Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. - SEMESTER – VIII EXAMINATION – OCTOBER 2012

Subject code: 180501 **Date: 27/10/2012**

Subject Name: Chemical Reaction Engineering-II

Time: 02.30pm - 05.00pm **Total Marks: 70**

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **All notations have conventional meaning.**

Q.1 **(a)** Define E, F, & C curves and derive relation between them. **07**

(b) The concentration readings given in the following table represent a continuous response to a pulse input into a closed vessel, which is to be used as a chemical reactor. Calculate mean residence time of fluid in the vessel and tabulate and plot the exit age distribution 'E' **07**

Time min	0	5	10	15	20	25	30	35
Concentration , gm/lit	0	3	5	5	4	2	1	0

Q.2 **(a)** Discuss with diagram various contacting pattern in two phase system **07**

(b) Explain linear and non- linear process with examples **07**

OR

(b) Discuss fitting dispersion model for small and large extent of dispersion. **07**

Q.3 **(a)** For a chemical reaction control fluid particle reaction, derive relation for time required for conversion for unreacted core model for spherical particles of unchanging size. Also find time required for complete conversion. **07**

(b) Calculate the time needed to burn to completion the particles of graphite (diameter of particle=12 mm, ρ_B= 2.2 gm/cm^3, k_s= 25 cm/sec) in an 10% oxygen stream. For the higher gas velocity used assume that film diffusion does not offer any resistance to transfer and reaction. The reaction temperature is 900°C. **07**

OR

Q.3 **(a)** Discuss in detail different models for fluid particle reactions. **07**

(b) A feed consisting of 30% of 50 micron radius particles, 40% of 100 micron radius particles and 30% of 200 micron radius particles is to be reacted in a fluidized bed steady state reactor. The fluidizing gas is a gas phase reactant and at planned operating conditions the time required for complete conversion is 5, 10 and 20 min respectively for 3 sizes of feed. Find the conversion of solids in the reactor for feed rate of 1 kg solids/min if the bed contains 10 kg of solids. A cyclone separator is used to separate and return to the bed any solids that may be entrained by gas. **07**

Q.4 **(a)** Derive rate expression for instantaneous fluid-fluid reaction **07**

(b) Carbon dioxide is to be removed from air by counter current contact with water at 25^oC. **07**

i) Estimate the relative resistances of gas and liquid Films for this operation.

ii) What simplest form of rate equation would you use for tower design?

Data: From literature for CO_2 between air and water

$k_g a = 0.8$ mol/h.m^3.Pa

$k_l a = 25$ h^{-1}

H = 3000 (Pa.m^3)/mol

OR

Q.4 **(a)** Discuss in brief about slurry reaction kinetics **07**

(b) Write about following: **07**

i) Film conversion parameter

ii) Clues to kinetic regimes from solubility data

Q.5 **(a)** Discuss about determination of surface area for catalysts **07**

(b) Write a short note on Experimental methods of finding rates for solid catalyzed reactions **07**

OR

Q.5 **(a)** Describe briefly about Catalyst: Promoters, Inhibitors and poisons. **07**

(b) Write a brief note on 'Heat transfer and mixing in fluidized bed reactor'. **07**

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