

GUJARAT TECHNOLOGICAL UNIVERSITY
BE – SEMESTER – VIII EXAMINATION – WINTER 2016

Subject Code: 180501**Date: 22/10/2016****Subject Name: Chemical Reaction Engineering II****Time: 02:30 PM to 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) Derive and discuss dispersion model for non-ideal flow. **07**
 (b) Discuss different parameters which are useful for determining rate controlling Step for fluid- Particle reaction. **07**
- Q.2** (a) In a uniform environment 4 mm solid particles are 87.5% converted to product in 5 min. The solids are unchanged in size during reaction and ash diffusion step is known to be rate controlling. What mean conversion is obtainable in a fluidized bed reactor operating with same environment but using feed consisting of equal mass of 2 mm and 1 mm particles? The mean residence time of solids in this reactor is 30 minutes. **07**
 (b) Discuss the reactors used for finding the rate for Catalytic reaction **07**
- OR**
- (b) Discuss briefly about different types of adsorption processes **07**
- Q.3** (a) Discuss various resistance encountered in slurry reaction with help of diagram **07**
 (b) Explain E, F and C curves with their relation. **07**
- OR**
- Q.3** (a) What is film conversion parameter? State various criteria of it which is used in the study of fluid-fluid reactions. **07**
 (b) Describe with diagram various contacting patterns for two phase reacting system **07**
- Q.4** (a) A sample of tracer is injected to get pulse response of reactor. The effluent concentration is measured with respect to time as per following table **07**
- | | | | | | | | | | | | | | |
|---------------------|---|---|---|---|---|----|---|---|---|---|-----|-----|-----|
| Time, min | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 14 |
| Concentration gm/cc | 0 | 1 | 1 | 5 | 8 | 10 | 8 | 6 | 4 | 3 | 2.2 | 1.5 | 0.6 |
- i) Construct C & E curves
 ii) Calculate average residence time.
 iii) If reaction is I order and $k = 0.307 \text{ min}^{-1}$, find conversion of real reactor.
- (b) Derive rate equation for fluid-fluid reaction. **07**
- OR**
- Q.4** (a) For kinetics of fluid-solid catalytical reaction, write about “Adsorption isotherm”. **07**
 (b) Discuss: Bubbling bed model for fluidized bed.

- Q.5 (a)** Reactant gas ($u_o = 0.3$ m/s, $V_o = 0.311$ m³/s) passes upward through a 2 m diameter fluidized bed ($u_{mf} = 0.028$ m/s, $E_{mf} = 0.48$) containing 7 tons of catalyst ($W = 7000$ kg, $\rho_s = 2100$ kg/m³). Reaction proceeds as follows:
 $A \longrightarrow R$ $-r''' = k'''C_A$, $k''' = 0.8$ m³gas/m³cat.s.
 Calculate the conversion of reactant if $C_{A0} = 100$ moles/m³, $\Delta = 20 \times 10^{-6}$ m²/s, $\alpha = 0.33$, $d_b = 0.16$ m
- (b)** Discuss about “Determination of Surface area for catalysts”

07

OR

- Q.5 (a)** What is effectiveness factor? Derive a relationship between effectiveness factor and Thiele Modulus
- (b)** Describe construction and working of Double Mixed Reactor.

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