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CS/M.TECH(TT/MCP)/SEM-1/MTT-103/2011-12

2011

PHYSICAL PROPERTIES OF TEXTILE FIBRES

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* questions taking at least *two* from each Group.

GROUP – A 5 × 14 = 70

1. a) Explain the 'Bolzman Super Position' principle for creep and stress relaxation.

   b) Write the assumptions that taken in BSP principle.

   c) Solve the following problem :

   A straight rod of polymer is 10 mm in diameter ($2r$) and 1 m long. The polymer behaves in a linear viscoelastic manner with a tensile creep compliance that can be well approximated by $J(t) = (2 - e\text{^}(-0 \cdot 1t)$, Gpa-1, where t is in hours. The rod is suspended vertically and a mass M of 10 kg is hung from it. Find the change in length after (i) 1 h, (ii) 10 h and (iii) 100 h.

   8 + 2 + 4

2. a) "Maxwell's model is suitable to explain stress relaxation and Kelvin's model is suitable to explain creep of viscoelastic materials." Explain the statement with necessary empirical relation and graphs.

   b) Write about the 'Standard Linear Solid' model of viscoelastic materials. How these models overcome certain extent of limitation of above two models ? 10 + 4

3. a) Describe briefly the 'Time-Temperature super position' principle.

   b) What do you mean by 'Shift factor' ? Why 'Shift factor' is important for 'Time-Temperature super position' principle ?

   c) Justify the WLF equation by using 'Free volume' concept.

   d) On which temperature WLF equation is valid ?

   5 + 3 + 5 + 1

4. a) Write a short note on 'Loss modulus' for cyclic deformation in dynamic testing of textile fibre.

   b) Derive an empirical relation among 'Loss modulus', 'Storage modulus' and 'Phase angle'. 4 + 10

5. a) Explain briefly about energy and entropy elasticity of polymeric chain.

   b) Discuss the thermodynamic relationship of rubber elasticity. 4 + 10

GROUP – B

6. a) What do you mean by glass transition temperature, melting temperature and crystallization temperature of thermoplastic polymers ?

   b) What happens during drawing and heat setting of partially oriented yarn ? What is natural draw ratio ? What happens to thermoset polymer when we gradually increase the temperature of it by heating ?

   2 + 2 + 2 + 4 + 2 + 2

7. What do you mean by isotropic and anisotropic material ? Explain the phenomenon of birefringence in relation to isotropic and anisotropic material and specially in relation to textile filaments. What are specular and diffuse reflection ? How can the lustre of textile yarns be influenced ?

   2 + 5 + 2 + 2 + 3

8. a) What are the factors upon which the moisture absorption depends on ? Briefly describe Hearley's theory of moisture absorption. In Hysteresis loop the absorption curve does not follow the same path as desorption. Why ?

   b) Describe stick slip phenomenon. On what factors the fibre friction depends ? 2 + 4 + 3 + 2 + 3

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