microbiology as a subject of biological sciences • Historical development and Scope of Microbiology • Techniques to study microbiology like staining techniques • Understanding of various types of microscopes • Classification, characterization and identification of microorganisms. • General characteristics and significance of eukaryotic microbes: fungi, algae, protozoa, lichens

Course Content		
Unit	Description	Weightage* (%)
1.	**History of Microbiology:** a) Discovery of Microorganisms b) Microbiology and Origin of Life c) Spontaneous generation Conflict d) Germ theory of Fermentation e) Germ theory of disease f) Development of Laboratory techniques and pure cultures g) Principles of Immunization h) Developments in Medical microbiology i) Developments in Non medical microbiology i. Soil and Agricultural microbiology ii. Food and Industrial microbiology iii. Molecular biology j) Microbiology and Society	25%

2.	**The Scope of Microbiology and Microbial world** a) Microbiology as a field of Biology b) Place of microorganisms in the living world: Haeckel's Kingdom Protista, Whittaker's Five-Kingdom Concept , c) Difference between eukaryotes and Prokaryotes d) Kingdom Prokaryote after Bergey's Manual of Systematic Bacteriology e) Major groups of Microorganisms i. Introduction to prokaryotes (Eubacteria and Archaebacteria) ii. Introduction to Eukaryotes(Fungi, Algae and Protozoa) iii. A cellular entities(Viruses) f) Distribution of Microorganisms in Nature g) Applied Areas of Microbiology	25%
3.	**Techniques to study Microbiology:** (A) Stains and Staining: a) Importance ofstaining b) Microbiological stains: Definition and examples: (acidic dyes, basic dyes and neutral) c) Principles of staining technique in Bacteria: Steps in staining process i. Smear Preparation ii. Fixation of smear iii. Role of intensifier, mordants and decolorizers d) Types of staining: i. Monochrome staining (Negative staining, Positive Staining) ii. Differential staining (Gram's staining) (B) Microscopy: a)Introduction to Microscopes and Types of Microscopy i) Light microscopy • Bright field Microscopy (Resolving power, Numerical Aperture, Limit of Resolution, Magnification), • Dark field microscopy. • Fluorescent microscopy. • Phase contrast microscopy. ii) Electron microscopy (Principle,working, application and limitation) • Transmission Electron Microscopy • Scanning Electron Microscopy	25%

4.	**Prokaryotic cell organization:** a) Morphology of bacteria b) Typical prokaryotic cell structure c) The Bacterial cell wall d) Structures external to the cell wall: Flagella Pili, Capsules, Sheaths, Prosthecae and stalks e) Structures internal to the cell wall: Cytoplasmic membrane, Membranous intrusions , Intracellular membrane systems, Cytoplasm ,Cytoplasmic inclusions,Vacuoles ,Nuclear material f) Protoplasts and spheroplasts g) Introduction to Spores and Cyst.	25%

Teaching-Learning Methodology	• The major teaching- learning consists of lectures and discussions (large group) in which conventional methods like use of classroom blackboard teaching as well as power point presentation to introduce the learning objectives related to the basic concepts of the subject. • These sessions incorporate space for interactive participation and involvement of students through questions.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal continuous assessment in the form of class test/internal written test – 15 marks(30%), quiz -15 marks (30%) active learning 05 marks(10%) home assignment – 05 marks(10%), class assignment -05 marks (10%) , attendance- 05 marks (10%)(As per SPU Letter No. E-3/2748 dated 02/02.2024 & As per CBCS R.6.8.3) Total 50 marks (50%)	50%
2.	External University Examination	50%

Course Outcomes:	
1.	Understand the scope and History of Microbiology.
2.	Use the knowledge of staining techniques and microscopes in microscopic examination
3.	Understand different groups of microorganisms

Suggested Reference Books:	
Sr. No.	Reference Books
1.	Microbiology - Michael J. Pelczar JR.; E.C.S.Chan; Noel R. Krieg. Fifth edition
2.	Elementary Microbiology Vol : I – Dr. H.A. Modi
3	"Microbiology" Prescott L, Harley J P, and Klein D A, 6th edition. WmC.Brown - McGraw Hill, Dubuque, IA Ltd.

On-line resources
On-line Resources : INFLIBNET, Google Web Google books,

(B. Sc.) (Microbiology) Semester- I Practicals

Course Code	US01MAMI02	Title of the Course	Microbiology Practicals: Based on Introduction to Microbiology
Total Credits of the Course	4	Hours per Week	8

Course Objectives:	To demonstrate: • Understanding of various laboratory equipment and use of microscope. • Microbial handling techniques and disposal of laboratory waste. • Basic skills like preparation of smear, culture media & reagents as well as illustrating staining techniques to visualize bacterial cell and their external and internal structures.

Course Content:

Sr. No.	**Practicals: Based on theory course : Introduction to Microbiology**	Weightage (%)
	SECTION-1	
1.	Good laboratory practices (Rules and safety)	
2.	Introduction to Laboratory Apparatus and Instruments.	100 %
3	Introduction to glassware used in microbiology laboratory.	
4.	Cleaning, Neutralization and Preparation of Glassware for Sterilization.	
5.	Disposal of laboratory culture and waste	
6.	Preparation of Standard solutions – (Normal, Molar and percent) (%) Solution of HCl and NaOH	
7	Preparation of reagents and stains for Gram staining.	
8	Demonstrations for aseptic handling during microbiological work, preparation of smear, use of oil immersion lens of microscope, making stained slides permanent for future use.	
9.	Monochrome staining using basic dye: Positive staining	
10	Monochrome staining using acidic dye: Negative staining	

11	Gram staining as a differential staining technique.	
12	Study of motility by hanging drop preparation	
13	Microscopic examination of Hay infusion	
	SECTION-2	
14	Cell wall staining by Dyar's/ Ringer's method	
15	Capsule staining of bacteria by Hiss/Maneval's method.	
16	Endospore staining by Dorner's / Snyder's method	
17	Metachromatic granule staining by Albert's method	
18	Spirochete staining by Fontana's method	
19	Study of omnivorous presence of microorganisms in different habitat – environment : Air, Water, Soil, Food, Milk, Curd, Skin, Surface of table	

Teaching-Learning Methodology	• By briefing them with the theoretical aspects as well as providing them with the protocol (Aim, Requirements and Procedure) of the experiment to be performed using chalk and duster as well as power point presentation. • Students are trained for microscopic observations and its handling. • Demonstrations of the practical are also carried out and care is taken for aseptic handling and skill development for microbiological work in the laboratory. • Possibility of various results and their interpretation is also discussed.

Evaluation Pattern:		
Sr. No.	Details of the Evaluation:	Weightage %
1.	During practical examination; student should have a certified journal duly signed by head of department and the teacher in charge at the time of examination.	

Course Outcomes: Having completed this course, the learner will be able to:	
1.	Get acquainted with the use of microscope for viewing stained specimen.
2.	Use common laboratory equipments.
3.	Become proficient at safety procedures & microbial handling techniques.
4.	Acquire requisite laboratory skills in preparing stained smear and identify the morphology and arrangement of bacteria.

Suggested References:	
Sr. No.	References:
1.	Experimental Microbiology - Rakesh J. Patel &Kiran R. Patel, Volume-I
2.	Practical Microbiology- Dr. R.C. Dubey and Dr. D.K. Maheshwari (Revised edition), S. Chand publication
3.	Microbiology : A Practical Approach – Dr Bhavesh Patel and Dr NandiniPhanse

On-line resources to be used if available as reference material

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