Reg. No. : | | | | | | | | | | | | |

Question Paper Code: R5C01

B.E./B.Tech. DEGREE EXAMINATION, NOV 2025

Fifth Semester

R21UBT501 – BIO PROCESS ENGINEERING

Biotechnology

(Regulations R2021)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1.	Write about the two methods to prevent foaming inside the reactor.	CO1-U
2.	Mention the types of filters for gas sterilization with example.	CO1-U
3.	If the dissolved oxygen tension is measured as 60% and the solubility of oxygen is 8.0×10^{-3} Kg/m^3. What is the concentration of dissolved oxygen?	CO3-App
4.	Define Microbial Oxygen Demand.	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.	CO2-App
6.	What is the purpose of using dynamic simulation in batch fermentation?	CO1-U
7.	List the factors that affect the immobilized enzyme kinetics.	CO1-U
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-App

PART – B (5 x 16= 80 Marks)

11.	(a)	Derive the equation to find exit age distribution by using pulse input experiment with a neat plot of C curve and E curve.	CO2-App	(16)

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) Mass transfer is one of the key parameters determining the performance of the bioreactor. In aerobic culture the oxygen molecule must overcome a series of transport resistances before utilized by the cells. Analyze and validate the oxygen mass transfer steps involved in the transport of oxygen from the gas bubble to the site of intracellular reaction. CO3-App (16)

Or

(b) Analyze the scale up process with necessary derivation based on following criteria CO3-App (16)

1. constant kLa
2. constant P/V
3. constant impeller tip speed

13. (a) Compute the necessary equations for the model for aerobic growth of the Yeast Saccharomyces cerevisiae. CO2-App (16)

Or

(b) Construct the necessary design equations required to study the batch cultivation process. Obtain the relationship in terms of biomass and substrate to calculate batch process time. CO2-App (16)

14. (a) Illustrate with neat diagram and operational procedures of packed bed reactor system. CO1-U (16)

Or

(b) Explain with necessary derivation about the film and pore diffusional effect on the immobilized enzyme system. CO1-U (16)

15. (a) Choose the correct strategy to achieve high cell density cultivation in the reactor system with justifications. CO3-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. CO3-App (16)