

Branch Name:	B.Sc. Microbiology
Program Code:	SC102
Course Name:	Industrial Microbiology
Course Code:	2SC1020604
Pre-requisite Course:	Basics of Fermentation

Course Objective:

1. To understand fermentation process and strain improvement
2. To understand Medium formulations for industry
3. To understand Design of fermenter
4. To understand downstream processing

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	--	--	3	70	30	--	--	100

Subject Contents:

Unit	Content	Lectures	Weightage
1	Introduction to fermentation and strain improvement • Concept of Fermentation, Range of fermentation processes, component parts of fermentation process. • Growth kinetics: Batch, fed-batch and continuous culture (chemostat and turbidostat) • Isolation, Enrichment & screening (Primary & Secondary) of Industrial Important Microorganisms. • Preservation techniques • Strain Improvement: Induced mutants for primary and secondary metabolites, Application of r-DNA technology for strain improvement.	13	28%
2	Concept of fermentation media and inoculum development • Medium formulations for industry and types (crude and synthetic) of fermentation media Raw materials used in fermentation media and criteria for selection, Batch and Continuous sterilization, Del factor, Sterilization of Media & Air • Inoculum Development: Typical Inoculum Development program, Inocula development for Bacteria, Yeast and Fungal processes. • Scale-Up	13	28%
3	Design of fermenter • Design of fermentor :Basic function of typical fermenter • Design of ideal STR and various auxillary parts(aeration, agitation and body construction) • Aseptic operations and Containments • Types of fermenters: Tower, Cyllindroconical, Air lift, AcetatorCavitator, Bioreactors for animal cell cultures Downstream processing. • Removal of Solid & Microbial Cells and other solid Matter, Foam separation, Precipitation, Filtration and Centrifugation	19	44%

	• Cell disruption • Concentration of extracted product: Liquid-Liquid extraction, Distillation, • Purification products: Chromatography, Membrane processes and ultra filtration • Drying & Crystallization • Quality Assurance-Bioassay • Drying & Crystallization • Quality Assurance-Bioassay		
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Text books:

1. Patel AH. (1996). Industrial Microbiology .1st Edition. MacMillan India Limited Publishing Company Ltd. New Delhi, India
2. Stanbury and Whitaker. Principles of fermentation technology.

Reference Books:

1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
2. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
3. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An introduction.9th Edition. Pearson Education
4. Biotechnology –The Biological Principles, M.D.Treva n , S.Boffey, K H Goulding, P Stanbury Mukhopadhyay, Process Biotechnology Fundamental. Viva book.
5. Shuler and Kargi, 1992. Bioprocess engineering, Prentice-Hall.
6. Bialy & Ollis.1986. Biochemical Eng. Fundaments. McGraw-Hill.
7. Schugerl. 1987. Bioreaction engineering, J/W.
8. Sikyta. Methods in Industrial microbiology. Ellis Hardwood Ltd.
9. Krysman. Product recovery in bioprocess technology.
10. T.K. Ghose. Bioprocess computation in biotechnology, Ellis Hardwood Ltd.
11. MurryJoh. 1997. Microorganisms and Biotechnology.
12. Demainefal. (ED) 1999. Manual of industrial Microbiology and Biotechnology. Asin Press.
13. Bioprocess Engineering Principles by Doran (D); Academic Press, 1998.
14. Cooney, A.E. Humphrey, Comprehensive Biotechnology : The principles and Regulation of Biotechnology in Industry, Agriculture and Medicine. Vol.2, Pergamon Press, 1985. Edition. Panima Publishing Company, New DelhiWilley JM, Sherwood LM AND Woolverton CJ (2013)
15. Prescott, Harley and Klein's Microbiology.9th Edition. McGraw Hill Higher education

List of Open Source Software/learning website:

1. <https://www.youtube.com/watch?v=PLpfVLg5f08>
2. https://www.youtube.com/watch?v=hav_yLrgFqs

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understanding the concept of fermentation ,enlist various Range of fermentation and Parts of fermenter .	1 Remembering 2 Understanding
CLO2	Discuss growth of microbes and the control of biosynthetic pathway.	1 Remembering 2 Understanding 3 Applying
CLO3	Discuss various design of fermenter , Overview of downstream processing in which students will have knowledge of purification of microbial products.	1 Remembering 2 Understanding 3 Applying
CLO4	Describe and compare various methods of Isolation, Enrichment, screening& preservation techniques of Industrial Important Microorganisms. Strain Improvement	1 Remembering 2 Understanding 3 Applying 4 Analyze
CLO5	Discuss types of media and ingredients used in production media its advantages and disadvantages for medium	1 Remembering 2 Understanding 3 Applying

	formulations, for industry ,	4 Analyze 5 Evaluate 6 Create
CLO6	Evaluate and compare different methods of sterilization, inoculums development processes and Scale-Up	1 Remembering 2 Understanding 3 Applying 4 Analyze 5 Evaluate 6 Create

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)									Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CLO1	M	M				M		M				
CLO2	H	H	M		M			L	M			
CLO3	M	M	H					M	M		M	
CLO4	M				M				H	M		
CLO5	M		H		M					H		
CLO6				H		M	H		H		H	M

L= Low M= Medium H= High