

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – I • EXAMINATION – WINTER 2012****Subject code: 711602N****Date: 09-01-2013****Subject Name: Advance Kinetics and Reaction Engineering****Time: 02.30 pm – 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.
4. All notations have conventional meaning.

Q.1 (a) Derive relationship for unreacted core model of spherical particles of unchanging size between time, radius and conversion for diffusion through ash layer control **07**

(b) Derive Tanks in series model for non ideal flow **07**

Q.2 (a) Derive rate equation for slow fluid-fluid reaction **07**

(b) Discuss determination of rate controlling step for fluid particle reactions **07**

OR

(b) On doubling the particle size from R to $2R$, the time needed for conversion of particles triples. Determine the contribution of ash diffusion to overall resistance for particles of size (i) R and (ii) $2R$. Neglect gas film resistance. **07**

Q.3 (a) Develop performance equation for a fluidized bed reactor **07**

(b) With neat diagram explain schemes for avoiding serious bypassing in beds with large bubbles in case of fluidised bed reactor **07**

OR

Q.3 (a) Derive equation for evaluating conversion in a Moving bed reactor **07**

(b) Evaluate conversion in a fluidized bed reactor having following details **07**

Length of reactor = 210 cm $u_0 = 25$ cm/sec

Rate constant = 1.32 sec^{-1} $u_{mf} = 3.75$ cm/s

$\epsilon_{mf} = \epsilon_m = 0.5$ Diffusivity = $0.22 \text{ cm}^2/\text{sec}$

$\alpha = 0.35$ Bubble diameter = 8 cm

Q.4 (a) Discuss design criteria for Bubble column reactor **07**

(b) Discuss slurry reaction kinetics with mathematical derivation. **07**

OR

Q.4 (a) For a trickle bed reactor discuss flow regimes in detail **07**

(b) Compare bubble column reactor with agitated vessel type reactor **07**

Q.5 (a) Write a brief note on different types of loop reactors used in chemical industry. **07**

(b) Discuss briefly about Monolithic reactors **07**

OR

Q.5 (a) Discuss in detail formulation of chemical reactor optimization problem. **07**

(b) Write a short note on 'Bioreactors' and also describe about mass balances in a bioreactor **07**
