

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
Syllabus of B.Sc.(Honors & Honors with Research)as per NEP-2020
Faculty of Life Science
Effective from June 2026
Subject: Biotechnology
SEMESTER-7

SUMMARY OF THE SYLLABUS

Sr. No.	Category of Course	Course Title	Course Level	Credit	Teaching Hours	Internal Marks	External Marks	Practical Internal Marks	Practical External Marks	Total Marks
1	MINOR-7	Bioprocess Engineering for Biotechnology (Theory)	6.0	3	45	25	50	-	-	75
2	MINOR-7	Bioprocess Engineering for Biotechnology (Practical)	6.0	1	30	-	-	25	-	25

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Course Level	UG (6.0)	Internal Marks	25
Programme	B.Sc. Microbiology	External Marks	50
Semester	VII	Practical Internal	25
Category of Course	MINOR-7	Practical External	-
Course Credit	4 (3T+1P)	Prac. External Exam Duration	-
Teaching Hours	75 (45T +30P)	Total	100
Course Code	MINBTT701	Exam Duration	2 hrs.
Course Title	Bioprocess Engineering for Biotechnology (Theory)		

Course Objectives:

The objectives of this course are:

- To impart fundamental knowledge of industrial bioprocesses and the production of commercially important bioproducts.
- To develop an understanding of biochemical and bioprocess engineering principles.
- To enhance analytical and practical skills related to industrial microbiology, fermentation technology, and advanced bioprocess engineering.
- To familiarize students with industrially important microorganisms and their applications in biotechnology.
- To provide knowledge of process optimization, scale-up, and industrial bioproduct manufacturing.

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

1. Understand the fundamental concepts and principles of bioprocess systems and biochemical engineering.
2. Identify industrially important microorganisms and understand their isolation, strain improvement, and preservation techniques.
3. Explain microbial growth kinetics and their significance in industrial bioprocesses.
4. Optimize culture media and process parameters for industrial-scale bioprocess applications.
5. Understand the production processes of major industrial bioproducts and their commercial applications.

Course Contents

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Unit No.	Syllabi	Teaching Hours
1	Isolation, Screening and Improvement of Industrial Microorganisms • Enrichment techniques for isolation of industrially important microorganisms • Primary and secondary screening methods • Strain improvement through mutation and recombinant DNA technology • Preservation and storage techniques for industrial cultures	10
2	Growth Kinetics, Fermenter Design and Media Optimization • Fermenters and bioreactors: Design, components and types • Aeration and agitation in bioprocesses • Oxygen transfer rate and heat control in fermenters • Basic concepts of microbial growth and growth kinetics • Batch, fed-batch and continuous culture operations • Formulation of fermentation media • Media optimization for industrial fermentation processes • Sterilization of media, air and bioprocess equipment	12
3	Downstream Processing • Overview and significance of downstream processing • Cell disruption methods • Extraction and separation techniques • Purification methods for bioproducts • Product concentration and formulation techniques	11
4	Industrial Production of Bioproducts • Production of organic acids (Citric acid, Lactic acid) • Production of industrial enzymes • Production of antibiotics • Production of probiotics and fermented products • Applications of bioprocess engineering in industry	12

Suggested Reading:

1. Mukhopadhyay SN (2020) Process Biotechnology Fundamental. Viva Book
2. Shuler and Kargi (2002) Bioprocess engineering. Prentice-Hall. 2nd edition
3. Bialy & Ollis (1986) Biochemical Eng. Fundaments. McGraw-Hill.
4. Stanbury and Whitaker (1984). Principles of fermentation technology.

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5. Krijnsman (1992). Product recovery in bioprocess technology. Oxford butterworth Helnemann
6. Ghose (1990). Bioprocess computation in biotechnology. Ellis Hardwood Ltd. 15
7. Demain (ED). 1999. Manual of industrial Microbiology and Biotechnology. Asm Press.
8. Doran (2001). Bioprocess Engineering Principles - Academic Press
9. Michael L. Shuler and Fikret Kargi (2003). Bioprocess engineering basic concepts. (2nd edition). Prentice Hall of India Pvt. Ltd. India.
10. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.

