Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2018

Subject Code: 2172602/2172607 **Date: 19/11/2018**

Subject Name: Polymer Kinetics

Time: 10:30 AM TO 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (a) The rate constants for a certain reaction are $1.6*10^{-3}$ and $1.625*10^{-2}$ $(second)^{-1}$ at 10°C and 30°C respectively. Calculate the activation energy. **03**

Q.1 (b) Compare collision theory to transition state theory. **04**

Q.1 (c) The primary reaction occurring in the homogeneous decomposition of nitrous oxide is found to be $N_2O \rightarrow N_2+1/2O_2$ with a rate $-r_{N2O}= k_1*[N_2O]/1+k'*[N_2O]$. Devise a mechanism to explain this observed rate. **07**

Q.2 (a) Give classification of reactors based on it's thermal behavior. **03**

Q.2 (b) Differentiate integral method of analysis and differential method of analysis. **04**

Q.2 (c) Derive integral rate expression for second order irreversible bimolecular reaction $A+B \rightarrow P$ for variable volume system. **07**

OR

Q.2 (c) The decomposition of NH_3 on tungsten wire at 856°C yield the following result: **07**

Total Pressure,(Torr)	228	250	273	318
Time(s)	200	400	600	1000

Determine the order of reaction and calculate value of the rate constant.

Q.3 (a) Write a brief note on term 'molecularity' **03**

Q.3 (b) With the suitable examples, explain the term space time and space velocity respectively. **04**

Q.3 (c) Assuming a stoichiometry $A \rightarrow R$ for first order gas reaction, we calculate the size of plug flow reactor needed for given duty (99%conversion of pure feed) to be V=32 liters. Infact, however, the reactions stoichoimetry is $A \rightarrow 3R$ with this corrected stoichiometry, what is the required reactor volume? **07**

OR

Q.3 (a) Write a brief note on order of reaction. **03**

Q.3 (b) Consider a gaseous feed $C_{A0}=100$, $C_{B0}=200$ to a steady flow reactor operated at constant temperature and pressure. The isothermal gas phase reaction taking place is $A+B \rightarrow R+S$. For $X_A=0.8$, find C_A, C_B, and X_B. **04**

Q.3 (c) The homogeneous gas phase decomposition of phosphine proceeds at 649°C, $4PH_3 \rightarrow P_{4(g)}+6H_{2(g)}$ with the first order rate $r_{PH3}=(10/hr)*C_{PH3}$. What size of plug flow reactor for operating at 649°C and 4.6 atmosphere can produce 80% conversion of feed consisting of 2 kgmoles of pure phosphine per hour? **07**

Q.4 (a) Write down the practical significance of chain modifier with suitable rubber reaction chemistry. **03**

Q.4 (b) Explain the kinetics of non-catalyzed polycondensation reaction. **04**

Q.4 (c) Discuss the kinetics of cationic polymerization. **07**

OR

Q.4 (a) With reaction chemistry explain the term 'telomerization'. **03**

Q.4 (b) Explain the kinetics of catalyzed polycondensation reaction. **04**

Q.4 (c) Discuss the kinetics of anionic polymerization. **07**

PTO.

03

Q.5 (a) Explain the principle of membrane osmometry method to determine the polymer molecular weight.

Q.5 (b) Write about the methods used to determine the reactivity ratio. **04**

Q.5 (c) The following data were obtained on the osmotic pressure of solution of β-globulin in 0.15MNacl at 37°C **07**

C, grammole/100ml	19.27	12.53	5.81
Π, mmH_2O	453	253	112

Calculate the polymer weight of polymer.

OR

Q.5 (a) Write down the full form of USLV. Also give it's major advantages. **03**

Q.5 (b) Write in brief about the effect of reactivity ratio on copolymerization behavior. **04**

Q.5 (c) Calculate the intrinsic viscosity of polystyrene sample in toluene from the following relative viscosity data obtained at 25°C. **07**

$C*10^3$Kgmole/m^3	0.002	0.004	0.006	0.008	0.010
η_r	1.102	1.208	1.317	1.430	1.548

Calculate M_v, if the Mark Houwink constants are α=0.69 and K=1.7*$10^{-3}$$m^3$/Kgmole

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