Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (New) EXAMINATION – WINTER 2015

Subject Code:2133602 **Date:18/12/2015**

Subject Name: Polymer Chemistry (Elective-I)

Time: 2:30pm to 5:00pm **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		**Short Questions**	**14**
	1	Draw the structure of Polypropylene	
	2	Draw the structure of Caprolactam	
	3	ΔU of combustion of methane is -89kJ mol^{-1}. The value of ΔH is (=/</>ΔU)?	
	4	Predict in which of the following, entropy increases/decreases: A liquid crystallizes into a solid; Temperature of a crystalline solid is raised from 0 K to 100 K	
	5	The tensile strain of a uniformly extending plastic specimen of initial length l_0 and extended length l is?	
	6	The unit of rate constant (K) for the third order of reaction is?	
	7	Give two examples of commodity polymers	
	8	Give two examples of amorphous polymers	
	9	Write the relationship between M_n, M_w and M_v	
	10	Define polydispersity index	
	11	What is functionality of phthalic anhydride and glycerol	
	12	Draw the structure of nylon-66 and circle an amide linkage in the structure	
	13	NH_3 and NF_3 which one higher dipole moment and why?	
	14	Identify polar and non-polar compounds: CO_2, H_2O, CH_4, CH_2Cl_2, BF_3, NF_3	
Q.2	**(a)**	Which type of initiators are used in suspension and emulsion polymerization of vinyl derivative monomers?	**03**
	(b)	Explain the functionality of monomers. Justify this statement, for a compound to undergo polymerization reaction it must be functionality≥2.	**04**
	(c)	State the characteristics of monomers used for addition and condensation polymerization (with examples)	**07**
		OR	
	(c)	Explain with examples average functionality of monomers. What is the functionality of the following monomers in reaction with (a) styrene and (b) ethylene glycol? (i) Divinyl benzene (ii) Maleic anhydride (iii) Phthalic anhydride	**07**
Q.3	**(a)**	Explain the end uses of polymers?	**03**
	(b)	Write repeating formulas for (a) Nylon-6; (b) Nylon-11; (c) Nylon-	**04**

6,10; (d) Nylon-5,7

	(c)	Explain with examples functionality and average functionality. Calculate average functionality for 4 mole of acrylonitrile, 3 mole of butadiene and 5 mole of styrene. Is it polymerization possible?	**07**

OR

Q.3	**(a)**	Explain with examples glass transition temperature	**03**
	(b)	Write repeating formulas for (a) poly(butylene terephthalate), (b) poly-caprolactam (c) polyacrylonitrile, (d) polystyrene	**04**
	(c)	(i) What are the different components present in crude oil? Explain in detail (ii) What are the different ways of expressing molecular weight of a polymer? Give the formulas for expressing them	**07**
Q.4	**(a)**	Compare emulsion and suspension polymerisation	**03**
	(b)	Define with example the following: (i) Rubber (ii) Repeat unit (iii) homo polymer (iv) copolymer	**04**
	(c)	How the following monomers are synthesized (any two)? (i) Caprolactum (ii) Vinyl Chloride (iii) Methacrylate	**07**

OR

Q.4	**(a)**	Compare emulsion and solution polymerization	**03**
	(b)	Define with example the following: (i) Polymer (ii) Degree of polymerization (iii) rigid plastics (iv) elastomer	**04**
	(c)	How are the following monomers synthesized? (i) styrene (ii) butadiene (iii) isocyanates	**07**
Q.5	**(a)**	A polymer sample consist of 20% by weight of macromolecules of molecular weight 20,000 and 80% by weight of macromolecules with molecular weight 200,000. Calculate M_n and M_w	**03**
	(b)	Explain important of crystallinity in polymers. Calculate % crystallinity of nylon having amorphous area 57600 unit and total area 132500 unit (obtained from WXRD)	**04**
	(c)	Write detail note on the mechanism and kinetics of cationic polymerization	**07**

OR

Q.5	**(a)**	Describe in detail the characteristics of addition and condensation polymerization	**03**
	(b)	What are the different methods to determine the crystallinity in polymers? Why crystallinity is calculated in term of % crystallinity?	**04**
	(c)	Derive an expression for the rates of all the reactions involved in cationic polymerization. Also derive expressions for degree of polymerization in cationic polymerization	**07**

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