



# CBCS SCHEME

18ME34

## Third Semester B.E. Degree Examination, June/July 2024 Material Science

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. Define APF. Derive an expression for APF for HCP and FCC. (10 Marks)  
b. What is diffusion? Explain the laws of diffusion with equations. (10 Marks)

OR

- 2 a. Draw Stress-Strain curve for ductile materials. Explain salient point. (08 Marks)  
b. Explain mechanical properties in both plastic and elastic region. (12 Marks)

### Module-2

- 3 a. Define endurance strength and explain the method to find the endurance strength of the material. (10 Marks)  
b. What is Creep? Explain different stages of creep curve with a neat diagram. (10 Marks)

OR

- 4 a. Give brief description of different phases formed in Iron-carbon phase diagram with a neat sketch of phase diagram. (12 Marks)  
b. Define homogeneous and heterogeneous nucleation. Obtain an expression for critical radius of nucleation. (08 Marks)

### Module-3

- 5 a. Draw TTT diagram for a plain Carbon Steel and label all the regions. Show the cooling curve which forms 100% martensite and explain it. (10 Marks)  
b. Define Annealing. Explain various Annealing processes. (10 Marks)

OR

- 6 a. What is age hardening? Explain age hardening of 4% Cu alloy with its microstructure, with sketch. (10 Marks)  
b. Explain the composition, structure and properties and applications of 3 types of cast Iron. (10 Marks)

### Module-4

- 7 a. Under Iso-strain condition derive an expression for Young's modulus of fiber reinforced composites. List the advantages and applications of composite materials. (08 Marks)  
b. Explain Resin transfer moulding process. (08 Marks)  
c. Calculate the tensile modulus of elasticity of an unidirectional carbon fiber material which contains 62% by volume of carbon fibers in ISO – stress and ISO – strain condition.  
 $E_c = 3.86 \times 10^4 \text{ Kgf/mm}^2$ ;  $E_{eposy} = 428 \times 10^2 \text{ Kgf/mm}^2$ . (04 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 8 a. Calculate the modulus of elasticity, tensile strength, and the fraction of the load carried by the fiber for the following composite material stressed under iso-strain condition. The composite consists of a continuous glass fiber reinforced epoxy resin produced by using 60% by volume of E-glass ( $E = 72400 \times 10^6 \text{ N/m}^2$ ), tensile strength of  $2400 \times 10^6 \text{ N/m}^2$  and a hardened epoxy resin with a modulus of elasticity of  $3100 \times 10^6 \text{ N/m}^2$  and a tensile strength of  $60 \times 10^6 \text{ N/m}^2$ . Also find the modulus of elasticity of the composite when stressed under iso stress condition. (08 Marks)
- b. With a neat sketch, explain pultrusion process. (08 Marks)
- c. Discuss the role of composite materials in technological development. (04 Marks)

Module-5

- 9 a. What are ceramic materials? Write chemical, optical, thermal and mechanical properties of ceramics. (10 Marks)
- b. Discuss about mechanical behavior of plastics. (04 Marks)
- c. Explain Injection moulding technique. (06 Marks)

OR

- 10 a. What is NiTiNol? How is it different from its alloying materials? (05 Marks)
- b. Explain the following :
- i) Materials used in Human implants
  - ii) Fiber optic materials
  - iii) Pseudoelasticity. (15 Marks)

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