B.Tech. Sem VI (Chemical 2014 Course (CBCS) : SUMMER - 2019
SUBJECT : CHEMICAL REACTION ENGINEERING – II

Day : Monday | S-2019-2707 | Time : 02.30 PM TO 5:30 P.M
Date : 27/05/2019 | Max. Marks : 60

N. B. :

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Draw neat and labeled diagram **WHEREVER** necessary.
4) Assume suitable data, if necessary.

Q. 1 A feed consisting of **(10)**
30 % of 50 μm radius particles
40 % of 100 μm radius particles
30 % of 200 μm radius particles
is to be reacted in a fluidized bed steady state flow reactor constructed from a vertical 2-m long 20 cm ID pipe. The fluidizing gas is the gas phase reactant, and at the planned operating conditions the time required for complete convention is 5, 10 and 20 minutes for the three sizes of feed. Find the conversion of solids in the reactor for a feed rate of 1 kg solids/min if the bed contains 10 kg of solids.

OR

a) Differentiate between progressive conversion model and unreacted core model. **(05)**

b) Illustrate steps involved in developing overall rate equation for heterogeneous reactions. **(05)**

Q. 2 The concentration of undesirable impurity in air $\left(at\ 1\ bar = 10^5\ Pa\right)$ is to be reduced from 0.2 % to 0.03 % by absorption in pure water. Find the height of tower required for counter current operation. **(10)**

$Data\ \ K_{A_g}a = 0.32\ mol/hr.m^3\ Pa$

$K_{A_l}a = 0.1/hr$

The solubility of A in water is given by: $H_A = 12.5\ Pa.m^3/mol.$

$L = 7 \times 10^5\ mol/hr.m^3$

$G = 1 \times 10^5\ mol/hr.m^3, \qquad C_T = 56000\ mol/m^3$

OR

The concentration of undesirable impurity in air $\left(at\ 1\ bar = 10^5\ Pa\right)$ is to be reduced from 0.2 % to 0.03 % by using high concentration reactant 700 mol/m^3. Material B reacts with A extremely rapidly **(10)**

$A(g) + B(l) \rightarrow P(l) \qquad K = \infty$

Assume that the diffusivities of A and B in water are the same $K_{Al} = K_{Bl} = K_l$.

$Data\ \ K_{A_g}a = 0.32\ mol/hr.m^3\ Pa$

$K_{A_l}a = 0.1/hr$

The solubility of A in water is given by:

$H_A = 12.5\ Pa.m^3/mol.$

$L = 5 \times 10^5\ mol/hr.m^3$

$G = 2 \times 10^5\ mol/hr.m^3, \qquad C_T = 56000\ mol/m^3$

P. T. O.

Q. 3 **a)** Illustrate Langmuir adsorption isotherm. **(06)**

b) Give mechanism of catalytic reactions. **(04)**

OR

a) Write a detail note on catalyst preparation. **(06)**

b) Give reasons for catalyst deactivation. **(04)**

Q. 4 Discuss experimental methods for finding rates for heterogeneous reactions. **(10)**

OR

Elaborate: **(10)**

i) Film resistance

ii) Pore resistance

Q. 5 Derive the relation for pore diffusion resistance combined with surface kinetics for single cylindrical pore. **(10)**

OR

Explain the following terms: **(10)**

i) Internal effectiveness factor

ii) Overall effectiveness factor

iii) Mass transfer and reaction in packed bed

Q. 6 **a)** Give relationship between E, F and C curve. **(06)**

b) Explain step experiment for determining RTD. **(04)**

OR

Discuss role of RTD in determining reactor behaviour. **(10)**

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