Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – VII • EXAMINATION – WINTER 2012

Subject code: 170501 **Date: 26/12/2012**

Subject Name: Chemical Reaction Engineering - I

Time: 10.30 am – 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **All notations have conventional meaning**

Q.1 **(a)** Discuss with examples, classification of reactions **07**

(b) State various theories of temperature dependency, discuss any one in detail **07**

Q.2 **(a)** Discuss elementary and non-elementary reactions **07**

(b) What is steady state approximation. Explain how this concept helps to test the suggested mechanism of reaction **07**

OR

(b) For a zero order reaction A→R, 90% conversion is obtained in 80 minutes. If the initial concentration is 1.1 kmol/m^3 **07**

Calculate: i) rate of reaction

ii) time for attaining 95% conversion

iii) conversion after 45 minutes

Q.3 **(a)** For a liquid phase reaction 2A→ Products derive integrated rate expression **07**

(b) A reaction has following data **07**

Temp. T^o K	273	293	313	333
Rate constant k sec^{-1}	2.46×10^{-5}	47.5×10^{-5}	576×10^{-5}	5480×10^{-5}

Find energy of activation of the above reaction

OR

Q.3 **(a)** Derive integrated rate expression for an autocatalytic reaction **07**

(b) At certain temperature, the half-life period and initial concentration for a reaction are **07**

$t_{1/2}$ = 420 sec; C_{A0} = 0.405 mole/lit

$t_{1/2}$ = 275 sec; C_{A0} = 0.640 mole/lit

Calculate the order of reaction and rate constant of the reaction.

Q.4 **(a)** Derive performance equation for a CSTR. **07**

(b) A liquid phase reaction A + B→ C + D takes place in a CSTR of volume 25 m^3. The feed stream consist of 5 kmol/ m^3 of A and 100 kmol/ m^3. What volumetric flow rate and space time is required to obtain 60% conversion of limiting reactant. The reaction rate constant is 0.0001 m^3/kmol/sec at reaction temperature. **07**

OR

Q.4 **(a)** Derive performance equation for a Plug flow rector **07**

(b) A homogeneous liquid phase reaction A→ S, $-r_A = kC_A^2$ takes place with 50% conversion in a mixed flow reactor. What will be conversion if this reactor is replaced by another mixed flow reactor having 5 times volume that of original reactor all else remaining unchanged **07**

Q.5 **(a)** Write in brief about Recycle reactor **07**

(b) Discuss about reactions in series **07**

OR

Q.5 **(a)** Write short note on Optimum temperature progression **07**

(b) Compare Integral method of analysis with differential method of analysis **07**

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