DGG-003-011201   Seat No. _____

M. Sc. (Sem. II) (CBCS) Examination
April / May – 2015
IC - 201 : Industrial Chemistry
(Reaction Engineering)

Faculty Code : 003
Subject Code : 011201

Time : $2\frac{1}{2}$ Hours]   [Total Marks : **70**

Instructions:

1) All Questions are compulsory.
2) Each question carries 14 marks.
3) Assume suitable data wherever necessary.

Q1] Answer any seven out of the following:

1) Define the term space velocity and space time?
2) What do you mean by the term macro fluid and micro fluid?
3) What do you mean by the term activity of a catalyst?
4) Define the term rate constant of a chemical reaction. Give its units.
5) Draw contacting pattern for two phase system of plug A fluid with plug B fluid.
6) Explain series reaction and parallel reaction.
7) What do you mean by exothermic reaction? Give an example.
8) What do you mean the term Residence Time Distribution.
9) Explain equilibrium concept applied to reaction engineering?
10) What is meant by the term rate of reaction based on unit volume of solid in gas-solid system?

Q2] Answer any two from the following:

1) Explain in detail order of a chemical reaction.
2) Explain the role of thermodynamics in reactor designing.
3) Explain testing of a kinetic model and search for the correct mechanism for the following:
   Consider **2A + B ⟷ A₂B**, the irreversible reaction proceeds by more than one step by formation of intermediate A* and Rate $_{(A2B)}$ = (0.72 $C_A^2.C_B$)/ (1+2C_A).
   Check a model of two step irreversible reaction formation of intermediate A* is correct or not.

Q3] Answer the following:

1) Give point of difference between selection of batch reactors and continuous reactors.
2) What will be initial rate of reaction if the rate constant is 1×10^{-3} min^{-1} and concentration of reactant is 0.2 mol.dm^{-3}. What % conversion takes place after 200 minutes?

OR

Q3] Answer the following:

1) Explain mechanism of solid catalyzed gas phase reaction (L-H-H-W Model).
2) Derive an equation for rate dependency of a chemical reaction with temperature using Arrhenius equation.

Q4] Answer any two from the following:

1) Explain in detail CSTR with a labeled diagram along with advantages and disadvantages.
2) Derive an equation for integral rate equation for first order reaction.
3) The following data was obtained for the reaction

$2NO + Br_2 \text{ -------> } 2NOBr$

| Experiment | Initial Concentration ($Mol.L^{-1}$) | | Initial Rate |
	[NO]	[Br_2]	$Mol.L^{-1}.min^{-1}$
I	0.1	0.1	1.30×10^{-6}
II	0.2	0.1	5.20×10^{-6}
III	0.2	0.3	1.56×10^{-6}

Determine:
a) Order of reaction with respect to NO and Br_2.
b) Rate constant.
c) Rate law.

Q5] Answer any two from the following:

1) Explain in detail Plug Flow Reactor with a neat diagram.
2) Derive an equation for Langmuir adsorption isotherm.
3) The half-life period for radioactive decay of ^{14}C is 5730 years. An archeological artifact contained wood had only 80% of the ^{14}C found in the living tree. Estimate the age of the sample.
4) Rate of decomposition of hydrogen peroxide at particular temperature was measured
   By titrating its solution with acidic potassium permanganate.

Time (s)	0	10	20
Mole of KMnO$_4$ ($mol.L^{-1}$)	22.8	13.8	8.3