Paper Code: CH-402	**Roll No.**									

B.TECH
FOURTH SEMESTER EXAMINATION, 2015-16
CHEMICAL REACTION ENGINEERING-I

[Time: 3 Hours] **[Max. Marks: 100]**

Note: Attempt all questions. All questions carry equal marks. Assume suitable data if missing.

1. Attempt any four parts of the followings:- **[5x4=20]**

   (a) Define the rate of reaction for different kind of reaction systems.
   (b) What are the elementary and non-elementary reactions? Give examples also.
   (c) Define molecularity and order of reactions with suitable examples.
   (d) Discuss the temperature dependence of the equilibrium constant from thermodynamics point of view.
   (e) What is Arrhenius law? What is importance of activation energy in this law?
   (f) Derive kinetic expression for the irreversible unimolecular type first order reactions.

2. Attempt any four parts of the followings:- **[5x4=20]**

   (a) Explain the general procedure for analyzing the kinetic data by integral method of analysis.
   (b) Derive the kinetic expression for irreversible bimolecular type second order reactions.
   (c) A 10 minute experimental run shows that 75% of liquid reactant is converted to product by a half order rate. What would be the amount converted in a half hour run?
   (d) After 8 minute in a batch reactor, reactant (C_{A0}= 1mol/liter) is 80% converted; after 18 minute conversion is 90%. Find a rate equation to represent this reaction.
   (e) What are autocatalytic reactions? Derive the rate expression for autocatalytic reactions.
   (f) What are the salient features of a constant volume batch reactor? Give suitable examples also.

3. Attempt any two parts of the followings:- **[10x2=20]**

   (a) Derive the performance equation for ideal batch reactor and CSTR.

   (b) A homogeneous liquid phase reaction $A \rightarrow R$, $-r_A = k C_A^2$ takes place with 50% conversion in a mixed reactor ,
      (i) What will be the conversion if this reactor is replaced by one six times as large- all else remaining unchanged?
      (ii) What will be the conversion if the original reactor is replaced by a plug flow reactor of equal size- all else remaining unchanged?

   (c) The homogeneous gas decomposition of phosphine;

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

   Proceeds at 1200^0F with first order rate ($-r_{PH_3} = (10/hr)C_{PH_3}$). What size of plug flow reactor operating at 1200^0F and 4.6 atmcan produce 80% conversion of a feed consisting 4 lb-mol of pure phosphine per hour?

4. Attempt any two parts of the followings:- **[10x2=20]**

(a) Define the following terms:
   (i) Space time and space velocity
   (ii) Holding time and Residence time distribution (RTD)

(b) What is recycle reactor? Derive performance equation for the recycle reactor.

(c) Describe the E, F and C curve with the neat diagram.

5. Attempt any two parts of the followings:- **[10x2=20]**

(a) The concentration readings in Table:1 represents a continuous response to a delta function input into a closed vessel which is to be used as a chemical reactor. Tabulate and plot the exit age distribution E.

Table: 1

Time, t (min)	0	5	10	15	20	25	30	35
Tracer output concentration, (gm/liter)	0	3	5	5	4	2	1	0

(b) What do you understand from dispersion model and tanks in series model? Explain in detail. Write the name of the parameter which measures the extent of axial dispersion.

(c) Write short notes on any two of the following:
   (i) Optimum temperature progression
   (ii) Single and multiple reactions
   (iii) Half life time of a reaction.

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