



SEMESTER 2

BACTERIOLOGY (Theory)

Program: B. Sc. in Microbiology	Year, Semester: 1st Yr., 2nd Sem
Course Title: BACTERIOLOGY (Theory)	Subject Code: TIU-UMB-MJ-T12101
Contact Hours/Week: 2-1-0 (L-T-P)	Credit: 3

COURSE OBJECTIVE :

Enable the student to:

To understand the fundamental characteristics of bacterial cells, including size, shape, and arrangement.

To learn methods of pure culture isolation, including streaking, serial dilution, and plating techniques.

To understand the working principles and applications of different types of microscopes, including Bright Field, Dark Field, and Phase Contrast Microscopes.

To understand the fundamental principles of microbial classification, systematics, and taxonomy.

COURSE OUTCOME :

On completion of the course, the student will be able to:

CO-1:	Understand Prokaryotic Cell Organization	K2
CO-2:	Interpret Bacteriological Techniques for Culture Isolation and Preservation	K2
CO-3:	Apply Staining Techniques for Bacterial Identification and Explore Advanced Microscopy Techniques	K4
CO-4:	Analyze Bacterial Growth and Nutritional Requirements	K3
CO-5:	Understand Bacterial Reproduction and Growth Kinetics	K3

CO-6:	Classify Important Archaeal and Eubacterial Groups	K3
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COURSE CONTENT :

MODULE 1:	HISTORY OF DEVELOPMENT OF MICROBIOLOGY	8 Hours
<p>Cell size, shape and arrangement, glycocalyx, capsule, flagella, endoflagella, fimbriae, and pili. Cell wall: Composition and detailed structure of Gram-positive and Gram-negative cell walls, Archaeobacterial cell wall, Gram and acid-fast staining mechanisms, lipopolysaccharide (LPS), spheroplasts, protoplasts, and L-forms. Effect of antibiotics and enzymes on the cell wall. Cell Membrane: Structure, function, and chemical composition of bacterial and archaeal cell membranes. Cytoplasm: Ribosomes, mesosomes, inclusion bodies, nucleoids, chromosomes, and plasmids Endospore: Structure, formation, stages of sporulation.</p>		
MODULE 2:	BACTERIOLOGICAL TECHNIQUES	6 Hours
<p>Pure culture isolation: Streaking, serial dilution, and plating methods; cultivation, maintenance, and preservation/stocking of pure cultures; cultivation of anaerobic bacteria, and accessing non-culturable bacteria.</p>		
MODULE 3:	STAINS AND STAINING TECHNIQUES	6 Hours
<p>Definition of auxochrome; chromophores; acidic and basic dyes; classification of stains; simple and differential staining: theories of staining, mordant and its function; Gram staining; acid fast staining; endospore staining; negative staining ; capsule staining; flagella staining; mechanism of Gram staining.</p>		
MODULE 4:	MICROSCOPY	5 Hours
<p>Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluorescence Microscope, Confocal microscopy, Scanning and Transmission Electron Microscope</p>		
MODULE 5:	GROWTH AND NUTRITION	7 Hours
<p>Nutritional requirements in bacteria and nutritional categories; Culture media: components of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media Physical methods of microbial control: heat, low temperature, high pressure, filtration, desiccation, osmotic pressure, radiation Chemical methods of microbial control: disinfectants, types, and mode of action</p>		

MODULE 6:	REPRODUCTION IN BACTERIA	5 Hours
Asexual methods of reproduction, logarithmic representation of bacterial populations, phases of growth, calculation of generation time, and specific growth rate		
MODULE 7:	IMPORTANT ARCHAEAL AND EUBACTERIAL GROUPS	8 Hours
<p>Aim and basic principles of classification, systematics, and taxonomy, the concept of species, taxa, strain; Archaeobacteria: General characteristics, phylogenetic overview, genera belonging to Nanoarchaeota(Nanoarchaeum), Crenarchaeota (Sulfolobus, Thermoproteus) and Euryarchaeota [Methanogens (Methanobacterium, Methanocaldococcus), thermophiles (Thermococcus, Pyrococcus, Thermoplasma), and Halophiles (Halobacterium, Halococcus)] Eubacteria: Introduction and importance of following groups: Gram Negative: Non-proteobacteria: General characteristics with suitable examples Alpha proteobacteria: General characteristics with suitable examples Beta proteobacteria: General characteristics with suitable examples Gamma proteobacteria: General characteristics with suitable examples, Delta proteobacteria: General characteristics with suitable examples, Epsilon proteobacteria: General characteristics with suitable examples Zeta proteobacteria: General characteristics with suitable examples</p> <p>Gram Positive: Low G+ C (Firmicutes): General characteristics with suitable examples High G+C (Actinobacteria): General characteristics with suitable examples Cyanobacteria: An Introduction</p>		
TOTAL LECTURES		45 Hours**

Books:

1. Tortora GJ, Funke BR and Case CL. (2008). Microbiology: An Introduction. 9th edition.

Pearson Education

2. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition

3. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition.

