

U.G. 6th Semester Examination - 2020**CHEMISTRY****Course Code : BCEMDSHC6****Course Title : Polymer Chemistry**

Full Marks : 30

Time : 2 Hours

*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.*

1. Answer any **ten** questions: 1×10=10
- Polydispersity index (PDI) of a polymer is always greater than 1. why?
 - Which one should have higher melting temperature (T_m): Polyvinyl chloride or Polypropylene? Why?
 - Draw the regioregular structures of poly (3-alkylthiophene).
 - Write down erythro-diisotactic structure for polymer derived from 1,2-disubstituted ethylene ($RCH=CHR'$).

[Turn Over]

- Nylon is a highly polar molecule but does not soluble in water. why?
- Write down the name of two initiators that are generally used in radical polymerization.
- For polypropylene $\Delta H_f = 3.94 \text{ kJ/mol}$ at $T_f = 137^\circ\text{C}$. Determine ΔS_f .
- How will you identify block copolymer and random copolymer by measuring their glass transition temperature?
- What is the basic difference between solution and bulk polymerization?
- What is meant by theta (θ) temperature for a polymer solution?
- What kind of molecular weight will you get by osmotic pressure measurement method?
- Which of the following molecules will undergo radical polymerization?
Isobutylene, N-vinyl caprolactam, Acrylamide, ϵ -caprolactone.
- Give the IUPAC nomenclature for nylon-6,6.
- Why α -methylstyrene cannot be polymerized by radical polymerization using AIBN as initiator between $50-80^\circ\text{C}$?

- o) Write down polymer dissolution steps in a good solvent.

2. Answer any **five** questions: $2 \times 5 = 10$

- a) Is polypeptide a polyamide? Justify.
- b) What are the differences between step growth and chain growth polymerization?
- c) Give synthetic scheme of nylon 6,6 polymer.
- d) What do you mean by lower critical solution temperature (LCST) of PNIPAM is 37°C in water?
- e) What is teflon? Mention its applications.
- f) How chain branching occurs during the polymerization of ethylene? Show a scheme.
- g) Using the notation of 'O' and '●' for two comonomers, sketch representative structures of the following:
block copolymer, random copolymer, graft copolymer and alternating copolymer.
- h) What are n- and p-type conducting polymers? Explain with example.

3. Answer any **two** questions: $5 \times 2 = 10$

- a) i) The reaction rate of a self-catalyzed polycondensation reaction is given as

$$-\frac{d[\text{COOH}]}{dt} = k[\text{COOH}]^2[\text{OH}].$$

If $[\text{M}]_0$ be the initial concentration of hydroxyl and carboxyl monomers, then show that the degree of polymerization (X_n) is given by

$$\chi_n^2 = 2[\text{M}]_0^2 kt + 1 \quad 3$$

- ii) Show that for step growth polymerization of linear polymers the maximum value of polydispersity index (\mathfrak{D}) is 2. 2
- b) i) Maleic anhydride does not self-propagate rather it alternately propagates with styrene monomer– Explain. 2
- ii) Why ionic polymerization are generally carried out at lower temperature? 1
- iii) Polystyrene having $M_n = 100,000$ g/mol obeys the Mark-Houwink-Sakurada equation in acetone with $k = 0.0001$ and $a = 0.8$. Calculate the relative viscosity of polystyrene in acetone at 0.001 g/mL concentration. 2

- c) i) Draw log modulus vs. temperature for an amorphous polymer. What are the five regions of viscoelasticity, and where do they fit? 4
- ii) What kind of material is generally used in GPC/SEC column? 1
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