1+2=8.

SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

ROLL No: | | | | | | | | | | | | | **Total number of pages:[3]**

B.Tech. || CHE || 5th Sem
CHEMICAL REACTION ENGG-1
Subject Code: BTCH-502A

May 2018
Reappear.
2015 Batch onwards

Time allowed: 3 Hrs **Max Marks: 60**

Important Instructions:

- **All questions are compulsory**
- **Assume any missing data**

PART A (10x 2marks)

Q. 1. Short-Answer Questions:

a) Distinguish between elementary and non- elementary reactions. Give e.gs of both.

b) What is integral method of analysis of reaction data?

c) State Arrhenius' Law. Give the significance of activation energy.

d) How would you compare PFR's and Mixed flow reactors?

e) What is the use of multiple reactors? Give one example.

f) What do you mean by the term "optimum temperature progression"? Elaborate.

g) How would you predict overall order of an irreversible reaction from half life?

h) What are homogeneous catalyzed reactions?

i) Define the terms overall fractional yield and instantaneous yield.

j) Briefly explain the difference between E and F – curves.

PART B (5×8marks)

Q 2. The aqueous phase reaction A $\longrightarrow$ R proceeds as follows:

t,sec	780	2080	3540	7200
x_A, %	11.2	25.7	36.7	55.2

Find the reaction rate constant and order of the reaction. Determine the time required for 50% conversion of A. Assume $C_{A_0} = 0.05$mol/lit. CO_1

OR

Following gas phase reaction takes place at 500°C CO_1

$$4PH_3(g) \longrightarrow P_4(g) + 6H_2(g)$$

With $r_{PH3} = 85\ hr^{-1} C_{PH3}$. Find the volume of the plug flow reactor operating at this temperature and

5.5 atm giving 80% conversion for a feed of 2.5 kg moles PH_3 per hour.

Q3 a. The activation energy of a bimolecular reaction is 9150cal/mol. How much faster is this reaction if it takes place at 500K than at 400K? CO_2

b. Decomposition of a gas is second order. When the initial conc. Of gas is 5×10^{-4} mol/l, it is 40% decomposed in 50 min. Calculate the value of rate constant.

OR

A+B $\longrightarrow$ C takes place in a two stage CSTR one of volume $100m^3$ and other $25m^3$. The volumetric feed rate is 20lit/min. $C_A = C_B$ = 1.5gm/lit and the overall rate constant is 0.010 lit/gm mol.min. Calculate the overall conversion. CO_2

Q4 Derive an expression for the concentration in the N-th reactor, if N equal sized stirred tank reactors are assembled in series. Assume first order reaction. Also compare the performance of N equal sized CSTR's in series with a PFR. CO_3

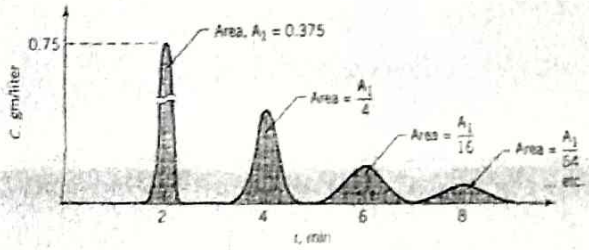
OR

What are Autocatalytic reactions? Compare the mixed flow and plug flow reactors for autocatalytic reactions, with and without recycle. CO_3

Q5 A large tank (860liters) is used as a gas-liquid contactor. Gas bubbles up through the vessel and out the top, liquid flows in at one part and out the other at 5 liters/min. To get an idea of the flow pattern of liquid in this tank a pulse of tracer (M=150gm)is injected at the liquid inlet and measured at the outlet ,as shown in Fig. below: CO_4

a. Find the liquid fraction in the vessel.

b. Determine the E curve for the liquid



OR

b. Determine the equilibrium conversion for the following elementary aqueous reaction between 0°C and 100 °C for reaction A $\longrightarrow$ R at 298 K , G°_{298}= -14130 J/mol , H°_{298} = -75300 J/mol , $Cp_A = Cp_R$ = constant. Construct a plot of temperature versus conversion. CO_4

Q6 (a) Derive a relationship between conversion and temperature for both adiabatic operations. CO_5

(b) What is a Recycle reactor? Derive an expression for optimum recycle ratio.

OR

(a) For the series reaction A $\xrightarrow{k_1}$ R $\xrightarrow{k_2}$ S . Determine the maximum concentration or w.r.t A and the time when it is reached.

(b) State the general rules for the most effective use of a given set of ideal reactors .