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SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

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Total number of questions:06

B.Tech. || CHE || 4th Sem

Chemical Reaction Engg-I

Subject Code: BTCH-405

Paper ID:

Max Marks: 60

Time allowed: 3 Hrs

Important Instructions:

- **All questions are compulsory**
- **Assume any missing data**

PART A (2×10)

All Cos

Q. 1. Short-Answer Questions:

(a) What are single and multiple reactions.
(b) Differentiate Molecularity and order of a reaction.
(c) What is activation energy?
(d) What are the advantages of plug flow reactor?
(e) Define space time and space velocity.
(f) What is a second order reaction?
(g) Define Fractional Conversion 'X_A'.
(h) For the rate equation 2A + B --> C is $-r_A = kC_A^2C_B$, find the units of k.
(i) Define tracer. Give basic characteristics for contacting or flow pattern
(j) Differentiate micro fluid from macro fluid.

PART B (8×5)

CO

Q 2 (a) A reaction with stoichiometric equation $\frac{1}{2}A + B \rightarrow R + \frac{1}{2}S$ has the following rate expression 1

$$-r_A = 2C_A^{0.5}C_B$$

What is the rate expression for this reaction if the stoichiometric equation is written as

$$A + 2B \rightarrow 2R + S$$

(b) The pyrolysis of ethane proceeds with an activation energy of about 300 kJ/mol. How much faster is the decomposition at 650°C than at 500°C?

OR

(a) Define the term 'specific reaction rate' or 'rate of reaction'. What are the variables affect the rate of reaction? (4) CO1

(b) Differentiate constant volume and variable volume methods of analysis of reactors. (4)

Q 3 (a) Derive the performance equation for second-order irreversible reaction for the batch reactor. (4) CO2

(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)

OR

(a) Differentiate integral and differential method of analysis of batch reactor data. (4) CO2

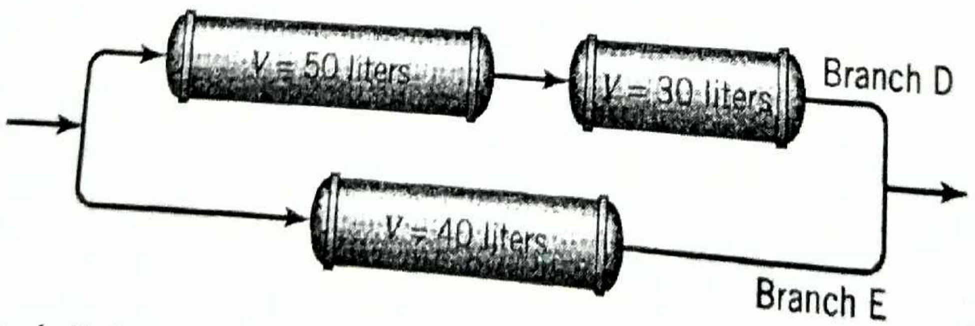
(b) After 8 minutes in a batch reactor, reactant (C_{A0} = 1 mol/liter) is 80% converted; after 18 minutes, conversion is 90%. Find a rate equation to represent this reaction. (4)

Q 4 (a) Differentiate Mixed Flow Reactor and Plug Flow Reactor. (4) CO3

(b) Consider a gas-phase reaction $2A \rightarrow R + 2S$ with unknown kinetics. If a space velocity of l/min is needed for 90% conversion of A in a plug flow reactor, find the corresponding space-time and mean residence time or holding time of fluid in the plug flow reactor. (4)

OR

(a) The reactor setup shown in figure below consists of three plug flow reactors in two parallel branches. CO3



Branch D has a reactor of volume 50 liters followed by a reactor of volume 30 liters. Branch E has a reactor of volume 40 liters. What fraction of the feed should go to branch D? (4)

(b) Derive the performance equation for the reaction A → R (first order kinetics) takes place in equal-size mixed flow reactors in series. (4)

Q 5 (a) Write short notes on Optimum temperature progression. CO4

(a) How will you determine the size of reactor required for a given duty and for a given temperature progression?

OR

(a) How will you find the best reactor type for adiabatic operations?

(b) What reaction schemes and conditions would you use to have maximum concentration of 'R' for the following parallel reactions? CO4

$A + B \longrightarrow R$ (Desired) $r_R = 15.e^{-273/t} . C_A^{0.5} * C_B$

$A + B \longrightarrow S$ (Undesired) $r_S = 200.e^{-2000/t} . C_A * C_B$

Q 6 (a) W hat is residence time distribution? How exit age distribution is calculated experimentally? (4) CO5

(b) Explain the concept of earliness and lateness of mixing in non ideal flow. (4)

OR

The data given below represent a continuous response to a pulse input into a closed vessel which is to be used as a chemical reactor. Calculate the mean residence time of fluid in the vessel t , Tabulate and construct the E-curve.

t, min	0	5	10	15	20	25	30	35
C_{pulse}, g/l (tracer O/P conc.)	0	3	5	5	4	2	1	0