Attempt the following:

(a) Highlight some physical and thermal properties of PVC and HDPE with special reference to their structure.

(b) Why do we consider average molecular weight for polymers? Give different types of average molecular weight for polymers.

(c) Write short notes on any two of the following with the help of example(s).
   (1) Intermolecular forces
   (2) Chemical Stability
   (3) Chain - extending bond.
2 Attempt any **four** of the following:

(a) Discuss the method of end-group analysis for determining number average molecular weight. A sample (3.0 gm) of carboxyl-terminated polybutadiene (CTPB) required titration with 20 ml 0.1N-KOH solution to reach a phenolphthalein end point. Calculate number-average molecular weight of the polymer sample.

(b) What do you understand by solution viscosity? Give different types of viscosity terms used for solution viscosity. Also, give the significance of the following relation:

\[ r_i = r_i = 1 + 2.5\langle|\rangle, \]

where the terms are of their usual meanings.

(c) Write down the merits and demerits of measuring the molecular weights based on colligative properties.

(d) How does the crystallinity affect mechanical properties of polymers? Discuss this.

(e) Discuss linear, branched and crosslinked polymers in terms of their basic properties.

3 Attempt any **two** of the following:

(a) Describe the Zimm's method for the determination of molecular weight of polymers with the help of Light-scattering phenomenon.

(b) Describe Gel Permeation Chromatographic (GPC) technique for the determination of molecular weights and molecular weight distribution curve for polymers.
(c) What is solubility parameter? Discuss different methods for determining solubility parameter.

4 Attempt any two of the following:
(a) Describe the melting behaviour of polymers. How can it be correlated with the structure of polymers? Explain with examples.
(b) What do you understand by glass-transition temperature (Tg) of polymers? Explain its significance at molecular level. Also describe, with examples, the various structural factors which affect the Tg.
(c) Discuss, in detail, the experimental procedure for the determination of Tg and Tm by differential scanning calorimetry (DSC).

5 Attempt any two of the following:
(a) What do you understand by copolymerization technique? What are the various properties affected due to change in the structure of comonomer of the copolymer? Discuss with the help of suitable example.
(b) Discuss the principle of Scanning Electron Microscopic (SEM) analysis. Give the instrumental details and procedure for analyzing polymer samples by SEM.
(c) What are the various requirements for the polymers to be crystalline? Describe the Fringed Micelle and Folded - chain crystallites models for the polymers.