Pearson Education Limited

4. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9 Edition. McGraw Hill International.

5. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers.

6. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.

7. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1	3	2	2	1	2	1	1	2	1	2	2	2	3	2	2
CO-2	3	2	2	1	3	1	1	2	2	2	2	3	2	3	2
CO-3	3	3	3	2	3	1	1	2	2	2	2	3	3	3	2
CO-4	3	3	3	2	3	1	1	2	2	2	2	3	2	3	2
CO-5	3	2	3	2	2	1	1	2	1	2	2	3	2	2	3
CO-6	3	2	2	1	2	2	1	2	1	2	2	2	3	2	2

BACTERIOLOGY (Practical)

Program: B. Sc. in Microbiology	Year, Semester: 1st Yr., 2nd Sem
Course Title: BACTERIOLOGY (Practical)	Subject Code: TIU-UMB-MJ-L12101
Contact Hours/Week: 0-0-1 (L-T-P)	Credit: 1

COURSE OBJECTIVE :

Enable the student to:

To understand the composition and preparation of synthetic media

To study the principles and applications of negative staining.

To understand the principle and mechanism of staining techniques.

To explore various bacterial culture preservation techniques such as refrigeration, deep freezing, and lyophilization.

COURSE OUTCOME :

On completion of the course, the student will be able to:

CO-1:	Prepare and Utilize Different Microbiological Media	K2
CO-2:	Understand how to perform Essential Bacterial Staining Techniques	K2
CO-3:	Evaluate bacterial morphology and structure	K5
CO-4:	Apply the Techniques for bacterial culture Isolation	K3
CO-5:	Cultivation of Pure Cultures techniques in different selective medium	K3
CO-6:	Quantify Bacterial Growth Using CFU Estimation	K5

COURSE CONTENT :

MODULE 1:	SKILLED IN MICROBIOLOGICAL CULTURE PREPARATION	15 Hours
<p>Preparation of different media: synthetic media CzapekDox media and /or BG-11, Complex media-Nutrient agar, McConkey agar, EMB agar.</p> <p>2. Simple staining</p> <p>3. Negative staining</p> <p>4. Gram's staining</p> <p>5. Capsule staining</p> <p>6. Endospore staining.</p> <p>7. Isolation of pure cultures of bacteria by the streaking methods.</p> <p>8. Preservation of bacterial cultures by various techniques.</p> <p>9. Estimation of CFU count by spread plate method/pour plate method.</p>		
TOTAL LECTURES		15 Hours**

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)	PROGRAM SPECIFIC OUTCOMES (PSO)
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	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1	3	2	2	2	3	1	1	2	1	2	2	3	3	3	2
CO-2	3	2	2	2	3	1	1	2	1	2	2	3	3	3	2
CO-3	3	2	3	2	3	1	1	2	1	2	2	3	3	2	2
CO-4	3	3	2	2	3	1	1	2	2	2	2	3	3	3	2
CO-5	3	3	2	2	3	1	1	2	2	2	2	3	3	3	2
CO-6	3	3	3	2	3	1	1	2	1	2	2	3	2	3	3

B.Sc. Chemistry (minor)

Syllabus

(Program: B.Sc. Chemistry (minor))	Year, Semester: Ist year., 2nd Sem.
Course Title: Chemistry	Subject Code: TIU-UCH-MI-T12101
Contact Hours/Week: 3-0-0 (L-T-P)	Credit: 3

COURSE OBJECTIVE:

Enable the student to:

Understand the basic concept of structure of atom, covalent bonding, non covalent bonding thermodynamics, chemical kinetics ionic equilibria, nomenclature, stereochemistry, structures, reactivity, and mechanism of chemical reactions.

Apply the concept of thermodynamics, chemical kinetics, and ionic equilibria, in the relevant advanced and emerging field of biotechnological studies.

Apply the concept of covalent and non covalent bonding, in acquiring information regarding the metals used in any process of biotechnological system.

Remember the knowledge of stereochemistry and reaction mechanism in understanding the glimpse of the reaction pathways involved in the biotechnology process.

