BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE)

B.Tech.Sem - VI CHEMICAL :SUMMER- 2022

SUBJECT : CHEMICAL REACTION ENGINEERING-II

Day : Friday | Time : 02:30 PM-05:30 PM

Date : 17-06-2022 | **S-13510-2022** | Max. Marks : 60

N.B.

1) All questions are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable calculator is allowed.

Q.1 **a)** Differentiate between progressive conversion model and unreacted core model. **(03)**

b) On doubling the particle size from R to 2R, the time for complete conversion triples. What is the contribution of ash diffusion to the overall resistance for particles of size R. **(07)**

OR

Solids of unchanging size, R = 0.3 mm are reacted with gas in a steady flow bench scale fluidized reactor with the following result, **(10)**

$F_0 = 10 gm/\sec. \; W = 1000\,\text{gm}, \overline{X}_B = 0.75$

Also, the conversion is strongly temperature sensitive suggesting that the reaction step is rate-controlling. Design a commercial sized fluidized bed reactor (find W) to treat 4 metric tons/hr of solid feed of size R = 0.3 mm to 98% conversion.

Q.2 Derive the rate equation for instantaneous reaction with respect to mass transfer. **(10)**

OR

The concentration of undesirable impurity in air (at 1 bar = 10^5 Pa) is to be reduced from 0.1% to 0.02% by absorption in pure water. Find the height of tower required for counter current operations.

Data: $k_{Ag}a = 0.32\,mol/\text{hr}.m^3.Pa$

$k_{Al}a = 0.1/\text{hr}$

The solubility of A in water is given by Henry's law constant.

H_A = 12.5 Pa.m^3/mol.

The flow rates per meter squared cross section of tower are

$F_g / A_{cs} = 1\times10^5\,mol/hr.m^2$, $F_l / Acs = 7\times10^5\,mol/hr.m^2$.

The molar density of liquid under all conditions if C_T = 56000 mol/m^3.

Q.3 **a)** Elaborate in detail Langmuir adsorption isotherm. **(05)**

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

OR

Elaborate with cumene adsorption synthesizing a rate law rate limiting step.

Q.4 What are experimental methods for finding rates? Give rate equation for each method. **(10)**

P.T.O.

OR

Give design considerations of fixed bed reactor. **(10)**

Q.5 Derive the rate equation for diffusion and reaction in spherical catalyst pellet. **(10)**

OR

a) Illustrate mass transfer and reaction in packed bed.

b) Chemical vapor decomposition.

Q.6 Elaborate on "Role of RTD in determining reactor behaviour." Give examples. **(10)**

OR

Illustrate relationship between E, F and C curve. Give details of pulse experiment.

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