Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V • EXAMINATION – SUMMER • 2014

Subject Code: 150403 Date: 19-06-2014

Subject Name: Chemical Reaction Engineering

Time: 10:30 am - 01:00 pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Define and explain the following terms. **04**

i) Order of reaction (ii) Elementary and non-elementary reactions

iii) Activation Energy iv) Single and multiple reactions. **03**

(b) What are the different ideal reactors? Derive the performance equation of Ideal Plug flow reactor (PFR). **07**

Q.2 **(a)** Continuous stream of gaseous enters a vessel at temperature T_0=400 K, P_0=4 atm, reacts there and leaves at T=300 K, P=3 atm and C_{AO}=100, C_{BO}=200, A+B--→2R find X_A, X_B, $C_B.C_A$=20. **07**

(b) Define ideal reactors. Explain the importance of reactor design with broad classification of reactor types. **07**

OR

(b) Explain the size comparison of single ideal CSTR with PFR and mention the different parameter affecting the sizes of the reactor. **07**

Q.3 **(a)** Write short notes on

1) Space time and Space velocity **03**
2) Optimum temperature progression profile. **04**

(b) Derive the design equation of Recycle reactor. **07**

OR

Q.3 **(a)** Show that for a first order irreversible reaction ln(1/(1-xA))=kt. **07**

(b) Find the conversion after 1 hr. in a batch reactor for A--→R, $-r_A=3C_A^{0.5}$ mol/lit-hr and C_{A0}=1 mol/l. **07**

Q.4 **(a)** Explain the temperature dependency term in the rate equation using thermodynamics and collision theory. **07**

(b) Write short notes on half life time of the reaction. **07**

OR

Q.4 **(a)** A first order irreversible reaction A -→ B is carried out in a plug flow reactor followed by an equal size CSTR in series. The concentration of A in the feed is 1 kg mole/m^3 and the residence time in each reactor is 3600 sec. The specific reaction rate constant for the reaction is 1/3600 sec^{-1}. Find the conversion of A at the exit of the system. **07**

Q.4 **(b)** Explain the terms instantaneous fractional yield and overall fraction yield of a product. Give its advantages in the product distribution. **07**

Q.5 **(a)** Derive the C_{Rmax} and t_{Rmax} for the reaction first order followed by zero-order reaction for **07**

$A \xrightarrow{k1} R \xrightarrow{k2} S$

(b) Give the general graphical design procedure to give the relationship of temperature, composition and rate of single homogeneous reaction. **07**

OR

Q.5 **(a)** Discuss in detail the qualitative product distribution for series reaction. **07**

(b) Define autocatalytic reactions. Derive an expression to find its kinetics. Explain plots of rate of reaction Vs. time and concentration Vs. time. **07**

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