

CBCS SCHEME

USN

--	--	--	--	--	--	--	--	--	--

21BT51

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Biokinetics and Bioreaction Engineering

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Explain briefly about Arrhenius and Collision theory. (10 Marks)
b. The rate of reaction is doubled for each 10°C rise. Derive the correlation between activation energy and T. Also find the value if E at 27°C and 327°C. (10 Marks)

OR

- 2 a. Briefly explain Differential method of analysis and Integral method of analysis. (10 Marks)
b. Derive an integrated rate equation for a unimolecular First order reaction both in terms of concentration and conversion. (10 Marks)

Module-2

- 3 a. Derive the performance equation for both reactor for constant volume system in terms of concentration and conversion. (10 Marks)
b. Enzyme E catalyses the fermentation of substrate A to produce R. Find the size of mixed flow reactor needed for 95% conversion of reactant in a feed stream of 25 lpm of reactant (2 moles/lit) and enzyme. The kinetics of fermentation at this enzyme concentration is given as $A \rightarrow R$,

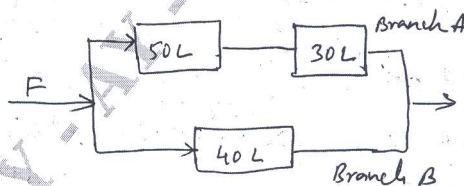
$$-r_A = \frac{0.1C_A}{1 + 0.5C_A} \text{ moles/liter.min}$$

(10 Marks)

OR

- 4 a. Discuss the various reasons for non ideality in reactor operations. Explain the experimental method to determine the residence time distribution and list out the properties of tracer. (10 Marks)
b. The reactor set up shown in Fig. Q4(b) consists of 3 plug flow reactors in 2 parallel branches. Branch A has a reactor volume of 50 liters, followed by a reactor volume of 30 liters, Branch B has a reactor of volume 40 litres. What fraction of the feed should go to the branch A? (10 Marks)

Fig. Q4(b)



Module-3

- 5 a. Derive Michaelis – Menten equation, stating with all assumptions. (10 Marks)
b. Explain the Wineweer – Burke plot, Eadie – Hofstee and Hanes wolf plot to estimate the M – M parameters. (10 Marks)

OR

1 of 2

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

- 6 a. Beef Wiver catalyst has been used to accelerate the decomposition of H_2O_2 to yield H_2O and O_2 . The concentration of H_2O_2 is given as a function of time for a reaction mixture with a P^H of 6.7 and maintained at $30^\circ C$.

t, min	0	10	20	50	100
Concentration of H_2O_2 , mol/lit	0.02	0.0175	0.0158	0.0106	0.005

Determine M-M parameters, U_{max} and K_m . (10 Marks)

- b. Explain the following terms :

- i) Competitive inhibition ii) Non competitive inhibition
 iii) Allosteric enzyme iv) Free and Bound enzyme. (10 Marks)

Module-4

- 7 a. With a neat graphical representation, explain the Monod model. (10 Marks)
 b. Explain Batch growth kinetics. (10 Marks)

OR

- 8 a. Explain Elemental balance for a biological reactions in which no extra cellular products produced. (10 Marks)
 b. Aerobic degradation of benzoic acid by a mixed culture of microbes can be represented by the following reaction : $C_6H_5COOH + aO_2 + bNH_3 \rightarrow cC_5H_7NO_2 + dH_2O + eCO_2$. Determine i) a, b, c, d and e if respiratory quotient (RQ) is 0.9.
 ii) Yield coefficient $Y_{x/s}$, Y_{x/o_2} . (10 Marks)

Module-5

- 9 a. Discuss briefly media required for Fermentation process. (10 Marks)
 b. Explain Thermal death kinetics of microorganism. (10 Marks)

OR

- 10 a. Differentiate between Batch and Continuous Sterilization of Liquid media. (10 Marks)
 b. With a neat sketch, explain Filter Sterilization. (10 Marks)
