

**U.G. 5th Semester Examination - 2020**

**CHEMISTRY**

**[HONOURS]**

**Discipline Specific Elective (DSE)**

**Course Code : CHEM-H-DSE-T-1A**

**(Polymer Chemistry)**

Full Marks : 40

Time : 2½ 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 **five** questions : 2×5=10
- Write the systematical name for the co-polymer of styrene and methyl methacrylate.
  - Write the full name of PAN and PET.
  - What are the monomer components of Bakelite?
  - Give examples of homochain and heterochain polymers.
  - Draw the head-to-tail and head-to-head configurations for polypropylene.
  - Define critical chain length,  $z$  and show that how it is related to melt viscosity,  $\eta$ ?
  - Define cohesive energy density, CED and explain Hildebrand equation.

[Turn Over]

- Write the WLF equation and explain the terms.
2. Answer any **two** : 5×2=10
- Define the first-order temperature,  $T_M$  and second-order temperature,  $T_g$  for a polymer. Draw the plot of change of specific volume a polymer with the change in temperature. How physical properties of a polymer change at  $T_g$ . 2+1+2
  - How degree of polymerization (DP) is related to the molecular weight,  $M$  of a polymer? Write the major characteristic differences between chain-growth and step-growth mechanisms. 2+3
  - Write short notes on (i) Preparation of nylon-6.6 and (ii) Ziegler-Natta catalyst . 2.5+2.5
  - What are thermoplastic and thermosets? Draw the structures of isotactic, syndiotactic and atactic poly(vinyl chloride). 2+3
3. Answer any **two** : 10×2=20
- What are meant by the primary, secondary and tertiary structures of a polymer? Derive the expressions for number average and weight average Molecular weight,  $M_n$  and  $M_w$  respectively. Calculate  $M_n$ ,  $M_w$  and  $M_z$  for three

polymer molecules with molecular weights of  $1.0 \times 10^5$ ,  $2.0 \times 10^5$  and  $3.0 \times 10^5$ . 3+4+3

b) Discuss the corresponding initiation, propagation and termination steps of the vinyl chloride polymerization in presence of a radical initiator, I. Derive the expression of rate of polymerization for such chain-growth polymerization process. 6+4

c) Discuss the characteristics of the spherulite, lamellar and 'Shish kebab' structures of a linear polymer PE. Discuss Maxwell model for visco-elastic deformation of polymers and show that under constant strain, the stress,  $s = s_0 [\exp(-t/\tau)]$ . 6+4

d) Why polymer solutions exhibit large deviation from Raoult's law? Describe the Flory-Huggins model in brief. Write the expression of the osmotic pressure,  $\pi$  for a polymer solution. Write the Huggins equation for the reduced viscosity,  $\eta_{\text{red}}$  for a polymer solution of concentration 'c'. What is Mark-Houwink-Sakurada equation? 2+2+2+2+2

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