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GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2017

Subject Code: 2170501 **Date: 02/11/2017**

Subject Name: Chemical Reaction Engineering - II

Time: 10:30 AM TO 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

MARKS

Q.1 **(a)** Define the factors required to formulate contacting patterns. **03**

(b) Prove that degree of segregation does not have any effect on the conversion for first order reaction in CSTR. **04**

(c) The tabulated data represent a continuous response to pulse input into a closed vessel which is to be used as chemical reaction. Calculate the mean residence time of fluid in the vessel and tabulate and construct E curve. Determine the fraction of material leaving the vessel that has spent between 10 and 15 min in the vessel. **07**

t, min	0	5	10	15	20	25	30	35
Cpulse, gm/l	0	3	5	5	4	2	1	0

Q.2 **(a)** Discuss the factors to consider in selecting contactors for fluid- fluid reactions. **03**

(b) Explain the enhancement factor and Hatta modulus. **04**

(c) Discuss with diagrams various contacting patterns for two phase system. **07**

OR

(c) Describe all eight cases for mass transfer and reaction for fluid-fluid reactions with neat sketch **07**

Q.3 **(a)** Give some industrial examples of fluid particle reactions. **03**

(b) Describe Progressive Conversion Model (PCM) with appropriate diagram. **04**

(c) Derive the expression for fractional conversion for the reaction between solid and fluid when particles of solid are changing in size and Diffusion through Gas film controls. **07**

OR

Q.3 **(a)** Discuss the limitation of Shrinking Core Model. **03**

(b) Discuss the effects of temperature, time and particle size on determination of rate controlling step for fluid particle reactions. **04**

(c) Spherical particles of Znic blends of size R=1 mm are roasted in an 8% oxygen stream at 900°C and 1 atm. The stoichiometry of the reaction is **07**

$$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$$

Assuming that reaction proceeds by the shrinking core model calculate the time needed for complete conversion of a particle and the relative resistance of ash layer diffusion during this operation. Film resistance can safely be neglected as long as a growing ash layer is present.

Data:
Density of solid ρ_B =4.13 gm/cm^3
Reaction rate constant k" =2 cm/sec
For gases in the ZnO layer $\check{D}_e$= 0.08 cm^2/sec

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Q.4	**(a)**	Describe the physical properties of catalyst.	**03**
	(b)	Explain catalyst promoters. Catalyst inhibitors, Catalyst poisons, molecular sieves.	**04**
	(c)	Discuss various industrial catalytic reactors.	**07**

OR

Q.4	**(a)**	Discuss classification of catalyst.	**03**
	(b)	Write short notes on Tank in series model for the non Ideal Reactor.	**04**
	(c)	Give merits and Demerits of fixed bed and fluidized bed reactor.	**07**
Q.5	**(a)**	Determine the amount of catalyst needed in a packed bed reactor with a very large recycle rate for 35% conversion of A to R for a feed rate of 2000 mol/hr of pure A at 3.2 atm and 117°C. The reaction at given temperature is A→4R. Assume mixed flow reaction.	**03**
	(b)	Discuss in detail deviations from ideal flow pattern with examples.	**04**
	(c)	Explain various experimental methods for finding reaction rates	**07**

OR

Q.5	**(a)**	Explain difference between activity and selectivity of catalyst.	**03**
	(b)	Explain the mechanism of solid catalysed reactions.	**04**
	(c)	Discuss heat effects during solid catalysed reactions.	**07**

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