Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–III(OLD) • EXAMINATION – WINTER 2016**

**Subject Code:133602 Date:30/12/2016**

**Subject Name:Polymer Chemistry for Chemical Technology(Department Elective-I)**

**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.**

| | | | MARKS |
|---|---|---|---|
| **Q.1** | | **Short Questions** | **14** |
| | **1** | Define copolymer? | |
| | **2** | Draw the structure PAN | |
| | **3** | Define monomer? | |
| | **4** | Give examples of thermoplaic polymer | |
| | **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 second order of reaction is? | |
| | **7** | Give examples of engineering polymers polymers | |
| | **8** | Give examples of amorphous polymers | |
| | **9** | Write the relationship between $M_n$, $M_w$ and $M_v$ | |
| | **10** | Define PDI | |
| | **11** | What is functionality of glycol | |
| | **12** | Draw the structure of nylon-612 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: $CO_2$, $H_2O$, $CH_4$, $CH_2Cl_2$ | |
| **Q.2** | **(a)** | Differentiate between bulk and suspension polymerization | **03** |
| | **(b)** | Define functionality of monomers. For a compound to undergo polymerization reaction it must be functionality≥2. Justify this statement | **04** |
| | **(c)** | State the characteristics of monomers used for addition and condensation polymerization. Give two examples of each polymer. | **07** |
| | | **OR** | |
| | **(c)** | Define average functionality of monomers. Calculate average functionality for 5 mole of glycol and 5 mole of terephthalic acid. Is it polymerization possible | **07** |
| **Q.3** | **(a)** | What are the end uses of polymers? Explain | **03** |
| | **(b)** | Write repeating formulas for (a) Nylon-6; (b) Nylon-11; (c) Nylon-1010; (d) Nylon-6,7 | **04** |
| | **(c)** | Explain with examples functionality and average functionality. Calculate average functionality for 4 mole of acrylonitrile, 1 mole of butadiene and 6 mole of styrene. Is it polymerization possible? | **07** |

**OR**

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|---|---|---|---|
| **Q.3** | **(a)** | Explain with example glass transition temperature | **03** |
| | **(b)** | Write repeating formulas for (a) poly(butylene terephthalate), (b) poly-caprolactam | **04** |
| | **(c)** | (i) What are the different components present in crude oil? Explain in detail<br>(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) Monomer (ii) homo polymer | **04** |
| | **(c)** | How are the following monomers synthesized? (i) Caprolactum (ii) Vinyl Chloride | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Compare bulk and solution polymerization | **03** |
| | **(b)** | Define with example the following: (i) Repeating unit (ii) elastomer | **04** |
| | **(c)** | How are the following monomers synthesized? (i) butadiene (ii) isocyanates | **07** |
| **Q.5** | **(a)** | A polymer sample consist of 50% by weight of macromolecules of molecular weight 1000 and 50% by weight of macromolecules with molecular weight 10000. Calculate $M_n$ and $M_w$ | **03** |
| | **(b)** | Write short note on crystallinity in polymers. Calculate % crystallinity of nylon having amorphous area 7600 unit and total area 5000 unit (obtained from WXRD) | **04** |
| | **(c)** | Write detail note on the mechanism and kinetics of free radical 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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