Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:2162304 **Date:30/11/2018**

Subject Name:Polymer reaction engineering and Rheology

Time: 02:30 PM TO 05:00 PM **Total Marks: 70**

Instructions:

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

			MARKS
Q.1	**(a)**	Give difference between elementary and nonelementary reactions.	**03**
	(b)	Discuss working of Batch reactor. Give its advantages and limitations.	**04**
	(c)	Define: Rheology. Classify non-Newtonian fluids and give time-dependent fluids, time independent fluids with suitable examples.	**07**
Q.2	**(a)**	Explain die swell and melt fracture effect in polymer melt flow.	**03**
	(b)	Explain Voigt model for viscoelasticity.	**04**
	(c)	Discuss working of Torque rheometer with diagram.	**07**
		OR	
	(c)	Classify chemical reactions and explain with suitable examples.	**07**
Q.3	**(a)**	Polymer has a glass transition temperature of 0 ºC, at 50 ºC; it has a melt viscosity of 2.69 $x10^4$ poises (P). What will its viscosity be at 70 ºC?	**03**
	(b)	Discuss WLF equation.	**04**
	(c)	Explain kinetics studies of Free radical polymerization.	**07**
		OR	
Q.3	**(a)**	Explain Maxwell model for viscoelastic materials.	**03**
	(b)	Explain flow analysis using Power law.	**04**
	(c)	Discuss: Free volume Theory	**07**
Q.4	**(a)**	Explain working of Continuous stirred tank reactor (CSTR) along with its advantages.	**03**
	(b)	Explain the creep curve for plastic materials.	**04**
	(c)	Explain temperature dependency from Arrhenius law.	**07**
		OR	
Q.4	**(a)**	The following are data for polymerisation of styrene in benzene at 60ºC with benzoyl peroxide as the initiator. If the spontaneous decomposition rate of benzoyl peroxide is 3.2 x 10^{-6} m^3/mol sec^{-1}. Calculate of rate of propagation for free radical polymerisation. [M]=3.34 $x10^3$ mol/m^3, [I] = 4.0 mol/m^3, f =1, kp^2 / kt = 0.95 x 10^{-6} m^3/mol sec.	**03**
	(b)	How molecular weight and molecular weight distribution affect polymer viscosity? Discuss.	**04**
	(c)	What is Weissenberg effect? Discuss.	**07**
Q.5	**(a)**	The rate constants of a certain reaction are 1.6 $x10^{-3}$ & 1.625$x10^{-2}$ $(s)^{-1}$ at 10˚C & 30˚C. Calculate the activation energy.	**03**

	(b)	Discuss: (i) Effect of Temperature on Polymer Viscosity (ii) Effect of Shear Rate on Viscosity.	**04**
	(c)	With neat diagram explain Cone and plate viscometer for polymer melt.	**07**

OR

Q.5	**(a)**	What are the advantages and limitations of Semi batch reactor?	**03**
	(b)	Explain kinetics studies of Cationic polymerization.	**04**
	(c)	Write a note on: Boltzman superposition principle.	**07**

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