

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Examination January 2010

Subject code: 711602

Subject Name: Advanced Kinetics & Reaction Engineering

Date: 22 / 01 / 2010

Time: 12.00 – 2.30 pm

Total Marks: 60

Instructions:

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

- Q.1** (a) Define and derive Dispersion model for Non ideal flow. **06**
 (b) For a fluid-solid reaction, derive relation for conversion for diffusion through Ash layer control in case of un reacted core model **06**

- Q.2** (a) Derive performance equation for Fluidized Bed reactor **06**
 (b) Discuss rate laws and stiochiometry for Bio reactors **06**

OR

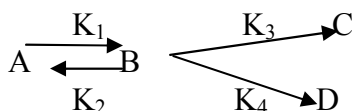
- (b) Derive relation for Dilution rate for (i) Wash out and (ii) Maximum rate of cell production in case of Bio reactor **06**

- Q.3** (a) Discuss in detail formulation of chemical reactor optimization problem **06**
 (b) A slurry reactor is used to study the kinetics of slurry reaction. The following results are obtained when liquid volume is 210 cm³. Assuming chemical step on catalyst surface as rapid. Develop rate equation for rate of reaction based on unit volume of slurry **06**

Run	Gas liquid interfacial area	gm-cat/cm ³ liquid	Rate based on interfacial area
1	10	0.1	10
2	10	0.4	22
3	45	0.09	2.5
4	45	0.45	10

OR

- Q.3** (a) Discuss determination of rate controlling step for fluid particle reactions in detail. **06**
 (b) The following reaction mechanism takes place in a well stirred batch reactor. **06**



For the following initial concentration and values of reaction rates

$$C_{A0} = 75 \text{ gmol/lit} \quad K_1 = 0.031 \text{ min}^{-1}$$

$$C_{B0} = 7 \text{ gmol/lit} \quad K_2 = 0.015 \text{ min}^{-1}$$

$$C_{C0} = 0 \text{ gmol/lit} \quad K_3 = 0.003 \text{ min}^{-1}$$

$$C_{D0} = 0 \text{ gmol/lit} \quad K_4 = 0.01 \text{ min}^{-1}$$

Estimate the optimal residence time to yield maximum value of C_B

- Q.4 (a)** Discuss working of trickle bed reactor with a neat sketch **06**
(b) Discuss various factors affecting operation of Bubble Column reactor **06**
OR
- Q.4 (a)** For trickle bed reactor write briefly about **06**
(i) Liquid side mass transfer (ii) Liquid solid mass transfer
(b) Discuss design criteria for Bubble column reactor **06**
- Q.5 (a)** Write a brief Note on “ Loop Reactors” **06**
(b) Derive rate equation for instantaneous fluid-fluid reaction **06**
OR
- Q.5 (a)** Derive equation for conversion for a Moving Bed reactor **06**
(b) Write a brief note on “Monolithic reactors”. **06**
