GUJARAT TECHNOLOGICAL UNIVERSITY BE - SEMESTER-IV(New) EXAMINATION – SUMMER 2016

	S	ubject Code:2142305 Date:08/06/2016	
	S	ubject Name: Applied Mathematics in Plastic Industry	
	Time:10:30 AM to 01:00 PM Total Marks:		
	In	structions:	
		1. Attempt all questions.	
		2. Make suitable assumptions wherever necessary.	
		3. Figures to the right indicate full marks.	
			MADVS
			MAKKS
Q.1		Short Questions	14
	1	Explain: Fourier number and temperature gradient	
	2	Discuss Stress relaxation curve	
	3	Weight avg. and no avg. m w calculations formula derivation.	
	4	Explain Tensile curve along with necessary conditions	
	5	Explain the radius of gyration of an ideal branched polymer(kramers theorem)	
	07	what are Thixotropic, Rheopectic fluids?	
	/ 0	Explain Shear Stress, Shear Strain	
	0	Explain the radius of gyration of infeat ideal chain Explain the concentric cylinder viscometer in detail used to obtain the flow data of	
	,	explain the concentric cylinder viscometer in detail used to obtain the now data of	
		polymer.	
	10	Explain the isothermal flow in channels of Non-Newtonian fluids having the flow of	
		fluid along a channel of uniform circular cross-section.	
	11	Explain Creep curve	
	12	Explain Pseudoplastic fluids	
	13	Discuss Bingham fluids	
0.2	14	Define terms: Newtonian fluid, Non-Newtonian Fluid	02
Q.2	(a)	Explain the Ram extruder in detail.	03
	(h)	Explain the Viscoelastic behavior of plastics	04
	(c)	A hall-point pen made from polypropylene has the clip design shown in Fig 1	07
	(0)	When the near is inserted into a necket, the clin is subjected to a deflection of 2	01
		when the period inserted into a pocket, the clip is subjected to a denection 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	
		40 mm	
		width 6 mm	
		2.4 mm	

OR

(c) Explain the analysis of continuous fiber composite having the longitudinal 07 properties

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- Q.3 (a) Explain the mechanism of flow of plastic material into the screw barrel.
 - (b) The density of a composite made from unidirectional glass fibres in an epoxy matrix 04 is 1950 kg/m³. If the densities of the glass and epoxy are known to be 2540 kg/m³ and 1300 kg/m³, calculate the weight fraction of fibres in the composite
 - (c) Explain the Kelvin-voigt model in detail

OR O.3 (a) Define drag flow, pressure flow, leakage flow

- (b) In a plunger-type injection moulding machine the torpedo has a length of 40 mm, a diameter of 23 mm and is supported by three spiders. If, during moulding of polythene at 170°C, the plunger moves forward at a speed of 15 mm/s, estimate the pressure drop along the torpedo and the shear force on the spiders. The barrel diameter is 25 mm. assume that flow is isothermal. The gap between the torpedo and the barrel may be considered as a rectangular slit with $T = (\pi x \ 24 \ x \ 10^{-3})$ m and $H = 1 \ x \ 10^{-3}$ m.
- (c) In a particular extruder screw the channel depth is 3 mm, the screw diameter is 60mm, the screw speed is 100 rev/min, the flight angle is 17°42' and the pressure varies linearly over the screw length of 1000 mm from zero at entry to 20 MN/m² at the die entry. Estimate (a) the drag flow (b) the pressure flow (c) the total flow. the plastic has a viscosity of 210Ns/m²
- Q.4 (a) Explain the isothermal flow in channels of Newtonian fluids having the flow of fluid 03 between parallel plates
 - (b) Derive the expressions for the pressure flow and leakage flow in detail for the analysis of flow in the extruder.
 - (c) Explain the Maxwell model in detail.

OR

- Q.4 (a) Derive the expressions for the drag flow in detail for the analysis of flow in the 03 extruder.
 - (b) Explain the analysis of heat transfer during polymer processing. 04
 - (c) Enlist the experimental methods used to obtain the flow data of polymer material 07 and explain any one in detail
- Q.5 (a) Explain the isochronous and Isometric graphs for design methods for plastics using 03 deformation data.
 - (b) 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 10⁵ N/m²
 - (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 fibre direction.

Material	Density	Tensile	Modulus(GN/m2)
	(kg/cm3)	strength(GN/m2)	

03

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03

07

РЕЕК	1300	0.058	3.8				
Carbon fiber	1800	2.1	400				
OR							

- Q.5 (a) A polypropylene beam is 100 mm long, simply supported at each end and is subjected to a load W at its mid-span. If the maximum permissible strain in the material is to be 1.5%, calculate the largest load which may be applied so that the deflection of the beam does not exceed 5 mm in a service life of 1 year. For the beam *I* = 28 mm4 and Modulus is 347 MN/m2
 - (b) Derive the expressions of creep, relaxation and recovery for model in which the 04 spring and dashpot are connected in series.
 - (c) Explain the forms of fiber reinforcement in composites.

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