CBCS SCHEME

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18CH61

Sixth Semester B.E. Degree Examination, July/August 2022
Chemical Reaction Engineering – II

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. What are the main causes for the non-ideal behavior in the reactor. **(05 Marks)**

b. The following table gives the concentration-time data for delta function into the closed vessel. The rate of decomposition is given by $-r_A = KC_A$ …. $K = 0.307min^{-1}$.
Find the fraction of material converted using:
i) Non ideal reactor ii) Ideal PFR iii) Ideal CSTR.

t, min	0	5	10	15	20	25	30	35
c, g/l	0	3	5	5	4	2	1	0

(15 Marks)

OR

2 a. Derive the equation for disperssion model. Explain the significance of disperssion number. **(12 Marks)**

b. What is stimulus response technique? Explain various inputs used in the study of non-ideal behavior. **(08 Marks)**

Module-2

3 a. Derive expression to find fractional conversion for a spherical particle of unchanging size, when diffusion through gas film controls the mechanism. **(14 Marks)**

b. A batch of spherical solids is treated by gas in a uniform environment. Solid is converted to a firm non-flaking product according to shrinking core model. The conversion is 87.5% in a reaction time of 1h and it is completed (100%) in 2hr. Determine the rate controlling mechanism. **(06 Marks)**

OR

4 a. Explain in detail the kinetic regims of liquid-liquid reaction. Write general form of equation. **(14 Marks)**

b. Write a note on Hatta number. **(06 Marks)**

Module-3

5 a. Explain any two methods for determining pore volume distribution. **(10 Marks)**

b. The following data are obtained at 70°C for equilibrium adsorption of m-hexane on silica gel particle:

Partial pressure of n-hexane	0.002	0.008	0.013	0.0156	0.0206
n-hexane adsorb gmol/cm^3	7.1×10^{-8}	2.8×10^{-7}	4×10^{-7}	5.5×10^{-7}	7.3188×10^{-7}

Determine whether this data fits Langmuir isotherm if so find $\overline{Cm}$ and K_C. **(10 Marks)**

OR

6 a. Derive an equation that relates the changing gas composition with time in Batch – Solids + Batch – fluid. **(12 Marks)**

b. Explain different mechanism for catalyst deactivation. **(08 Marks)**

Module-4

7 a. Discuss the heat effects in solid-catalysed reaction. **(05 Marks)**

b. Derive expression for solid catalysed reaction for pore diffusion resistance combined with surface kinetics for first order reaction. **(15 Marks)**

OR

8 a. Derive equation for surface kinetics when surface reaction is rate controlling step. **(14 Marks)**

b. Explain heat effects during catalytic reaction. **(06 Marks)**

Module-5

9 a. Explain the experimental methods in determining rates in differential and integral reactor. **(12 Marks)**

b. The results of the kinetic runs on the reaction $A \rightarrow R$ made in an experimental packed bed reactor a fixed feed rate $F_{A_o} = 10\,\text{kmol/hr}$ are as follows:

w, Kg cat	1	2	3	4	5	6	7
X_A	0.12	0.20	0.27	0.33	0.37	0.41	0.44

Find the reaction rate at 40% conversion. **(08 Marks)**

OR

10 a. With neat sketch, explain and develop kinetic expression for slurry reactor. **(12 Marks)**

b. Write a note on packed bed reactor. **(08 Marks)**

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