## **GUJARAT TECHNOLOGICAL UNIVERSITY BE – SEMESTER – V (NEW) EXAMINATION – WINTER 2015**

	t Code: 2150403 Date:08/12/2018 t Name: Basics of Reaction Engineering	ate:08/12/2015 Fotal Marks: 70	
Ins	1 2	<ul> <li>Attempt all questions.</li> <li>Make suitable assumptions wherever necessary.</li> <li>Figures to the right indicate full marks.</li> </ul>	
Q.1	(a) (b)	Classify chemical reactions and discuss the variables affecting the rate of reaction. Define and explain the following terms: i) Order of reaction ii) Elementary and non-elementary reactions iii) Activation energy iv) Single and multiple reactions	07 07
Q.2	(a) (b)	Derive the integrated rate expressions for first order and second order $(2A \rightarrow products)$ irreversible reactions. Derive the $C_{Rmax}$ and $t_{Rmax}$ for the first order reactions given below: $A \rightarrow R \rightarrow S$	07 07
		OR	
	( <b>b</b> )	Define autocatalytic reactions. Derive an expression to find its kinetics. Explain plots of rate of reaction Vs. time and concentration Vs. time.	07
Q.3	(a)	Write a short note on temperature dependency of reaction rate constant from Arrhenius law. Compare the same with transition state and collision theories.	07
	(b)	The rate constant of a reaction measured at different temperatures is reported below. Calculate the activation Energy and frequency factor for this reaction.	07
Q.3	<b>(a)</b>	Explain differential and integral method of analysis with their merits and demerits.	07
	(b)	In a batch reactor the conversion of a liquid reactant A is 70% in 13 min. Find the space time required to effect this conversion in a plug flow reactor and in a mixed flow reactor. Assume first order kinetics.	07
Q.4	(a) (b)	Derive performance equation of recycle reactors. Derive an equation for equal-size mixed flow reactors connected in series for first order reaction.	07 07
		OR	
Q.4	(a)	A first order reaction is to be treated in a series of two CSTR. Show that the total volume of the two reactors is minimum when the reactors are equal in size.	07
	(b)	A two-liquid reactant stream with $C_{Ao} = 1$ mol/lit is passing through two mixed flow reactors in series. The concentration of A in the exit stream from the first reactor is 0.5 mol/lit. Find the concentration of A in the exit stream of the second reactor. The reaction $A \rightarrow R$ follows second order kinetics and $V_2/V_1 = 2$ .	07

- Q.5 (a) Explain quantitative product distribution for mixed flow reactors for the reaction 07  $A \rightarrow R \rightarrow S$ . 07
  - (b) Write a short note on Optimum Temperature Progression profile.

- Q.5 (a) State the quantitative treatment method of product distribution for reactions in 07 parallel.
  - (b) Define space time and space velocity. Derive the design equation of steady-state 07 mixed flow reactor.

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