

INSTITUTE	FACULTY OF SCIENCE
PROGRAM	MASTER OF SCIENCE (MICROBIOLOGY)
SEMESTER	3
COURSE TITLE	BIOPROCESS TECHNOLOGY
COURSE CODE	02MB0505
COURSE CREDITS	4

Objective:

- 1 To acquaint students with a deep understanding of the principles, methodologies and process optimization in industrial applications of microorganisms for production of pharmaceuticals, biofuels, enzymes, and food additives.

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

- 1 Apply the basic knowledge of microbiology in inoculum preparation for bacterial and fungal fermentation processes
- 2 Analyse the process for media optimization to enhance microbial growth and product yield in fermentation.
- 3 Apply the principles of fermentor and bioreactor design to optimize construction, material selection, and operational efficiency for industrial bioprocesses.
- 4 Apply advanced separation, purification, and bioprocess automation techniques for efficient biomass recovery, product extraction in industrial biotechnology.

Pre-requisite of course:NA

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
4	0	0	50	30	20	0	0

Contents : Unit	Topics	Contact Hours
1	Introduction to bioprocess technology Basic principle for components of fermentation technology. Types of microbial culture and its growth– Batch, Fedbatch and Continuous culture. Inoculum preparation for bacterial and fungal fermentation processes.	15

Contents : Unit	Topics	Contact Hours
2	Media Formulation for Fermentation Process Natural Media (Conventional); Synthetic media. Variation in sources of components of media and other chemicals required to carry out fermentation process. Study of Process parameters: measurement of temperature; pressure and pH; dissolved Oxygen; foam etc. Strain Improvement: By mutation and screening of improved cultures; Strategic screening for production of primary and secondary metabolite production with examples.	15
3	Types of Fermentation Solid Substrate fermentation and submerged fermentation. Design and construction of a Fermentors: Body construction; construction material; Aeration and agitation systems; Stirrer glands and bearings; Baffles; Valves and steam traps; Pressure-control valves. Waldhof type fermenter, tower fermenter, air lift fermenter, deep-jet fermenter, rotating disc fermenter. Specialized bioreactors: membrane bioreactors; tower bioreactors; fluidized bed bioreactors; Immobilized system and packed bed reactors and Photo bioreactors.	15
4	Downstream Processing Techniques for the separation of Biomass; Centrifugation, Filtration, Flocculation. Cell disintegration techniques; Physical, Chemical and Enzymatic. Product Recovery: Phase separation (Solid/Liquid), Purification techniques for microbial products. Design of Bioprocess using automation and application of computers; Recombinant products and its examples. Preservation and maintenance of industrially important microorganisms.	15
Total Hours		60

Textbook :

- 1 Bioprocess Engineering: Basic Concepts, Shuler, M.L., & Kargi, F. , Pearson, 2017
- 2 Bioprocess Engineering Principles, Doran, P.M. , Academic Press, 2012
- 3 Principles of Fermentation Technology, Stanbury, P.F., Whitaker, A., & Hall, S.J. , Elsevier, 2016

References:

- 1 Fermentation and Biochemical Engineering Handbook, Fermentation and Biochemical Engineering Handbook, Celeste M. Todaro, Henry C. Vogel., William Andrew Press. Norwich, NY, 2014
- 2 Biotechnology of Antibiotics and other Bioactive Microbial Metabolites., Biotechnology of Antibiotics and other Bioactive Microbial Metabolites., G. Lancini, R. Lorenzetti., Springer publications, Germany, 2014

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 and evaluation

Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
5.00	10.00	30.00	30.00	20.00	5.00

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, etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the class-room in the form of attendance, assignments, verbal interactions etc.
- 3 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

- 1 https://nptel.ac.in/domains/discipline/102?course=102_0
- 2 https://onlinecourses.nptel.ac.in/noc20_bt25/preview