

**Department of Liberal Education**  
**Era University, Lucknow**  
**Course Outline**  
**Effective From: 2023-24**

<b>Name of the Program</b>	<b>B.A. / B.Sc. (LIBERAL EDUCATION)</b>			<b>Year/ Semester:</b>	<b>3<sup>rd</sup> / 6<sup>th</sup></b>
<b>Course Name</b>	<b>Industrial Microbiology</b>	<b>Course Code:</b>	<b>MB306</b>	<b>Type:</b>	<b>Theory</b>
<b>Credits</b>	<b>04</b>			<b>Total Sessions Hours:</b>	<b>60 Hours</b>
<b>Evaluation Spread</b>	<b>Internal Continuous Assessment:</b>	<b>50 Marks</b>		<b>End Term Exam:</b>	<b>50 Marks</b>
<b>Type of Course</b>	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
<b>Course Objectives</b>	<p><b>This module will help students to understand following;</b></p> <ol style="list-style-type: none"> <li>a. Advantages &amp; limitations in bioprocess</li> <li>b. Intellectual property rights</li> <li>c. Important microbes; Industrial microbiology</li> <li>d. Fermentation and its types</li> <li>e. Down-stream processing</li> <li>f. Purification; solvent extraction</li> <li>g. Production of; alcohol, vitamin, enzyme, amino acid, hormones &amp; vaccine</li> <li>h. Production of; Biofuel</li> </ol>				
<b>Course Outcomes (CO):</b> <i>After the successful course completion, learners will develop following attributes:</i>					
<b>Course Outcome (CO)</b>	<b>Attributes</b>				
<b>CO1</b>	Upon completion the students will learn about a typical Bio process: Introduction, advantages & limitations, Patents and intellectual property rights and important characteristics of microbes used in Industrial Microbiology.				
<b>CO2</b>	Students will be able to learn the process of fermentation with its types.				
<b>CO3</b>	They will be able to know about the processing & selection of best microbial strains for the industry.				
<b>CO4</b>	Students will gain knowledge about production of alcohol, vitamin enzyme, amino acid, hormones, vaccine & biofuel.				
<b>Pedagogy</b>	Interactive, discussion-bases, student-centered, presentation.				
<b>Internal Evaluation Mode</b>	Mid-term Examination: 20 Marks Activity: 10 Marks Class test: 05 Marks Online Test/Objective Test: 05 Marks Assignments/Presentation: 05 Marks Attendance: 05 Marks				
<b>Session Details</b>	<b>Topic</b>			<b>Hours</b>	<b>Mapped CO</b>
<b>Unit 1</b>	<b>History &amp; Multidisciplinary nature of Industrial microbiology &amp; Taxonomic diversity of industrially useful microorganisms</b> <ul style="list-style-type: none"> <li>• A typical Bio process: Introduction, advantages &amp; limitations</li> <li>• Patents and intellectual property rights</li> </ul>			15	CO1

