17562

11819

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) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

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

Marks

1. (A) Answer any THREE of the following : **12**

(a) List the factors affecting the rate of a chemical reaction.

(b) Define Gibb's free energy. How the feasibility of a chemical reaction is determined from Gibb's free energy ?

(c) Define Σ_A and X_A. Give the mathematical expression for Σ_A.

(d) Define space velocity and space time. Give its unit.

(B) Answer any ONE of the following : **6**

(a) Explain the steps involved in the differential method of analysis of kinetic data. Give its one merit and one demerit over integral method of analysis.

(b) Give the Arrhenius equation and explain the terms involved in it. At 500 K the rate of bimolecular reaction is ten times the rate at 400 K. Find the energy of activation from Arrhenius law.

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

(a) Derive the temperature dependency of rate constant from Collision theory.

(b) A homogeneous liquid phase reaction $A \rightarrow R$, $-Y_A = KC_A^2$ takes place with 50% conversion in MFR.

What will be the conversion if the original reactor is replaced by PFR of equal size – all else remaining unchanged ?

(c) Explain any four methods of preparation of catalyst with example.

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

(a) What will be the entropy change when 2g mole of an ideal gas is heated from a volume of 80 *l* at 50° C to volume of 140 *l* at 200° C ? $C_V = \frac{7.8\,\text{cal}}{\text{mol K}}$

(b) Derive the integrated form of rate expression for zero order reaction in terms of concentration and conversion.

(c) Derive the relation between ΔG and K.

(d) Compare elementary reaction and non-elementary reaction (4 points).

(e) Explain the steps involved in solid catalysed gas phase reactions.

4. (A) Answer any THREE of the following : **12**

(a) Derive the integrated form of rate equation for second order irreversible reaction of the form $2A \rightarrow$ products.

(b) Compare fluidized bed reactor and packed bed reactor based on following points :

(i) Recovery units

(ii) Catalyst regeneration

(iii) Isothermal condition

(iv) Size of Catalyst

(c) Define half life. Give its mathematical expression and explain the terms involved in it.

(d) Derive the relation between k_p and k_y.

(B) Answer any ONE of the following : **6**

(a) Explain the types of intermediates formed in a non-chain reaction.

(b) Derive the relation between conversion and thermodynamic equilibrium constant for the second order reversible reaction $A + B \rightleftharpoons R + S$.

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

(a) After 8 minutes in a batch reactor, reactant (C_{AO} = 1 mole/*l*) is 80% converted. After 18 minutes conversion is 90%. Find the rate of reaction. (K and order both)

(b) Derive the performance equation for a constant volume MFR where first order reaction is taking place. Give the graphical representation also.

(c) Compare MFR and PFR. (8 points)

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

(a) How feed should be admitted when PFR's are connected in parallel ?

(b) Based on Vant Hoff equation, explain why temperature increase is not desirable for exothermic reactions.

P.T.O.

(c) Differentiate between molecularity and order of reaction. (4 points)

(d) Draw the graph of concentration Vs time for

(i) First order reversible reaction

(ii) First order irreversible reaction

Write the value of slope also.

(e) Give the relation between C_A and X_A for constant volume and variable volume systems.
