**Reg. No. :**

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**Question Paper Code:U5D02**

B.E./B.Tech. DEGREE EXAMINATION, NOV 2023

Fifth Semester

Biotechnology

21UBT502 BIOPROCESS ENGINEERING

(Regulations 2021)

Duration: Three hours                                                          Maximum: 100 Marks

Answer All Questions

PART A - (10x 2 = 20 Marks)

| | | |
|---|---|---|
| 1. | Mention the types of filters for gas sterilization with example. | CO2-App |
| 2. | Write about the two methods to prevent foaming inside the reactor. | CO1-U |
| 3. | Identify the process which is consider as the rate limiting step in transfer of dissolved oxygen from Gas bubble to cells. | CO2-App |
| 4. | Give the expression of oxygen transfer rate and oxygen uptake rate. | CO1-U |
| 5. | Calculate specific growth rate of the microorganism if the maximum specific growth rate is 0.7 h-1, substrate concentration is 10 g/L and Monod constant is 1.5 g/L. | CO3-Ana |
| 6 | Describe the temporal organization of systems within the cell in brief. | CO1-U |
| 7 | Justify with reason why the critical radius of the immobilized enzyme is necessary. | CO3-Ana |
| 8 | Comment on the effectiveness factor of an immobilized enzyme | CO1-U |
| 9 | Mention the advantages of *E. coli* acting as host for recombinant cell preparation | CO1-U |
| 10 | Comment on the factors need to be consider while animal cell cultivation is done | CO3-Ana |

11. (a) A sample of the tracer hytane at 320 K was injected as a pulse to a reactor, and the effluent concentration was measured as a function of time, resulting in the data shown in Table   CO2-App    (16)

| t (min) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 14 |
|---------|---|---|---|---|---|---|---|---|---|---|----|----|----|
| C (g/m$^3$) | 0 | 1 | 5 | 8 | 10 | 8 | 6 | 4 | 3 | 2.2 | 1.5 | 0.6 | 0 |

TRACER Data

The measurements represent the exact concentrations at the times listed and not average values between the various sampling tests, (a) Construct figures showing C(t) and E (t) as functions of time, (b) Determine both the fraction of material leaving the reactor that has spent between 3 and 6 min in the reactor.

Or

(b) The concentration reading in the table represents a continuous response to pulse input into a closed vessel. (a) Calculate the mean residence time of fluid in the vessel, (b) Plot the C- curve (b) Tabulate and plot the E- curve.   CO2-App    (16)

| t (min) | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 |
|---------|---|---|----|----|----|----|----|----|
| C (g/L) | 0 | 3 | 5 | 5 | 4 | 2 | 1 | 0 |

12. (a) Explain in detail about the non- fermentative method of kLa determination with neat diagram and model graph.   CO1-U    (16)

Or

(b) Explain about the steps involved in oxygen mass transfer from the gas bubbles to the active site of the cells. Validate each step with proper reasons.   CO1-U    (16)

13. (a) Describe the two-compartment model of bacterial growth with neat block diagram   CO1-U    (16)

Or

(b) Derive necessary equations required to study the Fed-batch cultivation of microorganism   CO1-U    (16)

14. (a) Evaluate the film and pore diffusion effect of substrate on immobilized enzymes.   CO2-App    (16)

Or

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(b) Design a fluidized bed reactor for the biocatalyst and explain their advantages over packed bed reactor.　CO2-App　(16)

15. (a) Choose the correct strategy to achieve high cell density cultivation in the reactor system with justifications.　CO2-App　(16)

Or

(b) "In order to increase the biomass concentration in the reactor, Fed batch cultivation strategy can be adopted" – Justify this statement with necessary block diagram and design equations.　CO2-App　(16)

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