**Time: 1 Hour 15 Minutes**   **Full Marks: 25**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as possible

1. Answer *any five* of the following questions: $1 \times 5 = 5$

(a) Write the chemical reaction (balanced equation) for preparation of poly(ethylene terephthalate) (PET).

(b) How can you distinguish (experimentally) rubbers and plastics?

(c) Give the structure of isotactic polypropylene (PP).

(d) Write the common and IUPAC name of the following polymer.

$$\left[CH_2 - \underset{\underset{CO_2CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} \right]_n$$
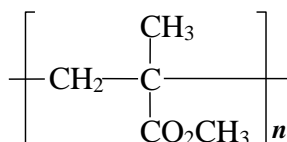
(e) Calculate the average functionality for the polycondensation reaction between glycerol and adipic acid.

(f) What is the factor(s) affecting glass transition temperature of polymers?

(g) Give the name and structure of one heat resistance polymer.

(h) Mention one method for determination of $\overline{M_w}$ of polymers.

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

(a) What are thermosetting polymers? What are elastomers? Cite one inorganic colorant used in polymer processing. $2+2+1 = 5$

(b) Derive Carothers equation. Predict gel point from it for bifunctional polymerization. What is the physical significance of gel point? $3+1+1 = 5$

Please Turn Over

(c) Give the most important application(s) of the following polymers:

      I)   Styrene Butadiene Rubber (SBR)

      II)   Polyvinylchloride (PVC)

      III)   Poly(methyl methacrylate) (PMMA)

      IV)   Polyurethanes (PUs)

      V)   Polycarbonate (PC) $1\times5 = 5$

(d) Derive the rate of condensation polymerization (R_p) for self-catalyzed reaction between a dicarboxylic acid and a diol. Hence deduce the number average degree of polymerization ($\overline{X_n}$) in term of extent of reaction. $3+2 = 5$

3. Answer *any one* of the following questions: $10\times1 = 10$

(a) (i) How are polymers synthesised by solution and emulsion polymerization techniques? Mention their advantages and limitations.

(ii) What is polydispersity index?

(iii) In a polymer solution equimolecular amounts of two species of molecular weights 80,000 and 60,000 respectively are mixed together. Calculate the weight average molecular weight of polymer. $(3+3)+1+3 = 10$

(b) (i) What is meant by copolymerization? Derive the copolymer equation for binary radical copolymerization.

(ii) What are the major criteria for polymer solubility? From Flory-Huggins mean-field theory derive Flory-Huggins equation for entropy of mixing (ΔS_{mix}) for the dilute polymer solution.

(iii) What is meant by conducting polymers? What are the essential features of conducting polymers? $(1+3)+(1+3)+2 = 10$

———————