Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject code: 711602N **Date: 09-01-2013**

Subject Name: Advance Kinetics and Reaction Engineering

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.**
4. **All notations have conventional meaning.**

Q.1	**(a)**	Derive relationship for unreacted core model of spherical particles of unchanging size between time, radius and conversion for diffusion through ash layer control	**07**
	(b)	Derive Tanks in series model for non ideal flow	**07**
Q.2	**(a)**	Derive rate equation for slow fluid-fluid reaction	**07**
	(b)	Discuss determination of rate controlling step for fluid particle reactions	**07**
		OR	
	(b)	On doubling the particle size from R to 2R, the time needed for conversion of particles triples. Determine the contribution of ash diffusion to overall resistance for particles of size (i) R and (ii) 2R. Neglect gas film resistance.	**07**
Q.3	**(a)**	Develop performance equation for a fluidized bed reactor	**07**
	(b)	With neat diagram explain schemes for avoiding serious bypassing in beds with large bubbles in case of fluidised bed reactor	**07**
		OR	
Q.3	**(a)**	Derive equation for evaluating conversion in a Moving bed reactor	**07**
	(b)	Evaluate conversion in a fluidized bed reactor having following details Length of reactor = 210 cm u_0 = 25 cm/sec Rate constant = 1.32 sec^{-1} u_{mf} = 3.75 cm/s $\varepsilon_{mf} = \varepsilon_m = 0.5$ Diffusivity = 0.22 cm^2/sec $\alpha = 0.35$ Bubble diameter = 8 cm	**07**
Q.4	**(a)**	Discuss design criteria for Bubble column reactor	**07**
	(b)	Discuss slurry reaction kinetics with mathematical derivation.	**07**
		OR	
Q.4	**(a)**	For a trickle bed reactor discuss flow regimes in detail	**07**
	(b)	Compare bubble column reactor with agitated vessel type reactor	**07**
Q.5	**(a)**	Write a brief note on different types of loop reactors used in chemical industry.	**07**
	(b)	Discuss briefly about Monolithic reactors	**07**
		OR	
Q.5	**(a)**	Discuss in detail formulation of chemical reactor optimization problem.	**07**
	(b)	Write a short note on 'Bioreactors' and also describe about mass balances in a bioreactor	**07**

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