	<ul style="list-style-type: none"> <li>• Important characteristics of microbes used in Industrial Microbiology</li> <li>• Isolation techniques</li> <li>• Concept &amp; examples of microorganisms classified as Generally Regarded as Safe (GRAS)</li> <li>• Exploitation of microorganism and their products</li> <li>• Screening, Strain development strategies</li> <li>• Immobilization methods</li> </ul> <p><b>Activity:</b> List industrially important microorganisms and mention its role in different industries.</p>		
<b>Unit 2</b>	<p><b>Fermentation</b></p> <ul style="list-style-type: none"> <li>• Media</li> <li>• Raw material</li> <li>• Antifoaming agents</li> <li>• Buffers</li> <li>• Equipments</li> <li>• Fermenter design</li> <li>• Types of fermentation –Single, Batch, Continuous</li> </ul> <p><b>Activity:</b> Making fermented plant juice (FPJ) for crop treatments</p>	15	CO2
<b>Unit 3</b>	<p><b>Down-stream processing steps</b></p> <ul style="list-style-type: none"> <li>• Down-stream processing steps</li> <li>• Detection and assay of the product</li> <li>• Recovery (intercellular and extracellular product)</li> <li>• Purification (solvent extraction &amp; chromatography)</li> </ul> <p><b>Activity:</b> Solvent extraction by distillation unit and performance of thin layer chromatography (TLC)</p>	15	CO3
<b>Unit 4</b>	<p><b>Production of Alcohol, Production of Vitamin &amp; biofuel</b></p> <ul style="list-style-type: none"> <li>• Production of Alcohol (industrial alcohol, wine, beer, whiskey)</li> <li>• Organic acid (Citric acid), Antibiotic (Penicillin)</li> <li>• Production of Vitamin (B12), Enzyme (Amylase), Amino acid (Glutamic acid), Hormones (Insulin), Vaccine (Hepatitis B)</li> <li>• Biofuel (Methane)</li> <li>• Production of Biofertilizers &amp; Biopesticides</li> <li>• Biotransformation of steroids</li> </ul> <p><b>Activity:</b> Create a poster to highlight commercially available biofertilizers and biopesticides.</p>	15	CO4

### CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2		1			1			2		1			
CO2	2		1	2	2	1	2	2	2		2	2	2	
CO3	2		1	2	2	1	3	2	2		3	2		2
CO4	2		1	2	2	1	3	2	2		3	3	3	2

*Strong contribution-3, Average contribution-2, Low contribution-1,*

### Suggested Readings:

<b>Text- Books</b>	<ol style="list-style-type: none"> <li>1. Industrial Microbiology (2000) by AH Patel, Macmillan Publishers India</li> <li>2.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Industrial Microbiology (2000) by AH Patel, Macmillan Publishers India</li> <li>2. Biology of Industrial microorganism (1981) by Arnold L. Domain, Benjamin/ cummings Pub. Co.</li> <li>3. Industrial Microbiology by Prescott &amp; Dunns, AVI Publishing Company Inc.</li> </ol> <p>Industrial Microbiology by Casida LE, New age International (P) Ltd.</p>

<b>Para Text</b>	<b>Unit 1:</b> 1. <a href="http://foodhaccp.com/foodsafetymicro/onlineindex.html">http://foodhaccp.com/foodsafetymicro/onlineindex.html</a> <b>Unit 2:</b> 1. <a href="http://www.cpe.rutgers.edu/courses/current/lf0401wa.html">http://www.cpe.rutgers.edu/courses/current/lf0401wa.html</a> <b>Unit 3:</b> 1. <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2291482/pdf/pgen.1000024.pdf">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2291482/pdf/pgen.1000024.pdf</a> <b>Unit4:</b> 1. <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3253344/pdf/nihms-312011.pdf">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3253344/pdf/nihms-312011.pdf</a>	
<b>Recapitulation &amp; Examination Pattern</b>		
<b>Internal Continuous Assessment:</b>		
<b>Component</b>	<b>Marks</b>	<b>Pattern</b>
<b>Mid Semester</b>	20	<b>Section A:</b> Contains <b>10</b> MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries <b>0.5 mark</b> . <b>Section B:</b> Contains <b>07</b> descriptive questions out of which <b>05</b> questions are to be attempted. Each question carries <b>03 marks</b> .
<b>Activity</b>	10	Will be decided by subject teacher
<b>Class Test</b>	05	Contains <b>05 descriptive questions</b> . Each question carries <b>01</b> mark.
<b>Online Test/ Objective Test</b>	05	Contains <b>10 multiple choice questions</b> . Each question carries <b>0.5</b> mark.
<b>Assignment/ Presentation</b>	05	Assignment to be made on topics and instruction given by subject teacher
<b>Attendance</b>	05	As per policy
<b>Total Marks</b>	<b>50</b>	

Course created by: **Dr. Manaal Zahera**

Signature:

Approved by: **Dr. Amita Jain**

Signature: