Seat No: _____ Enrollment No: _____

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech., Summer2018-19 Examination

Semester: 6 **Date: 02/05/2019**
Subject Code: 03103352 **Time: 10:30am to 1:00pm**
Subject Name: Chemical Reaction Engineering-I **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions. **(15)**

1. List out the variables affects the rate of reaction.
2. Write down the example of Non-elementary reactions.
3 Explain 'specific reaction rate' or 'rate of reaction'.
4. Define : Auto-catalytic Reaction.
5. Define chemical kinetics.
6. For A+B➔ R reaction what is Fractional conversion for reactant A
   a) $X_A = 1 - C_A$ b) $X_A = 1 - C_A / C_{Ao}$ c) $X_A = C_A / C_{Ao}$ d) $X_A = 1 + C_A / C_{Ao}$
7. Define : Space Velocity.
8. From _____ the frequency factor does not affect the temperature sensitivity of a reaction.
9. A space velocity of 4 hr^{-1} means that _____ reactor volumes of feed at specified conditions are being fed into the reactor per hour.
10. Define the general unit of rate constant K for n^{th} order of reaction.
11. Give Four important factors while selecting Reactor system.
12. Back mixing is allowed in MFR – State true or false.
13. Show the contacting patterns of Batch Reactor and Semi-batch reactor.
14. Write down the advantages of Batch reactor.
15. Define : Half-life Reaction.

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Derive the performance equation for Continues Stirred tank Reactor.
B) Derive the performance equation for Batch Reactor with respect to space time.
C) Develop a rate constant for Irreversible First order reaction.
D) Compare plug flow reactor and mixed flow reactor for finding the size of reactor for adiabatic operations.

Q.3 A) Explain steps-wise procedure of Analysis for Differential Method. **(07)**

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? **(08)**

OR

B) Consider an Irreversible first order reaction of the type A➔ R. It is carried out Adiabatically in PFR, Develop an Equation with respect to Arrhenius equation in terms of volume and conversion. **(08)**

Q.4 A) For a gas reaction at 400K, the rate is reported as $-dp_A/dt = 3.66\ p_A^2$, atm/hr. **(07)**

a) What are the units of the rate constant?

b) What is the value of rate constant for the reaction if the rate equation is expressed as $-r_A = -(1/V)\ dN_A/dt = kC_A^2$, mol/liter-hr

OR

A) An aqueous feed of A and B (400 liter/min, 100 mmol A/liter, 200 mmol B/liter) is to be converted to product in a plug flow reactor. The kinetics of the reaction is represented by **(07)**

$A+B \rightarrow R,\ -r_A = 200\ C_A * C_B$ mol/lit. min

Find the volume of reactor needed for 99.9% conversion of A to product.

B) Compare the Integral and Differential method of analysis for analyzing reaction kinetics data. **(08)**