Understand the concept of various types of bonding, energy distributions in atomic and molecular orbital makes the student easier to understand the technology based on them.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Understand the underlying concepts of development of periodic table and learn to predict properties of elements by going through periodic variations of properties across the period and down the group. They will be able to use the periodic table to rationalize similarities and differences of elements, including physical and chemical properties and reactivity.	K2
CO-2:	Understand the nature of metal-ligand bonding in complexes and prediction of various properties of complexes by ligand field theory. They will also be able to explain the structure, spectral and magnetic properties of coordination complexes using the theory.	K2
CO-3:	Analyze the physical and chemical properties of organic molecules to predict their reactivity, nature of reactive intermediates, and various types of reaction mechanisms.	K2
CO-4:	Analyze several physical parameters controlling the organic transformations and comprehend the chemistry of numerous functionalized organic compounds.	K1
CO-5:	Understand two important properties of liquids which are viscosity, surface tension. They will also learn several factors that affect viscosity and surface tension of liquid and methods of their measurements.	K2
CO-6:	Remember the knowledge of analytical chemistry by learning nature of various types of electrolytes (acid, base, salt) in solution, measurement of their strength, preparation of buffers etc.	K3

COURSE CONTENT:

MODULE 1:		14 Hours
1.	PERIODIC TRENDS AND PROPERTIES	5 hours
(i) General idea about modern periodic table, Definition and trends of variation of atomic and ionic radii, ionization energy, electron affinity and electro negativity, Prediction of chemical behaviour of elements and compounds. (ii) Comparative study of p-block elements: Electronic configuration, common oxidation states, inert pair effect. Important compounds and their properties and reactivity's		

BOOKS

Basic Inorganic Chemistry, F. A Cotton, G. Wilkinson, John Wiley & Sons.

Concise Inorganic Chemistry, J. D. Lee, Chapman & Hall.

Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice-Hall, New Delhi.

Organic Chemistry, I. L. Finar, [Vol. I & Vol. II], ELBS and Longman Ltd., New Delhi.

Organic Chemistry, J. Clayden, N. Greeves, S. Warren, and E. Wothers, , Oxford Univ. Press.

Physical Chemistry, P. C. Rakshit, Sarat Book House, Calcutta.

Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania, Shoban Lal Nagin Chand & Co., Jalandhar.

L. Stryer, Biochemistry, Freeman & Co.

D. L. Nelson and M. M. Cox, Lehninger, Principles of Biochemistry, McMillan North Publication.

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1	3	2	3	2	2	2	1	1	1	1	2	2	3	2	1
CO-2	3	2	3	2	3	1	1	1	1	1	2	2	2	3	2
CO-3	3	3	3	2	2	2	1	2	1	1	2	3	3	3	2
CO-4	2	3	3	3	2	2	1	1	1	1	2	3	2	3	2
CO-5	2	2	3	2	2	3	1	1	1	1	2	3	2	3	3
CO-6	3	3	3	2	3	2	1	2	1	2	2	3	3	2	2

B.Sc. Chemistry (minor)

Lab Syllabus

Program: B.Sc. Chemistry (minor)	Year, Semester: 1st year., 2nd Sem.
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Course Title: Chemistry Lab	Subject Code: TIU-UCH-MI-L12101
Contact Hours/Week: 0-0-2 (L-T-P)	Credit: 1

COURSE OBJECTIVE:

Enable the student to:

Understand the safety protocol and adhere to the best laboratory practical purpose

Understand the chemical nature of the hazardous chemicals.

Create an experimental procedure to perform reactions in order to synthesize important organic compounds and metal complexes.

Understand the characterization techniques such as melting point, UV-visible absorption etc.

Understand the basic analytical tool in order to prepare the solutions required for various types of titrimetric analysis

Apply the knowledge of analytical technique for the determination of exact strength of the solutions by using a primary standard.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Understand the safety protocols, and practice the best practices inside a chemistry lab.	K2
CO-2:	Understand the nature of various types of reagents and their handling as well as storage.	K2
CO-3:	Create an experimental procedure and perform reactions to synthesize important organic compounds and metal complexes	K6
CO-4:	Understand the preliminary characterization techniques such as melting point, UV-visible absorption etc.	K2
CO-5:	Understand the basic analytical techniques, such as Prepare the solutions required for various types of titrimetric analysis and determination of exact strength of the solutions by using a primary standard.	K2
CO-6:	Apply the analytical skills to estimate quantitatively various metal ions, inorganic elements, active ingredients etc. present in samples of various types.	K3

