

MAX MARKS 35

*Note: Be brief and to the point, use figures to explain as far as possible!*

- Q1. a) What is the difference between an Injection Molding (IM) Machine and an Extruder for thermoplastic processing? (2)  
b) Differentiate between the dosing and packing of polymer melt in IM process. (2)  
c) Which parameter(s) can affect the flow behavior of a polymer melt in a runner? (2)
- Q2. a) What do you understand by balanced runner; explain the situation of unbalance with an example and also its remedy! (2)  
b) How runner size and shape is decided, compare semicircular to square runner efficiency! (2)  
c) Why does the taper exist in a sprue and what decides its length (2)
- Q3. a) Elaborate two main reasons for i) shrinkage and ii) warpage, could you please make a figure to differentiate between these two phenomenon? (2)  
b) Which polymer properties can affect warpage behavior? (2)  
c) What precautions will you take to eliminate or minimize warpage in the chosen product of your mini project? Else, in any known product. (2)
- Q4. a) Give a visual layout for a PP based car bumper manufacturing mold attached with a sprue, runner and gate(s) during the filling process. (2)  
b) If this bumper is made of glass fiber reinforced PP with a fiber volume fraction of 15% . The fiber length is 1.1 mm in the final product and the fiber diameter is 11 micron. Calculate the Elastic modulus, Shear modulus and Poisson's ratio of the bumper when  $E_m = 1.5$  GPa for PP and  $E_f = 72$  GPa for Glass. The Poisson's ratio for matrix is 0.25 and for fiber it is 0.3. (5)
- Q5. a) If no gate mark is allowed on the outside surface of a bottle cap having internal threads and no weld line is permitted on the threaded portion, can you visualize and draw the schematic layout of the mold for this near net shape product with core, cavity and ejection system for mass production (3)  
b) What are the major reasons of voids and sink marks, how a part designer, tool designer and a molder can avoid these as per individual expertise (2)
- Q6. A glass epoxy cuboid specimen with voids has dimensions of  $a \times b \times c$  and its mass is  $M_c$ . After its put into a mixture of sulfuric acid and hydrogen per oxide, the remaining glass fibers have a mass of  $M_f$ . From independent tests the densities of glass and epoxy are  $\rho_f$  and  $\rho_m$  respectively. Find the volume fraction of voids in terms of  $a, b, c, M_f, M_c, \rho_f$  and  $\rho_m$ . (5)