

**UNIVERSITY OF MADRAS**  
**B.Sc. DEGREE PROGRAMME IN PLANT BIOLOGY**  
**AND PLANT BIOTECHNOLOGY**  
**SYLLABUS WITH EFFECT FROM 2023-2024**

**SKILL ENHANCEMENT COURSES (SEC 6)**

**FERMENTATION TECHNOLOGY**

<b>Title of the Course</b>		<b>FERMENTATION TECHNOLOGY</b>					
<b>Paper Number</b>		Skill Enhancement					
<b>Category</b>	Elective	<b>Year</b>	II	<b>Credits</b>	2	<b>Course Code</b>	239S4A
		<b>Semester</b>	IV				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practi ce</b>	<b>Total</b>
		1		-		-	1
<b>Pre-requisite</b>		To students to know about the various fermentation technology.					
<b>Learning Objectives</b>							
<b>C1</b>		To appreciate the significance of microbes synthesizing fermented products.					
<b>C2</b>		To gain insights on safety and quality control in large scale production of fermentative products.					
<b>C3</b>		To design and operation of industrial practices in mass production of fermented products.					
<b>C4</b>		To know about the various fermentation technology.					
<b>C5</b>		To learn about the bioproduct recovery.					
<b>Course outcomes:</b>		<b>Programme Outcomes</b>					
On completion of this course, the students will be able to: CO							
1. Enumerate the significance of industrially useful microbes.		K1					

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2. Explain the design and operation of industrial practices in mass production of fermented products.	K2
3. Explain the process of maintenance and preservation of microorganisms.	K3
4. Analyze the various aspects of the fermentation technology and apply for fermentative production.	K4
5. Validate the experimental techniques for microbial production of enzymes: amylase and protease, bio product recover.	K5 & K6
<b>UNIT</b>	<b>CONTENTS</b>
<b>I</b>	Preparation of microbial culture, Preparation and sterilization of fermentation media. Isolation and improvement of industrially important microorganisms.
<b>II</b>	Maintenance and preservation of microorganisms, Metabolic regulations and overproduction of metabolites. Kinetics of microbial growth and product formation.
<b>III</b>	Scope and opportunities of fermentation technology. Principles of fermentation: Submerged, solid state, batch, fed-batch and continuous culture.
<b>IV</b>	Fermentative production of vinegar, alcohol (ethanol, wine, beer), acids (citric acid and gluconic acid), amino acids (lysine and glutamic acid) and antibiotics (penicillin and streptomycin).
<b>V</b>	Microbial production of enzymes: Amylase and Protease. Bioproduct recovery.

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<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved  (To be discussed during the Tutorial hour)</p>
<p>Skills acquired from this course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<p><b>Recommended Texts</b></p>	<ol style="list-style-type: none"> <li>1. Waites M.J. 2008. Industrial Microbiology: An Introduction, 7th Edition, Blackwell Science, London, UK.</li> <li>2. Prescott S.C., Dunn C.G., Reed G. 1982. Prescott &amp; Dunn's Industrial Microbiology, 4th Edition, AVI Pub. Co., USA.</li> <li>3. Reed G. 2004. Prescott &amp; Dunn's industrial microbiology, 4th Edition, AVI Pub. Co., USA.</li> <li>4. JR Casida L.E. 2015. Industrial Microbiology, 3rd Edition, New Age International (P) Limited Publishers, New Delhi, India.</li> <li>5. Waites M.J., Morgan N.L., Rockey J.S. and Higton G. 2001. Industrial Microbiology: An Introduction. 1st Edition, Blackwell Science, London, UK.</li> <li>6. Pelczar M.J., Chan E.C.S. and Krieg N.R. 2003. Microbiology. 5th Edition, Tata McGraw-Hill Publishing Company Limited, New</li> </ol>

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	Delhi.
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Peter F Stanbury, Allan Whitaker, Stephen J Hall. 2016. Principles of Fermentation Technology. Butterworth-Heinemann Press. UK.</li> <li>2. Pepler, H. J. D. Perlman. 2014. Microbial Technology: Fermentation Technology. Academic Press.</li> <li>3. T. El-Mansi, C. Bryce, Arnold L. Demain, A.R. Allman. Fermentation Microbiology and Biotechnology. Second Edition. 2006. CRC Press, USA.</li> <li>4. Hongzhang Chen. Modern Solid State Fermentation: Theory and Practice. 2013. Springer Press, Germany.</li> <li>5. John E. Smith. Biotechnology. 2009. Cambridge University Press. UK.</li> <li>6. Celeste M. Todaro, Henry C. Vogel. 2014. Fermentation and Biochemical Engineering Handbook. William Andrew Press. Norwich, NY.</li> <li>7. Lancini, G. R. Lorenzetti. 2014. Biotechnology of Antibiotics and other Bioactive Microbial Metabolites. Springer publications, Germany.</li> </ol>
<b>Web resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://ebooks.foodtechlearning.xyz/2020/12/principial-of-fermentation-technology-by.html">https://ebooks.foodtechlearning.xyz/2020/12/principial-of-fermentation-technology-by.html</a></li> <li>2. <a href="https://www.amazon.in/Principles-Fermentation-Technology-Peter-Stanbury-ebook/dp/B01LMDYFNQ">https://www.amazon.in/Principles-Fermentation-Technology-Peter-Stanbury-ebook/dp/B01LMDYFNQ</a></li> <li>3. <a href="https://www.amazon.in/Principles-Fermentation-Technology-Peter-Stanbury-ebook/dp/B01E3IC73W">https://www.amazon.in/Principles-Fermentation-Technology-Peter-Stanbury-ebook/dp/B01E3IC73W</a></li> <li>4. <a href="https://www.pdfdrive.com/principles-of-fermentation-technology-e189052809.html">https://www.pdfdrive.com/principles-of-fermentation-technology-e189052809.html</a></li> <li>5. <a href="https://www.ebooks.com/en-us/book/2698294/principles-of-fermentation-technology/peter-f-stanbury/">https://www.ebooks.com/en-us/book/2698294/principles-of-fermentation-technology/peter-f-stanbury/</a></li> </ol>

**Mapping with Programme Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	2	1	3	2	1	2	2	1	2
<b>CO 2</b>	3	3	2	2	1	2	3	2	2	3
<b>CO 3</b>	2	2	3	1	1	1	2	3	1	2
<b>CO 4</b>	3	3	2	1	3	2	1	3	2	1
<b>CO 5</b>	3	3	2	1	2	2	3	3	2	3

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**S-Strong (3)**

**M-Medium (2)**

**L-Low(1)**