COURSE CONTENT: -----

EXPERIMENT-1:	Synthesis of metal complex
Synthesis of a series of metal complexes (with ligands of varying ligand field strength), electronic spectral interpretation and calculation of various ligand-field parameters.	
Synthesis of metal complexes and determination of melting point, UV-vis absorption.	
EXPERIMENT-2:	Preparation of Inorganic Compounds
Standardization of Na ₂ S ₂ O ₃ solution against standard K ₂ Cr ₂ O ₇ solution.	
(ii) Estimation of available chlorine in bleaching powder.	
(iii) Determination of reaction rate of iodide with hydrogen peroxide in acidic medium (iodine clock reaction)	
EXPERIMENT-3:	Preparation of Organic Compounds:

m-dinitrobenzene, Acetanilide, Bromo acetanilide, Oxidation of primary alcohols-Benzoic acid from benzyl alcohol. Azo dye	
EXPERIMENT-4:	Determination of surface tension of liquids.
EXPERIMENT-5:	Determination of viscosity coefficients of liquids.
EXPERIMENT-6:	Quantitative Analysis through titrations (Physical and Volumetric)
Preparation of standard solution of oxalic acid and standardization of (a) NaOH solution and (b) KMnO ₄ solution. Estimation of Carbonate and bicarbonate present together in a mixture Estimation of acetic acid in commercial Vinegar. Preparation and standardization Mohr's solution by standard KMnO ₄ solution. Complexometric titrations: Zn ²⁺ , Mg ²⁺ , Ca ²⁺ , Fe ²⁺ with EDTA Estimation of total hardness of water by titration with EDTA Estimation of Fe(II) and Fe(III) in a given mixture using standard K ₂ Cr ₂ O ₇	

BOOK

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
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CO-1	3	2	2	1	2	2	1	2	2	3	3	2	3	2	1
CO-2	3	2	2	1	2	1	1	2	2	3	3	2	2	3	2
CO-3	3	3	3	3	3	2	2	3	3	3	3	3	3	3	2
CO-4	3	2	3	2	3	1	1	2	2	3	2	3	2	3	2
CO-5	3	2	3	2	2	1	1	2	2	3	2	3	2	3	3

CO-6	3	3	3	2	3	1	1	2	2	3	3	3	3	2	2
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COMMUNICATIVE ENGLISH- II

Program:	Year, Semester: 1st year., 2nd Sem.
Course Title: Communicative English- II	Subject Code: TIU-UEN-AEC-S1201
Contact Hours/Week: 2-0-0 (L-T-P)	Credit: 2

COURSE OBJECTIVE :

The primary objective is to develop in the undergraduate students a level of competence in English required for independent and effective communication for academic and industry needs. In addition to fostering the ability to use English skillfully, the graduates are trained to adapt to the changing social circumstances. These courses also enable them to engage in life-long learning and pursue advanced level studies in future.

COURSE OUTCOME :

On completion of the course, the student will be able to:

CO-1:	Apply common rules of English grammar in analyzing sentence structure	K1
CO-2:	Read, understand and evaluate a text intrinsically as well as extrinsically	K2
CO-3:	Articulate one's ideas and thoughts in grammatically correct and culturally appropriate language in various academic and professional writings.	K3
CO-4:	Apply the strategies and techniques learnt in carrying out conversations across different contexts.	K4
CO-5:	Create presentations to address general as well as technical audiences.	K5
CO-6:	Acquire skills required in a professional environment.	K6

COURSE CONTENT :

MODULE 1:	Advanced Grammar & Expressive Language	6 Hours
Sentence Structure, Tenses, Articles, Prepositions		
Subject-Verb Agreement		
Similes, Idioms, and Anecdotes		
MODULE 2:	Professional & Technical Writing	6 Hours
Poster & Multimedia Presentations		
Press Releases & Technical Documents		
Presentation Skills for Meetings		
MODULE 3:	Workplace Communication & Email Etiquette	6 Hours
Formal and Informal Communication		
Writing Effective Emails		
Interpersonal Communication and Empathy		
MODULE 4:	Analytical Reading & Employability Skills	6 Hours
Critical Reading and Evaluation Techniques		
Grooming and Social Etiquette		
MODULE 5:	Course Review	6 Hours
Course Review		

Recommended Books:

Main Reading:

Lata, Pushp, Communication Skills, Oxford University Press, 2015.

Rizvi Ashraf, Effective Technical Communication, Tata McGraw-Hill, 2017

Wren & Martin, High School Grammar & Composition, S. Chand and Sons, 1998.

Supplementary Reading:

Viswamohan Aysha, English for Technical Communication, Tata McGraw-Hill.

Gregory Bassham, William Irwin, Henry Nardone & James M. Wallace. Critical Thinking: A Student's Introduction, Tata McGraw Hill.

CIEFL, Hyderabad, Exercises in Spoken English. Parts.I-III.. Oxford University Press

Robin Torres- Gouzerh. Intermediate English Grammar for ESL Learners. Tata McGraw Hill.

Christopher Davies. Divided by a Common Language. Houghton Mifflin Company.

Course Articulation Matrix:

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	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
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CO-2	2	2	3	2	2	0	2	3	1	2	2	2	2	2	2
CO-3	3	2	3	2	2	0	3	3	2	3	3	3	2	3	3
CO-4	2	2	3	3	2	0	3	3	3	3	3	3	2	3	3
CO-5	3	2	3	3	2	0	3	3	3	3	3	3	2	3	3
CO-6	3	3	3	3	2	0	3	3	3	3	3	3	2	3	3

Department of Microbiology, FOOD FERMENTATION TECHNIQUES AND PACKAGING (Theory)

Program: B. Sc. in Microbiology	Year, Semester: 1st Yr., 2nd Sem
Course Title: FOOD FERMENTATION TECHNIQUES AND PACKAGING (Theory)	Subject Code: TIU-UMB-SEC-T1201
Contact Hours/Week: 2-1-0 (L-T-P)	Credit: 3

COURSE OBJECTIVE :

Enable the student to:

To define fermented foods and understand their classification and types.

To explore the fermentation process involved in Idli, Dosa, Bread, Soy Sauce, and Tempeh, and milk products.

To understand the microbiological criteria used for food quality control.

To understand the basic principles and importance of food packaging.

COURSE OUTCOME :

On completion of the course, the student will be able to:

CO-1:	Understand the Fundamentals of Fermented Foods	K2
CO-2:	Examine Milk-Based Fermented Foods and Dairy Starter Cultures	K5
CO-3:	Study the Microbiology of Grain-Based Fermented Foods	K4
CO-4:	Analyze the Fermentation of Vegetables and Investigate Fermented Meat and Fish Products	K4
CO-5:	Evaluate the Role of Probiotics in Human Health by evaluating the implementation of Food Microbiological Quality Control Measures	K5
CO-6:	Explore Food Packaging Techniques and Their Impact	K6

COURSE CONTENT :

MODULE 1:	FERMENTED FOODS	6 Hours
Definition, types, advantages, and health benefits		
MODULE 2:	MILK BASED FERMENTED FOODS	8 Hours
Dairy starter cultures, Dahi, Yogurt, Buttermilk (Chach), acidophilus milk, kumiss, kefir, and cheese: Preparation of inoculums, types of microorganisms, and production process		
MODULE 3:	GRAIN-BASED FERMENTED FOODS	4 Hours
Idli, Dosa, Bread, Soy sauce, tampeh: Microorganisms and production process		

MODULE 4:	VEGETABLE-BASED FERMENTED FOODS	6 Hours
Pickle, Saeurkraut: Microorganisms and production process		
MODULE 5:	FERMENTED MEAT AND FISH	5 Hours
Types, microorganisms involved, fermentation process		
MODULE 6:	PROBIOTICS	5 Hours
Probiotics: Health benefits, types of microorganisms used, probiotic foods available in the market.		
MODULE 7:	CONTROLLING THE MICROBIOLOGICAL QUALITY OF FOODS	5 Hours
Quality Control using Microbiological Criteria, Control at Source (Training, Facilities and Operations, Equipment, Cleaning, and Disinfection), Codes of Good Manufacturing Practice (HACCP), Identification of Critical Control Points, Quality Systems: FSSAI, BSI and their importance.		
MODULE 8:	FOOD PACKAGING TECHNIQUES	6 Hours
Basic principle of food packaging, importance, techniques in practice, merits and demerits of food packaging techniques		
TOTAL LECTURES		45 Hours**

Books:

Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.

Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.

Davidson PM and Brannen AL. (1993). Antimicrobials in Foods. Marcel Dekker, New York.

Dillion VM and Board RG. (1996). Natural Antimicrobial Systems and Food Preservation. CAB International, Wallingford, Oxon.

Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.

Gould GW. (1995). New Methods of Food Preservation. Blackie Academic and Professional, London.

Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India.

Lund BM, Baird Parker AC, and Gould GW. (2000). The Microbiological Safety and Quality of Foods. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
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CO-2	3	3	3	2	3	2	2	2	1	1	2	2	3	3	2
CO-3	3	3	3	2	3	3	2	2	2	1	2	3	3	3	2
CO-4	3	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO-5	3	3	3	3	3	3	2	2	2	2	2	3	3	3	3
CO-6	3	3	3	3	2	3	2	2	2	2	2	3	2	3	3