



# CBCS SCHEME

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21BT71

## Seventh Semester B.E./B.Tech. Degree Examination, June/July 2025 Upstream and Downstream Bioprocess Technology

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Describe the preservation methods of microbial cultures and their significance in upstream processing. (10 Marks)
- b. Discuss the components of a fermenter and explain their roles in microbial growth and product formation. (10 Marks)

OR

- 2 a. Explain the principle and applications of solid-state fermentation. What are its advantages and limitations compared to submerged fermentation? (10 Marks)
- b. Discuss strain improvement strategies and their impact on fermentation efficiency and product yield. (10 Marks)

### Module-2

- 3 a. Illustrate the stages of microbial growth kinetics in batch fermentation and describe their industrial relevance. (10 Marks)
- b. Describe the optimization of environmental conditions in fermentation to maximize yield. (10 Marks)

OR

- 4 a. Explain the design criteria for producing high-value, low-volume and low-value, high-volume metabolites in fermentation. (10 Marks)
- b. Discuss the industrial applications of secondary metabolites, including antibiotics and alcohols. (10 Marks)

### Module-3

- 5 a. Explain the role of downstream processing (DSP) in bioproduct recovery. Discuss the main challenges associated with DSP. (10 Marks)
- b. Describe the principle of centrifugation and compare ultra and differential centrifugation methods. (10 Marks)

OR

- 6 a. Discuss the process of flocculation and sedimentation as primary separation techniques in DSP. (10 Marks)
- b. Explain the role of aqueous two-phase extraction in bioprocessing and provide examples of its applications. (10 Marks)

**Module-4**

- 7 a. Describe the principles of gel filtration and affinity chromatography in product enrichment and recovery. (10 Marks)
- b. Discuss the factors influencing solute polarization in membrane filtration and methods to control it. (10 Marks)

**OR**

- 8 a. Explain the principle of HPLC and its application in bioproduct analysis and purification. (10 Marks)
- b. Discuss membrane separation equipment and the design considerations for effective operation. (10 Marks)

**Module-5**

- 9 a. Describe the challenges in scaling up a bioprocess from laboratory to industrial scale. How are process variables optimized during scale-up? (10 Marks)
- b. Explain the importance of quality control (QC) and good manufacturing practices (GMP) in bioprocess industries. (10 Marks)

**OR**

- 10 a. Discuss the methods used for waste disposal in bioprocess industries, focusing on aerobic and anaerobic treatment. (10 Marks)
- b. Describe various methods of bioproduct purification, such as drying, crystallization, and membrane processing. (10 Marks)

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