L 1168

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2006.

Second Semester

Textile Technology

TT 1151 — POLYMER SCIENCE

(Common to Textile Chemistry)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Calculate the average functionality for glycerol-phthalic anhydride system in the ratio of 2 : 3.

2. Write down the mechanism of polymerization of methyl methacrylate initiated by benzoyl peroxide.

3. How High Density Polyethylene is prepared?

4. Calculate $\overline{M}_n$ and $\overline{M}_w$ for a mixture of two chains of degrees of polymerization 1 and 100 assuming m to be the molecular weight of the repeating unit.

5. What are the informations one can obtain from a DSC study of a polymer?

6. Explain why polystyrene is transparent and HDPE is translucent.

7. Polyacrylonitrile is a thermoset eventhough it is a linear polymer. Give the reason.

8. Give two different polymers that are used as solid lubricants.

9. Give two applications of conducting polymers.

10. Give an example for a UV stabilizer and mold release agent.

PART B — ($5 \times 16 = 80$ marks)

11. (i) Derive the Van't Hoff equation relating the osmotic pressure of a polymer solution with the molecular weight of the polymer.

(ii) A polymer with M = 100,000 obeys the Mark-Howink-Sakuvada equation with $K' = 1 \times 10^{-4}$ and $\alpha = 0.80$. Huggins constant is 0.33. Calculate the relative viscosity at $C = 0.30$ g/dL.

(iii) Discuss the effect of structure on the solubility of a polymer.

12. (a) (i) Classify polymers according to source and application giving examples.

(ii) Explain how the monomers for the following polymers are manufactured : PMMA, PE, PS and PVA.

Or

(b) (i) Draw the structures of the following polymers : Natural Rubber, PET, Nylon 6 and Isotactic PP.

(ii) Assign the functionality of the following monomers. Justify your answers : Glycerol, Urea, Phenol and Melamine.

13. (a) (i) Prove that $\nu = \frac{K_p [M]}{2 (f K_d K_t)^{1/2} [I]^{1/2}}$ where ν is the kinetic chain length, for a free radical polymerization.

(ii) Describe how PVC is manufactured by emulsion polymerization with the help of a flow sheet.

Or

(b) (i) Derive the Carothers equation.

(ii) Give the mechanism of Zeigler-Natta polymerization of propylene to give stereoregular polymers.

14. (a) (i) Describe the synthesis, properties and applications of the following : Polyacrylonitrile, Polyurethane Kerlar and Glyptal.

(ii) Describe the synthesis, properties and uses of carbon fibres.

Or

(b) (i) Describe the synthesis, properties and applications of the following : HDPE, LDPE, Polycarbonate and Terylene.

(ii) Describe with two examples the preparation, properties of conducting polymers.

15. (a) Write short notes on :

(i) Antimicrobial agents.

(ii) Antistatic agents.

(iii) Coupling agents.

(iv) Blowing agents.

Or

(b) (i) Write short notes on Flame retardants and heat stabilizers.

(ii) With the help of a diagram explain film extrusion.