



Subject Code: 02BT0502

Subject Name: Bioprocess Technology (Core)

M. Sc. Semester - III

Objective: To acquaint students with technical and biological aspect of microbial utilisation for production of metabolites.

Credits Earned: 4 Credits

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

1. Isolate and develop the microbial strain having high commercial value.
2. Select, design or optimise media for maximum production of microbial metabolites.
3. Designing of bioreactors and control as per the requirements.
4. Design, develop and apply various techniques used for separation of molecules after fermentation process.

Pre-requisite of course: N.A.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Practicals/ TW	
4	0	0	4	50	30	20	0	0	100



Contents:

Unit	Topics	Contact Hours
1	Introduction to Fermentation Technology Basic component parts of fermentation process. Range of fermentation processes. Screening & Strain development of industrially important microorganisms. Microbial culture preservation techniques at laboratory and industrial level. Overview on inoculum development and scale up process. Fermentation economics.	10
2	Fermentation Media and Components of Fermenter Raw materials: Water, Sources of Carbon, Nitrogen, other Micronutrients and antifoams; Significance of oxygen in mass transfer (K_{La}) and factor affecting K_{La} ; Media optimization using classical & statistical designs. Overview on sterilization of media and components of fermenter. Designing of the fermenter: Basic body construction, Aeration & Agitation devices, Valves for various purposes. Device and mechanism for controlling process parameters: Types of sensors: Online, Inline and Offline sensors; Measurement of physical parameters: temperature, pressure, pH, dissolved Oxygen, other gases, foam and agitation. Types of control system. Application of computer in fermentation industry.	20
3	Types of Fermentation and Bioreactors Types of fermentation: Batch, Continuous, Fed batch and their variations; Solid Substrate fermentation and submerged fermentation. Types of bioreactors: Specialized bioreactors; membrane bioreactors; tower bioreactors; fluidized bed bioreactors; Immobilized system and packed bed reactors and Photobioreactors.	10
4	Downstream Processing and Production study Biomass separation: Centrifugation, filtration, flocculation and other methods. Cell disintegration: Physical, Chemical and Enzymatic methods. Product concentrating techniques: Whole broth processing, Drying and use of membranes. Product recovery and purification: Liquid-Liquid extraction, Biphasic liquid extraction, Supercritical fluid extraction and Chromatography. Fermentation of commercially valuable products: Vitamin B12, Lysine and Insulin.	20
	Total Hours	60



References:

1. Peter F Stanbury, Allan Whitaker, Stephen J Hall. *Principles of Fermentation Technology*. (2016) Butterworth-Heinemann Press. UK.
2. H. J. Peppler, D. Perlman. *Microbial Technology: Fermentation Technology*. (2014). Academic Press.
3. T. El-Mansi, C. Bryce, Arnold L. Demain, A.R. Allman. *Fermentation Microbiology and Biotechnology*. Second Edition. (2006). CRC Press, USA.
4. Hongzhang Chen. *Modern Solid State Fermentation: Theory and Practice*. (2013). Springer Press, Germany.
5. John E. Smith. *Biotechnology*. (2009). Cambridge University Press. UK.
6. Celeste M. Todaro, Henry C. Vogel. *Fermentation and Biochemical Engineering Handbook*. (2014). William Andrew Press. Norwich, NY.
7. G. Lancini, R. Lorenzetti. *Biotechnology of Antibiotics and other Bioactive Microbial Metabolites*. (2014). Springer publications, Germany.

Suggested Theory distribution:

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

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

Instructional Method:

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher, in addition to conventional black board teaching method, may use tools such as demonstration, role play, Quiz, brainstorming, etc.
- b. The continuous evaluation (internal evaluation) of the students will be done on the basis of attendance, assignments, verbal interactions etc.
- c. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.