GUJARAT TECHNOLOGICAL UNIVERSITY BE - SEMESTER-VII(OLD) • EXAMINATION – WINTER 2016

Subject Code: 170501 Date: 29/11/20 Subject Name: Chemical Reaction Engineering-I			
Ti	me: 10 struction	0:30 AM to 01:00 PM Total Marks: 70	
	1. 2. 3.	Attempt all questions. Make suitable assumptions wherever necessary. Figures to the right indicate full marks.	
Q.1	(a)	Define and explain the following terms. i) Order of reaction (ii) Elementary and non-elementary reactions iii) molecularity iv) Single and multiple reactions v) Space time (vi) Space velocity	07
	(b)	Explain the Arrhenius theory of temperature dependency. How activation energy affects temperature sensitivity of reaction.	07
Q.2	(a)	What are the different ideal reactors? Derive the performance equation of ideal Mixed Flow Reactor	07
	(b)	Explain reaction of shifting orders. Derive expression to determine its kinetics.	07
	(b)	Explain Autocatalytic reactions. Derive expression to determine its kinetics.	07
Q.3	(a)	Find the first order rate constant for the disappearance of A in the gas phase reaction $2A \rightarrow R$. if on holding the pressure constant, the volume of the reaction mixture starting with 80 % of A decreases by 20% in 3 minutes.	07
	(b)	Derive the expression for A+B \rightarrow P by applying integral method of analysis. Rate expression is represented by $-r_A = kC_A^2$	07
Q.3	(a)	The decomposition of sulfurile chloride to sulfur dioxide and chlorine is carried out in closed vessel (Batch reactor) for 60 minutes at 610 0F. Calculate the time required to decompose 95% of sulfurile chloride, when the reaction proceeds according to first order reaction and the reverse reaction is negligible. The specific reaction rate constant at 610^{0} E is 0.00132 per minute	07
	(b)	Describe qualitative discussion about product distribution for reactions in parallel.	07
Q.4	(a) (b)	Define Recycle ratio R and derive the performance equation for recycle reactor. Write short note on half life method to determine kinetics of reaction.	07 07
Q.4	(a)	What do you understand by instantaneous fractional yield and overall fractional yield of a product? Explain different contacting patterns for different concentration of reactant for non-continuous operations.	07
	(b)	A two liquid reactant for holf-continuous operations. A two liquid reactant stream with $C_{A0} = 1 \text{ mol/L}$ passing through two mixed flow reactors in series. The concentration of A in the exit stream from the first reactor is 0.5 mol/L. 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)	An aqueous feed of A and B (400 liter/min, 100milimol A/liter, 200 milimol B/liter) is to be converted to product in a plug flow reactor. The kinetics of the reaction is represented by $A + B \rightarrow R$, $-rA=200C_AC_B$ mol/lit*min. Find the	07

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

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	(b)	Write short note on differential method and integral method of analysis	07
		OR	
Q.5	(a)	Write a short note on optimum temperature progression.	07
	(b)	Explain the size comparison of single ideal CSTR with PFR and mention the	07
		different parameter affecting the sizes of the reactor.	
