GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3140408
MICROBIOLOGY
4TH SEMESTER

Type of course: Basic Science

Prerequisite: Basic Knowledge of Cell Biology

Rationale: Microbiology is emerging as the key biological science and provides model used in molecular biology research as well as serve as systems for studying the relationships between species in mixed populations.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	**Basics of Microbiology:** History and Scope of Microbiology, Distinctive characteristics of major group of micro organisms, Basic microbiology and applied microbiology.	4	9%
2	**Microscopic techniques:** Visulization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze- fracture methods for EM, image processing methods in microscopy, confocal microscopy for live cell imaging.	5	11%
3	**Bacterial Taxonomy and Diversity:** Microbial taxonomy and evolution of diversity, classification of microorganisms, criteria for classification; classification of bacteria; Cyanobacteria, acetic acid bacteria, Pseudomonads, lactic and propionic acid bacteria, endospore forming bacteria, Mycobacteria and Mycoplasma; Archaea: Halophiles, Methanogens, Hyperthermophilic archaea, Thermoplasm; Techniques of genetical and molecular characterization of the organisms – GC%, sequencing, homology, conserved sequences and 16S rRNA analysis, allied phylogenetically useful genes.	17	38%

	Reproduction and growth of bacteria, Quantitative measurement of bacterial growth. Nutritional requirements and nutritional types of bacteria		
4	**Fungi – Molds and yeast** Characteristics and morphology of fungi, reproduction, Some fungi of importance, Molds and their associations with other organisms.	4	9%
5	**Viruses:** General characteristics of bacterial viruses, morphology and classfication, Replication, multiplication and lysogeny, Morphology of animal viruses, cultivation of animal and plant viruses.	6	13%
6.	**Microbial ecology:** Culture independent and culture dependent methods of analysis of microbial communities, biogeochemistry and nutrient cycles, microbial environments and microenvironments, microbial biofilms, terrestrial habitat and aquatic habitat, Present status of microbial taxonomy and ecology	9	20%

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**30**	**30**	**10**	**10**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Microbiology by M. J. Pelczer, JR., E. C. S. Chan, Noel R. Krieg, Publication by Tata McGraw Hill Education Private Limited.
2. Brock Biology of Microorganism by Micheal T. Madigan, John M Martinko, Kelly S. Bender, Daniel H Buckley, David A Stahl, Pearson Publications.
3. Microbiology-An application based approach by M. J. Pelczer, JR., E. C. S. Chan, Noel R. Krieg, and Publication by Tata McGraw Hill Education Private Limited.

Course Outcome:

Sr. No.	**CO Statement**	**Marks % Weightage**

CO-1	Use and understand Microscopy techniques for visualizing microbes.	10%
CO-2	The student will be able to identify various types of microbes using a multitude of microscopy, biochemical and molecular techniques.	35%
CO-3	The student will be able to gain basic understanding of mycology and virology.	20%
CO-4	The student will be able to understand dynamics of microbial metabolism sustainning ecosystems, which will serve as a primer for engineering multi-organism systems.	35%

LIST OF PRACTICALS:

1. Lactophenol cotton blue mounting of fungi.
2. Demonstration of bacterial lysis by bacteriophages.
3. Estimation of biomass by different methods.
4. Isolation of rhizobia from root nodules.
5. Isolation of actinomycetes from soil.
6. Identification of unknown bacteria.
7. Cultivation of white button mushroom.

Reference Books:

1. Experiments in microbiology, plant pathology and Biotechnology by K R Aneja, New Age Publications.

Major Equipment:

1. Microscope
2. Incubator
3. Laminar Air Flow
4. Moisture Analyzer
5. Shaker

List of Open Source Software/learning website:

1. NPTEL
2. MIT Open course lecture