

TE/Insem/APR-134
TE (Chemical)
CHEMICAL REACTION ENGINEERING - I
(2015 Pattern)

Time : 1 : Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

Unit - I**Q1) a)** The irreversible reactions **[7]**

has been studied kinetically. The rate equation is given by.

$$r_{A_2B} = k [A]^2[B] / (1+2[A])$$

propose suitable mechanism consistent with the above rate equation.

- b) How kinetic model is tested explain rules for matching the rate expression and found experimentally. **[3]**

OR

Q2) a) Derive the temperature dependency of rate constant from collision theory. **[6]**

- b) A certain reaction has a rate given by **[4]**

$$-r_A = 0.005 C_A^2, \frac{\text{mol}}{\text{cm}^3, \text{min}}$$

If the concentration is to be expressed in mol/liter and time in hours, what would be the value and units of the rate constant?

Unit - II**Q3) a)** Explain the differential method of analysis of batch reactor data in detail. **[5]**

- b) Derive the following equation $t_{1/2} = \frac{(0.5)^{1-n} - 1}{k(n-1)} C_{A0}^{1-n}$ **[5]**

P.T.O.

OR

- Q4) a)** At certain temperature, the half life period and initial concentration for a reaction are. [5]

$$t_{1/2} = 420 \text{ sec}; C_{A0} = 0.405 \text{ mol/lit}$$

$$t_{1/2} = 275 \text{ sec}; C_{A0} = 0.64 \text{ mol/lit}$$

Find the rate constant of reaction.

- b)** For irreversible first order reaction derive the necessary relation between conversions versus time. [5]

Unit - III

- Q5)** Develop performance equation for the Plug flow reactor (PFR) with its graphical representation. [10]

OR

- Q6) a)** A homogeneous gas reaction $A \rightarrow 3R$ has a reported rate at 215°C [6]

$$-r_A = 10^{-2} C_A^{1/2}, [\text{mol/liter. sec}].$$

Find the space-time needed for 80% conversion of a 50% A-50% inert feed to a plug flow reactor operating at 215°C and 5 atm ($C_{A0} = 0.0625$ mol/liter).

- b)** Define and explain Space time and space velocity along with the interrelations. [4]

