Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (New) EXAMINATION – WINTER 2015

Subject Code:2142305 **Date:04/01/2016**

Subject Name: Applied Mathematics in Plastic Industry

Time: 2:30pm to 5:00pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain the viscoelastic behavior of plastics. **07**

(b) Explain the Kelvin-Voigt model in detail. **07**

Q.2 **(a)** Define: Stress relaxation, Creep, Newtonian fluid, shear stress, shear strain, Fourier number, apparent Viscosity. **07**

(b) Explain the analysis of continuous fiber composite having the longitudinal properties. **07**

OR

(b) Explain the radius of gyration of rod polymer **07**

Q.3 **(a)** A ball-point pen made from polypropylene has the clip design shown in Fig. When the pen is inserted into a pocket, the clip is subjected to a deflection of 2 mm at point A. If the limiting strain in the material is to be 0.5% calculate (i) a suitable thickness, d, for the clip (ii) the initial stress in the clip when it is first inserted into the pocket. The short term modulus of Polypropylene is 1.6 GN/m^2 **07**

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(b) Explain the concept of Weight and number average molecular weight calculations for polymer. **07**

OR

Q.3 **(a)** Explain the radius of gyration of an ideal branched polymer(kramers theorem) **07**

(b) PEEK is to be reinforced with 30% by volume of unidirectional carbon fibres and the properties of the individual materials are given below. Calculate the density, modulus and strength of the composite in the fiber direction. **07**

Material	Density (kg/cm^3)	Tensile strength(GN/m^2)	Modulus(GN/m^2)
PEEK	1300	0.058	3.8

Carbon fiber	1800	2.1	400

Q.4 **(a)** Enlist the experimental methods used to obtain the flow data of polymer material and explain cone and plate viscometer in detail **07**

(b) Derive the expressions for the drag flow in detail for the analysis of flow in the extruder. **07**

OR

Q.4 **(a)** Derive the expressions for the pressure flow and leakage flow in detail for the analysis of flow in the extruder. **07**

(b) Explain the mechanism of flow of plastic material into the screw barrel. **07**

Q.5 **(a)** Explain the analysis of heat transfer during polymer processing. **07**

(b) Explain the isothermal flow in channels of Newtonian fluids having the flow of fluid between parallel plates. **07**

OR

Q.5 **(a)** Explain the concentric cylinder viscometer in detail used to obtain the flow data of polymer. **07**

(b) In a particular extruder screw the channel depth is 2.4 mm, the screw diameter is 50 mm, the screw speed is 100 rev/min, the flight angle is $17^{o}42'$ and the pressure varies linearly over the screw length of 1000 mm from zero at entry to 20 MN/m^2 at the die entry. Estimate (a) the drag flow (b) the pressure flow (c) the total flow. the plastic has a viscosity of 200 Ns/m^2 **07**

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