

Total No. of Questions : 10]

SEAT No. :

P3650

[5560]-606

[Total No. of Pages : 3

TE(Chemical)

CHEMICAL REACTION ENGINEERING - I

(2015 Pattern) (309348)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Attempt Q1 OR Q2, Q3 OR Q4, Q5 OR Q6, Q7 OR Q8, Q9 OR Q10.*

Q1) a) Milk is pasteurized if it is heated to 63°C for 30min, but if it is heated to 74°C it only needs 15 s for the same result. Find the activation energy of this sterilization process. **[4]**

b) Explain rate of reaction and give various ways of expressing the reaction rate. **[6]**

OR

Q2) After 8 minutes in a batch reactor, reactant (C_{A0} —1 mol/lit) is 60% converted: after 18 minutes, conversion is 70%. Find rate equation to represent this equation. **[10]**

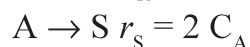
Q3) Explain the various methods of analyzing reaction data to find out rate of reaction. **[10]**

OR

Q4) a) Derive performance equation for plug flow reactor. **[6]**

b) In a homogeneous isothermal liquid polymerization, 20% of the monomer disappears in 34 minutes for initial monomer concentration of 0.04 and also for 0.8 mol/liter. What rate equation represents the disappearance of the monomer? **[4]**

Q5) a) Consider the parallel decomposition of A of different orders.



Product R is the desired material. Determine the maximum concentration of desired product obtainable in **[10]**

P.T.O.

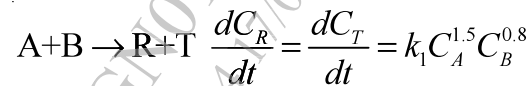
- i) Plug flow
- ii) Mixed flow

For $C_{A0} = 4$

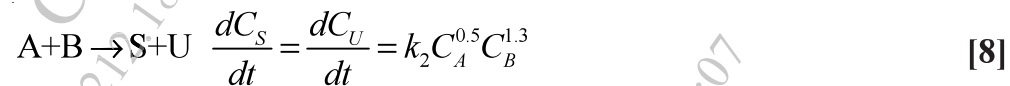
- b) Define instantaneous fractional yield and overall fractional yield in detail. [6]

OR

- Q6)** a) The desired liquid phase reaction



Is accompanied by the unwanted side reaction.



What contacting scheme (reactor type) would you use to carry above reaction to maximize the concentration of desired product?

- b) Describe the qualitative discussion about product distribution for series reactions. [8]

- Q7)** a) Explain in detail the effect of temperature on equilibrium conversion of reactant at constant pressure. [8]

- b) Derive the relation between conversion and temperature for an adiabatic reactor using the energy balance and explain how you determine the reactor size for adiabatic operation of a plug flow and a stirred tank reactor. [8]

OR

- Q8)** a) For aqueous reaction $A \leftrightarrow R$, between the temperature ranges 0° to 100°C , determine the equilibrium conversion as a function of temperature in graphical form. What should be the maximum temperature so that the conversion of A achieved is 75% or higher? [10]

For $C_R^\circ = C_A^\circ = 1 \text{ mol/liter}$

$$\Delta G_{298}^0 = -3375 \text{ cal/mol}; \Delta H_{r,298}^0 = -18,000 \text{ cal/mol.}$$

- b) Explain energy balance equation for adiabatic operation graphically. [6]

Q9) a) From a pulse input into a vessel we obtain the following output signal[10]

Time, min	1	3	5	7	9	11	13	15
Concentration (arbitrary)	0	0	10	10	10	10	0	0

We want to represent the flow through vessel with tank - in - series model.

Determine the number of tanks to use.

b) Discuss Dispersion Model and tank in series model. [8]

OR

Q10) Write a note on (Any Three). [18]

- a) E and F curve.
- b) Segregation model
- c) Micro and macro mixing of fluids
- d) Early and late mixing

