Federal University of Technology, Owerri
Department of Polymer & Textile Engineering
PTE 405 Properties of Bulk Polymers

2014/2015 Harmattan Semester Examinations

Instruction: Answer ANY FIVE (5) questions **Time allowed:** 3 hours

1. (a.) Explain the processes of polymer crystallization
   (b.) Explain how crystallization growth rate of a polymer material from melt varies with temperature at; (i) close to T_g and (ii) close to Tm. Use graphical expressions where possible.

2. Define glass transition temperature (Tg) in polymers and explain any 5 factors that can affect crystallization in polymers. With a well-labelled graph, show how the specific volume varies with temperature during polymer crystallization process.

3. (a.) State the Avrami's equation for studying crystallization kinetics explaining all the terms therein. (b.) How can you obtain the values of K and n, given that the densities of an isolated polymer crystal grown from melt on cooling and measured at 3 minutes interval had the following sizes; 110mg/μm^3, 101mg/μm^3, 90mg/μm^3, 72mg/μm^3, 68mg/μm^3, 53mg/μm^3, 44mg/μm^3, 38mg/μm^3, 32mg/μm^3, 25mg/μm^3, 25mg/μm^3, 25mg/μm^3, 25mg/μm^3.

4. (a.) For a thermoplastic material, explain the following; (i.) Stiffness, (ii.) Resilience, (iii.) Tensile strength, (iv.) Toughness, (v.) Brittleness
   (b.) Draw the stress-strain diagrams to represent the mechanical behaviour of 4 plastic materials

5. (a) Explain one of the drawbacks associated with amorphous state with respect to materials application and how it can be sufficiently minimized.
   (b.) What do you understand by the term "draw ratio" and what are the effects of drawing on fibres? What are the parameters that can affect the ultimate properties of drawing?

6. (a.) Give the ASTM definition of "Plasticizer" and differentiate between internal and external plasticization. State the properties of a good plasticizer.
   (b.) Define; (i.) Reinforced plastics, (ii.) Crosslinking, (iii.) Vulcanization