17562

21819

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) **Attempt any THREE of the following:** **12**

(i) Name the factors affecting the rate of reaction

(ii) Define the following terms:

1) Internal energy

2) Gibb's free energy

3) Entropy

4) Fugacity

(iii) Define the term space time and space velocity with their units.

(iv) Write down the types of catalyst deactivation.

b) **Attempt any ONE of the following:** **6**

(i) Write stepwise procedure of analyzing the kinetic data by the integral method.

(ii) At 500 K the rate of a bimolecular reaction is 10 times the rate at 400K. Find the activation energy of this reaction from Arrhenius law.

Marks

2. Attempt any TWO of the following: **16**

a) Give mathematical statement of Arrhenius law. Explain temperature dependency from Arrhenius law.

b) In an isothermal batch rector, the conversion of a liquid reactant A achieved in 13 min is 70% Find the space time and space velocity necessary to effect this conversion in a plug flow reactor and in a mixed flow reactor for first order kinetics.

c) Draw neat and labeled sketch of fluidized bed reactor and multitubular fixed bed reactor.

3. Attempt any FOUR of the following: **16**

a) Write down characteristics of chemical equilibrium.

b) Differentiate order and molecularity (any four points)

c) Derive the relation $C_A = C_{Ao}\ (1 - X_A)$.

d) Write down advantages and disadvantages of batch reaction (any each of four points).

e) Write any four characteristics of first order constant volume batch reaction.

4. a) Attempt any THREE of the following: **12**

(i) Derive the integrated rate expression for zero order reaction (in term of conversion).

(ii) Define rate of reaction and rate constant give units of rate constant for first and second order reaction.

(iii) Derive the relation $\Delta S = n.Cv.\ In\left(\frac{T_2}{T_1}\right)$ for entropy change for a constant volume process.

(iv) Define the following terms:

1) Catalyst

2) Promoters

3) Inhibitors

4) Catalyst poisoning.

Marks

b) **Attempt any ONE of the following:** **6**

(i) In case of a first order reaction, show that the time required for 75% conversion is double the time required for 50% conversion.

(ii) Derive the relationship $\Delta G° = RT \text{ Ln } Kp$.

5. Attempt any TWO of the following: **16**

a) Derive performance equation for ideal batch reactor.

b) Derive the integrated rate expression for the reaction $2A \longrightarrow$ Products with respect to following points:

(i) Defination

(ii) Expression

(iii) Graphical representation

(iv) Example

c) List types of reactors used in industry and write one application for each type.

6. Attempt any FOUR of the following: **16**

a) Draw graphical representation for batch reactor and mixed flow reactor.

b) Differentiate between elementary and non elementary reactions.

c) Write down method of catalyst preparation. Explain precipitation method.

d) Define:

(i) Thermodynamics

(ii) Enthalpy

(iii) Chemical potential

(iv) Chemical kinetics.

e) Derive relation $K_P = K_C . (RT)^{\Delta n}$

f) Explain types of intermediates.