T.E - V Sem - Chem

Chemical Reaction Engineering - I

(27)

CHEM./V/CBGS/CRE-I

Q.P. Code : 3403

(3 Hours) **[Total Marks : 80**

Question no 1 is compulsory
Attempt any three questions from remaining five questions
Assume suitable data if needed & justify

Q1 a. Define: Elementary and Non elementary reaction 04

Q1 b. Define: Molecularity and order of reaction 04

Q1 c. Derive complete Design equation for Mixed Flow Reactor. 06

Q1 d. Write short note on integral method of analysis of rate data. 06

Q2 a. $A+A \leftrightarrow A+A^*$

$A^* \rightarrow$ Product

Obtain the overall rate equation. State the conditions when the reaction order will be first and when it will be second? 08

Q2 b. Find the first-order rate constant for the disappearance of A in the gas reaction $2A \rightarrow R$ if, on holding the pressure constant, the volume of the reaction mixture, starting with 80% A, decreases by 20% in 3 min. 12

Q3 a. Write short note on Homogeneous catalyzed reactions. 08

Q3 b. Use the half life method to determine the order and rate constant of the reaction using following information 12

$t_{1/2}$ (sec)	0	100	200	300	400
C_{A0} (mol/lit)	4.4	3.5	2.9	2.6	2.3

TURN OVER

10/06/15

Chemical Reaction Eng

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Q4 a After 8 minutes in a batch reactor, reactant (C_{AO} =1 mol/liter) is 80% converted; after 18 minutes, conversion is 90%. Find a rate equation to represent this reaction. 08

Q4 b A liquid reactant stream (1 mol/liter) passes through two mixed flow reactors in series. The concentration of A in the exit of the first reactor is 0.5 mole/liter. Find the concentration in the exit stream of the second reactor. The reaction is second order with respect to A and V_2/V_1 =2. 12

Q5 a. Assuming a stoichiometry $A \rightarrow R$ for a first order gas phase reaction, the size of plug flow reactor for 99% conversion of pure A is calculated to be 32 liters. In fact however the reaction stoichiometry is $A \rightarrow 3R$ .With this corrected stoichiometry, what is the required volume of the reactor? 12

Q5 b. Write a short note on Recycle reactors. 08

Q6 Between 0°C and 100°C determine the equilibrium conversion for the elementary aqueous 20

Reaction $A \rightleftarrows R$

~~$\Delta G^0_{298} = -14130$ J/mol~~, ~~$\Delta H^0_{298} = 75300$ J/mol~~

$\Delta G^0_{298} = -14130$ J/mol $\quad \Delta H^0_{298} = -75300$ J/mol.

$Cp_A = Cp_R$ = constant

Present the results in the form of a plot of temperature versus conversion. What restrictions should be placed on the reactor operating isothermally if we are to obtain a conversion of 75% or higher?

X