BACHELOR OF TECHNOLOGY (C.B.C.S.) (2020 COURSE)
B.Tech.Sem - V CHEMICAL : WINTER- 2022
SUBJECT : HOMOGENEOUS REACTION ENGINEERING

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

Date : 8/12/2022 | **W-24449-2022** | Max. Marks : 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Assume suitable data if necessary.

Q.1 **a)** Illustrate molecularity and order of reaction. **(05)**

b) For a non-catalyzed reaction carried out at 40^0C, the activation energy is 75KJ/mol. The activation energy of the same reaction carried out in presence of catalyst is 55KJ/mol. Calculate the ratio of the rate constants of the catalyzed and non-catalyzed reactions. **(05)**

OR

Q.1 **a)** In fermentation of sucrose 0.13 M solution of sucrose is reduced to 0.065M in 560 minutes and to 0.0325 M in 1120 minutes. Estimate the order of reaction and the reaction rate constant. **(05)**

b) Illustrate Temperature dependency from Arrhenius law. **(05)**

Q.2 In the presence of a homogeneous catalyst of given concentration, aqueous reactant A is converted to product at the following rates and C_A alone determine this rate. **(10)**

C_A, mol/ lit	1	2	4	6	7	9	12
$-r_A$, mol/ lit hr	0.06	0.1	0.25	1.0	2.0	1.0	0.5

We plan to run this reaction in a batch reactor at the same catalyst concentrations as used in getting the above data. Find the time needed to lower the concentration of A from C_{A0} =10 mol/ lit to C_{Af} = 2 mol/ lit.

OR

Q.2 Find the first order rate constant for the disappearance of A in the gas reaction A→1.6 R if the volume of the reaction mixture, starting with pure A increases by 50% in 4 min. The total pressure within the system stays constant at 1.2 atm and the temperature is 25^0C. **(10)**

Q.3 Pure gaseous reactant $A\left(C_{A_0} = 100 \text{ milimol/liter}\right)$ is fed at a steady rate into a mixed flow reactor (V = 0.1 liter) where it dimerizes (2A → R). For different gas feed rates, the following data is obtained: **(10)**

Run number	1	2	3	4
v_o liter/hr	30.0	9.0	3.6	1.5
C_{Af}, milimol/ liter	85.7	66.7	50	33.4

Find a rate equation for this reaction.

OR

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Q.3 a) In an isothermal batch reactor 70% of a liquid reactant is converted in 13 min. What space time and space velocity are needed to effect this conversion in a plug flow reactor and in a mixed flow reactor. **(06)**

b) Derive performance equation for batch reactor. **(04)**

Q.4 A radioactive fluid having half-life 23.5 hrs is to be treated by passing it through two ideal CSTRs arranged in series. The volumetric flow rate of radioactive fluid is 125 liters/ hr. The volume of each reactor is 48000 liters. Calculate the concentration decrease of radioactive fluid in passing through the reactor system. The reaction follows order mechanism. **(10)**

OR

Q.4 Elaborate with example "Best arrangement of a set of ideal reactors. **(10)**

Q.5 Illustrate qualitative discussion about product distribution for parallel reactions. **(10)**

OR

Q.5 Illustrate qualitative discussion about product discussion for series reactions. **(10)**

Q.6 a) Elaborate equilibrium constant from thermodynamics and equilibrium conversion. **(05)**

b) Give graphical design procedure to represent relationship of temperature, composition and rate for a single homogeneous reaction. **(05)**

OR

Q.6 Elaborate optimum temperature progression. **(10)**

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