COURSE TITLE	**BIOCHEMICAL ENGINEERING**
COURSE CODE	**01CH1606**
COURSE CREDITS	**3**

Objective:

1 This subject put emphasis on the basic engineering principles of biochemical processes useful for developing products in chemical industries. It also highlights the modern application of biotechnological process and the role of chemical engineer in that.

Course Outcomes: After completion of this course, student will be able to:

1 Understand the basics of fermentation processes and products and unit operations

2 Design and decide on various media for fermentation Process for given applications

3 Analyse the principles and kinetics of Sterilization methods and compare the batch, fed-batch and continuous systems.

4 Evaluate the needs and given process situations concerning aeration and agitation

Pre-requisite of course: Basic concepts of Biology and Science.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	0	50	30	20	0	0

Contents : Unit	Topics	Contact Hours
1	**FERMENTATION PROCESSES** Introduction and Outline of Fermentation processes,, Types of fermentation processes, aerobic and anaerobic fermentation processes and products,, concise view on Unit operations involved in bioprocess engineering, Fermenter design.	10
2	**MEDIA FOR INDUSTRIAL FERMENTATIONS** Various media components and its role, Selection criteria of appropriate medium,, types of media-simple, complex, crude and synthetic,, design and usage of various commercial media for industrial fermentations. Isolation, preservation and improvement of microorganisms	6
3	**KINETICS: GROWTH AND PRODUCT FORMATION** Understanding modes of working with correlations for Batch Culture,, Continuous Culture and Fed Batch culture. Monod Kinetics, Michaelis-Menten equation., Chemostat and Turbidostat models. Applications. Stoichiometry of growth with equation and product formation, Yield.	6

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Contents : Unit	Topics	Contact Hours
4	**AERATION AND AGITATION** Introduction, Oxygen requirement in fermentations, Oxygen supply, Determination of KLa values,, Factors affecting KLa values, Fluid rheology, Balance between oxygen demand and supply,, Scale up and Scale down- concepts,, parameters and case studies.	10
5	**STERILIZATION** Definition and process, types of sterilization methods - batch and continuous, Thermal death kinetics,, Filter sterilization of liquid media and air,, Chemical and physical techniques of sterilization.	6
Total Hours		**38**

Textbook :

1 Principles of Fermentation Technology, Peter F Stanbury, Allen Whitaker, Stephen Hall, Butterworth-Heinmann,, Butterworth-Heinmann, 2003

2 Bioprocess Engineering Principles, Pauline Doran,, Elsevier Science & Technology Books., 2013

References:

1 Introduction to Biochemical Engineering, Introduction to Biochemical Engineering, by D. G. Rao,, Tata McGraw-Hill Education,, 2005

2 Biochemical Engineering Fundamentals,, Biochemical Engineering Fundamentals,, James E. Bailey and David F Ollis., Tata McGraw-Hill Education, 2017

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
10.00	20.00	25.00	25.00	10.00	10.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

2 Students will use supplementary resources such as online videos, NPTEL videos, e-courses,Virtual Laboratory

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Supplementary Resources:

1 https://onlinecourses.nptel.ac.in/noc21_bt17/preview#:~:text=Students%20undergoing%20this%20course%20will,Biotechnology

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