Assignment-4: CEM 403 (UNIT-3) 03/06/2024

1. What is the most striking distinguishing feature of the thermoplastic and thermosetting polymers?
2. What do you understand by the tacticity of a polymer? Draw the basic skeletal structures of isotactic, syndiotactic and atactic polymers.
3. Write down the Flory's assumption regarding polymer reactivity. What do you understand by the term extent of reaction in case of the step-growth polymerization? Derive the integrated rate law for the step-growth polymerization in the absence of an acid (strong) catalyst. How would you determine the rate constant of such a reaction from the integrated rate law?
4. Derive the integrated rate law for the step-growth polymerization in the presence of an acid (strong) catalyst. How would you determine the rate constant of such a reaction from the integrated rate law?
5. Define the number average degree of polymerization. How would you express the number average molecular weight of a polymeric material in terms of the number average degree of polymerization?
6. What do you understand by the term conversion in the case of a free-radical polymerization reaction? Derive an expression for conversion for free-radical polymerization reaction, and hence find out the value of maximum conversion. What is gel (or Trommsdorff) effect?
7. Derive an expression for the mass fraction of crystalline component in a polymeric system. Estimate the fraction of crystalline material in a sample of polyethene of density $0.983\ \mathrm{gm/cm^3}$. Given the density of amorphous polyethene to be $0.866\ \mathrm{gm/cm^3}$. The unit cell dimensions of polyethene crystal (containing four $\mathrm{CH_2}$ groups) are $a = 7.41\ \text{Å}, b = 4.94\ \text{Å}, c(\text{fibre axis}) = 2.55\ \text{Å};\ \alpha = \beta = \gamma = 90°$. Distinguish between the terms, glass transition temperature and heat deflection temperature.