BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE)
B.Tech.Sem - VI CHEMICAL : WINTER- 2022
SUBJECT : CHEMICAL REACTION ENGINEERING-II

Day : Monday | Time : 10:00 AM-01:00 PM

Date : 28-11-2022 | **W-13510-2022** | Max. Marks : 60

N.B.

1) All Questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Assume suitable data if necessary.
4) Use of none-Programmable calculator is allowed.
5) Draw neat and labeled diagrams wherever necessary.

Q.1 **a)** Draw ideal contacting patterns for two flowing fluids. **(04)**

b) Derive the relation for diffusion through chemical reaction controls for spherical particles of unchanging size. **(06)**

OR

An ore of uniform size particles is to be roasted in a fluidized bed reactor. The time required for complete conversion of solid particles is 20 minutes and the mean residence time of particles in the bed is 48 minutes. The solids remain unchanged in size during reaction. Calculate the fraction of the original ore remaining unconverted assuming **(10)**

i) Chemical Reaction step as rate controlling
ii) Ash diffusion as rate controlling

Q.2 **a)** Draw concentration profile for mass transfer with chemical reaction. **(04)**

b) Dilute A diffuses through a stagnant liquid film onto a plane surface of solid B. On this surface, A and B react to yield liquid product R which then diffuses back through the film into the main liquid stream. Develop the overall rate expression for the L/S reaction. **(06)**

OR

We plan to remove 95% of the reactant present in a gas stream by absorption in water. Find the height of tower required for countercurrent operation. **(10)**

Data : For gas stream

F_g= 800 mol/hr at $\pi = 10^5$ Pa

$p_{A\,in}$= 1000 Pa

p_{Aout} = 100 Pa

For the packed bed

F_l= 80,0000 mol/hr

k_{gA}= 0.36 mol /(hr.m^3 Pa)

k_{lA}= 72 /hr

Molar density of liquid under all conditions is = C_T= 55556 mol/m^3

H_A= 17(Pa .m^3)/mol

k=0 m^3/ (mol.h)

Q.3 a) Discuss Langmuir adsorption isotherm. **(05)**

b) Give various methods for preparation of catalyst. **(05)**

OR

a) Give reasons for deactivation of catalyst **(05)**

b) Illustrate importance of adsorption isotherm **(05)**

P.T.O.

Q.4 How much catalyst is needed in a packed bed reactor with very large recycle ratio (assume mixed flow) for 35% conversion of 2000mol/hr of pure gaseous A at 3.2 atm and 117^0C if the stoichiometry and rate are given by **(10)**

$A \rightarrow 4\,R \quad , -r'_A = 96.55\ l/(h.kg\ cat)\ C_A$

OR

How much catalyst is needed in a packed bed reactor with very large recycle ratio (assume plug flow) for 30% conversion of 3000mol/hr of pure gaseous A at 3.2 atm and 117^0C if the stoichiometry and rate are given by

$A \rightarrow 4\,R \quad , -r'_A = 96.55\ l/(h.kg\ cat)\ C_A$

Q.5 Derive the relation for rate of diffusion through single cylindrical pore. **(10)**

OR

Discuss on

i) Thiele modulus
ii) Design aspects of fluidized bed

Q.6 Discuss on " Role of RTD in determining non ideal behavior " **(10)**

OR

Give experimental methods for finding residence time distribution for non-ideal behavior of fluid.

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