SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

ROLL No: | | | | | | | | | | | | Total number of pages:[2]

Chemical Reaction Engg.-II

Subject Code: BTCH- 602A/601(RG | RP)

Paper ID : M|18

Batch: 2015 onwards

Time allowed: 3 Hrs **Max Marks: 60**

Important Instructions:

- **All questions are compulsory**
- **Assume any missing data**
- **Additional instructions, if any**

PART A (10x 2marks)

Q1. Short-Answer Questions:

(a) What is the basic difference between homogenous & heterogeneous reactions?
(b) What are Catalyst Promoters & Inhibitors?
(c) What are Supported catalyst?
(d) What is Dissociative Adsorption?
(e) What are the limitation of Shrinking Core Model.
(f)What do you mean by the term 'Enhancement factor'?
(g) What is Thiele Modulus MT for Solid- Catalyzed reactions?
(h)What do you mean by Film Conversion parameter M_H.
(i) How to apply the Surface Renewal theory for fluid-fluid reactions?
(j) What are the various resistances to diffusion in Slurry reaction kinetics?

PART B (5×8marks)

Q. 2. Discuss methods of preparation for catalysts with examples. Discuss in detail the methods for determination of surface area and void volume for catalysts. CO1

OR

Differentiate between Physical Adsorption and Chemisorption. List out all the assumptions and derive Langmuir adsorption isotherm equation for catalytic reaction. Also discuss the significance for failure of Langmuir model and necessary modification. CO1

Q. 3. Discuss various steps involved in reaction of shrinking spherical particles. Also derive the relation between time and conversion of solid for low gas velocity, if diffusion through gas film controls where small particles are in the Stokes regime. CO2

OR

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. Discuss the effects of temperature, time and particle size on determination of rate controlling step for fluid particle reactions. CO2

Q. 4. Calculate the amount of catalyst needed in a packed bed reactor to achieve 80% conversion of 1000m3/h of pure gaseous A (C_{A0} = 100 mol/m3) for CO1

(i) $A \rightarrow R$, $-r_A' = \frac{50\, C_A}{1+0.02\, C_A} \frac{mol}{h.kgCat}$

(ii) $A \rightarrow R$, $-r_A' = 8\, C_A^2 \frac{mol}{h.kg\ Cat}$

OR

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. The reaction at given temperature is $A \rightarrow 4R$. Assume mixed flow reaction. CO1

Q. 5. Discuss with diagrams various contacting patterns for two phase system. Describe all eight cases for mass transfer and reaction for fluid-fluid reactions with neat sketch CO3

OR

Air with gaseous A bubbles through a tank containing aqueous B. Reaction occurs as follows: CO3

$A\ (g \rightarrow l) + B(l) \rightarrow R(l)$, $-r_A = kC_AC_B$

$k = 10^6 m^3/mol.hr$

For this system

$k_{Ag}\, a = 0.10\ mol/hr.m^3.Pa$, $f_l = 0.01\ m^3 liquid / m^3 reactor$

$k_{Al}\, a = 100\ m^3 liquid/m^3 reactor .hr$, $H_A = 10^4 Pa.\ m^3/mol$

$D_{Al} = D_{Bl} = 10^{-6} m^2/hr$, $a = 100\ m^2/m^3$

For a point in the absorber-reactor where

$P_A = 100$ Pa and $C_B = 100\ mol/m^3$

(a) Locate the resistance to reaction

(b) Calculate the rate of reaction (mol/m^3hr).

Q. 6. Describe along with a neat sketch the detailed design of a fixed bed reactor and a fluidized bed reactor. Give merits and Demerits of fixed bed and fluidized bed reactor. CO4

OR

Discuss Hydrodynamic flow models for the bubbling fluidized bed. Also, write a brief note on 'Heat transfer and mixing in fluidized bed reactor.' CO4