SEMESTER S8

BIOPROCESS ENGINEERING

Course Code	**OECHT834**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None/ (Course code)	**Course Type**	Theory

Course Objectives:

1. To provide the students with the basics of bioprocess engineering.
2. To develop bioengineering skills for the production of biochemical product using integrated biochemical processes

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Isolation of Microorganisms:** Isolation, preservation, and improvement of industrially important microorganisms, screening methods, culture preservation. **Strain improvement:** mutagenesis, protoplast fusion and r-DNA technology, culture collection and biological resource centres. **Fermentation:** General requirements of a fermentation process, classification of fermentation processes. Media Optimization	9
2	**Sterilization:** Medium & air sterilisation methods, del factor, batch & continuous sterilization. Design of depth filter and estimation of efficiency, in-situ sterilization in fermenter, thermal death kinetics of cells and spores, extinction probability, batch and continuous steriliser design aspects, sterilisation of liquid wastes.	9
3	**Role of diffusion in bioprocessing:** oxygen uptake in cell cultures, oxygen transfer in bioreactors, measurement of volumetric oxygen transfer coefficient Ideal reactor operation, batch, fed batch and continuous operation of mixed bioreactors, chemostat with immobilized cells, chemostat with cell recycle.	9

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4	**Study of structured models for analysis of various bioprocess:** compartmental models, models of cellular energetic and metabolism, single cell models, plasmid replication and plasmid stability model. Dynamic simulation of batch, fed batch, steady and transient culture metabolism.	**9**

Course Assessment Method
(CIE: 40 marks,ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

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In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain the development of inoculums and general needs of fermentation	**K2**
CO2	Summarize medium and air sterilization methods	**K2**
CO3	Summarize the mass transfer effects in bioreactors	**K2**
CO4	Explain the modelling and simulation of bioprocesses	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3									3		3
CO2	3	3										3
CO3	3					2				2		3
CO4	3					3						3

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

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Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Bioprocess Engineering Basic Concepts	Michael L Schuler, FrikretKhargii	Prentice Hall of India	
2	Bioprocess Engineering Principles	Pauline M Doran	Academic Press Inc: CBS Publishers and Distributors Pvt Ltd	2nd edition 2013
3	Biochemical Engineering Fundamentals	James E Bailey, David F Ollis	McGraw-Hill	2nd edition 1986

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of Modern Bioprocessing	Sarfaraz K. Niazi, Justin L. Brown	Taylor & Francis	2017
2	Perry's Chemical Engineers Handbook	Don W. Green, Marylee Z. Southard	McGraw-Hill	9th edition
3	Bioprocess Technology: Kinetics and Reactors	Anton Moser	Springer Verlag, 2012	
4	Principles of Fermentation Technology	P F StanburyDr. A Whitaker	Elsevier,	2nd edition 1995

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/103/105/103105054/
2	https://archive.nptel.ac.in/courses/103/105/103105054/
3	https://archive.nptel.ac.in/courses/103/105/103105054/
4	https://archive.nptel.ac.in/courses/102/105/102105064/

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