

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) - EXAMINATION – SUMMER 2017****Subject Code: 2142305****Date: 12/06/2017****Subject Name: Applied Mathematics in Plastic Industry****Time: 10:30 AM to 01:00 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 Short Questions****14**

- 1 Define: Newtonian fluid
- 2 Write the unit to measure Stress
- 3 Define : dilatent fluid
- 4 Give the example of Pseudoplastic Fluid(shear thinning).
- 5 Define the young's modulus
- 6 What is the unit to measure shear stress
- 7 Define creep
- 8 What is swelling of thickness
- 9 Hot water is the best example of non newtonion fluid: say true or false
- 10 What is aspect ratio in fiber.
- 11 Viscosity is the temperature dependent: say true or false
- 12 Toothpaste is the example of bingham plastic: say true or false
- 13 Define non Newtonian fluid
- 14 Suspension of corn starch in water is example of shear thickening: say true or false.

- Q.2** (a) Explain the Viscoelastic behavior of plastics **03**
 (b) Explain the isochronous and Isometric graphs for design methods for plastics using deformation data **04**
 (c) Derive the expressions of creep, relaxation and recovery for model in which the spring and dashpot are connected in series **07**

OR

- (c) Explain the more complex models in detail **07**
Q.3 (a) Explain the forms of fiber reinforcement in composites **03**
 (b) The output of polythene from an extruder is $30 \times 10^{-6} \text{ m}^3/\text{s}$. 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 $1.2 \times 10^5 \text{ N/m}^2$ **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 fibre 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

OR

Q.3	(a)	What do you mean by number average molecular weight and weight average molecular weight.	03
	(b)	A blow moulding die has an outside diameter of 30 mm and an inside diameter of 27 mm. The parison is inflated with a pressure of 0.4 MN/m^2 to produce a plastic bottle of diameter 50 mm. If the extrusion rate used causes a thickness swelling ratio of 2, estimate the wall thickness of the bottle.	04
	(c)	Determine the expressions of the creep, relaxation and recovery for the Kelvin-voigt model.	07
Q.4	(a)	Explain the mechanism of flow of plastic material into the screw barrel.	03
	(b)	Define drag flow, pressure flow, leakage flow	04
	(c)	Derive the expressions for the pressure flow and leakage flow in detail for the analysis of flow in the extruder	07
OR			
Q.4	(a)	Explain: Fourier number and temperature gradient	03
	(b)	Explain the isothermal flow in channels of Newtonian fluids having the flow of fluid along a channel of uniform circular cross-section	04
	(c)	Explain the radius of gyration of an ideal branched polymer(kramers theorem)	07
Q.5	(a)	Explain in brief about the Ram extruder used to obtain flow data.	03
	(b)	Derive the expressions for the drag flow in detail for the analysis of flow in the extruder	04
	(c)	Explain the cone and plate viscometer in detail used to obtain the flow data of polymer	07
OR			
Q.5	(a)	Explain in brief stress relaxation.	03
	(b)	Explain the analysis of heat transfer during polymer processing	04
	(c)	Explain the radius of gyration of linear ideal chain	07
