GUJARAT TECHNOLOGICAL UNIVERSITY
Integrated Master of Science (Biotechnology)
Semester: 7
Subject Name: Industrial Microbiology
Subject Code: 1370402

Prerequisite: Candidates should have a strong foundation in core microbiology, cell biology, biochemistry, and molecular biology. Prior coursework covering microbial physiology, metabolic pathways, and microbial genetics is essential, along with hands-on laboratory experience in aseptic techniques, microbial culture methods, and basic analytical procedures.

Rationale: Industrial microbiology is a cornerstone of industrial biotechnology, as microorganisms drive essential processes in fermentation, biocatalysis, and environmental remediation. It will equip students with the necessary expertise to harness, optimize, and engineer microbial systems for sustainable production of biofuels, pharmaceuticals, and other high-value products, thereby fostering innovation and addressing global challenges in health, agriculture, and environmental sustainability.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	PA(I)	ESE (V)	
4	0	8	8	70	30	20	30	150

Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	Unit I: Fundamentals of Microbiology and Microbial Isolation Characteristics of microbes: Introduction to Microbiology and Microbes; Morphology, Structure and Growth; Bacterial and other Microbial growth curves. Isolation of microbes from nature and screening of biological activities: Actinomycetes, Bacteria, Fungi; Developing and Semi-automating Screening Tests.	**9**	20%
2	Unit II: Culture Techniques and Fermentation Culture preservation and inoculum development: Culture Preservation; Cryopreservation; Inoculum Development. Small scale liquid fermentation: Fermentation Vessels, Shakers, Media /Composition and Gas Exchange; Sampling and Analysis.	**9**	20%

	Small scale solid state fermentation: Advantages/Disadvantages of Solid State Fermentation; Growth and Production of Enzymes; Small Scale Process Control.		
3	Unit III: Process Optimization and Enzyme Technology Experimental designs for improvement of fermentation: Sequential Nature of Design Experiments; Screening Designs; Optimization Designs and Verification of Models. Cell and enzyme immobilization: Different types of Immobilizations (entrapment, cross linking, covalent etc.); Performance and case studies.	**9**	20%
4	Unit IV: Strain Improvement and Gel Microdrop Techniques Strain improvements by recombinant and non-recombinant methods: Recombinant Methods; Non recombinant (Mutagenesis, fusion, recombination etc.); Operational Conditions, Statistical analysis. Culture and analysis using gel microdrops: GMD's for Culture and Assays; Open GMD's; Closed GMD's.	**9**	20%
5	Unit V: Extremophiles and Their Cultivation Culture of extremophiles: Culture strategies and Challenges; Preservation; Batch and Continuous cultivation etc.	**9**	20%

Reference Books:

- Madigan, M.T. and Martinko, J.M. Brock Biology of Microorganisms Pearson Prentice-Hall, Latest Edition
- Willey, J.M., Sherwood, L., Woolverton, C.J., and Prescott, L.M. Prescott's Microbiology McGraw Hill, New York, Latest Edition
- Demain, A.L. and Davies, J. Manual of Industrial Microbiology and Biotechnology ASM Press, Latest Edition

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level

1	Describe the fundamental characteristics, growth, and morphology of microorganisms.	UN
2	Apply various techniques for microbial isolation, culture preservation, and inoculum development.	AP
3	Analyze and compare small-scale fermentation processes and optimize production parameters.	AN
4	Evaluate enzyme immobilization techniques and recombinant/non-recombinant methods for strain improvement.	EV, AP
5	Design experimental strategies using gel microdrop techniques and culture of extremophiles.	CR, AP

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

List of Experiments:

1. Preparation and Sterilization of Culture Media
2. Isolation and Screening of Microorganisms from Natural Sources
3. Isolation of Soil Microorganisms by Serial Dilution and Spread Plate Method
4. Preservation of Microbial Cultures
5. Inoculum Development for Fermentation
6. Microbial Growth Curve Analysis
7. Primary Screening of Enzyme-Producing Microorganisms

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