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Fifth Semester B.E. Degree Examination, July/August 2022
Chemical Reaction Engineering

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Derive rate equation for first order rate of reaction $A \rightarrow R$ both in terms of concentration and conversion. (10 Marks)
- b. Explain the various steps involved in integral and differential method of kinetic data analysis. (10 Marks)

OR

- 2 a. Define the following :
- (i) Elementary and non-elementary reactions. (06 Marks)
 - (ii) Order and molecularity. (04 Marks)
 - (iii) Law of mass action. (10 Marks)
- b. The pyrolysis of Ethane proceeds with an activated energy of about 300 kJ/mol. How much faster is the decomposition at 650°C than at 500°C. (10 Marks)
- c. At 500 K, the rate of a bimolecular reaction is ten times the rate at 400 K. Find the activation energy for this reaction from (i) Arrhenius law (ii) Collision theory. (06 Marks)

Module-2

- 3 a. Derive the performance equation for batch reactor. (12 Marks)
- b. In an isothermal batch reactor, the conversion of liquid reactant is 70% in 13 minutes. Find the space time and space velocity necessary to affect this conversion in a MFR and PFR. (08 Marks)

OR

- 4 a. Derive the design equation for Continuous Stirred Tank Reactor (CSTR) and give the graphical representation of the same. Add a note on the definitions of (i) Space time (ii) space velocity. (14 Marks)
- b. A homogenous liquid phase reaction $A \rightarrow S$, $-r_A = kC_A^2$ takes place with 50% conversion in a mixed flow reactor. What will be the conversion if this reactor is replaced by another mixed flow reactor having volume 6 times that of original reactor-all else remain unchanged? (06 Marks)

Module-3

- 5 a. Write short notes on:
- (i) Characteristic features of traces. (12 Marks)
 - (ii) State of aggregation. (08 Marks)
 - (iii) Early and late mixing of fluids. (12 Marks)
- b. Explain the pulse input experiment. (08 Marks)

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.

OR

- 6 a. Derive an expression for RTD in CSTR. (10 Marks)
 b. Calculate the mean residence time and the variance for the vessel from the following data:

t, min	0	1	2	3	4	5	6	7	8	9	10	12	14
E, Min^{-1}	0	0.02	0.10	0.16	0.20	0.16	0.12	0.08	0.06	0.044	0.03	0.012	0

(10 Marks)

Module-4

- 7 a. Explain in detail about the different types of enzyme specificities. (10 Marks)
 b. Explain un-competitive inhibition. (10 Marks)

OR

- 8 a. Derive Michaelis-Menton equation with all assumptions. Add a note on significance of K_m and V_{max} . (14 Marks)
 b. Derive equation for Lineweaver-Burk plot with neat graphical representation. (06 Marks)

Module-5

- 9 a. Write a detailed note on various medium requirements for fermentation process. (10 Marks)
 b. Explain "Monod Model" for kinetics of cell growth. (10 Marks)

OR

- 10 a. Write a note on growth of filamentous organisms. (10 Marks)
 b. Explain in detail about "Leudeking-Piret" model. (10 Marks)

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