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GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III (New) EXAMINATION – WINTER 2019

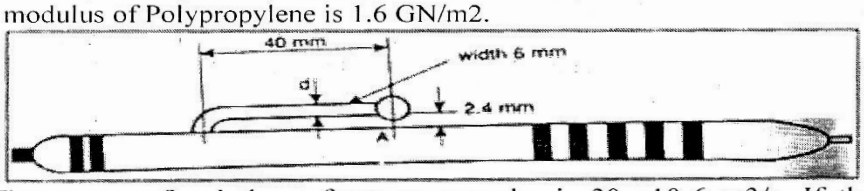
Subject Code: 3132306 Date: 26/11/2019

Subject Name: Applied mathematics in Plastic Industry

Time: 02:30 PM TO 05:00 PM Total Marks: 70

Instructions:

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

			Marks
Q.1	(a)	Define i)Stress ii)Strain iii)Creep	03
	(b)	Explain the Hooke's model along with stress-strain and elongation-time plots.	04
	(c)	Determine the expressions of the creep, relaxation and recovery for the Maxwell mathematical model.	07
Q.2	(a)	Explain the viscoelastic behavior of plastics.	03
	(b)	Write a short note on the Ram extruder.	04
	(c)	Explain the Maxwell & Voigt models for visco-elasticity along with their stress-strain and elongation-time plots.	07
		OR	
	(c)	Determine the expressions of the creep, relaxation and recovery for the Kelvin or Voigt mathematical model.	07
Q.3	(a)	Explain the General behaviour of polymer melts.	03
	(b)	Explain the Newton's model along with stress-strain and elongation-time plots.	04
	(c)	Explain the deformation behavior of Polymeric Materials.	07
		OR	
Q.3	(a)	Discuss briefly the isometric & isochronous graph	03
	(b)	Explain the creep curve in detail.	04
	(c)	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/m2. 	07
Q.4	(a)	The output of polythene from an extruder is 30 x10-6 m3/s. If the breaker plate in this extruder has 80 holes, each being 4 mm diameter and 12 mm long, estimate the pressure drop across the plate assuming the material temperature is 170°C at this point. The shear stress is 1.2 x 10^5 N/m^2 .	03
	(b)	Explain the types of fibre reinforcement in composites.	04
	(c)	Discuss about the experimental methods used to obtain flow data and explain the cone and plate viscometer.	07

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OR

Q.4 (a) Explain the Melt Fracture flow defect. **03**

(b) Discuss about the short term testing of plastics. **04**

(c) Explain the analysis of heat transfer during polymer processing and state the equations of Fourier number and Temperature Gradient. **07**

Q.5 (a) Discuss the Sharkskin flow defect. **03**

(b) Explain briefly the Pseudo elastic design methods of plastics. **04**

(c) 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/m^3)	Tensile Strength (GN/m^2)	Modulus (GN/m^2)
PEEK	1300	0.058	3.8
Carbon fibre	1800	2.1	400

OR

Q.5 (a) Discuss about concentric cylinder viscometer. **03**

(b) Explain the analysis of longitudinal properties for continuous fibre composites. **04**

(c) The constants for a four- parameter model are $E_1=5x10^8$ N/m^2 , $\eta_2 = 5x10^{10}$ $N.s/m^2$, $E_3 = 10^8$ N/m^2 and $\eta_3 = 5x10^8$ $N.s/m^2$ **07**

For creep and creep recovery experiments calculate:

a. The instantaneous elastic strain
b. The recoverable retarded elastic strain
c. The permanent set

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