**Registration No :** | | | | | | | | | | |

**Total number of pages : 02** **B.Tech.**

**PCCH4305**

**6th Semester Back Examination 2017-18**
**CHEMICAL REACTION ENGINEERING**
**BRANCH : CHEM**
**Time : 3 Hours**
**Max Marks : 70**
**Q.CODE : C537**

**Answer Question No. 1 which is compulsory and any FIVE from the rest.**
**The figures in the right-hand margin indicate marks.**
**Assume suitable notations and any missing data wherever necessary.**
**Answer all parts of a question at a place.**

**Q1.** **Answer the following questions :** **(2 x 10)**

**(a)** Discuss the significance of Activation energy.
**(b)** Enumerate the ways of defining the rate equation.
**(c)** Define a constant density system with suitable examples.
**(d)** Write the integrated equation for a third order reaction.
**(e)** What are the disadvantages of half life method of interpreting batch reactor data?
**(f)** Find out the holding time for the conversion in a mixed reactor accomplishing a reaction A → 3R is 50% when gaseous reactant A is introduced at the rate of 1 lit/sec and the leaving flow rate is 2 lit/sec.
**(g)** Give an account of chain and non-chain reactions with a suitable example.
**(h)** Briefly describe about age distribution of fluid.
**(i)** A common rule of temperature is that the rate of reaction doubles for each $10^o$ rise in temperature. What activation energy would this suggest at a temperature of $25^oC$?
**(j)** Define selectivity in multiple reactions.

**Q2.** Derive the integrated rate equation for a reversible unimolecular type first order reaction. Explain in details the typical concentration-time curves for the same. **(10)**

**Q3.** **(a)** Derive the performance equation of a mixed flow reactor for constant and variable systems. **(7)**

**(b)** From the data given below show that the conversion of N- para – chloroacetanilide is a reaction of first order : **(3)**

| Time (h) | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| N | 49.3 | 35.6 | 25.75 | 18.5 |

Where N is the number of ml of $Na_2S_2O_3$ solution required for a definite volume mixture.

**Q4.** **(a)** Give a qualitative description about product distribution in case of parallel reactions. **(6)**

**(b)** Differentiate between molecularity and order of reaction with suitable examples. **(4)**

**Q5.** **(a)** Define $\epsilon_A$. Consider a gaseous feed at $T_0$ = 1000 K, $P_0$ = 5 atm, $C_{A0}$ = 100moles/lit, $C_{B0}$ = 200moles/lit enters a flow reactor in which A + B $\rightarrow$ 5 R occurs. Find $\epsilon_A$. **(3)**

**(b)** In an isothermal batch reactor 70 % of a reactant is converted in 13 minutes. Find the space time and space velocity needed to effect this conversion in a plug flow reactor and a mixed flow reactor. **(7)**

**Q6.** Compare the size of mixed flow reactor with plug flow reactor for a second order reaction. **(10)**

**Q7.** **(a)** Explain the differential method of analysis of rate data. **(4)**

**(b)** Consider a gas phase reaction 2A = R + 2S with unknown kinetics. If for 90 % conversion of a A in plug flow reactor, the space velocity of 1 lit/min is needed, find the corresponding space time and mean residence time of a fluid in the reactor. **(6)**

**Q8.** **Write short notes on any TWO :** **(5 x 2)**

**(a)** Residence time distribution

**(b)** Basics of non-ideal flow

**(c)** Temperature dependency from transition state theory

**(d)** Steady state continuous stirred tank reactor