

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

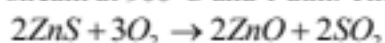
- Q.1** (a) Define the factors required to formulate contacting patterns. **03**
- (b) Prove that degree of segregation does not have any effect on the conversion for first order reaction in CSTR. **04**
- (c) The tabulated data represent a continuous response to pulse input into a closed vessel which 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
C_{pulse}, 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 $\tilde{D}_c = 0.08 \text{ cm}^2/\text{sec}$



- 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
