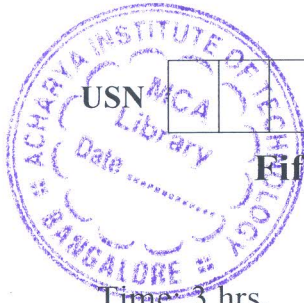


CBCS SCHEME



18BT52

Fifth Semester B.E. Degree Examination, June/July 2024 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. The rate of bimolecular reaction at 227°C is ten times the rate of 127°C. Find the activation energy of this reaction from Arrhenius law. (06 Marks)
- b. Define the following :
 - i) Order and molecularity
 - ii) Elementary and non elementary reaction
 - iii) Law of mass action. (06 Marks)
- c. Explain Integral and differential method of analyzing the kinetic for constant volume system. (08 Marks)

OR

- 2 a. Derive an integrated rate equation for bimolecular irreversible 2nd order reaction both in terms of concentration and conversion. ($2A \rightarrow P$, where $C_A = C_B$). (10 Marks)
- b. After 8 min in a batch reactor reactant A ($C_{A0} = 1$ moles/lit) is 80% converted. After 18 min, the conversion is 90%. Find the rate equation to represent this reaction. (10 Marks)

Module-2

- 3 a. Derive the design equation for a steady state plug flow reactor both in terms of concentration and conversion. (10 Marks)
- b. 1 lpm of a liquid containing A and B flows into a mixed flow reactor (MFR) [$C_{A0} = 0.1$ mole/lit and $C_{B0} = 0.01$ mole/lit] of volume 1 lit. The material reacts in a complex manner for which the stoichiometry is unknown. The outlet stream from the reactor contains A, B and C ($C_A = 0.02$ mole/lit, $C_B = 0.03$ mole/lit and $C_C = 0.04$ mole/lit). Find the rate equation of A, B and C for the condition within the reactor. (10 Marks)

OR

- 4 a. Derive the design equation for batch reactor both in terms of conversion and concentration with a graphical representation. (10 Marks)
- b. A liquid stream of 1 mole/lit passes through 2 MFR's in series. The concentration of A in the exit of 1st reactor is 0.5 mole/lit. Find the concentration of exit stream of 2nd reactor if the reaction is 2nd order w.r.t A ($\frac{V_2}{V_1} = 2$). (10 Marks)

Module-3

- 5 a. Explain the pulse experiment to idealize the non ideal reactor. (10 Marks)
- b. With a neat sketch, explain the reasons for non ideality in the reactor operations. (06 Marks)
- c. Write a brief note on characteristics of trach. (04 Marks)

OR

- 6 a. A first order liquid phase reaction, $A \rightarrow P$, $-r_A = KC_A$, where $K = 0.307 \text{ min}^{-1}$ is carried out in a reactor for which the results of pulse tracer test is given below. Calculate the conversion using ideal PFR, ideal MFR and tanks in series model. (12 Marks)

t, min	0	5	10	15	20	25	30	35
e_{pulse} g/lit	0	3	5	5	4	2	1	0

- b. Derive an equation for Residence Time Distribution (RTD) in MFR. (08 Marks)

Module-4

- 7 a. Derive Michaelis – Menten equation stating all assumptions. (10 Marks)
 b. Determine M.M parameters V_{max} and K_m for the reaction



The rate equation is given below as a function of urea concentration.

Urea, [S] (Kmol/m^3)	0.2	0.02	0.01	0.005	0.002
Rate, V ($\text{Kmol/m}^3, \text{sec}$)	1.082	0.55	0.38	0.2	0.09

(10 Marks)

OR

- 8 a. What is Enzyme Inhibition? Explain competitive and non – competitive inhibition. (12 Marks)
 b. Explain any two methods for estimation of M – M parameters. (08 Marks)

Module-5

- 9 a. Discuss about Monod model and Lue deKing – Piret model of growth rate of micro organisms. (12 Marks)
 b. Discuss in detail the thermal death kinetics of micro organisms. (08 Marks)

OR

- 10 a. Write a note on the different medium requirement for fermentation process. (10 Marks)
 b. Explain the objective of heating, holding and cooling operations of sterilization. (10 Marks)