Suggested Practical Course:

Sr. No.	Practical	Teaching Hours
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1	Isolation, screening and characterization of lipolytic, proteolytic, and amylolytic microorganisms and their enzyme activities.	30
2	Screening and preservation of antibiotic-producing microorganisms using the Crowded Plate and Waksman/Wilkins Method.	
3	Study of media optimization techniques using Response Surface Methodology (RSM) and Plackett–Burman Design (theoretical/computational approach).	
4	Bioassay of antibiotics by the agar diffusion method and determination of antimicrobial activity.	
5	Isolation of probiotic bacteria from traditional fermented foods such as Dhokla, Kanji, Idli, Curd, or other indigenous fermented products.	
6	Characterization of Lactic Acid Bacteria (LAB) based on: • Acid tolerance test • Bile salt tolerance test • β-Galactosidase activity • Antimicrobial activity against indicator microorganisms	
7	Determination of microbial growth curve and calculation of growth parameters in batch culture.	
8	Sterilization of fermentation media and laboratory equipment used in bioprocess industries.	

Suggested Reading:

1. Mukhopadhyay SN (2020) Process Biotechnology Fundamental. Viva Book
2. Shuler and Kargi (2002) Bioprocess engineering. Prentice-Hall. 2nd edition
3. Bialy & Ollis (1986) Biochemical Eng. Fundaments. McGraw-Hill.
4. Stanbury and Whitaker (1984). Principles of fermentation technology.
5. Krijnsman (1992). Product recovery in bioprocess technology. Oxford butterworth Helnemann
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Theory Paper Style:
(Major and Minor)

Time: 2 Hours

Total Marks: 50

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Instructions:

1. Illustrate your answer with neat and labelled diagrams.
2. Figure to the right side indicates full marks of questions.

EXTERNAL ASSESSMENT BY UNIVERSITY			
Que. No.	Particulars	Unit	Marks
Que. 1	(1)	Unit 1	05
	(2)		05
	Or		
	(1)		05
	(2)		05
Que. 2	(1)	Unit 2	05
	(2)		05
	Or		
	(1)		05
	(2)		05
Que. 3	(1)	Unit 3	05
	(2)		05
	Or		
	(1)		05
	(2)		05
Que. 4	(1)	Unit 4	05
	(2)		05
	Or		
	(1)		05
	(2)		05
Que. 5	(1)	Unit 1 & 2	05
	(2)		05
	Or		
	(1)	Unit 3 & 4	05
	(2)		05
Total			50

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INTERNAL EVALUATION SCHEME (MAJOR)			
INTERNAL ASSESSMENT			
No.	Particulars	Marks	Weightage
1	Internal Test	50	25
2	Assignment		10
3	Field visit report/ class presentation		10
4	Attendance		05
	Total		50

INTERNAL EVALUATION SCHEME (MINOR)			
INTERNAL ASSESSMENT			
No.	Particulars	Marks	Weightage
1	Internal Practical	50	25
2	Internal Test		10
3	Field visit report/ class presentation		10
4	Attendance		05
	Total		50

INTERNAL EVALUATION SCHEME		
INTERNAL ASSESSMENT		
No.	Particulars	Weightage
1	Practical Performance	40
2	Viva	10
	Total	50

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Paper Style:

INTERNAL EVALUATION SCHEME		
INTERNAL ASSESSMENT PRACTICAL		
No.	Particulars	Weightage
1	Perform any Four practical from the given list of exercises as per the instruction of the examiner.	40
2	Viva	10
Total		50

ASSESSMENT BY UNIVERSITY		
Que. No.	Particulars	Marks
EXTERNAL EXAMINER		
1	Perform any Three or Four practical from the given list of exercises as per the instruction of the examiner	40
2	Viva-voce	10
Total		50