

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

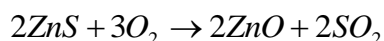
- Q.1** (a) Define the factors required to formulate contacting patterns. **03**
- (b) Prove that degree of segregation does not have any effect on the conversion for first order reaction in CSTR. **04**
- (c) The tabulated data represent a continuous response to pulse input into a closed vessel which 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 Zinc 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**



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 $\rho_B = 4.13 \text{ gm/cm}^3$

Reaction rate constant $k'' = 2 \text{ cm/sec}$

For gases in the ZnO layer $\check{D}_e = 0.08 \text{ cm}^2/\text{sec}$

- 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. **03**
 The reaction at given temperature is $A \rightarrow 4R$. Assume mixed flow reaction.
 (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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