GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3131407
Semester – III
Subject Name: Basic Microbiology

Type of course: Basic Science

Prerequisite: Nil

Rationale: Food microbiology is the study of the microorganisms that inhabit, create, or contaminate food. It includes the study of microorganisms causing food spoilage and "Good" bacteria, such as probiotics. In addition, microorganisms are essential for the production of foods such as cheese, yogurt, other fermented foods, bread, beer and wine. Another indispensable aspect of food microbiology is food safety which entails testing of foods for permissible count and type of microorganisms and presence of pathogens (disease or infection causing microorganisms)

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)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1.	**Introduction to Microbiology** The scope and history of microbiology.	4
2.	**Morphology and Fine Structure** External and Internal structures of Bacteria, (membrane and major organelles, Appendages, Spores). Morphology and Characteristics of Fungi and Algae	5
3	**Identification of Microbes** Characterization and Identification of microorganisms (Biochemical and staining methods). Principles and types of different microscopes.	5
4.	**Microbial Growth** Bacterial Growth phases, auxotroph, bradytroph, Replica plating, Microbial Reproduction and preservation of microorganisms.	4
5.	**Introduction to microbial genetics** Microbial genome and plasmids, detection of microorganisms using molecular, serological and proteomic techniques (SDS-PAGE, Blotting techniques, hybridization, PCR, ELISA).	07
6.	**Modification of Microbial Genome** Genotype changes (acquisition of resistance markers), Bacterial recombination, conjugation, transformation and transduction.	05

7.	**Significance of Microorganisms in Foods** Primary sources of microbes in food, Role of intrinsic and extrinsic parameters that effect microbial growth in foods.	05
8.	**Fermented Foods** Starter organism, Probiotics, Prebiotics, Synbiotics, functional foods, Fermented foods (dairy, traditional, meats).	05
9	**Control of Microorganisms** Control of microorganisms by Physical and Chemical agents.	05

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**30**	**20**	**15**	**15**	

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

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. General Microbiology by Roger Y. Stanier, John L. Ingram, Mark L. WheelsandPage R. Painter. (Macmillan Press Ltd.)
2. Microbiology by M. J. Pelczar Jr., E.C.S Chan and Noel R Krieg. Tata McGraw-Hill
3. Food Microbiology, W C Frazier and D C Westhoff, McGraw Hill Book Company,NY

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Identify the microorganisms based on their structural and growth characteristics	15
CO-2	Identify and quantify the microorganisms using rapid techniques (molecular, immunological, proteomic)	20
CO-3	Develop concept of genetic transfer mechanisms leading to multidrug resistance	15
CO-4	Understand and characterize the natural microflora, starter, probiotic and pathogenic	15
CO-5	Understand the methods to control microorganisms	15
CO-6	Understand the factors affecting growth of microorganisms in food	20

List of Experiments:

1) Experiment 1: Introduction to Biosafety Levels and Lab equipment and Biosafety Levels:
   a) Laminar air flow/ Biosafety cabinets
   b) Autoclave
   c) Microscope
2) Experiment 2: Preparation of growth media for microorganism
3) Experiment 3: Simple staining for visualization of bacteria
   a) Simple / Monochromatic staining
   b) Negative Staining
4) Experiment 4: Differential staining for visualization of bacteria (Gram Staining)
5) Experiment 5: Staining for visualization of fungi
6) Experiment 6: To study the effect of various factors on microbial growth
7) Experiment 7: To perform viable plate count in given sample by pour plate method
8) Experiment 8: To perform viable plate count in given sample by spread plate method
9) Experiment 9: To study carbohydrate fermentation using Triple Sugar Iron Agar
10) Experiment 10: Identification of enteric bacteria using biochemical tests (IMViC)
    a) Indole test;
    b) Methyl Red test;
    c) Voges–Proskauer test;
    d) Citrate Utilization test:
11) Experiment 11: To study microbial growth curve
12) Open ended problem

Major Equipment:

1. Laminar air flow cabinet
2. Autoclave
3. Microscope
4. Rotatory Shaker
5. Biological /BOD incubator
6. Refrigerator

List of Open Source Software/learning website:

1) http://highered.mcgraw-hill.com/sites/0072556781/student_view0/chapter13/animation_quiz_1.html
2) http://highered.mcgraw-hill.com/sites/0072943696/student_view0/chapter3/animation.html
3) http://users.ugent.be/~avierstr/principles/pcrani.html
4) http://aggie-horticulture.tamu.edu/food-technology/food-processing-entrepreneurs/microbiology-of-food/