



**ST JOSEPH'S UNIVERSITY, BENGALURU -27**  
**M.Sc. Biotechnology- III SEMESTER**  
**SEMESTER EXAMINATION: OCTOBER 2023**  
**(Examination conducted in November/December 2023)**  
**BT 9323: INDUSTRIAL BIOTECHNOLOGY,**  
**ENTREPRENEURSHIP AND BIOETHICS**  
**(For current batch students only)**

Registration Number:

Date & session:

Time: 2 hours

Max Marks: 50

This paper contains **TWO** printed pages and **THREE** parts

Instructions:

- Draw diagrams wherever necessary and label them correctly.
- Draw the diagrams and/or graphs using a ballpoint pen.

**PART A**

Answer any **SEVEN** of the following

2m x 7 = 14 marks

1. What are the basic requirements of a Biosafety level 3 facility?
2. In four statements, justify a counter debate to this statement: GM crops will breed with other crops, and hence the biodiversity will be eventually lost.
3. How does hybridisation help in strain improvement of yeast?
4. Is considering 'the six forces of change' important for an Bio Entrepreneurial venture? Justify your response with two statements.
5. How is sterilization achieved in the oxygen transfer units of a fermentor?
6. Explain the drivers of sustainability and self-sufficiency in an industrial biotechnology process.
7. Explain any two factors that impact the 'approaches' towards scale-up process.
8. Using a diagram, show the oxygen transfer rate inside a bioreactor with respect to distance traveled. Indicate the respective transfer rates at each interface.
9. Mention two disadvantages of the freeze-drying process.

**PART B**

Answer any **FOUR** of the following:

5m x 4 = 20 marks

10. What are risks associated with the key resources for a venture detailed below?



11. What are the components that help the optimization of the upstream process in fermentation?
12. Draw a neat labeled diagram of a packed bed reactor.

13. The displacement of an air bubble inside a bubble column reactor satisfies the differential equation  $\frac{d^2x}{dt^2} + 6\frac{dx}{dt} + 8x = 0$ , where  $x$  cm is the displacement of the bubble at time  $t$  seconds. The initial displacement at  $t = 0$  seconds is 4 cm and the final displacement at  $t = 1$  seconds is 10 cm. Solve the equation for  $x$ .
14. Using diagrams, briefly explain the plate-frame, cross-flow and dead-end based filtration mechanisms.
15. Write a note on downstream processing steps involved in product crystallization. Mention the methods used to achieve supersaturation for crystallization.

### PART C

Answer any TWO of the following:

8m x 2 = 16 marks

16. What are the approaches to improve a strain on an industrial level? Add a note on the target for improvement and focus of research for *Yeast strains* (6+2).
17. Briefly explain the process of methanol production using biomass as feedstock.
18. Answer the following:
- Name any eight physical requirements that are to be considered when designing a fermenter. (4 Marks)
  - How does enzyme immobilization affect downstream processing in terms of product separation and product finishing? Explain any two irreversible variants of enzyme immobilization. (4 Marks)