Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER 2012

Subject code: 713001N Date: 08-01-2013

Subject Name: Advance Reactor Design

Time: 02.30 pm – 05.00 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)**	Give industrial examples of reactions in parallel and reactions in series.	**07**
	(b)	Discuss interstate cooling for exothermic reactors.	**07**
Q.2	**(a)**	(i) Derive design equation for CSTR operating at steady state when X, v_0, CAo, and F_{Ao} are specified. (ii) In CSTR if variables V, v_0, CAo, and F_{Ao} are specified, find the temperature and conversion at which CSTR will operate stable.	**07**
	(b)	Discuss Design equation for semi batch reactor with heat exchanger.	**07**
		OR	
	(b)	Obtain the expression for τ_{max} and C_{Bmax} for the reaction, $A \longrightarrow B \longrightarrow C$, in a PFR.	**07**
Q.3		An exothermic irreversible first order reaction A B, is carried out in an adiabatic batch reactor. The production rate of B is 100 kg/hr. Determine the volume of the reactor needed for adiabatic operation. If isothermal operation is carried out at 120°C, find the size. Data: Reaction rate constant at 120°C = 0.017 min^{-1} Activation Energy = 30000 cal/gmmole Heat of Reaction – 100 cal/g M.W. = 300 Heat Capacity of A & B = 0.75 cal/g°C Density of reaction mixture = 1000 kg/m^3 Reactor filling & draining time = 30 min Final conversion = 95% Temperature of feed = 1200°C Temperature dependence on rate constant: $k = 2.5 \times 10^{14} e^{-15000/T}$	**14**
		OR	
Q.3	**(a)**	Write the steps to design the CSTR for non-isothermal operation for first order irreversible liquid phase reaction.	**07**
	(b)	For First Order Reaction and First Order decay Rate, Derive conversion equation for Moving Bed Reactor.	**07**
Q.4	**(a)**	Derive the equation for thickness of the film by vapour deposition in a LPCVD. Show how the deposition thickness varies along the length of the reactor.	**07**
	(b)	Discuss: Bubble Column Reactor.	**07**
		OR	
Q.4	**(a)**	With reference to multiple-steady state encountered in exothermic reaction, discuss ignition-extinction curve.	**07**
	(b)	Discuss the stability of a CSTR handling exothermic reactions.	**07**
Q.5	**(a)**	Derive the rate equation for slurry reactor.	**07**
	(b)	Discuss Mass Balance and Design equation of Bio reactor.	**07**
		OR	
Q.5	**(a)**	Discuss: Fluidized bed reactor.	**07**
	(b)	Discuss Rate Laws and Stoichiometry of Bio reactor.	**07**

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